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Langley Research Center

Scientific and Technical Information Program Office

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

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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.

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Subject Divisions

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H. Physics
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J. Space Sciences
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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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01 Aeronautics (General) 1

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

02 Aerodynamics 1

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

03 Air Transportation and Safety 4

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 10

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

05 Aircraft Design, Testing and Performance 12

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

06 Avionics and Aircraft Instrumentation 15

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

07 Aircraft Propulsion and Power 17

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 Aircraft Stability and Control 18

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

09 Research and Support Facilities (Air) 20

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

Subject Categories of the Division B. Astronautics

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

12 Astronautics (General) 22

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

14 Ground Support Systems and Facilities (Space) 25

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

16 Space Transportation and Safety 25

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 32

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 32

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 34

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 35

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

Subject Categories of the Division C. Chemistry and Materials

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

23 Chemistry and Materials (General) 37

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 39

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

25 Inorganic, Organic, and Physical Chemistry 46

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

26 Metals and Metallic Materials 51

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

27 Nonmetallic Materials 60

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

28 Propellants and Fuels 71

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

29 Space Processing 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

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

31 Engineering (General) 76

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 78

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 89

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 97

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 105

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 107

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 114

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39 Structural Mechanics 114

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

Subject Categories of the Division E. Geosciences

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

42 Geosciences (General) 120

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 121

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 129

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

45 Environment Pollution 136

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

46 Geophysics 152

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 170

Includes weather observation forecasting and modification.

48 Oceanography 183

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

Subject Categories of the Division F. Life Sciences

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

51 Life Sciences (General) 185

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 193

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

53 Behavioral Sciences 202

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

54 Man/System Technology and Life Support 205

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

55 Exobiology 209

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Science*.

Subject Categories of the Division G. Mathematical and Computer Sciences

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

61 Computer Programming and Software 210

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 219

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 222

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 224

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

65 Statistics and Probability 226

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

66 Systems Analysis and Operations Research 227

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

67 Theoretical Mathematics 227

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

Subject Categories of the Division H. Physics

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

70 Physics (General) 229

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

71 Acoustics 231

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 232

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73 Nuclear Physics 238

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77 Physics of Elementary Particles and Fields 265

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

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

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

81 Administration and Management 272

Includes management planning and research.

82 Documentation and Information Science 273

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

83 Economics and Cost Analysis 281

Includes cost effectiveness studies.

85 Technology Utilization and Surface Transportation 281

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

Subject Categories of the Division J. Space Sciences

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

88 Space Sciences (General) 282

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

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 293

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

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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*.

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93 Space Radiation 374

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Subject Categories of the Division K. General

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

99 General 376

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,

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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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VOLUME 38, DECEMBER1, 2000

01
AERONAUTICS (GENERAL)

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

20000110545 Alaska Univ., History Dept., Fairbanks, AK USA
Closing The Door? High Speed Research at NACA/NASA
Millbrooke, Anne, Alaska Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 69; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Speeds Gradually Increased during the early days of airplanes. In the 1920s and '30s the National Advisory Committee on Aeronautics (NACA) worked on Cowlings, Propellers, and Streamlining as factors contributing to higher Speeds. The wartime introduction of jet and rocket-powered aircraft accelerated the trend toward faster planes. Was there a limit to how fast an aircraft could fly? In the 1940s NACA researchers conducted dive-flight research, dropped airplane models from airplanes, fired small solid-propellant rockets, and experimented with rocket-propelled aircraft. The research plane became the research tool of choice for studying supersonic flight in the late '40s and early '50s. The military services sponsored the development of the research planes, contractors built the planes, and the NACA served as research coordinator. NACA's duties included data collection and analysis and therefore the instrumentation of the research planes and the monitoring of flights. These parties developed and tested specialized aerodynamic research airplanes, the first of which was the Bell X-1. Air Force Captain Chuck Yeager flew the X-1 faster than the speed of sound on 14 October 1947. Fast flight was safe! The initial phase of supersonic research using research planes continued through the 1950s. by this time NACA had developed, constructed and placed into operation high-speed wind tunnels and initiated research into supersonic cruise technology, research continued by NACA's successor - NASA.
Derived from text
Supersonic Transports; Research Aircraft; Supersonic Flight; NASA Programs

02
AERODYNAMICS

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

20000109797 Aerospace Corp., Engineering and Technology Group, El Segundo, CA USA
Derivation of Forcing Functions for Monte Carlo Atmospheric Gust Loads Analysis ***Final Report***
Sako, B. H.; Kim, M. C.; Kabe, A. M.; Yeung, W. K.; Jul. 1999; 48p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A381177; TR-99(1534)-6; SMC-TR-00-25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A methodology developed to derive forcing functions from the turbulent component of measured wind profiles for a new Monte Carlo gust loads analysis approach is described. Several large sets of forcing functions were developed by extracting the short-duration, random component of measured Jimsphere wind profiles. A database consisting of Jimsphere wind soundings measured over the past three decades at the Eastern and Western Ranges of the USA was used to derive the forcing functions.

Validity of these forcing functions for heavy-lift and medium-lift launch vehicles was established by examining the error contributions from various sources within the wind measurement system and the application of a noise-reducing filter. A unique aspect of the method is the extraction of the relatively rapidly changing turbulent component associated with the non-persistent wind features which are expected over a given observation time period.
DTIC
Wind Velocity; Gust Loads; Launch Vehicles; Monte Carlo Method; Wind Measurement; Turbulent Flow; Error Analysis

20000109954 NASA Langley Research Center, Hampton, VA USA
Unsteady Aerodynamic Effects on the Flight Characteristics of an F-16XL Configuration
Wang, Zhongjun, Kansas Univ., USA; Lan, C. Edward, Kansas Univ., USA; Brandon, Jay M., NASA Langley Research Center, USA; [2000]; 15p; In English; Atmospheric Flight Mechanics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-1821
Report No.(s): AIAA Paper 2000-3910; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Unsteady aerodynamic models based on windtunnel forced oscillation test data and analyzed with a fuzzy logic algorithm arc incorporated into an F-16XL flight simulation code. The reduced frequency needed in the unsteady models is numerically calculated by using a limited prior time history of state variables in a least-square sense. Numerical examples arc presented to show the accuracy of the calculated reduced frequency. Oscillatory control inputs are employed to demonstrate the differences in the flight characteristics based on unsteady and quasi-steady aerodynamic models. Application of the unsteady aerodynamic models is also presented and the results are compared with one set of F16XIL longitudinal maneuver flight data. It is shown that the main differences in dynamic response are in the lateral-directional characteristics, with the quasi-steady model being more stable than the flight vehicle, while the unsteady model being more unstable. Similar conclusions can also be made in a simulated rapid side-slipping roll. to improve unsteady aerodynamic modeling, it is recommended to acquire test data with coupled motions in pitch, roll and yaw.
Author
Aerodynamic Characteristics; Flight Characteristics; Unsteady Aerodynamics; Models; Computerized Simulation

20000109955 NASA Langley Research Center, Hampton, VA USA
Wake Vortex Transport in Proximity to the Ground
Hamilton, David W., NASA Langley Research Center, USA; Proctor, Fred H., NASA Langley Research Center, USA; [2000]; 9p; In English; 19th; Digital Avionics Systems, 7-13 Oct. 2000, Philadelphia, PA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A sensitivity study for aircraft wake vortex transport has been conducted using a validated large eddy simulation (LES) model. The study assumes neutrally stratified and nonturbulent environments and includes the consequences of the ground. The numerical results show that the nondimensional lateral transport is primarily influenced by the magnitude of the ambient cross-wind and is insensitive to aircraft type. In most of the simulations, the ground effect extends the lateral position of the downwind vortex about one initial vortex spacing (b(sub o)) in the downstream direction. Further extension by as much as one b(sub o) occurs when the downwind vortex remains 'in ground effect' (IGE) for relatively long periods of time. Results also show that a layer-averaged ambient wind velocity can be used to bound the time for lateral transport of wake vortices to insure safe operations on a parallel runway.
Author
Aircraft Wakes; Vortex Precession; Aircraft Performance

20000110519 Rochester Inst. of Tech., Dept. of Mechanical Engineering, NY USA
Improved Drag Calculations Using a Wake Survey at the 0.3M TCT
Ghosh, Amitabha, Rochester Inst. of Tech., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 57; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The goals of this project were to improve the experimental wake-rake data acquisition and analysis at the 0.3-Meter Transonic Cryogenic Tunnel (TCT). The objective was to develop an automated optimization algorithm that would minimize the number of survey steps required to characterize the wake profile. An improved analysis tool was developed consisting of several FORTRAN programs, which can check the quality of experimental data and significantly reduce acquisition and processing time. With this method and reduced data acquisition, drag coefficients calculated using 25 survey steps are within 0.01% of the original 100-step data set. Thus the wake survey time has been reduced by a factor of 4. to develop the algorithm the test gas was treated

as ideal; the Beattie Bridgernan Gas Law will be used in the final version. Unlike the existing drag calculation, the present work computes and displays of results using non-dimensional variables. Thus the displayed data profiles are invariant of change of units and tunnel conditions. The program asks the user to interactively input the test, run and the point numbers to be processed for computing drag. It calculates drag coefficient using all the rake positions, and then the user is given a choice to process a subset of the total number of positions. Once the user inputs the required number of points, the program smoothes the experimental data and re-computes drag after re-distributing the points. The two calculations are compared and resulting plots are stored in TEC-PLOT format for display. The 0.3-meter Transonic Cryogenic Tunnel is currently inoperative due to the installation of new adaptive walls. Thus existing experimental data were used for testing the programs. However the improved technique can be easily implemented into the TCT's data reduction algorithms. It offers a quick check of data quality by calculating the mean and standard deviations in 6 key physical quantities. A total of 30 different input files were used to validate the results. Results show that significant reduction of data acquisition time can be achieved without sacrificing accuracy. The goal was to obtain an accuracy of 1/4 drag count. However the program achieves much better than that. Finally recommendations are made on screen for the engineer to gather data at reduced number of prescribed rake positions to obtain the same accuracy.
Author
Cryogenics; Data Acquisition; Drag Measurement; Transonic Wind Tunnels; Wakes; Surveys; Data Processing

20000112934 NASA Langley Research Center, Hampton, VA USA
Static Performance of Six Innovative Thrust Reverser Concepts for Subsonic Transport Applications: Summary of the NASA Langley Innovative Thrust Reverser Test Program
Asbury, Scott C., NASA Langley Research Center, USA; Yetter, Jeffrey A., NASA Langley Research Center, USA; July 2000; 370p; In English; The CD-ROM contains full text document in PDF format
Contract(s)/Grant(s): RTOP 522-25-31-01
Report No.(s): NASA/TM-2000-210300; L-17975; NAS 1.15:210300; NONP-NASA-CD-2000157395; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche; C01, CD-ROM

The NASA Langley Configuration Aerodynamics Branch has conducted an experimental investigation to study the static performance of innovative thrust reverser concepts applicable to high-bypass-ratio turbofan engines. Testing was conducted on a conventional separate-flow exhaust system configuration, a conventional cascade thrust reverser configuration, and six innovative thrust reverser configurations. The innovative thrust reverser configurations consisted of a cascade thrust reverser with porous fan-duct blocker, a blockerless thrust reverser, two core-mounted target thrust reversers, a multi-door crocodile thrust reverser, and a wing-mounted thrust reverser. Each of the innovative thrust reverser concepts offer potential weight savings and/or design simplifications over a conventional cascade thrust reverser design. Testing was conducted in the Jet-Exit Test Facility at NASA Langley Research Center using a 7.9%-scale exhaust system model with a fan-to-core bypass ratio of approximately 9.0. All tests were conducted with no external flow and cold, high-pressure air was used to simulate core and fan exhaust flows. Results show that the innovative thrust reverser concepts achieved thrust reverser performance levels which, when taking into account the potential for system simplification and reduced weight, may make them competitive with, or potentially more cost effective than current state-of-the-art thrust reverser systems.
Author
Subsonic Speed; Thrust Reversal; Turbofans; Aircraft Brakes; Brakes (For Arresting Motion); Aeronautical Engineering; Aircraft Design; Performance Tests

20000112958 NASA Ames Research Center, Moffett Field, CA USA
Cricket Ball Aerodynamics: Myth Versus Science
Mehta, Rabindra D., NASA Ames Research Center, USA; [2000]; 14p; In English; 3rd; The Engineering of Sport, 9-12 Jun. 2000, Sydney, Australia; Sponsored by International Sports Engineering Association, Unknown; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aerodynamics plays a prominent role in the flight of a cricket ball released by a bowler. The main interest is in the fact that the ball can follow a curved flight path that is not always under the control of the bowler. ne basic aerodynamic principles responsible for the nonlinear flight or "swing" of a cricket ball were identified several years ago and many papers have been published on the subject. In the last 20 years or so, several experimental investigations have been conducted on cricket ball swing, which revealed the amount of attainable swing, and the parameters that affect it. A general overview of these findings is presented with emphasis on the concept of late swing and the effects of meteorological conditions on swing. In addition, the relatively new concept of "reverse" swing, how it can be achieved in practice and the role in it of ball "tampering", are discussed in detail. A discus-

sion of the ”white” cricket ball used in last year’s World Cup, which supposedly possesses different swing properties compared to a conventional red ball, is also presented.
Author
Balls; Flight Paths

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.

20000109817 Naval Postgraduate School, Dept. of Operations Research, Monterey, CA USA
Modeling and Analysis of Human Error in Naval Aviation Maintenance Mishaps
Fry, Ashley D.; Jun. 2000; 99p; In English
Report No.(s): AD-A381266; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This study investigates human error associated with 599 Naval Aviation maintenance-related mishaps (MRMs) in Fiscal Years 90-99. The Human Factors Analysis and Classification System Maintenance Extension (HFACS-ME) taxonomy was utilized to classify contributory human errors within a robust theoretical framework. Variable Poisson process models are developed to predict MRMs and relationships between the error dimensions are investigated. The results of this study show that the HFACS-ME taxonomy provides an adequate framework for the classification of MRM causal factors; that variable Poisson process models are suitable for predicting future mishaps, and that there are significant relationships between selected causal dimensions; sufficient to warrant further investigation. These results provide information regarding the predicted impact of MRMs on future operational readiness and mission capability. Through being aware of these aspects, decision-makers are armed with the knowledge to make better decisions concerning the preservation and allocation of the resources at their disposal.
DTIC
Aircraft Maintenance; Human Factors Engineering; Accidents; Human Performance; Errors

20000109820 NASA Langley Research Center, Hampton, VA USA
A Study of Airline Passenger Susceptibility to Atmospheric Turbulence Hazard
Stewart, Eric C., NASA Langley Research Center, USA; [2000]; 15p; In English; Atmospheric Flight Mechanics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-3978; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simple, generic, simulation math model of a commercial airliner has been developed to study the susceptibility of unrestrained passengers to large, discrete gust encounters. The math model simulates the longitudinal motion to vertical gusts and includes (1) motion of an unrestrained passenger in the rear cabin, (2) fuselage flexibility, (3) the lag in the downwash from the wing to the tail, and (4) unsteady lift effects. Airplane and passenger response contours are calculated for a matrix of gust amplitudes and gust lengths of a simulated mountain rotor. A comparison of the model-predicted responses to data from three accidents indicates that the accelerations in actual accidents are sometimes much larger than the simulated gust encounters.
Author
Mathematical Models; Computerized Simulation; Gusts

20000109968 NASA Langley Research Center, Hampton, VA USA
Explosive Fracturing of an F-16 Canopy for Through-Canopy Crew Egress
Bement, Laurence J., NASA Langley Research Center, USA; [2000]; 15p; In English; 38th, 9-11 Oct. 2000, Reno, NV, USA; Sponsored by Space and Flight Equipment Association, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Through-canopy crew egress, such as in the Harrier (AV-8B) aircraft, expands escape envelopes by reducing seat ejection delays in waiting for canopy jettison. Adverse aircraft attitude and reduced forward flight speed can further increase the times for canopy jettison. However, the advent of heavy, high-strength polycarbonate canopies for bird-strike resistance has not only increased jettison times, but has made seat penetration impossible. The goal of the effort described in this paper was to demonstrate a method of explosively fracturing the F-16 polycarbonate canopy to allow through-canopy crew ejection. The objectives of this effort were to: 1. Mount the explosive materials on the exterior of the canopy within the mold line, 2. Minimize visual obstructions, 3. Minimize internal debris on explosive activation, 4. Operate within less than 10 ms, 5. Maintain the shape of the canopy after

functioning to prevent major pieces from entering the cockpit, and 6. Minimize the resistance of the canopy to seat penetration. All goals and objectives were met in a full-scale test demonstration. In addition to expanding crew escape envelopes, this canopy fracture approach offers the potential for reducing system complexity, weight and cost, while increasing overall reliability, compared to current canopy jettison approaches. to comply with International Traffic in Arms Regulations (ITAR) and permit public disclosure, this document addresses only the principles of explosive fracturing of the F-16 canopy materials and the end result. ITAR regulations restrict information on improving the performance of weapon systems. Therefore, details on the explosive loads and final assembly of this canopy fracture approach, necessary to assure functional performance, are not included.
Author
Harrier Aircraft; Polycarbonates; Canopies; Weapon Systems; Supports; Reliability; Fracturing

20000110112 Federal Aviation Administration, Aviation Security Research and Development Div., Atlantic City, NJ USA
Operational Test and Evaluation Plan: Bottle Contents Tester Usability Assessment. Test and Evaluation Plan
Klock, B. A.; Siegel, S.; Maguire, W.; Jul. 13, 2000; 34p; In English
Report No.(s): PB2001-100151; DOT/FAA/AR-00/54; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Explosives and flammable materials may be concealed in bottles in carry-on or checked baggage. Given the volume of passenger baggage and the fact that bottles are often elaborately packaged or sealed, manual inspection of a bottle's contents is a difficult challenge. to improve the screening of liquid containers, devices are currently in development to screen bottles. This document describes a plan for collecting critical information about the interface and usability of a bottle contents tester. The assessment will proceed in two stages: a laboratory assessment at the Aviation Security Laboratory at the Atlantic City International Airport in NJ and a field assessment. Usability of a bottle contents tester in the operational environment as well as screener and passenger acceptance of bottle contents screening will be assessed.
NTIS
Bottles; Human Factors Engineering; Airport Security

20000110191 NASA Langley Research Center, Hampton, VA USA
Reducing Aviation Weather-Related Accidents Through High-Fidelity Weather Information Distribution and Presentation
Stough, H. Paul, III, NASA Langley Research Center, USA; Shafer, Daniel B., NASA Langley Research Center, USA; Schaffner, Philip R., NASA Langley Research Center, USA; Martzaklis, Konstantinos S., NASA Glenn Research Center, USA; [2000]; 13p; In English; 22nd; Congress, 27 Aug. - 1 Sep. 2000, Harrogate, UK; Sponsored by International Council of the Aeronautical Sciences, Unknown; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In February 1997, the US President announced a national goal to reduce the fatal accident rate for aviation by 80% within ten years. The National Aeronautics and Space Administration established the Aviation Safety Program to develop technologies needed to meet this aggressive goal. Because weather has been identified (is a causal factor in approximately 30% of all aviation accidents, a project was established for the development of technologies that will provide accurate, time and intuitive information to pilots, dispatchers, and air traffic controllers to enable the detection and avoidance of atmospheric hazards. This project addresses the weather information needs of general, corporate, regional, and transport aircraft operators. An overview and status of research and development efforts for high-fidelity weather information distribution and presentation is discussed with emphasis on weather information in the cockpit.
Author
Aircraft Accidents; Aircraft Safety; Flight Safety; Hazards

20000110524 Tennessee Technological Univ., Dept. of Electrical and Computer Engineering, Cookeville, TN USA
Development of the AWIN Integration and Technology Laboratory
Haggard, Roger L., Tennessee Technological Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 62; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The goal of the national Aviation Safety Program is to reduce the fatal accident rate for aviation by 80% within ten years. One component of this program at NASA, the Aviation Weather Information (AWIN) project, was created to develop and evaluate new technologies for the presentation of weather hazards to aviation personnel, both groundbased and in-flight. The work presented here primarily details the development of a technology demonstration laboratory, wherein current state-of-the-art weather information display systems are integrated and evaluated. These systems will serve as the framework for defining future display systems with regard to desirable types of weather content and display formats, including factors such as color, symbols, display size, and resolution. Three specific areas of investigation are presented in this study: development of the hardware tab, collection

and evaluation of weather sources, and data extraction from flight simulators. The first area, development of the hardware lab, includes the installation and debugging of four weather-related display avionics systems (Echo Flight StratoCheetah, J.P. Instruments NAV-2000, Honeywell/Northstar CT1000H, and Data test FlightVue 640). All of these are compact portable PCs with small color LCD screens, suitable for cockpit use. Most of them include a GPS moving map display and some include hardware/software to collect and display weather information via satellite or Internet. Future hardware and software needs for the lab are also examined. Actual weather information is needed to produce canned weather scenarios for use in the evaluation and testing of the weather display equipment. This second area involves research into the types of weather information needed, a search for appropriate sources of this information, and their evaluation. A summary of suggested weather products is derived. Numerous sources of weather data are examined, including Internet and satellite sources, both free and paid, current and archived. The collection of flight and performance data from commercial flight simulators for performing weather-related human factors evaluations is the third area of investigation. Specifications are established for purchasing the needed software technology from one simulator vendor, and data extraction software is developed inhouse for another simulator.
Author
Avionics; Information Systems; Software Engineering; Weather; Flying Personnel

20000110530 NASA Langley Research Center, Hampton, VA USA
Estimating The Rate of Technology Adoption for Cockpit Weather Information Systems
Kauffmann, Paul, Old Dominion Univ., USA; Stough, H. P., NASA Langley Research Center, USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 68; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In February 1997, President Clinton announced a national goal to reduce the weather related fatal accident rate for aviation by 80% in ten years. To support that goal, NASA established an Aviation Weather Information Distribution and Presentation Project to develop technologies that will provide timely and intuitive information to pilots, dispatchers, and air traffic controllers. This information should enable the detection and avoidance of atmospheric hazards and support an improvement in the fatal accident rate related to weather. A critical issue in the success of NASA's weather information program is the rate at which the market place will adopt this new weather information technology. This paper examines that question by developing estimated adoption curves for weather information systems in five critical aviation segments: commercial, commuter, business, general aviation, and rotorcraft. The paper begins with development of general product descriptions. Using this data, key adopters are surveyed and estimates of adoption rates are obtained. These estimates are regressed to develop adoption curves and equations for weather related information systems. The paper demonstrates the use of adoption rate curves in product development and research planning to improve managerial decision processes and resource allocation.
Author
Cockpit Weather Information Systems; Technology Utilization; NASA Programs

20000110930 Spirit Airlines (Pty) Ltd., Melbourne, Australia
Determinants of Price Dispersion in US Airline Markets
Cook, Gerald N., Spirit Airlines (Pty) Ltd., Australia; Journal of Air Transportation World Wide; 2000; ISSN 1093-8826; Volume 5, No. 2, pp. 39-54; In English; Copyright; Avail: Issuing Activity

Although a well recognized and unpredicted post deregulation development, the complex airline fare structure has received relatively little research attention. This paper develops a multiple regression model measuring the relationship of several market variables to the degree of ticket price dispersion observed in the 200 largest US airline markets during the third quarter of 1995. A wide range of ticket prices is evident on most routes. The results show that ticket price dispersion on some given route increases with the number of competitors, with service by a combination of non-stop and connecting flights, when a low-cost airline competes with other major carriers, and when the capacity of one of the airports is limited by regulation. The model explains 41 percent of observed ticket price dispersion.
Author
Airline Operations; Market Research; Mathematical Models; Operating Costs; Economic Analysis

20000110931 International Civil Aviation Organization, Montreal, Quebec Canada
Strategic Alliances of Airlines and Their Consequences
Abeyratne, Ruwantissa I. R., International Civil Aviation Organization, Canada; Journal of Air Transportation World Wide; 2000; ISSN 1093-8826; Volume 5, No. 2, pp. 55-71; In English; Copyright; Avail: Issuing Activity

This article will examine the semantics of strategic airline alliances and the manner in which such alliances overcome bureaucratic obstacles to gain access to open competition. The conclusion will address the issue of aviation safety, which has been inextricably linked by some to the proliferation of air transport activity envisioned in the near future.
Author
Air Transportation; Airline Operations; Agreements

20000110932 King Abdulaziz Univ., Industrial Engineering Dept., Jeddah, Saudi Arabia
The Determinants of Domestic Air Travel Demand in the Kingdom of Saudi Arabia
Ba-Fail, Abdullah O., King Abdulaziz Univ., Saudi Arabia; Abed, Seraj Y., King Abdulaziz Univ., Saudi Arabia; Jasimuddin, Sajjad M., King Abdulaziz Univ., Saudi Arabia; Journal of Air Transportation World Wide; 2000; ISSN 1093-8826; Volume 5, No. 2, pp. 72-86; In English; Copyright; Avail: Issuing Activity

For an airline, analyzing and forecasting air travel market is a part of its corporate planning process. This paper addresses the determinants of domestic air travel demand in the Kingdom of Saudi Arabia. Here an attempt is made to develop models for domestic air travel demand in the Kingdom with different combinations of explanatory variables utilizing stepwise regression technique. The model, which has the total expenditures and population size as the explanatory variables, is the most appropriate model to represent the demand for domestic air travel in the Kingdom. The rest of the models discussed suffer from multicollinearity. The model selected may be used to identify and measure the relations between domestic air travel demand and the economic and demographic forces in the Kingdom.
Author
Air Transportation; Airline Operations; Models; Forecasting

20000110933 State Dept., Foreign Service, USA
The Case of Morris Air: A Successful Startup
Schultz, Albert Charles, State Dept., USA; Schultz, Erika Patricia, Ragusin International, USA; Journal of Air Transportation World Wide; 2000; ISSN 1093-8826; Volume 5, No. 2, pp. 87-110; In English; Copyright; Avail: Issuing Activity

Morris Air, which began scheduled operations in 1992, provides an example of a start-up airline that succeeded during the dark days of US commercial aviation in the early 1990s. Morris Air benefited from a favorable regulatory climate for start-ups but owed most of its success to innovations in cutting costs and to its discipline in filling a well-defined market niche. When Morris Air began to hurt the operations of the major airlines, particularly Delta's hub at Salt Lake City, it began to suffer from aggressive responses that could be considered predatory. Morris Air was sold to Southwest Airlines at the end of 1993, resulting in substantial capital gains for its shareholders. There is evidence that Morris Air's founder anticipated a sale to Southwest from the time she incorporated the airline.
Author
Airline Operations; Operating Costs

20000110934 University of Southern Illinois, Dept. of Aviation Management and Flight, Carbondale, IL USA
University Flight Operations Internships with Major Airlines: Airline Perspectives
NewMyer, David A., University of Southern Illinois, USA; Ruiz, Jose R., University of Southern Illinois, USA; Rogers, Ryan E., University of Southern Illinois, USA; Journal of Air Transportation World Wide; 2000; ISSN 1093-8826; Volume 5, No. 2, pp. 111-129; In English; Copyright; Avail: Issuing Activity

This study examines the partnership between US airlines and aviation-oriented universities that facilitates flight-orientated internship programs. Through the use of a literature review and phone survey, the researchers investigate the similarities and differences between the top twelve airlines' internship programs. Additionally, the researchers work to dispel some of the myths surrounding these programs and reveal the tangible and intangible benefits to the participant, the sponsoring airline and the university.
Author
Airline Operations; Education; University Program

20000111092 Cranfield Univ., Air Transport Group, Bedford, UK
Marketing to Female Business Travellers
Alamdari, Fariba, Cranfield Univ., UK; Burrell, Julian, Business Air Centre Ltd., UK; Journal of Air Transportation World Wide; 2000; ISSN 1093-8826; Volume 5, No. 2, pp. 3-18; In English; Copyright; Avail: Issuing Activity

Business passengers are the most profitable segment of the market for airline industry. Airlines have put an enormous amount of effort into improving the quality of service offered to business travellers. However, a fast growing sub-segment of the market,

female business passengers, appears not to be receiving any special attention from airline product planners. In the US it was predicted that female travellers will represent 50 percent of the business travel market by the turn of the century. Such growth in this segment of the market raises a few questions. Do airlines view this sub-segment valuable enough to divert special effort to meet the passenger requirement? Do the requirements of female business travellers differ from those of male business travellers? Does the airline industry meet the travel needs of this sub-segment of the market? How can airlines increase their share of such a growing sub-segment of the market? to address these questions surveys of both airlines and female business travellers in Europe and the US were carried out. The findings indicate that the airlines view the growth of this sub-segment as important. However, only a few carriers have devoted resources to address female business travel needs. Although the needs of the female business travellers are in many ways similar to those of the male business traveller, there are differences in certain areas such as concerns over airport security, advice on safety and better washrooms. Clearly these requirements must be accommodated if airlines wish to increasingly attract this growing sub-segment of the market.
Author
Airline Operations; Females; Marketing; Passengers

20000111093 Catania Univ., Ist. Strade Ferrovie Aeroporti, Italy
A Fuzzy Approach to Overbooking in Air Transportation
Ignaccolo, Matteo, Catania Univ., Italy; Inturri, Giuseppe, Catania Univ., Italy; Journal of Air Transportation World Wide; 2000; ISSN 1093-8826; Volume 5, No. 2, pp. 19-38; In English; Copyright; Avail: Issuing Activity

A high load factor is important for airlines trying to maximise their profits without alienating customers. The loss of revenue caused by empty seats cannot be recaptured. The aim of this paper is to propose a method that minimises the unused seats and the denied boarding at the same time for every single flight. This can be achieved by monitoring the booking process during the days before the departure and by using an Inference Fuzzy System as an easy decision support system to assist the revenue management analysts.
Author
Airline Operations; Revenue; Passengers; Operational Problems; Fuzzy Systems; Models

20000112905 Royal Aeronautical Society, London, UK
Sharing Best Practice: Synergy in Rail and Aviation Safety: Proceedings
2000; 50p; In English; Sharing Best Practice: Synergy in Rail and Aviation Safety, 18 Oct. 2000, London, UK; See also 20000112906 through 20000112909; ISBN 1-85768-107-X; Copyright; Avail: Issuing Activity

This document represents the proceedings of the meeting of the Royal Aeronautical Society. The conference reviewed safety and safety management practices in the rail industry, and aviation.
Author
Conferences; Safety Management; Aircraft Safety; Aircraft Pilots; Aircraft Survivability; Rail Transportation

20000112906 Shadow Strategic Rail Authority, UK
Organisational Safety Culture, 1, Why Bother?
Sharing Best Practice: Synergy in Rail and Aviation Safety: Proceedings; 2000, pp. 1.1 - 1.7; In English; See also 20000112905; Copyright; Avail: Issuing Activity

The simple rules that are expanded in the presentation therefore are: (1) Recruit wisely; (2) Carry out induction training immediately on joining the company; (3) Use training aids to good effect ensures that on certification you are confident that the job will be done correctly; (4) Drill, drill and drill again; (5) Adopt an open and transparent safety reporting culture; (6) Ensure that development and training for development are a regular and important part of the management system. These rules are clearly not exhaustive. There are many other components which go together to make the human factor a controlled factor within safety management. This presentation attempts to give some simple tests that may be applied to anybody's system to establish whether improvements could be made. We must all strive to reduce the numbers of accidents and incidents, which occur within our industry. Good management equals good safety and good safety equals good management. If we are do to do this, human factors are extremely important and we must begin or indeed in some cases continue to value the staff who work for us almost as we would do with our own children.
Derived from text
Safety; Safety Management; Accident Prevention; Avoidance; Fail-Safe Systems

20000112907 Texas Univ., Human Factors Research Project, Austin, TX USA

Organisational Safety Culture, 2, Transferring Human Factors Experience from Aviation to Other Domains

Helmreich, Robert L., Texas Univ., USA; Sharing Best Practice: Synergy in Rail and Aviation Safety: Proceedings; 2000, pp. 2.1 - 2.7; In English; See also 20000112905; Sponsored in part by Gustav Daimler und Karl Benz Stiftung; Copyright; Avail: Issuing Activity

The nature of teamwork and error in situations where teams interact with technology is discussed and the determinants of team performance are described, Cultural and system factors related to error are considered. Aviation's approach to dealing with threat and error is explained and a model of threat and error management presented. Risks and barriers involved in transferring the aviation approach to threat and error management are explored. The need to build programmes on data reflecting the culture and conditions in the relevant domain is emphasized using the transfer of human factors approaches to medicine. A systematic, data driven approach to building a safety culture is presented.

Author

Human Factors Engineering; Human Performance; Safety; Safety Management; Safety Factors

20000112908 Cranfield Univ., Human Factors Technology Group, Cranfield, UK

Passenger Evacuation and Transference

Muir, Helen, Cranfield Univ., UK; Sharing Best Practice: Synergy in Rail and Aviation Safety: Proceedings; 2000, pp. 3.1 - 3.10; In English; See also 20000112905; Copyright; Avail: Issuing Activity

The issue of passenger safety has always been a major priority within the aviation and rail industries. Although the accident rate in both industries has steadily declined, nevertheless it is unfortunately the case that with the current operating systems accidents will continue to occur from time to time. A priority must be to ensure that where possible the numbers of fatalities and injuries are minimized. From an understanding of human behaviour in emergencies, together with the factors contributing to survival in accidents it is possible to determine the steps which could be taken to move towards the goal of 100% passenger survival in all accidents.

Author

Passengers; Aircraft Safety; Airline Operations; Evacuating (Transportation); Rail Transportation

20000112909 Civil Aviation Authority, Safety Regulation Group, UK

CFIT/Altitude Bust, How Do We Change Behaviour?

Griffiths, R. Peter, Civil Aviation Authority, UK; Sharing Best Practice: Synergy in Rail and Aviation Safety: Proceedings; 2000, pp. 8.1 - 8.5; In English; See also 20000112905; Copyright; Avail: Issuing Activity

This paper considers the way in which the CAA has sought to influence the behaviour of flight crews in relation to Controlled Flight into Terrain (CFIT) and altitude busts. Human factors in the form of Crew Resource Management (CRM) are considered as well as some of the technological aspects of such occurrences. Two typical CFIT incidents are examined and the causal factors considered together with the training and technological improvements which may have helped to alleviate the situation. Altitude busts are also looked at in the above manner and a new scheme to improve the standard of CRM training by the accreditation of instructors is proposed and outlined.

Author

Flight Control; Human Factors Engineering; Flight Altitude; Aircraft Accidents; Aircraft Control; Aircraft Safety

20000112926 Naval Postgraduate School, Monterey, CA USA

Ranger Air Load Planner

Moore, Maximo A., III; Jun. 2000; 82p; In English

Report No.(s): AD-A380251; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The USA Army 75th Ranger Regiment conducts combat parachute operations as part of USA Special Operations Command (USSOCOM). The Rangers are the largest deployable asset of USSOCOM, and are required to plan and execute large-scale parachute assaults into hostile theaters with little or no notice. Generally fighting numerically superior enemy, far from the support of the conventional Army, Rangers must arrive capable of self-sustaining combat operations in any operational environment. This thesis provides Ranger air load planners a tool to rapidly plan feasible mission equipment loads. The Ranger Air Load Planner (RAP) is simple to learn and operate, provides load plans selected from, pre-approved, USA Air Force load templates, and supports dynamic decision support with rapid solution response. An optimization model is used in the thesis to objectively assess the quality

of RAP load plans. RAP is a working product that can be adapted for use in air load mission planning by all units under USSOCOM.
DTIC
Mission Planning; Aerodynamic Loads; Attacking (Assaulting); Military Operations

20000113128 Federal Aviation Administration, Office of Aviation Policy and Plans, Washington, DC USA
General Aviation and Air Taxi Activity Survey ***Annual Report***
Jul. 2000; 132p; In English
Report No.(s): AD-A382669; FAA-APO-110; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report presents the results of the annual General Aviation and Air Taxi Activity Survey. The survey is conducted by the FAA to obtain information on the activity of the USA registered general aviation - and air taxi aircraft fleet. The report contains tabulations of active aircraft, annual flight hours, average flight hours, and other statistics by aircraft type, state and region of based aircraft, and use. Also included are file: consumption, lifetime airframe hours, estimates of the number of landings, and IFR hours flown.
DTIC
General Aviation Aircraft; Civil Aviation; Taxiing; Airfield Surface Movements; Surveys

20000114488 Illinois Univ. at Urbana-Champaign, Dept. of Civil Engineering, Urbana, IL USA
Development and Evaluation of VFR Lighted Flyways in the Chicago Class B Airspace ***Final Report, Apr. 1997 - Mar. 1999***
Hongschaovalit, Pongnate; Dempsey, Berry J.; Oct. 1999; 148p; In English
Report No.(s): PB2000-108481; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

The objective of this study was to develop a prototype to be used as a VFR flyway marker in the Chicago Class B airspace. by using visual markers as a reference, VFR aircraft may be persuaded from transitioning through controlled airspace. More importantly, by scanning outside more than at the onboard instrument, the pilot's probability to detect other aircraft, terrain, or obstructions would increase. In air-to-ground visual searches, size and color are the most important factors during daytime. With a 3-mile spacing, several testing schemes were developed to analyze the effect of size and colors on perceptibility. A commercially available structure manufactured by Sprung Instant Structure was determined to be the most economical. The recommended size is a ten-panel structure of 40-ft in diameter and 18-ft in height. The colors and marking pattern determined to be the most conspicuous and noticeable are the tangerine orange and yellow combination, with alternating solid colored pattern. Based upon laboratory testing, white lighting beacons capable of Morse code 'S' flashes should be used for nighttime. The intensity of the light should be 200,000-, 20,000-, and 8,000- candelas at daytime, dusk, and nighttime, respectively. Following laboratory testing, flight evaluations were conducted at the University of Illinois and Schaumburg airports. The results of this study has indicated that the prototype could be implemented as a VFR flyway marker. Further investigation is necessary, however, to fully understand its capability as well as its impact on aviation around the Chicago area.
NTIS
Visual Flight Rules; Aircraft Lights; Runway Lights; Air Traffic Control; Visual Control

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.

20000109796 Colorado Univ., Boulder, CO USA
Comprehension of Navigation Directions ***Annual Report***
Schneider, Vivian I., Colorado Univ., USA; Healy, Alice F., Colorado Univ., USA; Sep. 30, 2000; 17p; In English; Sponsored by Psychonomic Society, USA
Contract(s)/Grant(s): NCC2-1112; DASW01-99-K-0002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In an experiment simulating communication between air traffic controllers and pilots, subjects were given navigation instructions varying in length telling them to move in a space represented by grids on a computer screen. The subjects followed the instructions by clicking on the grids in the locations specified. Half of the subjects read the instructions, and half heard them. Half of the subjects in each modality condition repeated back the instructions before following them,and half did not. Performance was worse for the visual than for the auditory modality on the longer messages. Repetition of the instructions generally depressed per-

formance, especially with the longer messages, which required more output than did the shorter messages, and especially with the visual modality, in which phonological recoding from the visual input to the spoken output was necessary. These results are explained in terms of the degrading effects of output interference on memory for instructions.
Author
Air Traffic Controllers (Personnel); Message Processing; Programmed Instruction; Air Navigation

20000113669 Technion - Israel Inst. of Engineering, Haifa, Israel
Mixed Strategies for the Interception of Blind Highly Maneuvering Targets ***Annual Report, 1 Sep. 1998-31 Mar. 2000***
Shinar, Josef, Technion - Israel Inst. of Engineering, Israel; Shima, Tal, Technion - Israel Inst. of Engineering, Israel; Apr. 28, 2000; 38p; In English
Contract(s)/Grant(s): F61708-97-C-0004
Report No.(s): AD-A381807; EOARD-SPC-97-4071; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Annual Technical Report, being the final report on a long-term investigation, has two objectives. It describes the technical effort performed in the last year and also summarizes the results of the entire (two and half years) investigation with an outline of the directions for future research. Most missile guidance laws were developed using linearized two-dimensional models assumng constant speed and maneuverability. Simulation results demonstrated that linear guidance theory, based on such a model, couldn't predict the miss distance in an actual real world time-varying missile/target scenario, such as the interception of a reentering Tactical Ballistic Missile. An earlier Interim Report described the first attempt to extend the linear guidance model to include time-varying speed and maneuverability. In this report the generalized time-varying linear pursuit-evasion game model is developed. Based on this model a modified guidance law with improved homing performance is derived. The predictions of the time-varying linear model are validated by simulations of a realistic Ballistic Missile Defense scenario. Summarizing the more than two years investigation, it can be stated that its objective to gain an "understanding how key parameters in the models of the interceptor missile and of the target affect the outcome of an engagement" has been accomplished at least in a deterministic (noise free) environment. The affects of time-varying parameters and nonlinear kinematics were separately analyzed. Extension of the investigation to an environment corrupted by measurement noise, having been out of the scope of the reported effort from the outset, seems to be the appropriate direction for future research.
DTIC
Ballistic Missiles; Interception; War Games; Homing Devices; Pursuit-Evasion Games; Maneuverability; Missile Control; Missile Defense

20000113829 Georgetown Univ., Washington, DC USA
An Assessment of USA' Policy Concerning GPS in Light of Current and Planned Changes to the GNSS Environment
Peloquin, Perry J., Georgetown Univ., USA; Aug. 08, 2000; 50p; In English
Report No.(s): AD-A381007; LAWJ-406-09; AFIT-FY00-268; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current USA policy concerning use, implementation, and control of its Global Positioning System (GPS) global navigation satellite system (GNSS) is focused on autonomous control and oversight. The USA has however, for all intents and purposes, guaranteed that it will provide GPS Standard Positioning Service (SPS) navigational data, free of charge, to the entire world for peaceful, civil use. The USA has further enhanced this commitment by its promise to remove the current Selective Availability (SA) controls from GPS thereby providing worldwide access to the more accurate, non-degraded navigational data. In concert with such assurances, the United States has engaged in a campaign to encourage a universal adoption of GPS and GPS navigational data as the sole satellite source of such data for worldwide air traffic control and management and the myriad of other navigation, positioning, and timing applications made possible by GNSS.
DTIC
Global Positioning System; Navigation Satellites; International Relations; Policies; USA; Satellite Observation

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.

20000109892 Tokyo Denki Univ., Faculty of Engineering, Japan
Basic Research on Small Rotors for the Use of Hovering in Air
Horiyuki, Toshiyuki, Tokyo Denki Univ., Japan; Tsujiyama, Masashi, Tokyo Denki Univ., Japan; Niwa, Kazuhiro, Tokyo Denki Univ., Japan; Sakaki, Toshitaka, Tokyo Denki Univ., Japan; Kichise, Wataru, Tokyo Denki Univ., Japan; Research Reports of The Faculty of Engineering, Tokyo Denki University; Dec. 1999; ISSN 0389-617X, No. 47, pp. 29-37; In Japanese; Copyright; Avail: Issuing Activity

Basic research on hovering robots is performed, and rotor mechanisms are investigated through various experiments. Main purpose for developing a hovering robot is observing the circumstances of narrow and dangerous places where humans cannot enter. Such robots will be very useful especially in emergency. Lift force obtained by a rotor decrease much by minimizing the rotor size, because it is proportional to the third power of the rotor diameter and to the chord length. The lift given by a rotor with a size of 10-15 cm is about several 10s gf. Therefore, the weight of the robot should be suppressed in minimum. In addition, it is important to consider counter torque balance for the rotor moment and bending back of the rotor wings.
Author
Hovering; Lift; Research; Robots; Rotors

20000110024 Defence Science and Technology Organisation, Air Operations Div., Fishermens Bend, Australia
A Correlation Between Flight-Determined Lateral Derivatives and Ground-Based Data for the Pilatus PC 9/A Training Aircraft in Cruise Configuration
Keating, Hilary A., Defence Science and Technology Organisation, Australia; vanBronswijk, Nick, Defence Science and Technology Organisation, Australia; Snowden, Andrew D., Defence Science and Technology Organisation, Australia; Drobik, Jan S., Defence Science and Technology Organisation, Australia; June 2000; 60p; In English; Original Contains color illustrations
Report No.(s): DSTO-TR-0988; DODA-AR-011-475; Copyright; Avail: Issuing Activity

A series of flight tests were conducted on the PC 9/A aircraft, A23-045, at the Royal Australian Air Force's Aircraft Research and Development Unit. System identification techniques were applied to the data obtained from these flight tests to determine the stability and control derivatives of the aircraft. The lateral results for the aircraft in cruise configuration are presented in this report and comparisons are made with empirical and ground based estimates.
Author
Flight Tests; Derivation; Stability; Control Data (Computers); System Identification

20000110075 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
Stress Intensity Factors and Crack Interaction in Adjacent Holes ***Final Report, 1 Jun. 1996 - 30 Aug. 1998***
Fawaz, S. A.; de Rijck, J. J.; Apr. 2000; 34p; In English; Prepared in collaboration with The Netherlands Institute for Metals Research, Faculty of Aerospace Engineering, Delft University of Technology, The Netherlands.
Contract(s)/Grant(s): Proj-2401
Report No.(s): AD-A380271; AFRL-VA-WP-TR-2000-3014; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this analytical investigation, stress intensity factors, K, are calculated for oblique part-elliptical through cracks nucleating and growing from an array of collinear holes subjected to remote tension, bending, and pin loading. The finite element method is used with ;model validation through comparisons to known stress concentration factors solutions. The three-dimensional virtual crack closure technique (3D VCCT) is used to calculate the new K solutions. This work was motivated by the need to predict fatigue crack growth in transport aircraft fuselage lap-splice skin joints. Fatigue crack growth of adjacent through cracks with oblique crack fronts can now be predicted using the results of this investigation.
DTIC
Stress Intensity Factors; Crack Propagation; Aircraft Design; Holes (Mechanics); Stress Concentration

20000110511 Old Dominion Univ., Aerospace Engineering Dept., Norfolk, VA USA

Design Optimization Towards Quieter and More Efficient Aircraft

Baysal, Oktay, Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 48; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The motivation is to develop automated optimization tools that would ultimately allow one to design quieter and aerodynamically more efficient aircraft. The current design practices, which mostly rely on the ”cut-and-try” approaches, are a major contributor to the prolonged design cycles, hence are not desirable to use. The critical building block to this end, when a gradient-based optimization is to be used, are the sensitivities of the equations governing the underlying physics with respect to the design variables. Although much research has recently been published on the efficient analytical sensitivities, practically all of them are limited to the steady-state flowfield equations. However, it is the unsteady flows that are responsible for the dynamic loads on the aircraft and for the generation of the non-propulsive noise, also known as the airframe noise. Further, an aerodynamic shape optimally designed for steady flows, even when multipoint objectives are used, has inferior unsteady aerodynamic characteristics, as compared to one designed for unsteady flows. Therefore, time-dependent sensitivities are necessitated both by the unsteady flowfield around the aircraft and the propagation of the noise. This constitutes the main objective of the present investigation. Derived from text

Design Analysis; Noise Propagation; Optimization; Aircraft Noise

20000110625 Naval War Coll., Joint Military Operations Dept., Newport, RI USA

UAV Employment in Kosovo: Lessons for the Operational Commander ***Final Report***

Dixon, J. R.; Feb. 08, 2000; 36p; In English

Report No.(s): AD-A378573; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper addresses how the operational commander used Unmanned Aerial Vehicles (UAVs) during Operation Allied Force in Kosovo. The air phase of Operation Allied Force marked the largest employment of UAVs in military history. The writer argues that UAV doctrine and contingency operations must evolve in order for the operational commander to fully integrate UAVs into the joint force, and UAV intelligence and targeting, combined with reduced risk to U.S. pilots, significantly enhance the warfighting capability of the operational commander. This paper will first analyze the history of UAVs, then discuss their types and capabilities. Next, it will examine UAV employment in Kosovo, and analyze their effectiveness using operational factors as a tool. Finally, the paper will examine their losses, discuss potential roles in peace operations, and deduce lessons learned. Future operations will benefit from improved joint force integration and interoperability of UAVs.

DTIC

Pilotless Aircraft; Warfare; Drone Aircraft; Military Operations

20000112939 Army Vehicle Technology Center, Hampton, VA USA

Simulation of Aircraft Landing Gears with a Nonlinear Dynamic Finite Element Code

Lyle, Karen H., Army Vehicle Technology Center, USA; Jackson, Karen E., Army Vehicle Technology Center, USA; Fasanella, Edwin L., Army Vehicle Technology Center, USA; [2000]; 10p; In English; Modeling and Simulation Technologies, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4090; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Recent advances in computational speed have made aircraft and spacecraft crash simulations using an explicit, nonlinear, transient-dynamic, finite element analysis code more feasible. This paper describes the development of a simple landing gear model, which accurately simulates the energy absorbed by the gear without adding substantial complexity to the model. For a crash model, the landing gear response is approximated with a spring where the force applied to the fuselage is computed in a user-written subroutine. Helicopter crash simulations using this approach are compared with previously acquired experimental data from a full-scale crash test of a composite helicopter.

Author

Landing Gear; Finite Element Method; Crash Landing; Landing Simulation; Computerized Simulation

20000113825 Naval Research Lab., Washington, DC USA

DDG-51 FLT-IIA Airwake Study Part 3: Temperature Field Analysis for Baseline and Upgrade Configurations

Landsberg, Alexandria; Sandberg, William C.; Apr. 17, 2000; 31p; In English

Report No.(s): AD-A377019; NRL/MR/6401-00-8432; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The FAST3D flow solver was used to analyze the unsteady temperature field for a baseline configuration and a proposed upgrade configuration for the DDG-51 Flt-IIA destroyer. The upgrade configuration was proposed to reduce IR signature without

impacting other systems, particularly sensitive electronic equipment. The goal of this computational study was to analyze the Unsteady temperature field for the proposed upgrade configuration and identify areas of concern. Comparison are made to the current baseline configuration, since neither experimental nor full-scale data are available.
DTIC
Infrared Signatures; Wakes; Computerized Simulation; Computer Programs; Computational Fluid Dynamics; Unsteady Flow; Temperature Distribution

20000113921 Army Command and General Staff Coll., School of Advanced Military Studies, Fort Leavenworth, KS USA
The Physiological Impacts of Global Attack on Aircrew Performance
Christopherson, Patrick W.; Jan. 2000; 59p; In English
Report No.(s): AD-A374695; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Air Force's ability to execute global attack is critical. The Air Force markets global attack as a key contribution to the nations military effort. The execution of global attack, partly necessary because of the decline of total force structure and world-wide bases, has put substantial stress on the Air Force's airmen. This monograph analyzes the physiological impacts that global attack execution puts on airmen. Beginning with an introduction to the doctrine and history, the monograph explains the evolution of global attack doctrine and the history perspective it evolved from. Having outlined the history and theory, the monograph looks at the most recent and profound example of global attack, Operation Allied Force. The B-2 "Spirit" bomber missions from Missouri to Kosovo and back provide a unique opportunity to analyze the adverse physiological impacts on the airmen. A focus on aircrew performance related to stress, fatigue, sleep deprivation, and adjustments to work-sleep schedules indicate the level of preparation and reveal the challenges they encountered. The ultimate goal is to determine if aircrews are prepared for the physiological affects they encounter during the execution of global attack. Additionally, it provides insight into the ability to counter the adverse affects and makes the lessons exportable to future Air Force missions.
DTIC
Flight Crews; Stress (Physiology); Bomber Aircraft; Physiology; Fatigue (Biology)

20000114822 Association of the USA Army, Inst. of Land Warfare, Arlington, VA USA
Defense Report: RAH-66 Comanche Helicopter: Key to Future Army Warfighting
Apr. 1999; 3p; In English
Report No.(s): AD-A382443; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

DEFENSE REPORT is published by the Association of the USA Army's Institute of Land Warfare (ILW). The series is designed to provide information on topics that will stimulate professional discussion and further public understanding of the Army's role in national defense.
DTIC
Helicopters; Defense Program; Warfare

20000114842 NASA Ames Research Center, Moffett Field, CA USA
Improving Tiltrotor Whirl-Mode Stability with Rotor Design Variations
Acree, C. W., Jr., NASA Ames Research Center, USA; Peyran, R. J, Army Aviation Systems Command, USA; Johnson, Wayne, NASA Ames Research Center, USA; [2000]; 4p; In English; European Rotorcraft, 26-29 Sep. 2000, The Hague, Netherlands; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Further increases in tiltrotor speeds are limited by coupled wing/rotor whirl-mode aeroelastic instability. Increased power, thrust, and rotor efficiency are not enough: the whirl-mode stability boundary must also be improved. With current technology, very stiff, thick wings of limited aspect ratio are essential to meet the stability requirements, which severely limits cruise efficiency and maximum speed. Larger and more efficient tiltrotors will need longer and lighter wings, for which whirl-mode flutter is a serious design issue. Numerous approaches to improving the whirl-mode airspeed boundary have been investigated, including tailored stiffness wings, active stability augmentation, variable geometry rotors, highly swept tips, and at one extreme, folding rotors. The research reported herein began with the much simpler approach of adjusting the chordwise positions of the rotor blade aerodynamic center and center of gravity, effected by offsetting the airfoil quarter chord or structural mass with respect to the elastic axis. The research was recently extended to include variations in blade sweep, control system stiffness, and pitch-flap coupling (delta(sub 3)). As an introduction to the subject, and to establish a baseline against which to measure stability improvements, this report will first summarize results. The paper will then discuss more advanced studies of swept blades and control-system modifications.
Author
Boundaries; Rotation; Rotors; Stability; Stability Augmentation; Wings

20000114863 Southwest Research Inst., Dayton, OH USA

C-130 Flight Control Surfaces Depaint Process Optimization ***Final Report, 1 Sep. 1997 - 31 Dec. 1999***

Cundiff, Charles H.; Buckingham, Janet; Dec. 1999; 94p; In English

Contract(s)/Grant(s): F046006-95-D-0176

Report No.(s): AD-A382521; SWRI-01-8455-188; AFRL-ML-WP-TR-2000-4120; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Southwest Research Institute, acting on behalf of the Air Force Coating Technology Integration Office (CTIO), has conducted a test program of a plastic media blast (PMB) process proposed by Ogden Air Logistics Center (OO-ALC) for coatings removal on substrates consisting of spot welded, thin alloy materials. Specifically, the substrates under consideration for this assessment are C-130 flight control surfaces, and are fabricated with 0.016 inch, 2024-T3, clad aluminum.

DTIC

Flight Control; C-130 Aircraft; Coating; Control Surfaces; Paint Removal

20000114869 Southwest Research Inst., Dayton, OH USA

Large Aircraft Coatings Flight Testing ***Final Report, 1 Mar. 1997 - 29 Feb. 2000***

Wallace, Elah; Feb. 2000; 97p; In English

Contract(s)/Grant(s): F09603-95-D-0176-RZ03

Report No.(s): AD-A382563; SwRI-01-1886-528; AFRL-ML-WP-TR-2000-4118; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The reason for this project is to field-test systems that ”exceed” current Mil-Spec coating systems. All tested coatings comply with the 1998 National Emissions Standard for Hazardous Air Pollutants (NESHAP). This project provided a tool for ALCs to implement the best performing commercial ”off the shelf” (COTS) coating system available, utilizing the results of these KC-135 flights tests.

DTIC

Coatings; Flight Tests; C-135 Aircraft; Air Pollution

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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

20000109811 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

A Comparative Analysis of Cockpit Display Development Tools

Gebhardt, Matthew J.; Mar. 2000; 118p; In English

Report No.(s): AD-A381233; AFIT/GE/ENG/00M-10; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Currently, no standard methodology exists that enables cockpit display engineers to evaluate software tools used in the development of graphical cockpit displays. Furthermore, little research has been accomplished in comparing current software development tools with traditional hand-coded methods, This research effort discusses a framework for analyzing cockpit display software development tools and follows through with a detailed analysis comparing today’s hand-coding standard, OpenGL, with two of today’s cockpit display software development suites, Virtual Application Prototyping System (VAPS) and Display Editor. The comparison exploits the analysis framework establishing the advantages and disadvantages of the three software development suites. The analysis framework is comprised of several detailed questionnaires that enable the cockpit engineer to quantify important subjective criteria such as learning curve, user interface, readability, portability, extensibility, and maintenance. The questionnaires developed for each subjective criterion contain questions with weighted answers that enable the cockpit engineer to evaluate graphical software development tools, The questions were adapted from multiple sources including personal experience, display experts, pilots, navigators, case tool, and text sources. In addition, the comparative analysis evaluates several objective criteria with respect to development tools and the displays generated with them such as update rate, development time, executable size, and CPU/Memory usage level.

DTIC

Software Development Tools; Cockpits; Display Devices; Graphical User Interface

20000109850 Commerce Dept., Washington, DC USA

Technologic Papers of the Bureau of Standards. Number 237. Aeronautic Instruments

Hunt, Franklin L., Commerce Dept., USA; May 16, 2023; 66p; In English

Report No.(s): AD-A368673; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The purpose of this paper is to describe briefly the various types of aircraft instruments which have reached a state of development such that they have found extensive use in service. These are grouped in accordance with the outline given immediately below. A general description of representative instruments of the various types is given, which will be useful to a person who wishes to familiarize himself with the different instruments used on aircraft but is not interested in The mechanical details of their construction.

DTIC

Aircraft Instruments; Flight Instruments

20000110533 New Jersey Inst. of Tech., ECE Dept., Newark, NJ USA

On-Line and Off-Line Test of Airborne Digital Systems

Savir, Jacob, New Jersey Inst. of Tech., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 73; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This research deals with studying the effects of both on-line and off-line test during flight critical missions where safety is a major issue. The on-line test, in this context, is a test performed on a digital airborne system during some specified windows in time while it is still performing its intended task. An off-line test is a test that is performed on the digital system once it is taken off-line because of a suspected failure. Both the on-line and the off-line tests are performed during flight. The difference between the two is that the off-line test is more effective than an on-line test due to the Longer amount of time available for testing. Moreover. the off-line test may be designed to have diagnosis and repair capability built-in. Upon successful repair, the faulty processor may be reconfigured back into the system. This capability will undoubtedly increase the mission reliability.

Author

Digital Systems; On-Line Systems; Performance Tests; Airborne Equipment

20000110867 Civil Aeromedical Inst., Oklahoma City, OK USA

Impact of Aviation Highway-in-the-Sky Displays on Pilot Situation Awareness

Williams, Kevin W., Civil Aeromedical Inst., USA; October 2000; 20p; In English

Contract(s)/Grant(s): AM-A-00-HRR-519

Report No.(s): DOT/FAA/AM-00/31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thirty-six pilots were tested in a flight simulator on their ability to intercept a pathway depicted on a highway-in-the-sky (HITS) display. While intercepting and flying the pathway, pilots were required to watch for traffic outside the cockpit. Additionally, pilots were tested on their awareness of speed, altitude, and heading during the flight. Results indicated strong practice effects for a pilot's ability to intercept the pathway and that the presence of a flight guidance cue significantly improved performance. The ability to spot traffic was more affected by task difficulty than by display appeal. New display concepts ire needed for supporting secondary flight information present on the HITS display. Recommendations for training and use of HITS displays are given, along with recommendations for display enhancements to support situation awareness.

Derived from text

Display Devices; Flight Control; Aircraft Instruments; Flight Paths; Pilot Support Systems; Pilot Performance; Sensorimotor Performance; Flight Instruments; Aircraft Pilots

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.

20000110532 Old Dominion Univ., Dept. of Engineering Technology, Norfolk, VA USA
Numerical simulations of Mixing and Combustion in Scramjet Engines
Mohieldin, Taj O., Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 70; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The successful development of the supersonic combustion ramjet(scramjet) for use on future hypersonic vehicles is reliant on detailed understanding of the complex flowfields present in different regions of the system over a range of operating conditions. Constraints on system size and weight have led to the need of improving the technology for analyzing and designing such system. Considerable experimental and numerical research in the USA and abroad, have been conducted in the past thirty years to analyze and design various systems of hypersonic vehicles. Because of constraints on system size and weight, a strong motivation exists to improve combustion systems. Significant amount of experimental and numerical research have been developed towards designing lighter weight and shorter supersonic combustors. For the actual scramjet engine, at high fuel equivalence ratios, the combustor may be operating in the dual-mode regime (with mixed subsonic and supersonic flow). In fact all airbreathing scramjet propulsion systems must pass through this mode of transition, whether accelerating to a hypersonic cruise condition or on a trajectory into orbit. In the dual-mode regime, a shock train is located downstream of the fuel injection locations to provide the pressure rise required by the combustion heat release. At lower Mach numbers, or higher fuel equivalence ratios, this shock train moves upstream and interacts with the fuel injectors to alter the rate of fuel/air mixing. Because of the mixed subsonic/supersonic nature of the flow, it is very difficult to predict the mixing and combustion in this regime using Computational Fluid Dynamics (CFD). This is due to the large region of separated flow downstream of the shock train and the unsteadiness associated with the shock train. The objectives of the proposed research are to investigate and accurately model the mixing and combustion/ignition characteristics in supersonic and dual mode combustion flowfields in Scramjet engine.
Derived from text
Supersonic Combustion Ramjet Engines; Computerized Simulation; Air Breathing Engines; Numerical Analysis; Computational Fluid Dynamics; Multiphase Flow

20000110568 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 survey report / R and D of important region technology. R and D of technologies giving multi-functional characteristics to C/C composites, 1, control technology of micro structures of ultra- high temperature members
Mar. 31, 1998; 316p; In Japanese; In English
Report No.(s): DE99-736798; ETDE/JP-99736798; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

For the purpose of developing members most suitable for aircraft use engines with methane as fuel, the R and D were conducted of technology to reform surfaces and interfaces of materials. In the R and D, the paper took up carbon fiber reinforced carbon composite materials (C/C composites). In the surface control and reformation technology using the ion engineering method, etc., in the sealing processing of C/C composites, tried was the formation of a C/SiC/Si3N4 composite layer which was formed by Si3N4 much smaller in thermal expansion coefficient than SiC. Further, technologies on ion injection, thin film formation, giving of oxidation resistance/corrosion resistance, improving/giving of thermal shock resistance, etc. In the multi-functional coating formation technology such as high liability and corrosion resistance, the study was carried out of the dense composite functionally-gradient layer as thermal stress relaxation layer and the fiber reinforced layer by carbon fiber using pores. Besides, studies were made of technologies of the micro structure control combination, evaluation of ultra-high temperature resistant environmental characteristics, etc.
NTIS
Carbon-Carbon Composites; Fiber Composites

20000112945 California Univ., Dept. of Engineering, Berkeley, CA USA
Ensemble Diffraction Measurements of Spray Combustion in a Novel Vitiated Coflow Turbulent Jet Flame Burner *Final Report*
Cabra, R., California Univ., USA; Hamano, Y., California Univ., USA; Chen, J. Y., California Univ., USA; Dibble, R. W., California Univ., USA; Acosta, F., Process Metrix, LLC, USA; Holve, D., Process Metrix, LLC, USA; October 2000; 47p; In English,

13-14 Mar. 2000, Golden, CO, USA; Sponsored by Combustion Inst., USA; Original contains color illustrations
Contract(s)/Grant(s): NAG3-2103; RTOP 523-90-13
Report No.(s): NASA/CR-2000-210466; E-12462; NAS 1.26:210466; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental investigation is presented of a novel vitiated coflow spray flame burner. The vitiated coflow emulates the recirculation region of most combustors, such as gas turbines or furnaces; additionally, since the vitiated gases are coflowing, the burner allows exploration of the chemistry of recirculation without the corresponding fluid mechanics of recirculation. As such, this burner allows for chemical kinetic model development without obscurations caused by fluid mechanics. The burner consists of a central fuel jet (droplet or gaseous) surrounded by the oxygen rich combustion products of a lean premixed flame that is stabilized on a perforated, brass plate. The design presented allows for the reacting coflow to span a large range of temperatures and oxygen concentrations. Several experiments measuring the relationships between mixture stoichiometry and flame temperature are used to map out the operating ranges of the coflow burner. These include temperatures as low 300 C to stoichiometric and oxygen concentrations from 18 percent to zero. This is achieved by stabilizing hydrogen-air premixed flames on a perforated plate. Furthermore, all of the CO2 generated is from the jet combustion. Thus, a probe sample of NO(sub X) and CO2 yields uniquely an emission index, as is commonly done in gas turbine engine exhaust research. The ability to adjust the oxygen content of the coflow allows us to steadily increase the coflow temperature surrounding the jet. At some temperature, the jet ignites far downstream from the injector tube. Further increases in the coflow temperature results in autoignition occurring closer to the nozzle. Examples are given of methane jetting into a coflow that is lean, stoichiometric, and even rich. Furthermore, an air jet with a rich coflow produced a normal looking flame that is actually 'inverted' (air on the inside, surrounded by fuel). In the special case of spray injection, we demonstrate the efficacy of this novel burner with a methanol spray in a vitiated coflow. As a proof of concept, an ensemble light diffraction (ELD) optical instrument was used to conduct preliminary measurements of droplet size distribution and liquid volume fraction.
Author
Burners; Drop Size; Premixed Flames; Flashback; Combustion

20000114817 Cornell Univ., Dept. of Mathematics, Ithaca, NY USA
Computation Tools for Analysis of Reduced-Order Models for Aeroengine Instabilities ***Final Report, 1 Mar. 1997 - 30 Nov. 1999***
Guckenheimer, J.; Nov. 30, 1999; 12p; In English
Contract(s)/Grant(s): F49620-97-1-0135
Report No.(s): AD-A382351; AFRL-SR-BL-TR-00-0437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives of this project were to develop improved algorithms for analyzing the dynamics of nonlinear systems arising in the study of aeroengines. The emphasis was upon algorithms to compute periodic orbits. A close working relationship was established with United Technologies Research Corporation regarding aerodynamic, aeroelastic and thermoacoustic instabilities of engine components.
DTIC
Computational Fluid Dynamics; Finite Difference Theory; Nonlinear Systems; Hydrodynamics

08
AIRCRAFT STABILITY AND CONTROL

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

20000109829 NASA Langley Research Center, Hampton, VA USA
Multidisciplinary Techniques and Novel Aircraft Control Systems
Padula, Sharon L., NASA Langley Research Center, USA; Rogers, James L., NASA Langley Research Center, USA; Raney, David L., NASA Langley Research Center, USA; [2000]; 16p; In English; 8th; Multidisciplinary Analysis and Optimization, 6-8 Sep. 2000, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-4848; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Aircraft Morphing Program at NASA Langley Research Center explores opportunities to improve airframe designs with smart technologies. Two elements of this basic research program are multidisciplinary design optimization (MDO) and advanced flow control. This paper describes examples where MDO techniques such as sensitivity analysis, automatic differentiation, and genetic algorithms contribute to the design of novel control systems. In the test case, the design and use of distributed shape-change

devices to provide low-rate maneuvering capability for a tailless aircraft is considered. The ability of MDO to add value to control system development is illustrated using results from several years of research funded by the Aircraft Morphing Program.
Author
Airframes; Multidisciplinary Design Optimization; Control Systems Design; Aircraft Control

20000109866 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA
Development of a Design Methodology for Reconfigurable Flight Control Systems
Hess, Ronald A., California Univ., USA; McLean, C., California Univ., USA; [2000]; 14p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC1-345
Report No.(s): AIAA Paper 2000-0890; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A methodology is presented for the design of flight control systems that exhibit stability and performance-robustness in the presence of actuator failures. The design is based upon two elements. The first element consists of a control law that will ensure at least stability in the presence of a class of actuator failures. This law is created by inner-loop, reduced-order, linear dynamic inversion, and outer-loop compensation based upon Quantitative Feedback Theory. The second element consists of adaptive compensators obtained from simple and approximate time-domain identification of the dynamics of the 'effective vehicle' with failed actuator(s). An example involving the lateral-directional control of a fighter aircraft is employed both to introduce the proposed methodology and to demonstrate its effectiveness and limitations.
Author
Control Systems Design; Flight Control; Actuators; Compensators; Computerized Simulation

20000109867 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA
A Reconfiguration Scheme for Accommodating Actuator Failures in Multi-Input, Multi-Output Flight Control Systems
Siwakosit, W., California Univ., USA; Hess, R. A., California Univ., USA; [2000]; 20p; In English; Guidance, Navigation and Control, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-3942; A00-37004; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multi-input, multi-output reconfigurable flight control system design utilizing a robust controller and an adaptive filter is presented. The robust control design consists of a reduced-order, linear dynamic inversion controller with an outer-loop compensation matrix derived from Quantitative Feedback Theory (QFT). A principle feature of the scheme is placement of the adaptive filter in series with the QFT compensator thus exploiting the inherent robustness of the nominal flight control system in the presence of plant uncertainties. An example of the scheme is presented in a pilot-in-the-loop computer simulation using a simplified model of the lateral-directional dynamics of the NASA F18 High Angle of Attack Research Vehicle (HARV) that included nonlinear anti-wind up logic and actuator limitations. Prediction of handling qualities and pilot-induced oscillation tendencies in the presence of these nonlinearities is included in the example.
Author
Flight Control; Control Systems Design; Computerized Simulation

20000110542 Binghamton Univ., Dept. of Electrical Engineering, Binghamton, NY USA
Utility of SURE and ASSIST in Reconfigurable Flight Control Systems
Wu, N. Eva, Binghamton Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 82; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This summarizes the findings of my study this summer on the applicability of software tools SURE (WinSURE) and ASSIST developed here at NASA Langley to the reliability assessment of reconfigurable flight control systems. The full names of SURE and ASSIST are Semi-markov Unreliability Range Evaluator, and Abstract Semi-markov Specification Interface to the Sure Tool. The purpose of the study is to investigate the potential utility of the software tools in the ongoing effort of the aviation safety program, where the class of systems must be extended beyond the originally intended serving class of electronic digital processors. The first phase of the study is focused on the properties of the reliability models peculiar to reconfigurable flight control systems. These include larger building blocks with no spares and no repairs due to weight and cost constraints; present of both hardware and analytic redundancies; control performance dependent failures; high risks in reconfiguration decisions due to multiple sources of uncertainties. As a consequence, coverage of failures through redundancy management is low in comparison with systems consisting of digital processors only. The second phase of the study is focused on obtaining a semi-Markov model of an existing flight control system. An analysis is performed on the model to identify the key limiting factors for achieving a high reliability in the current reconfigurable flight control systems. Model simplifications are pursued along two different avenues to allow possible

on-line and more efficient off-line reliability evaluation. Error bounds are provided for these simplifications to better inform the users of the simplified reliability formulae. This study concludes that SURE and ASSIST are efficient and elaborate tools for reliability assessment of reconfigurable flight control systems with high reliability requirements. Currently however, other aspects of development in such systems are more urgently needed before one can effectively take advantage of these valuable tools.
Author
Flight Control; Reliability Analysis; Software Development Tools; Systems Analysis

20000113401 NASA Langley Research Center, Hampton, VA USA
Reconfigurable Flight Control Using Nonlinear Dynamic Inversion with a Special Accelerometer Implementation
Bacon, Barton J., NASA Langley Research Center, USA; Ostroff, Aaron J., NASA Langley Research Center, USA; [2000]; 15p; In English; Guidance, Navigation and Control, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-4565; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents an approach to on-line control design for aircraft that have suffered either actuator failure, missing effector surfaces, surface damage, or any combination. The approach is based on a modified version of nonlinear dynamic inversion. The approach does not require a model of the baseline vehicle (effectors at zero deflection), but does require feedback of accelerations and effector positions. Implementation issues are addressed and the method is demonstrated on an advanced tailless aircraft. An experimental simulation analysis tool is used to directly evaluate the nonlinear system's stability robustness.
Author
Accelerometers; Flight Control; Nonlinear Systems; Control Systems Design; Computerized Simulation; Dynamic Models

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).

20000109901 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Performance Study of a Free-Piston Shock Tunnel Driver Section
Mizoguchi, Makoto, Kyushu Univ., Japan; Fukami, Tomoya, Kyushu Univ., Japan; Aso, Shigeru, Kyushu Univ., Japan; Toshimitsu, Kazuhiko, Kyushu Univ., Japan; Technology Reports of Kyushu University; September 2000; ISSN 0023-2718; Volume 73, No. 5, pp. 593-598; In Japanese; Copyright; Avail: Issuing Activity

ln the present study performance of driver section of a free-piston shock tunnel is investigated, which is newly installed in our laboratory for high enthalpy flow study. Characteristics of compression tube are calculated under isentropic assumption, The calculated results agree not well with experimental results. So, the effective pressure of high pressure tube is considered to modify the calculated results. The modified results show good agreements with experiments. Furthermore, the measurements of shock Mach number and stagnation pressure in low pressure tube are conducted. The relationship between shock Mach number and pressure ratio is obtained in the experiments. The results show that experimental Mach number is lower than theory. While, the relationship between stagnation pressure ratio at the low pressure tube end and incident shock Mach number is obtained, The experimental results approximately agree with theoretical results. For the above results, the performance and operating condition of this facility is estimated.
Author
Enthalpy; Shock Waves; Piston Engines; Shock Tunnels

20000110030 Defence Science and Technology Organisation, Air Operations Div., Melbourne, Australia
Stress Analysis of a Tuner for an Electromagnetic Reverberation Chamber
Weeks, Frank, Defence Science and Technology Organisation, Australia; February 2000; 64p; In English
Report No.(s): DSTO-TN-0272; DODA-AR-011-423; Copyright; Avail: Issuing Activity

Structural analyses of a tuner for a large electromagnetic reverberation chamber are presented in this note. The analyses cover drive motor, highly stressed welds of the paddle assembly, torque in drive shafts, and weld fatigue life. The analyses have been

conducted for normal operating conditions as well as for a variety of possible overload conditions. Recommendations for minor modifications are made, including the installation of a safety collar.
Author
Stress Analysis; Tuners; Reverberation Chambers; Fatigue Life; Electromagnetism

20000110230 Defence Science and Technology Organisation, Air Operations Div., Melbourne, Australia
A Feasibility Study Into Increasing the Rotational Speed of the Tuner in the DSTO Electromagnetic Reverberation Chamber
Weeks, Frank, Defence Science and Technology Organisation, Australia; Philp, Grant, Defence Science and Technology Organisation, Australia; February 2000; 20p; In English
Report No.(s): DSTO-TN-0273; DODA-AR-011-424; Copyright; Avail: Issuing Activity

This note presents a feasibility study into reducing the test time in the Defense Science and Technology Organization (DSTO) Electromagnetic Reverberation chamber by increasing the rotational speed of the tuner. The analyses cover the tuner's structural integrity, the drive motor capacity, and whether the drive motor software can be modified to accommodate the increased speed.
Author
Research and Development; Testing Time; Tuners; Reverberation Chambers

20000110525 Christopher Newport Univ., Dept. of Physics, Computer Science and Engineering, Newport News, VA USA
Analysis of wind tunnel Temperature Profiles
Hereford, James, Christopher Newport Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 63; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The goal of this research was to analyze the temperature profiles on an internal balance during an actual test at the National Transonic Facility (NTF). We have previously looked at several temperature cycles from the Model Prep Area (MPA) as well as temperature cycles from the laboratory. The MPA and lab temperature cycles have the characteristic that there is no aerodynamic load on the balance so any change in output must be due to the thermal profile. However, there has not been a study that investigates whether these temperature cycles approximate the actual temperature conditions in the test area of NTF. This research project examined data from two tests at the NTF. The analysis was both qualitative and quantitative. The qualitative analysis highlighted the followed characteristics about the temperature profiles: (a) there is a rear (warm) to front (cold) gradient on the balance during tunnel tests; (b) there is a bottom-to-top gradient; (c) the sensors tend to get warmer (rather than cooler) during the runs; (d) the nine temperature measurements do not converge to a particular value but instead tend to stay ”parallel”. The quantitative analysis tried to characterize the impact of the thermal gradients on the overall accuracy of the data. to do that, we had to use data from the MPA (or the lab) since we do not know axial force (AF) output due to thermal gradients for the tunnel data. For the MPA and lab data, we assumed that all variation in AF output is due to temperature. For the quantitative analysis, we defined two gradient vectors: (TF-TR) and (T4+T7-T5T6). (Note: we also considered two gradient vectors that were derived using the KarhunenLoeve transformation but those vectors did not have any physical significance so they were not used to determine accuracy,) From the MPA data, we derived an equation that gives the error in the AF measurement as a function of the two gradient vectors. We then measured the thermal gradients present in the tunnel test section and computed AF error. The result is that the AF error due to uncompensated thermal gradients is not large. For one data set the error is 0.360 lbs (.09% of full scale) and for the other data set it is 0.137 lbs (.034% of full scale). Another aspect of this research is to apply the temperature gradients that occur in the tunnel on a balance under controlled conditions in the lab. Progress was made this summer on the data acquisition system to measure temperature and strain from a special-purpose research balance.
Author
Temperature Profiles; Wind Tunnel Tests; Transonic Wind Tunnels; Aerodynamic Balance

20000110534 Old Dominion Univ., Dept. of Mechanical Engineering, Norfolk, VA USA
Review of Implementation Plans for NASA LaRC's Wind - Tunnel University
Selby, Gregory V., Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 74; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The NASA LaRC Wind-Tunnel University (WTU) initiative has the following objectives, as interpreted by the present author: 1) to serve as a ”learning center” for NASA and non-NASA engineering managers, engineers, and technicians to acquire and sustain basic and advanced skills relevant to the management and operation of wind tunnels and design and execution of wind-tunnel experiments, including acquisition, analysis, and presentation/publication of wind tunnel data; a) to combine education

(broad-based) and training (in-depth, narrow-focused) strategies as appropriate to the skills/knowledge being imparted; b) to prepare participants to operate in the wind-tunnel environment expected to exist in the near future; and 2) to serve as a ”resource center” for ”best practices” in wind-tunnel skills/knowledge with resource persons drawn principally from the NASA LaRC community, but with participation also from the university and industrial communities.
Derived from text
Wind Tunnel Tests; Education

20000114865 Southwest Research Inst., Dayton, OH USA
Automated Surface Processing of Large Aircraft ***Final Report, 1 Jun. 1999 - 30 Jun. 2000***
Rafferty, William J.; Jun. 2000; 78p; In English
Contract(s)/Grant(s): F42620-96-D-0042
Report No.(s): AD-A382538; AFRL-ML-WP-TR-2000-4121; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Southwest Research Institute, acting on behalf of the Air Force Coating Technology Integration Office (CTIO), has conducted a technology review program to identify new systems for the surface processing of large aircraft. The project was to develop a simple, low cost paint stripping system concept to reduce depot flow time, reduce ALC personnel exposure to the extremely hazardous work environment, and reduce man-hours and lost time due to injuries.
DTIC
Aircraft Maintenance; Technology Assessment; Surface Finishing; Coating

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.

20000109794 NASA Langley Research Center, Hampton, VA USA
Sample Returns Missions in the Coming Decade
Desai, Prasun N., NASA Langley Research Center, USA; Mitcheltree, Robert A., NASA Langley Research Center, USA; Cheatwood, F. McNeil, NASA Langley Research Center, USA; [2000]; 14p; In English; 51st; International Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; Sponsored by International Astronautical Federation, France
Report No.(s): IAF Paper 00-Q.204; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the coming decade, several missions will attempt to return samples to Earth from varying parts of the solar system. These samples will provide invaluable insight into the conditions present during the early formation of the solar system, and possibly give clues to how life began on Earth. A description of five sample return missions is presented (Stardust, Genesis, Muses-C. Mars Sample Return, and Comet Nucleus Sample Return). An overview of each sample return mission is given, concentrating particularly on the technical challenges posed during the Earth entry, descent, and landing phase of the missions. Each mission faces unique challenges in the design of an Earth entry capsule. The design of the entry capsule must address the aerodynamic, heating, deceleration, landing, and recovery requirements for the safe return of samples to Earth.
Author
Mission Planning; Mars Sample Return Missions; Stardust Mission; Genesis Mission; Asteroid Missions

20000110139 NASA Johnson Space Center, Houston, TX USA
The Role of Lunar Development in Human Exploration of the Solar System
Mendell, Wendell W., NASA Johnson Space Center, USA; [1999]; 1p; In English; Space Frontier, 24-26 Sep. 1999, Los Angeles, CA, USA
Contract(s)/Grant(s): RTOP 344-31-00-05; No Copyright; Avail: Issuing Activity; Abstract Only

Human exploration of the solar system can be said to have begun with the Apollo landings on the Moon. The Apollo Project was publicly funded with the narrow technical objective of landing human beings on the Moon. The transportation and life support systems were specialized technical designs, developed in a project management environment tailored to that objective. Most scenarios for future human exploration assume a similar long-term commitment of public funds to a narrowly focused project managed by a large, monolithic organization. Advocates of human exploration of space have not yet been successful in generating the political momentum required to initiate such a project to go to the Moon or to Mars. Alternative scenarios of exploration may

relax some or all of the parameters of organizational complexity, great expense, narrow technical focus, required public funding, and control by a single organization. Development of the Moon using private investment is quite possibly a necessary condition for alternative scenarios to succeed.
Author
Lunar Exploration; Moon; Solar System; Mars (Planet)

20000110310 European Space Agency. European Space Research and Technology Center, ESTEC, Space Science Dept., Noordwijk, Netherlands
Mars Express: Overview and Scientific Investigations
Chicarro, A. F., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The European Space Agency and the scientific community have performed concept and feasibility studies for the last ten years on potential future ESA missions to the red planet (Marsnet, Intermarsnet), focusing on a network of surface stations complemented by an orbiter. The ESA Mars Express mission in-cludes an orbiter spacecraft and a small lander module. The mission, to be launched in 2003 by a Soyuz rocket, will recover some of the lost scientific objec-tives of both the Mars-96 mission and the Intermars-net study, following the recommendations of the Inter-national Mars Exploration Working Group (IMEWG) after the failure of Mars-96, and also the endorsement of ESA's Advisory Bodies that Mars Express be included in the Science Programme of the Agency. Additional information is contained in the original extended abstract.
Author
Atmospheric Circulation; Atmospheric Composition; Exobiology; Feasibility; Geochemistry; Geology; Impact Velocity; Mars Atmosphere; Solar Radiation

20000110373 Colorado Univ., Lab. for Atmospheric and Space Physics, Boulder, CO USA
Why Mars? Exploring Mars and the Nature of Human Civilization
Jakosky, V, Colorado Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Astronomy in general, and planetary science and Mars exploration in particular, are fields of study that have relatively few practical applications. There certainly are ways in which these fields can provide relevant and practical information, including finding near-Earth objects to help protect the Earth, studying the martian atmosphere as an analog to understanding terrestrial climate, or doing comparative planetology that will help us to understand the geology of the Earth and its history. However, it is clear that these issues are not the ones driving exploration of the solar system. The fact that there is such tremendous support for these programs by NASA, the government, and especially the public suggests that other factors are at play. In particular, it seems likely that the driving factor is the exploration value of the space program. Our society appears to derive substantial satisfaction from trying to understand their origins. This includes the origin of the universe, the origins of stars and planets, the origin(s) of life, and the evolution of each of these. In addition, we can look at the nature of science to better understand the issue of exploration. It is clear that the science that each of us is doing will be obsolete relatively quickly (some more quickly than others, perhaps). That is, studying Mars or any of these other areas involves continually obtaining a deeper and deeper understanding that supersedes previous knowledge. Within only a decade or less in some cases, our work will have been replaced. Even most of the greatest scientific achievements of the past have been superseded. This suggests that it is the scientific process that is most important, rather than any particular collection of scientific facts. These two issues combine to help us understand the nature of science and its relation to society at large. The fact that we as a society are trying to understand the world around us, and the fact that it is the process that seems important rather than the derived facts themselves, again indicates the importance of exploration in our society. Through this exploration, we are trying to understand what the uni-verse contains and how we interact with it. In essence, we are trying to understand our "place" in the universe and, through this, what it means to be human. There certainly are fields of science for which this is not correct, such as finding a cure for cancer or developing an understanding of greenhouse warming. However, the fields of pure science are to some extent separate from the applied sciences. Although one can argue that some basic research will have application and will dramatically change our world, and that we cannot predict ahead of time in which fields this will occur, this is somewhat misleading. Certainly, we are not exploring Mars with the hope of finding some practical application. Even those for whom Mars represents a place to go for resources or to allow humans to expand into the universe, the driver appears to be the exploration of the unknown, the moving out into the universe. The bottom line is that exploring Mars, and in broader context exploring the solar system and the rest of the universe, is a part of the picture of understanding our relationship to that universe. These activities take their place along with, for example, exploring the nature of the atom, exploring the oceans, moving

into near-Earth space, and even exploring the arts and humanities; each of these is an activity pushes back the limits of humanity in some way, and thereby helps to define the meaning of being human.
Derived from text
Atmospheric Heating; Climate; Earth Atmosphere; Greenhouse Effect; Planetology; Planets; Research; Solar System

20000110405 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Next Decade of Mars Exploration
McCleese, D. J., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Following a 20-year hiatus in missions to Mars, the planet has again become a focus of planetary research for space-faring nations. NASA and space agencies worldwide are returning to Mars with scientific research and public engagement sharing top priority. Collectively, the work to be performed within a decade will address much of the research associated with planetary evolution, past and present climates, and astrobiology. NASA's science goals are centered on the study of potential habitats - past and present environments that may have been suitable for the origin of life. These goals are approached through in situ measurements and through sample return. CNES has teamed with NASA to return samples, while also extending the research base by adding geophysical measurements via a network of landers. ASI has joined NASA and CNES by providing a drill to access the near subsurface. ESA will fly an orbiter and, potentially, a lander to Mars with the goal of addressing mineralogy, geochemistry, geology, and biology. ISAS will study the planet's aeronomy using an orbiter. Many other nations are contributors to these programs of exploration. The desire for national participation, presence on the Martian surface and, most importantly, samples to analyze motivate all nations involved. So important is public engagement that NASA and CNES will launch a network of communication satellites to improve public participation and enhance scientific data return. Further, NASA is currently preparing a Mars airplane that will undoubtedly engage the public's imagination. Additional research investigations will be sought; particularly those able to utilize small spacecraft on and above the surface. A recently announced NASA/CNES series of MicroMissions offers a means of pursuing discoveries, scouting potential landing sites for sample return, and further broadening the scope of scientific research. The timing for these opportunities will be presented.
Author
Biological Evolution; Climate; Exobiology; Geochemistry; Geophysics; Mars (Planet); Mars Exploration; Mars Surface; Mineralogy

20000112917 NASA Johnson Space Center, Houston, TX USA
Man-Made Debris In and From Lunar Orbit
Johnson, Nicholas L., NASA Johnson Space Center, USA; [1999]; 1p; In English; 50th; 50th International Astronautical Congress Meeting, 4-8 Oct. 1999, Amsterdam, Holland, Netherlands
Contract(s)/Grant(s): RTOP 478-80
Report No.(s): IAA-99-IAA.7.1.03; No Copyright; Avail: Issuing Activity; Abstract Only

During 1966-1976, as part of the first phase of lunar exploration, 29 manned and robotic missions placed more than 40 objects into lunar orbit. Whereas several vehicles later successfully landed on the Moon and/or returned to Earth, others were either abandoned in orbit or intentionally sent to their destruction on the lunar surface. The former now constitute a small population of lunar orbital debris; the latter, including four Lunar Orbiters and four Lunar Module ascent stages, have contributed to nearly 50 lunar sites of man's refuse. Other lunar satellites are known or suspected of having fallen from orbit. Unlike Earth satellite orbital decays and deorbits, lunar satellites impact the lunar surface unscathed by atmospheric burning or melting. Fragmentations of lunar satellites, which would produce clouds of numerous orbital debris, have not yet been detected. The return to lunar orbit in the 1990's by the Hagoromo, Hiten, Clementine, and Lunar Prospector spacecraft and plans for increased lunar exploration early in the 21st century, raise questions of how best to minimize and to dispose of lunar orbital debris. Some of the lessons learned from more than 40 years of Earth orbit exploitation can be applied to the lunar orbital environment. For the near-term, perhaps the most important of these is postmission passivation. Unique solutions, e.g., lunar equatorial dumps, may also prove attractive. However, as with Earth satellites, debris mitigation measures are most effectively adopted early in the concept and design phase, and prevention is less costly than remediation.
Author
Debris; Disposal; Fragmentation; Lunar Prospector; Lunar Satellites; Lunar Surface; Manned Space Flight; Moon; Populations; Space Debris

20000113403 NASA Goddard Space Flight Center, Greenbelt, MD USA

Cosmic Journeys: to the Edge of Gravity, Space, and Time ...

Wanjek, Christopher, NASA Goddard Space Flight Center, USA; [2000]; 24p; In English; Original contains color illustrations
Report No.(s): NASA/NP-2000-5-047-GSFC; NAS 1.835-047-GSFC; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We are embarking upon a cosmic journey. From the safety of our home planet Earth, scientists plan to explore the very limits of the known Universe. Our travels will take us to where space and time cease to exist as we know them, and to where the secrets of the past and future lie captured in the starlight of the present across an expanse of billions of light-years. Cosmic Journeys, a new series of NASA space science missions, will take us to the limits of gravity, space, and time. This virtual journey will use the power of resolution far greater than what current telescopes can muster to transport us to the rim of a black hole, to eagle-eye views of the galaxies and voids that pervade the Universe, and to the earliest moments of time, just fractions of a second after the Big Bang. The goal of our Cosmic Journeys is to solve the mystery of gravity, a force that is all around us but cannot be seen. Derived from text

Gravitation; NASA Space Programs; Space Missions; Big Bang Cosmology

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

20000110476 Centre d'Etude Spatiale des Rayonnements, Toulouse, France

EXOCAM: A "Chamber" to Simulate Oxido-Reduction Properties of the Mars Surface Layer

Toublanc, D., Centre d'Etude Spatiale des Rayonnements, France; Chassefiere, E., Centre d'Etude Spatiale des Rayonnements, France; Brack, A., Centre d'Etude Spatiale des Rayonnements, France; Cabane, M., Centre d'Etude Spatiale des Rayonnements, France; Carlier, P., Centre d'Etude Spatiale des Rayonnements, France; Ingrin, J., Centre d'Etude Spatiale des Rayonnements, France; Jacotin, A., Centre d'Etude Spatiale des Rayonnements, France; Lebonnois, S., Centre d'Etude Spatiale des Rayonnements, France; Millan, P., Centre d'Etude Spatiale des Rayonnements, France; Pinet, P., Centre d'Etude Spatiale des Rayonnements, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

EXOCAM is a one meter cube chamber devoted to exobiology. Since hydrogen peroxide is produced by photochemical processes in the atmosphere of Mars, it is a likely candidate for a martian soil oxidant. We would like to understand how H2O2 diffuses into the soil and how its concentration is determined by the extent to which it is adsorbed and by the rate at which it is catalytically destroyed. We will try to reproduce first a sample of martian soil to investigate the depth H2O2 can diffuse. We will cycle the chamber's temperature according to the diurnal temperature cycle of the surface of Mars. If there are depths below which H2O2 is not transported, it is plausible that organic compounds, protected from a oxidizing environment, may still exist. We will focus in this talk on the apparatus and the possibilities of such a chamber.
Author

Adsorption; Catalytic Activity; Exobiology; Organic Compounds; Oxidation; Oxidizers; Surface Layers

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.

20000109830 NASA Marshall Space Flight Center, Huntsville, AL USA

X-33 and RLV for the Future

Bland, Jeffery D., NASA Marshall Space Flight Center, USA; [2000]; 17p; In English; Military Space, 14 Sep. 2000, London, UK; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A viewgraph presentation outlines the design and testing of the single stage to orbit vehicle, the X-33. The history and objectives of the program to build the X-33 are discussed, as well as the specifications for the spacecraft. Flight test results are given and future plans for a spaceport are discussed.
CASI
X-33 Reusable Launch Vehicle; Single Stage to Orbit Vehicles; Functional Design Specifications

20000110575 NASA Johnson Space Center, Houston, TX USA
STS-92 Flight Day Highlights and Crew Activities: Day 9
Oct. 20, 2000; In English; Videotape: 21 min., 44 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000157382; BRF 1424I; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

On this ninth day of the STS-92 mission, the flight crew, Commander Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur participate in an audio interview while scenes are shown of the International Space Station (ISS) and the Earth.
CASI
International Space Station; Discovery (Orbiter); Service Module (Iss); Unity Connecting Module; Zarya Control Module

20000110586 NASA Marshall Space Flight Center, Huntsville, AL USA
X-33 Program Status
Dill, Charlie C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Space 2000, 19-21 Sep. 2000, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The presentation briefly presents the current status of the program. The program's objectives and near term plans are stated. A brief description of the vehicle configuration, the technologies to be demonstrated and the missions to be flown are presented. Finally, a status of the vehicle assembly, the launch control center development and the significant test programs' accomplishments are presented.
Author
X-33 Reusable Launch Vehicle; Aerodynamic Configurations

20000111087 NASA Johnson Space Center, Houston, TX USA
Simulated Shuttle Egress: Comparison of Two Space Shuttle Protective Garments
Lee, Stuart M.C., Wyle Labs., Inc., USA; Bishop, Phillip A., Alabama Univ., USA; Schneider, Suzanne M., NASA Johnson Space Center, USA; Greenisen, Michael C., NASA Johnson Space Center, USA; [2000]; 3p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In a previous study from our laboratory, we observed carbon dioxide (CO2) accumulation in the helmet of the NASA Launch and Entry Suit (LES) during a simulated emergency egress from the Space Shuttle. Eight of 12 subjects were unable to complete the egress simulation with a G-suit inflation pressure of 1.5 psi. The purpose of this report was to compare CO2 accumulation and egress walking time in the new Advanced Crew Escape Suit (ACES) with that in the LES.
Author
Accumulations; Carbon Dioxide; Helmets; Space Suits

20000112950 NASA Johnson Space Center, Houston, TX USA
STS-92 Crew Interview/W. McArthur
Sep. 14, 2000; In English; Videotape: 55 min. 31 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000138906; JSC-1810 D; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

The STS-92 Mission Specialist William S. McArthur is seen being interviewed. He answers questions about his inspiration to become an astronaut and gives details on the mission, including overviews of the Z1 truss, the third pressurized meeting adapter (PMA-3), and his spacewalks. He shares his thoughts on the international collaboration of space exploration, the contributions of the Russians, the role of STS-92 in preparing the International Space Station (ISS) for its first resident crew, and the importance of the ISS and the Space Shuttle in the future.
CASI
International Space Station; Astronauts; Prelaunch Summaries

20000112965 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-43 IUS Lift to Workstand at the VPF
Apr. 29, 1991; In English; Videotape: 9 min., 13 sec. playing time, in color, without sound
Report No.(s): NONP-NASA-VT-2000148072; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Footage filmed at the Vertical Processing Facility (VPF) shows the inertial upper stage (IUS) being lifted to the workstand.
CASI
Inertial Upper Stage; Space Transportation System

20000112966 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-46 TCDT Slideware Training and Photo Session
Jun. 15, 1992; In English; Videotape: 22 min., 26 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000148079; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
The crew of STS-46, Commander Loren J. Shriver, Pilot Andrew M. Allen, Payload Specialist Franco Malerba, Mission Specialists Jeffrey A. Hoffman, Franklin R. Chang-Diaz, Claude Nicollier, and Marsha S. Ivins are seen introducing themselves and discussing the mission during a photo session. The crew then answers questions from the press.
CASI
Atlantis (Orbiter); Prelaunch Summaries; Crew Procedures (Preflight)

20000112967 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-47 Mission Overview
Aug. 10, 1992; In English; Videotape: 42 min., 18 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000152239; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Flight Director Milt Heflin gives an overview of the goals of the Space Shuttle Endeavour. He describes the crew, the role of the orbiter, the planned experiments, and the timeline of activities on board. Mission Manager Aubray King introduces the Spacelab-J mission. He discusses the planned experiments and Japanese involvement in development. Heflin and King then take questions from the press.
CASI
Endeavour (Orbiter); Spacelab; Prelaunch Summaries; Spaceborne Experiments

20000113826 NASA Marshall Space Flight Center, Huntsville, AL USA
Space Shuttle Projects Overview to Columbia Air Forces War College
Singer, Jody, NASA Marshall Space Flight Center, USA; Aug. 25, 2000; 22p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper presents, in viewgraph form, a general overview of space shuttle projects. Some of the topics include: 1) Space Shuttle Projects; 2) Marshall Space Flight Center Space Shuttle Projects Office; 3) Space Shuttle Propulsion systems; 4) Space Shuttle Program Major Sites; 5) NASA Office of Space flight (OSF) Center Roles in Space Shuttle Program; 6) Space Shuttle Hardware Flow; and 7) Shuttle Flights to Date.
CASI
General Overviews; Space Shuttles; NASA Programs

20000114422 NASA Johnson Space Center, Houston, TX USA
STS-92 Crew Activity Report/Flight Day 11 Highlights
Oct. 22, 2000; In English; Videotape: 16 min. 37 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000159448; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
On this eleventh day of the STS-92 mission, the flight crew, Commander Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur participate in an audio interview while footage of the Earth is seen. Michigan and the northern USA can be identified.
CASI
International Space Station; Discovery (Orbiter); Service Module (Iss); Unity Connecting Module; Zarya Control Module

20000114428 NASA Johnson Space Center, Houston, TX USA
STS-92 Crew Activity Report/Flight Day 10 Highlights
Oct. 21, 2000; In English; Videotape: 17 min. 50 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000157386; 1424J; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

On this tenth day of the STS-92 mission, the flight crew, Commander Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur prepare for the undocking of Discovery from the International Space Station (ISS) as Lopez-Alegria is seen closing the hatch on the Unity Module. A slow sweep of the outside of the ISS shows the space station in detail against the backdrop of a dark Earth where the lights of a city shine. Lopez-Alegria closes the outer hatch and Discovery undocks from the ISS. As the two separate, the ISS is seen orbiting across a beautiful dark blue Earth.
CASI
International Space Station; Discovery (Orbiter); Service Module (Iss)

20000114429 NASA Johnson Space Center, Houston, TX USA
STS-92 Crew Activity Report/Flight Day 8 Highlights
Oct. 19, 2000; In English; Videotape: 18 min. 32 sec. playing time, in color, with sound; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
On this eighth day of the STS-92 mission, the flight crew, Commander Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur prepare for the fourth and final spacewalk of the mission. Scenes are shown of Lopez-Alegria and Wisoff during their 6 hour 56 minute spacewalk against a backdrop of the Earth. Central America and Florida are easily seen and North Carolina can be identified through the clouds. Lopez-Alegria and Wisoff prepare a latch assembly that will later hold the solar array truss while Wakata operates the arm.
CASI
International Space Station; Service Module (Iss); Discovery (Orbiter)

20000114430 NASA Johnson Space Center, Houston, TX USA
Crew Activity Report/Flight Day 6 Highlights
Oct. 17, 2000; In English; Videotape: 18 min. 9 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000157383; 1424F; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
On this sixth day of the STS-92 mission, the flight crew, Commander Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur continue working on the exterior of the International Space Station (ISS) to prepare the station for its first resident crew. Lopez-Alegria and Wisoff perform the second of four spacewalks to maneuver the third pressurized mating adapter (PMA-3) into its new location on the Unity module.
CASI
International Space Station; Service Module (Iss); Discovery (Orbiter); Unity Connecting Module; Zarya Control Module

20000114431 NASA Johnson Space Center, Houston, TX USA
STS-92 Crew Activity Report/Flight Day 2 Highlights
Oct. 13, 2000; In English; Videotape: 17 min. 22 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000157376; 1424B; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
On this second day of the STS-92 mission, the flight crew, Commander. Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur continue to approach the International Space Station (ISS) in the Discovery Orbiter. Wakata and Duffy are congratulated and questioned by Japanese dignitaries. A panoramic view of the Earth is seen as Discovery orbits.
CASI
International Space Station; Discovery (Orbiter); Service Module (Iss); Unity Connecting Module; Zarya Control Module

20000114432 NASA Johnson Space Center, Houston, TX USA
STS-92 Crew Activity Report/Flight Day 4 Highlights
Oct. 15, 2000; In English; Videotape: 21 min. 52 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000157375; 1424D; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
On this fourth day of the STS-92 mission, the flight crew, Commander Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur give an overview of the day's accomplishments. Footage of the third pressurized mating adapter (PMA-3), the common berthing mechanism (CBM), and the installed Z1 truss are shown.
CASI
International Space Station; Discovery (Orbiter); Service Module (Iss); Unity Connecting Module; Zarya Control Module

20000114433 NASA Johnson Space Center, Houston, TX USA

STS-92 Crew Activity Report/Flight Day 5 Highlights

Oct. 16, 2000; In English; Videotape: 17 min. 29 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000157374; 1424E; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

On this fifth day of the STS-92 mission, the flight crew, Commander Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur prepare for the first of four spacewalks. McArthur and Chiao are seen shortly before suiting up and Wakata is seen at the controls for the robotic arm. Footage is shown of the spacewalk where McArthur and Chiao remove the S-band Antenna Subassembly (SASA). Duffy gives an overview on the day's accomplishments.

CASI

International Space Station; Discovery (Orbiter); Service Module (Iss); Unity Connecting Module; Zarya Control Module

20000114493 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-50 Countdown Status

Jun. 23, 1992; In English; Videotape: 20 min. 16 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000152241; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

George Diller of the NASA Public Affairs Office introduces Mike Leinbach, NASA Shuttle Test Director, Russ Lunnen, Kennedy Space Center (KSC) USML Payload Manager, and Ed Priselac, U.S. Airforce/KSC Weather Officer to give a briefing on the countdown status for STS-50. Leinbach gives an overview of when certain tests are run and what problems are encountered. Lunnen outlines the payload activities for the shuttle. Priselac describes the current weather as well as the conditions needed for launch. They also take questions from the press.

CASI

Countdown; Prelaunch Summaries; Spacecraft Launching; Prelaunch Tests; Prelaunch Problems

20000114494 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-50 Crew Arrival

Jun. 22, 1992; In English; Videotape: 16 min. 54 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000152240; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The crew of STS-50, Commander Richard N. Richards, Pilot Kenneth D. Bowersox, Payload Commander Bonnie J. Dunbar, Mission Specialists Ellen S. Baker and Carl J. Meade, and Payload Specialists Lawrence J. DeLucas and Eugene H. Trinh are seen landing four T-38 aircraft at Kennedy Space Center for a terminal countdown and demonstration test.They are introduced by Richards and each makes a brief statement about his or her expectations for the upcoming Columbia mission.

CASI

Spacecrews; Space Transportation System; Prelaunch Summaries; Crew Procedures (Preflight)

20000114495 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-47 Post-Launch News Conference

Sep. 12, 1992; In English; Videotape: 21 min. 21 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000148082; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Dick Young of the NASA Public Affairs Office introduces Brewster Shaw, Deputy Director of the Space Shuttle Program, and Robert B. Sieck, Launch Director of the Kennedy Space Center. Shaw briefly describes the successful launch of STS-47 and Sieck gives an overview of the problems solved before launch. Shaw and Sieck also answer questions from the press.

CASI

Prelaunch Problems; Spacecraft Launching; Endeavour (Orbiter); Postlaunch Reports

20000114496 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-46 Unedited EURECA Solar Array Deploy

Jan. 01, 1992; In English; Videotape: 62 min. 22 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000148081; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

Footage shows the deployment of the solar panels on the EURECA satellite. The unfurling takes place against a backdrop of Earth and the Persian Gulf can be identified.

CASI

Deployment; EURECA (ESA); Solar Arrays

20000114497 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-44 TCDT Activities

Nov. 01, 1991; In English; Videotape: 11 min. 3 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000148080; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The crew of STS-44, Commander Frederick D. Gregory, Pilot Terence T. Henricks, Mission Specialists F. Story Musgrave, Mario Runco, Jr., and James S. Voss are seen landing T-38 aircraft at Kennedy Space Center in a terminal countdown and demonstration test (TCDT). Footage of the crew (including Payload Specialist Thomas J. Hennen) during various stages of training is shown, including training on the use of gas masks and other emergency equipment and suiting up preparatory to liftoff. A brief introduction of the crew is presented by Gregory.

CASI

Prelaunch Summaries; Crew Procedures (Preflight); Astronaut Training

20000114498 NASA Johnson Space Center, Houston, TX USA

STS-92 Crew Interview/B. Duffy

Sep. 14, 2000; In English; Videotape: 28 min. 47 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000138909; JSC-1810A; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The STS-92 Commander Brian Duffy is shown being interviewed. He answers questions about his inspiration to become an astronaut, his training, and gives details on the mission, including overviews of the Z1 truss, the S-band antenna, the third pressurized meeting adaptor (PMA-3), the common berthing mechanism (CBM), and the spacewalks. He shares his thoughts on Russia's contributions to the International Space Station (ISS), the role of STS-92 in preparing the ISS for its first resident crew, and the importance of the ISS in the future.

CASI

International Space Station; Astronauts; Prelaunch Summaries

20000114499 NASA Johnson Space Center, Houston, TX USA

STS-92 Crew Interview/P. Wisoff

Sep. 14, 2000; In English; Videotape: 20 min. 28 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000138907; JSC-1810 E; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The STS-92 Mission Specialist Peter J.K. Wisoff is seen being interviewed. He answers questions about his inspiration to become an astronaut and gives details on the mission, including overviews of the Z1 truss, the third pressurized meeting adapter (PMA-3), and his spacewalks. He shares his thoughts on the international collaboration of space exploration, the contributions of the Russians, the role of STS-92 in preparing the International Space Station (ISS) for its first resident crew, and the importance of the ISS and the Space Shuttle in the future.

CASI

International Space Station; Astronauts; Prelaunch Summaries

20000114500 NASA Johnson Space Center, Houston, TX USA

STS-92 Crew Interview/P. Melroy

Sep. 14, 2000; In English; Videotape: 23 min. 43 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000138903; JSC-1810 B; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The STS-92 Pilot Pamela A. Melroy is shown being interviewed.She answers questions about her inspiration to become an astronaut and gives details on the mission, including overviews of the Z1 truss, the third pressurized meeting adapter (PMA-3), and the spacewalks. She shares her thoughts on the international collaboration of space exploration, Russia's contributions, the role of STS-92 in preparing the International Space Station (ISS) for its first resident crew, and the importance of the ISS and the Space Shuttle in the future.

CASI

International Space Station; Astronauts; Prelaunch Summaries

20000114501 NASA Johnson Space Center, Houston, TX USA

STS-106 Crew Activity Report/Flight Day 8 Highlights

Sep. 15, 2000; In English; Videotape: 20 min. 8 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000136107; BRF 1423H; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

On this eighth day of the STS-106 Atlantis mission, the flight crew, Commander Terrence W. Wilcutt, Pilot Scott T. Altman, and Mission Specialists Daniel C. Burbank, Edward T. Lu, Richard A. Mastracchio, Yuri Ivanovich Malenchenko, and Boris V. Morukov move into the second half of preparing the International Space Station (ISS) for its first resident crew. Lu and Malenchenko are seen installing the power converters in the Zvezda module and components of the primary oxygen generation system. Mastracchio and Wilcutt moves supplies and logistics from the payload of Atlantis to the ISS. Wilcutt and Altman participate in several interviews and the crew wishes the Olympiads in Sydney good luck in their endeavors. Scenes also include external views of the ISS and images of Earth, including Sydney, Australia.

CASI

International Space Station; Space Transportation System; Service Module (Iss); Space Transportation System Flights; Spacecraft Maintenance

20000114879 NASA Johnson Space Center, Houston, TX USA

STS-92 Crew Interview/M. Lopez-Alegria

Sep. 14, 2000; In English; Videotape: 28 min. 59 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000138910; JSC-1810F; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The STS-92 Mission Specialist Michael Lopez-Alegria is seen being interviewed. He answers questions about his inspiration to become an astronaut and gives details on the mission, including overviews of the Z1 truss, the third pressurized meeting adapter (PMA-3), and his spacewalks. He shares his thoughts on the international collaboration of space exploration, the role of STS-92 in preparing the International Space Station (ISS) for its first resident crew, and the importance of the ISS and the Space Shuttle in the future.

CASI

International Space Station; Astronauts; Prelaunch Summaries

20000114880 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-51 ACTS/TOS Payload Briefing

Jul. 06, 1993; In English; Videotape: 56 min. 31 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000152230; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Richard Gedney, Project Manager of Lewis Research Center, gives an overview on the Advanced Communications Technology Satellite (ACTS). Al Hughes, Manager of Upper Stage Projects at Marshall Space Flight Center, gives an overview of the Transfer Orbit Station (TOS). They also answer questions from the press.

CASI

Transfer Orbits; ACTS; Postlaunch Reports; Space Transportation System

20000114881 NASA Johnson Space Center, Houston, TX USA

STS-92 Crew Activity Report/Flight Day 3 Highlights

Oct. 14, 2000; In English; Videotape: 17 min. 38 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000157387; 1424C; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

On this third day of the STS-92 mission, the flight crew, Cmdr. Brian Duffy, Pilot Pamela A. Melroy, and Mission Specialists Koichi Wakata, Leroy Chiao, Peter J.K. Wisoff, Michael E. Lopez-Alegria, and William S. McArthur prepare for their dock with the International Space Station (ISS). External views of the docking process are shown with the Earth as a backdrop. The crew is seen opening the outermost hatch between Discovery and the ISS.

CASI

International Space Station; Discovery (Orbiter); Service Module (Iss)

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.

20000112924 Aerojet-General Corp., Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Earth Observing System (EOS) Advanced Microwave Sounding Unit-A (AMSU-A): Engineering Telemetry Description
October 2000; 21p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-10377D; CDRL-305; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the Engineering Telemetry Description, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Author

Advanced Microwave Sounding Unit; Microwave Sensors

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.

20000109948 Boeing Phantom Works, Seattle, WA USA
Analysis of Ag/FEP Control Blanket Performance from Multiple Satellites
Pippin, H. G., Boeing Phantom Works, USA; Normand, E., Boeing Phantom Works, USA; Wol, S. L., Boeing Phantom Works, USA; [2001]; 1p; In English; 39th; 39th Aerospace Sciences Meeting, Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-98213; No Copyright; Avail: Issuing Activity; Abstract Only

Published data reporting the change in solar absorptance as a function of time on orbit for certain satellites has been re-examined. The optical property change of metallized FEP as a function of total particulate radiation dose received by specific satellites has been estimated. Results tend to follow a common trend and a design curve has been constructed to estimate solar absorptance change as a function of radiation dose for metallized FEP at any altitude. Effects due to apparent contamination on several of the satellites are addressed and taken into account in determining property changes. Data from LDEF, ML-101, NavStar 1-5, NTS-2, the SCATHA experiment, and SOLRAD 11 are used as the basis of the design curve. A similar comparison is made between published atomic oxygen recession data from numerous Space Shuttle flights, a LEO experiment flown by Lockheed, and LDEF results. Variation of atomic oxygen recession rate of FEP as a function of exposure conditions is determined. Author

Solar Energy Absorbers; Time Dependence

20000110539 Old Dominion Univ., Dept. of Mechanical Engineering, Norfolk, VA USA
Development of Hybrid Repair Patches for Damaged Space Structures
Williamson, Keith M., Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 79; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A program for structural repairs in space is based on the premise that a Space Station or other satellite in low earth orbit may sustain some form of structural damage while in orbit for an extended period of time. Damage could occur from micrometeorites, space debris or accidental impact during routine docking operations with a Space Shuttle. Under any of these circumstances, the safety of astronaut crew or the success of various missions could depend on a capability to make structural repairs in space. Space structures like the International Space Station typically consist of trusses, pressurized modules, and nodes. of these structural elements, the pressurized module is among the most critical since it provides a living environment and life support systems for the astronaut crew. In the Low Earth Orbit (LEO) environment, space debris and micrometeoroids travelling at hyper-velocities represent significant potential hazards for structural elements like pressure modules. While large debris can be detected and avoided, smaller particles may impact the module and cause local damage in the form of full penetration holes and cracks. Suitable tooling

and repair equipment must be readily available; effective in the LEO environment; and, restore both the pressure boundary and structural load bearing capacity. The purpose of this research is to investigate a new hybrid repair concept for thin walled aluminum pressure vessels like an orbiting pressure module.
Derived from text
Spacecraft Structures; Hybrid Structures; Spacecraft Maintenance; Damage

20000110577 NASA Johnson Space Center, Houston, TX USA
The Role of Independent Assessment in the International Space Station Program
Strachan, Russell L., Science Applications International Corp., USA; Cook, David B., Science Applications International Corp., USA; Baker, Hugh A., NASA Johnson Space Center, USA; [1999]; 11p; In English, 28 May 1999, Houston, TX, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the role of Independent Assessment in the International Space Station (ISS) Program. Independent Assessment is responsible for identifying and specifying technical and programmatic risks that may impact development, launch, and on-orbit assembly and operations of the ISS. The various phases of the assessment process are identified and explained. This paper also outlines current and future participation by Independent Assessment in Human Exploration and Development of Space projects including the X-38 Space Plane, Mars mission scenarios, and applications of Nanotechnology. This paper describes how Independent Assessment helps the shuttle, ISS, and other programs to safely achieve mission goals now and into the next century.
Author
International Space Station; Technology Assessment; NASA Space Programs

20000110580 NASA Marshall Space Flight Center, Huntsville, AL USA
Satellite Motion Effects on Current Collection in Low Earth Orbit
Zhang, T. X., Alabama Univ., USA; Hwang, K. S., Chonnam National Univ., Korea, Republic of; Wu, S. T., Alabama Univ., USA; Stone, N. H., NASA Marshall Space Flight Center, USA; Chang, C. L., Science Applications International Corp., USA; Drobot, A., Science Applications International Corp., USA; Wright, K. H., Jr., Alabama Univ., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Results from the Tethered Satellite System (TSS) missions unambiguously show that the electrodynamic tether system produced 2 to 3 times the predicted current levels in the tether. The pre-mission predictions were based on the well-known Parker-Murphy (PM) model, which describes the collection of current by an electrically biased satellite in the ionospheric plasma. How the TSS satellite was able to collect 2-3 times the PM current has remained an open question. In the present study, self-consistent potential and motional effects are introduced into the Thompson and Dobrowolny sheath models. As a result, the magnetic field aligned sheath-an essential variable in determining current collection by a satellite-is derived and is shown to be explicitly velocity dependent. The orientation of the satellite's orbital motion relative to the geomagnetic field is also considered in the derivation and a velocity dependent expression for the collected current is obtained. The resulting model provides a realistic treatment of current collection by a satellite in low earth orbit. Moreover, the predictions, using the appropriate parameters for TSS, are in good agreement with the tether currents measured during the TSS-1R mission.
Author
Low Earth Orbits; Tethered Satellites; Electrodynamics; Electric Current; Geomagnetism

20000112918 NASA Johnson Space Center, Houston, TX USA
CONSTELL: NASA's Satellite Constellation Model
Theall, Jeffrey R., NASA Johnson Space Center, USA; Krisko, Paula H., Lockheed Martin Space Mission Systems and Services, USA; Opiela, John N., Lockheed Martin Space Mission Systems and Services, USA; [1999]; 1p; In English; 50th; 50th International Astronautical Congress Meeting, 4-8 Oct. 1999, Amsterdam, Holland, Netherlands
Contract(s)/Grant(s): NAS9-17900; RTOP 478-80
Report No.(s): IAA-99-IAA.6.6.05; No Copyright; Avail: Issuing Activity; Abstract Only

The CONSTELL program represents an initial effort by the orbital debris modeling group at NASA/JSC to address the particular issues and problems raised by the presence of LEO satellite constellations. It was designed to help NASA better understand the potential orbital debris consequences of having satellite constellations operating in the future in LEO. However, it could also be used by constellation planners to evaluate architecture or design alternatives that might lessen debris consequences for their constellation or lessen the debris effects on other users of space. CONSTELL is designed to perform debris environment projections rapidly so it can support parametric assessments involving either the constellations themselves or the background environment which represents non-constellation users of the space. The projections need to be calculated quickly because a number of projections are often required to adequately span the parameter space of interest. to this end CONSTELL uses the outputs of other

NASA debris environment models as inputs, thus doing away with the need for time consuming upfront calculations. Specifically, CONSTELL uses EVOLVE or ORDEM96 debris spatial density results as its background environment, debris cloud snapshot templates to simulate debris cloud propagation, and time dependent orbit profiles of the intact non- functional constellation spacecraft and upper stages. In this paper the environmental consequences of the deployment of particular LEO satellite constellations using the CONSTELL model will be evaluated. Constellations that will undergo a parametric assessment will reflect realistic parameter values. Among other results the increase in loss rate of non-constellation spacecraft, the number of collisions involving constellation elements, and the replacement rate of constellation satellites as a result of debris impact will be presented.
Author
Computer Programs; Debris; Models; Space Debris; Satellite Constellations; Computerized Simulation

20000112931 NASA Marshall Space Flight Center, Huntsville, AL USA
X-37 Project Overview: Successfully Achieve Orbit and Return to Earth Safely
Turner, Susan, NASA Marshall Space Flight Center, USA; [2000]; 14p; In English; RLV Technical Exposition, 22 Jun. 2000, Edwards, CA, USA; Sponsored by NASA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A viewgraph presentation outlines the Boeing X-37 Project. The following are discussed: the program objectives, funding, program products, vehicle characteristics. An overview of the flight test program is described, including mission operations, tests of the flight envelope, and a schedule for the construction and flight of the X-37. The technologies and experiments being demonstrated on the X-37 are listed, as well as the aerospace areas being explored by the X-37 project.
CASI
Construction; X-37 Vehicle; Reusable Launch Vehicles

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.

20000110136 NASA Johnson Space Center, Houston, TX USA
Radiation Susceptibility Assessment of Off the Shelf (OTS) Hardware
Culpepper, William X., NASA Johnson Space Center, USA; [2000]; 1p; In English; Commercialization of Military and Space Electronics, Feb. 2000, Los Angeles, CA, USA; Sponsored by Components Technology Inst., Inc., USA
Contract(s)/Grant(s): NAS9-5374; No Copyright; Avail: Issuing Activity; Abstract Only

The reduction in budgets, shortening of schedules and necessity of flying near state of the art technology have forced projects and designers to utilize not only modern, non-space rated EEE parts but also OTS boards, subassemblies and systems. New instrumentation, communications, portable computers and navigation systems for the International Space Station, Space Shuttle, and Crew Return Vehicle are examples of the realization of this paradigm change at the Johnson Space Center. Because of this change, there has been a shift in the radiation assessment methodology from individual part testing using low energy heavy ions to board and box level testing using high-energy particle beams. Highlights of several years of board and system level testing are presented along with lessons learned, present areas of concern, insights into test costs, and future challenges.
Author
Radiation Tolerance; Hardware; Computers; Communication; Navigation

20000110247 Sandia National Labs., Albuquerque, NM USA
Planetary Instrument Definition and Design Program (PIDDP) Support Project ***Final Report***
Mar. 01, 1999; 229p; In English
Report No.(s): DE00-005886; SAND99-8235; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The results of Sandia National Laboratories' participation in the NASA Planetary Definition and Design Program are summarized. Areas reported include the characterization of large area cadmium zinc telluride spectrometers and the application of simulation techniques to the prediction of device performance. Also investigated was the response of mercuric iodide devices in the

region from 1 to 100 KeV. A literature study to determine the status or radiation damage measurements in room temperature semiconductor devices is also reported.
NTIS
Semiconductor Devices; Cadmium Tellurides; Spectrometers; Performance Prediction; Radiation Damage; Spacecraft Instruments

20000114824 NASA Goddard Space Flight Center, Greenbelt, MD USA
Performance of The Far Ultraviolet Spectroscopic Explorer Mirror Assemblies
Ohi, Raymond G., NASA Goddard Space Flight Center, USA; Barkhouser, Robert H., Johns Hopkins Univ., USA; Conard, Steven J., Johns Hopkins Univ., USA; Friedman, Scott D., Johns Hopkins Univ., USA; Hampton, Jeffery, Swales Aerospace, USA; Moos, H. Warren, Johns Hopkins Univ., USA; Nikulla, Paul, Swales Aerospace, USA; Oliveira, Cristina M., Johns Hopkins Univ., USA; Saha, Timo T., NASA Goddard Space Flight Center, USA; [2000]; 12p; In English, August 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, Unknown
Contract(s)/Grant(s): NAS5-32985; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Far Ultraviolet Spectroscopic Explorer is a NASA astrophysics satellite which produces high-resolution spectra in the far-ultraviolet (90.5-118.7 nm bandpass) using a high effective area and low background detectors. The observatory was launched on its three-year mission from Cape Canaveral Air Station on 24 June 1999. The instrument contains four coaligned, normal incidence, off-axis parabolic mirrors which illuminate separate Rowland circle spectrograph channels equipped with holographically ruled diffraction gratings and delay line microchannel plate detectors. The telescope mirrors have a 352 x 387 mm aperture and 2245 mm focal length and are attached to actuator assemblies, which provide on-orbit, tip, tilt, and focus control. Two mirrors are coated with silicon carbide (SiC) and two are coated with lithium fluoride over aluminum (Al:LiF). We describe mirror assembly in-flight optical and mechanical performance. On-orbit measurements of the far-ultraviolet point spread function associated with each mirror are compared to expectations based on pre-flight laboratory measurements and modeling using the Optical Surface Analysis Code and surface metrology data. On-orbit imaging data indicate that the mirrors meet their instrument-level requirement of 50 percent and 95 percent slit transmission for the high- and mid-resolution spectrograph entrance slits, respectively. The degradation of mirror reflectivity during satellite integration and test is also discussed. The far-ultraviolet reflectivity of the SiC- and AlLiF-coated mirrors decreased about six percent and three percent, respectively, between coating and launch. Each mirror is equipped with three actuators, which consist of a stepper motor driving a ball screw via a two-stage planetary gear train. We also discuss the mechanical performance of the mirror assemblies, including actuator performance and thermal effects. Author
Actuators; Astrophysics; Far UV Spectroscopic Explorer; Gratings (Spectra); Mirrors; Reflectance; Slits; Spectrographs

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.

20000109858 Air Force Research Lab., Space Vehicles Directorate, Hanscom AFB, MA USA
Lidar Measurement of Rocket Exhaust Plume Dispersion and Layering in the Stratosphere
Dao, Phan D., Air Force Research Lab., USA; Dentamaro, Anthony, Orion Research, Inc., USA; Sep. 16, 1999; 24p; In English
Report No.(s): AFRL-VS-TR-1999-1532; ERP-1225; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Mobile Lidar Trailer (MLT) measures backscattering returns from solid rocket booster exhaust plumes in the stratosphere. A worst-case assessment of the stratospheric ozone depletion, often associated with the use of Solid Rocket Motors such as the TITAN IV and the Space Shuttle, is provided. The study is based on the measurement of more than 1500 layers of plume sampled in the altitudes between 15 and 55 km. The results show that less than 2 percent of the ozone column is destroyed in the lidar line-of-sight as a result of the launch. Results are also presented on the fading of the plume return associated with the dispersion of the plume for times between 30 minutes and 3 hours after launch. A comparison with current dispersion models is provided. The measurement and analysis are based on the lidar backscattering signal from the rocket exhaust plume measured at the wavelengths of 308, 355, 532, and 1064 nm for times between 5 and 200 minutes after launch.
Derived from text
Backscattering; Radar Measurement; Rocket Exhaust; Stratosphere; Ozone Depletion; Dispersions; Launch Vehicles

20000109907 NASA Marshall Space Flight Center, Huntsville, AL USA

MC-1 Nozzle Testing Results

Peters, Warren, NASA Marshall Space Flight Center, USA; [2000]; 32p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document is the presentation graphics which reviews the test results of the MC-1 Nozzle. The MC-1 Nozzle was originally designed for a low cost engine for an expendable booster. It was modified for use in the X-34 propulsion plant. With this design the nozzle and chamber are one piece. The presentation reviews the design goals, the materials and fabrication. The tests and results are reviewed in considerable detail. Included are pictures of the nozzle, and diagrams of the nozzle geometry
CASI

Nozzle Design; Nozzle Geometry; Rocket Nozzles; Performance Tests; Test Firing; Ground Tests

20000109951 NASA Johnson Space Center, Houston, TX USA

Non-Toxic Orbiter Maneuvering System (OMS) and Reaction Control System

Hurlbert, Eric A., NASA Johnson Space Center, USA; [1999]; 1p; In English; Space Shuttle Development Conference, 28-30 Jul. 1999, San Francisco, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA is pursuing the technology and advanced development of a non-toxic (NT) orbital maneuvering system (OMS) and reaction control system (RCS) for shuttle upgrades, RLV, and reusable first stages. The primary objectives of the shuttle upgrades program are improved safety, improved reliability, reduced operations time and cost, improved performance or capabilities, and commonality with future space exploration needs. Non-Toxic OMS/RCS offers advantages in each of these categories. A non-toxic OMS/RCS eliminates the ground hazards and the flight safety hazards of the toxic and corrosive propellants. The cost savings for ground operations are over $24M per year for 7 flights, and the savings increase with increasing flight rate up to $44M per year. The OMS/RCS serial processing time is reduced from 65 days to 13 days. The payload capability can be increased up to 5100 IBMs. The non-toxic OMS/RCS also provides improved space station reboost capability up to 20 nautical miles over the current toxic system of 14 nautical miles. A NT OMS/RCS represents a clear advancement in the SOA over MMH/NTO. Liquid oxygen and ethanol are clean burning, high-density propellants that provide a high degree of commonality with other spacecraft subsystems including life support, power, and thermal control, and with future human exploration and development of space missions. The simple and reliable pressure-fed design uses sub-cooled liquid oxygen at 250 to 350 psia, which allows a propellant to remain cryogenic for longer periods of time. The key technologies are thermal insulation and conditioning techniques are used to maintain the sub-cooling. Phase I successfully defined the system architecture, designed an integrated OMS/RCS propellant tank, analyzed the feed system, built and tested the 870 lbf RCS thrusters, and tested the 6000 lbf OMS engine. Phase 11 is currently being planned for the development and test of full-scale prototype of the system in 1999 and 2000
Author

Orbit Maneuvering Engine (Space Shuttle); Reusable Launch Vehicles; Life Support Systems; Aerospace Environments; Spacecraft Environments

20000110128 Thiokol Propulsion, USA

Space Shuttle Solid Rocket Boosters Chemical Fingerprinting of Critical Materials

McClennen, W. H., Thiokol Propulsion, USA; Fife, D. J., Thiokol Propulsion, USA; Randall, A. R., Thiokol Propulsion, USA; Hill, K. W., Thiokol Propulsion, USA; Bowden, M. W., Thiokol Propulsion, USA; [2000]; 20p; In English, 16 Mar. 2000, Pittsburgh, PA, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS8-38100; Copyright; Avail: Issuing Activity

This paper presents viewgraphs of the Space Shuttle Solid Rocket Boosters Chemical Fingerprinting of Critical Materials. The topics include: 1) Background; 2) Objectives and Approach; 3) Database Overview; 4) Examples; and 5) Benefits.
CASI

Space Shuttle Boosters; Composite Materials; Chemical Analysis

20000112951 NASA Marshall Space Flight Center, Huntsville, AL USA

A Regeneratively-Cooled Thrust Chamber for the Fastrac Engine

Brown, Kendall, NASA Marshall Space Flight Center, USA; Sparks, Dave, NASA Marshall Space Flight Center, USA; Woodcock, Gordon, Space America, Inc., USA; [2000]; 21p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, Al, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document consists of presentation slides about the development of the regeneratively cooled thrust chamber for the Fastrac engine. The Fastrac engine was originally developed to demonstrate low cost design and fabrication methods. It was intended to be used in an expendable booster. The regen thrust chamber enables a more cost efficient test program. Using the low cost design and fabrication methodology designed for the 12K regeneratively cooled chamber, the contractor designed, developed and fabricated a regeneratively cooled thrust chamber for the Fastrac engine.
CASI
Regenerative Cooling; Thrust Chambers; Rocket Engine Cases; Rocket Engine Design; Combustion Chambers

20000112952 Boeing Co., Rocketdyne, Canoga Park, CA USA
Block III SSME Upgrade Project Overview
Plowden, John, Boeing Co., USA; [2000]; 20p; In English; Joint Propulsion, Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS8-45000; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A viewgraph presentation outlines the use and history of the Reusable Lox/LH2 Booster Engine. The Block III upgrade evolution is discussed. NASA goals, engine configuration, and major changes are described. The design concept is illustrated, including a construction comparison between a tube wall nozzle and a channel wall nozzle. The benefits, goals, and risks of the Block III are discussed and a baseline program schedule is provided.
CASI
Construction; Space Shuttle Main Engine; Reusable Rocket Engines; Rocket Engine Design; Hydrogen Oxygen Engines

20000112963 NASA Marshall Space Flight Center, Huntsville, AL USA
Fabrication and Testing of Ceramic Matrix Composite Propulsion Components
Effinger, Michael R., NASA Marshall Space Flight Center, USA; Clinton, R. G., Jr., NASA Marshall Space Flight Center, USA; Dennis, Jay, NASA Marshall Space Flight Center, USA; Elam, Sandy, NASA Marshall Space Flight Center, USA; Genge, Gary, NASA Marshall Space Flight Center, USA; Eckel, Andy, NASA Glenn Research Center, USA; Jaskowiak, Martha H., NASA Glenn Research Center, USA; Kiser, J. Douglas, NASA Glenn Research Center, USA; Lang, Jerry, NASA Glenn Research Center, USA; [2000]; 27p; In English; 11th; Aerospace Materials, Processes and Environmental Technology, 26-29 Jun. 2000, Bellevue, WA, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 713-23-51; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A viewgraph presentation outlines NASA's goals for the Second and Third Generation Reusable Launch Vehicles, placing emphasis on improving safety and decreasing the cost of transporting payloads to orbit. The use of ceramic matrix composite (CMC) technology is discussed. The development of CMC components, such as the Simplex CMC Blisk, cooled CMC nozzle ramps, cooled CMC thrust chambers, and CMC gas generators, are described, including challenges, test results, and likely future developments.
CASI
Ceramic Matrix Composites; Reusable Launch Vehicles

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.

20000110604 Bettis Atomic Power Lab., West Mifflin, PA USA
Effects of Neutron Irradiation on Deformation Behavior of Nickel-Base Fastener Alloys
Bajaj, R.; Mills, W. J.; Kammenzind, B. F.; Burke, M. G.; Jul. 01, 1999; 11p; In English; 9th; 9th International Conference on Environmental Degradation of Nuclear Power Systems - Water Reactor, 1-5 Aug. 1999, Newport Beach, CA, USA
Report No.(s): DE00-755393; B-T-3242; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This paper presents the effects of neutron irradiation on the fracture behavior and deformation microstructure of high-strength nickel-base alloy fastener materials, Alloy X-750 and Alloy 625. Alloy X-750 in the HTH condition, and Alloy 625 in the direct aged condition were irradiated to a fluence of 2.4 C in the Advanced Test Reactor. Deformation structures at low strains were examined. It was previously shown that Alloy X-750 undergoes hardening, a significant degradation in ductility and an increase in intergranular fracture. In contrast, Alloy 625 had shown softening with a concomitant increase in ductility and transgranular

failure after irradiation. The deformation microstructures of the two alloys were also different. Alloy X-750 deformed by a planar slip mechanism with fine microcracks forming at the intersections of slip bands with grain boundaries. Alloy 625 showed much more homogeneous deformation with fine, closely spaced slip bands and an absence of microcracks. The mechanism(s) of irradiation assisted stress corrosion cracking (IASCC) are discussed.
NTIS
Nickel Alloys; Fasteners; Neutron Irradiation; Deformation; Advanced Test Reactors; Degradation; Fracture Mechanics; High Strength Alloys

20000113027 NASA Langley Research Center, Hampton, VA USA
National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology
Arrington, Ginger L. F., Compiler, NASA Langley Research Center, USA; Gardner, James E., Compiler, NASA Langley Research Center, USA; Jacobs, James A., Compiler, Norfolk State Univ., USA; Fillion, John E., Compiler, DaimlerChrysler Corp., USA; Mallick, P. K., Compiler, Michigan Univ., USA; October 2000; 744p; In English; 14th; Standard Experiments in Engineering, Materials Science and Technology, 31 Oct. - 3 Nov. 1999, Auburn Hills, MI, USA; Sponsored by American Society for Engineering, USA; See also 20000113028 through 20000113075
Contract(s)/Grant(s): RTOP 251-10-01-01
Report No.(s): NASA/CP-2000-210325; L-18010; NAS 1.55:210325; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This document contains a collection of experiments presented and demonstrated at the National Educators' Workshop: Update 99, held at DaimlerChrysler, Auburn Hills, Michigan, from October 31 - November 3, 1999.
Derived from text
Materials Science; Education; Conferences; Experiment Design

20000113031 General Motors Corp., Research and Development Center, Troy, MI USA
Challenges and Opportunities for Materials Research in The Automotive Industry
Sloane, Christine S., General Motors Corp., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 51-67; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This presentation, in viewgraph format, reviews some of the efforts of the automotive industry to reduce weight in automobiles. These efforts include expanded use of aluminum in the automobile's body, the integration of parts, and the integration and elimination of functions.
CASI
Automobiles; Weight Reduction; Structural Weight; Structural Design

20000113056 California State Univ., Mechanical Engineering Dept., Los Angeles, CA USA
Every-Day Objects and Class Demonstration in Material Science Class, Designed to Help Students Learn
Fabris, Neda Saravanja, California State Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 423-429; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Based on my experience of teaching 27 different classes, Material Science or Engineering Materials classes require more facts to be remembered and more different concepts to understand than any other engineering class in the mechanical engineering curriculum. In order to facilitate students' learning, I have applied for the California State University institutional grant and in 1994-95 received "Innovative Instruction Award" in the form of four units of released time and limited funding for student assistant support and supplies. For my project I collected samples, made models and developed a set of simple experiments that can be brought to the classroom and/or used in laboratories to demonstrate different properties of engineering materials. I organized the material according to chapters 1-11 and chapter 18, of the textbook: The Science and Engineering of Materials by Donald Askeland, that we cover in "Materials Science and Engineering," the sophomore class for mechanical and civil engineering students. Most other science and engineering books are organized in a similar way so the examples and demonstrations explained in this paper can be used by instructors teaching from other textbooks in almost the same order. Also, I am using several simple examples and associations that help me and hopefully my students, to remember the large number of terms, laws and relations. In this paper, I summarize the content of my "magic box" for Chapter 1 through Chapter 6 and share some examples that I use

to make teaching interesting and help students learn. While some demonstrations are new, others are adapted from presentations from other Materials educators.
Author
Mechanical Engineering; Materials Science; Materials Tests

20000113064 Rensselaer Polytechnic Inst., Materials Science and Engineering Dept., Troy, NY USA
Simple Classroom Demonstrations in Chemistry and Materials Science
Hudson, John B., Rensselaer Polytechnic Inst., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 519-528; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Six classroom demonstrations developed for a freshman level course in Chemistry and Materials Science are described, and the message to be drawn from each is presented.
Author
Education; Chemistry; Materials Science

20000113827 Lockheed Martin Michoud Space Systems, Technology Labs., New Orleans, LA USA
Chemical Fingerprinting of Materials Developed Due to Environmental Issues
Smith, Doris A., Lockheed Martin Michoud Space Systems, USA; [2000]; 17p; In English; 4th; Aerospace Materials, Processes and Environmental Technology, 20 Sep. 2000, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-36200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents viewgraphs on chemical fingerprinting of materials developed due to environmental issues. Some of the topics include: 1) Aerospace Materials; 2) Building Blocks of Capabilities; 3) Spectroscopic Techniques; 4) Chromatographic Techniques; 5) Factors that Determine Fingerprinting Approach; and 6) Fingerprinting: Combination of instrumental analysis methods that diagnostically characterize a material.
CASI
Chemical Analysis; Aircraft Construction Materials; Technology Assessment

24
COMPOSITE MATERIALS

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

20000109845 NASA Marshall Space Flight Center, Huntsville, AL USA
Novel Materials for Application as Shielding During Extended Space Flights
Grugel, Richard N., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Minimizing radiation exposure to humans during extended, deep space missions is a major safety concern and, consequently, a complicated materials issue. These concerns are presented and considered in view of some novel composite materials suggested for shielding applications. Advantages and disadvantages of the composites will be discussed as well as the need for coordinated testing/evaluation and modeling efforts.
Author
Radiation Dosage; Space Missions; Radiation Shielding; Electromagnetic Shielding; Spacecraft Shielding; Composite Materials

20000109851 NASA Marshall Space Flight Center, Huntsville, AL USA
Composite Materials for Radiation Shielding During Deep Space Missions
Grugel, R. N., Metallurgical Society, USA; Watts, J., Metallurgical Society, USA; Adams, J. H., Metallurgical Society, USA; [2000]; 1p; In English, 12 Feb. 2001, New Orleans, LA, USA; Sponsored by Metallurgical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Minimizing radiation exposure from the galactic cosmic ray (GCR) environment during deep space missions is essential to human health and sensitive instrument survivability. Given the fabrication constraints of space transportation vehicles protective shielding is, consequently, a complicated materials issue. These concerns are presented and considered in view of some novel

composite materials being developed/suggested for GCR shielding applications. Advantages and disadvantages of the composites will be discussed as well as the need for coordinated testing/evaluation and modeling efforts.
Author
Deep Space; Galactic Cosmic Rays; Radiation Shielding; Space Missions; Spacecraft Shielding; Composite Materials

20000109864 NASA Marshall Space Flight Center, Huntsville, AL USA
A Comparison of Quasi-Static Indentation to Low-Velocity Impact
Nettles, A. T., NASA Marshall Space Flight Center, USA; Douglas, M. J., Old Dominion Univ., USA; August 2000; 98p; In English
Report No.(s): NASA/TP-2000-210481; M-991; NAS 1.60:210481; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

A static test method for modeling low-velocity foreign object impact events to composites would prove to be very beneficial to researchers since much more data can be obtained from a static test than from an impact test. In order to examine if this is feasible, a series of static indentation and low-velocity impact tests were carried out and compared. Square specimens of many sizes and thicknesses were utilized to cover the array of types of low velocity impact events. Laminates with a pi/4 stacking sequence were employed since this is by far the most common type of engineering laminate. Three distinct flexural rigidities -under two different boundary conditions were tested in order to obtain damage ranging from that due to large deflection to contact stresses and levels in-between to examine if the static indentation-impact comparisons are valid under the spectrum of damage modes that can be experienced. Comparisons between static indentation and low-velocity impact tests were based on the maximum applied transverse load. The dependent parameters examined included dent depth, back surface crack length, delamination area, and to a limited extent, load-deflection behavior. Results showed that no distinct differences could be seen between the static indentation tests and the low-velocity impact tests, indicating that static indentation can be used to represent a low-velocity impact event.
Derived from text
Low Speed; Composite Materials; Impact Tests; Indentation; Static Tests; Mechanical Properties

20000109878 NASA Johnson Space Center, Houston, TX USA
Mechanisms of Carbon Nanotube Production by Laser Ablation Process
Scott, Carl D., NASA Johnson Space Center, USA; Arepalli, Sivaram, GB Technology, Inc., USA; Nikolaev, Pavel, GB Technology, Inc., USA; Smalley, Richard E., Rice Univ., USA; [2000]; 1p; In English; American Physical Society March Meeting 2000, 20-34 Mar. 2000, Minneapolis, MN, USA; Sponsored by American Physical Society, USA
Contract(s)/Grant(s): RTOP 953-36-ES-95; No Copyright; Avail: Issuing Activity; Abstract Only

We will present possible mechanisms for nanotube production by laser oven process. Spectral emission of excited species during laser ablation of a composite graphite target is compared with that of laser irradiated C60 vapor. The similarities in the transient and spectral data suggest that fullerenes are intermediate precursors for nanotube formation. The confinement of the ablation products by means of a 25-mm diameter tube placed upstream of the target seems to improve the production and purity of nanotubes. Repeated laser pulses vaporize the amorphous/graphitic carbon and possibly catalyst particles, and dissociate fullerenes yielding additional feedstock for SWNT growth.
Author
Carbon; Nanotubes; Fullerenes

20000109887 Societe Francaise des Thermiciens, Chatenay-Malabry, France
Thermophysical properties of new materials
Dec. 31, 1998; 24p; In French; In English
Report No.(s): DE99-750730; ETDE-FR-99750730; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This conference day was organized by the 'thermo-kinetics' section of the French association of thermal engineers. This book of proceedings contains 5 papers entitled: 'characterization of thermal properties using periodical methods at the Odeillo test centre: developments and applications'; 'measurement of the distribution of local thermophysical properties by IR images processing and averaging technique'; 'extension of shock probes to the characterization of multi-layers - development of a simple device for the characterization of insulating materials or shear fluids'; 'thermal local diffusivity of constituents of carbon/carbon composites'; 'new method for the thermal diffusivity measurement of thermo-hardenable resins during polymerization'.
NTIS
Conferences; Thermophysical Properties; Thermodynamic Properties

20000109900 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Rate Dependence of Mode-1 Interlaminar Fracture Toughness in CFRP Laminates

Kato, Hideyuki, Kyushu Univ., Japan; Kundoo, Kazuo, Kyushu Univ., Japan; Uda, Nobuhide, Kyushu Univ., Japan; Ono, Kousei, Kyushu Univ., Japan; Nagayasu, Tadashi, Kyushu Univ., Japan; Technology Reports of Kyushu University; September 2000; ISSN 0023-2718; Volume 73, No. 5, pp. 585-591; In Japanese; Copyright; Avail: Issuing Activity

Measuring Mode-I interlaminar fracture toughness using a DCB specimen, we have several difficulties in measuring a crack length. In order to cope with these difficulties, we developed an electrical measuring method. This method is based on the nonlinear relationship between crack length and CFRP (Carbon Fiber Reinforced Plastics) specimen resistance. We compared this method with traditional ones of a camera and strain gages and verified the accuracy of the electrical method. After the verification of this method, we measured the energy release rate in various crack speeds. We have found that the energy release rate is constant over the range of the crack speeds measured. Furthermore, we tried stick slip phenomenon to measure the fracture toughness in faster crack speed.

Author

Technology Assessment; Crack Propagation; Fracture Strength; Measure and Integration; Measuring Instruments

20000109902 Texas Univ., Engineering Mechanics Research Lab., Austin, TX USA

The Effect of Temperature on Faceplate/Core Delamination in Composite/Titanium Sandwich Plates ***Final Report***

Liechti, Kenneth M., Texas Univ., USA; Marton, Balazs, Texas Univ., USA; September 2000; 64p; In English

Contract(s)/Grant(s): NCC1-303

Report No.(s): EMRL-00/7; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A study was made of the delamination behavior of sandwich beams made of titanium core bonded to face-plates that consisted of carbon fiber reinforced polymer composite. Nominally mode I behavior was considered at 23C and 180C, by making use of a specially reinforced double cantilever (DCB) specimens. The toughness of the bond between the faceplate and the core was determined on the basis of a beam on elastic foundation analysis. The specimen compliance, and toughness were all independent of temperature in these relatively short-term experiments. The fracture mechanism showed temperature dependence, due to the hygrothermal sensitivity of the adhesive.

Author

Composite Structures; Delaminating; Metal Plates; Sandwich Structures; Temperature Effects; Titanium; Failure Modes

20000110176 Oak Ridge National Lab., TN USA

Fiber-Matrix Interface Studies on Electron Beam Cured Composites

Drazel, L. T.; Janke, C. J.; Yarborough, K. D.; May 23, 1999; 15p; In English; 44th, 23-27 May 1999, Long Beach, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): DE00-003555; ORNL/CP-101114; No Copyright; Avail: Department of Energy Information Bridge

The recent completed Department or Energy (DOE) and industry sponsored Cooperative Research and Development Agreement (CRADA) entitled, "Electron Beam Curing of Polymer Matrix Composites," determined that the interlaminar shear strength properties of the best electron beam cured IM7/epoxy composites were 19-28% lower than autoclave cured IM7/epoxy composites (i.e. IM7/977-2 and IM7977-3).Low interlaminar shear strength is widely acknowledged as the key barrier to the successful acceptance and implementation of electron beam cured composites in the aircraft/aerospace industry. The objective of this work was to improve the interlaminar shear strength properties of electron beam cured composites by formulating and evaluating several different fiber sizings or coating materials. The researchers have recently achieved some promising results by having discovered that the application of epoxy-based, electron beam compatible sizings or coatings onto surface-treated, unsized IM7 carbon fibers improved the composite interlaminar shear strength properties by as much as 55% versus composites fabricated from surface-treated, unsized IM7 fibers. In addition, by applying these same epoxy-based sizings or coatings onto surface-treated, unsized IM7 fibers it was possible to achieve an 11% increase in the composite interlaminar shear strength compared to composites made from surface-treated, GP-sized IM7 fibers. Work is continuing in this area of research to further improve these properties.

NTIS

Fiber-Matrix Interfaces; Fiber Composites; Carbon Fibers; Epoxy Matrix Composites; Epoxy Resins

20000110187 Oak Ridge National Lab., TN USA

DOE Automotive Composite Materials Research: Present and Future Efforts

Warren, C. D.; Aug. 10, 1999; 15p; In English; Composites Manufacturing and Tooling 1999, 8-10 Feb. 1999, Anaheim, CA, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): DE00-003459; ORNL/CP-101220; No Copyright; Avail: Department of Energy Information Bridge

Automobiles of the future will be forced to travel further on a tank of fuel while discharging lower levels of pollutants. Currently, the USA uses in excess of 16.4 million barrels of petroleum per day. Sixty-six percent of that petroleum is used in the transportation of people and goods. Automobiles currently account for just under two-thirds of the nation's gasoline consumption, and about one-third of the total USA energy usage. By improving transportation related fuel efficiency, the USA can lessen the impact that emissions have on our environment and provide a cleaner environment for future generations.

NTIS

Automobiles; Composite Materials; Conferences

20000110624 NASA Johnson Space Center, Houston, TX USA

Nanotube Production and Applications at Johnson Space Center

Nikolaev, Pavel, NASA Johnson Space Center, USA; Files, Bradley, NASA Johnson Space Center, USA; Arepalli, Sivaram, NASA Johnson Space Center, USA; Scott, Carl, NASA Johnson Space Center, USA; Holmes, William, NASA Johnson Space Center, USA; [2000]; 1p; In English; Nanotube 1999: Science and Application of Nanotubes, 24-27 Jul. 1999, East Lansin, MI, USA; Sponsored by Michigan State Univ., USA

Contract(s)/Grant(s): RTOP 953-36-EM; No Copyright; Avail: Issuing Activity; Abstract Only

Promise of applications of carbon nanotubes has led to an intense effort at NASA/JSC, especially in the area of nanotube composites. Using the extraordinary mechanical strength of nanotubes, NASA hopes to design this revolutionary lightweight material for use in aerospace applications. Current research focuses on structural polymeric materials to attempt to lower the weight of spacecraft necessary for interplanetary missions. Other applications of nanotubes are also of interest for energy storage, gas storage, nanoelectronics, field emission, and biomedical applications. In pursuit of these goals, we have set up both laser and arc production processes for nanotubes. An in-depth diagnostic study of the plasma plume in front of the laser target has been studied to try to determine nanotube growth mechanisms. Complementary studies of characterization of nanotube product have added to knowledge of growth conditions. Results of our preliminary experiments in incorporating nanotubes into composites will be presented. Morphology and mechanical properties of the nanotubes composites will be discussed.

Author

Carbon; Nanotubes; Product Development; Products; Production Engineering; Nanotechnology; Technology Utilization; NASA Programs; Research and Development

20000110937 Thiokol Propulsion, USA

Composite, Cryogenic, Conformal, Common Bulkhead, Aerogel-Insulated Tank (CBAT) Materials and Processing Methodologies

Kovach, Michael P., Thiokol Propulsion, USA; Roberts, J. Keith; Finckenor, Jeffrey L.; McMahon, William M.; [2000]; 18p; In English; Aerospace Materials, Processes and Environmental Techniques, 18-20 Sep. 2000, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-134; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A viewgraph presentation outlines the current status and future activities of the composite, cryogenic, conformal, common bulkhead, aerogel-insulated tank (CBAT). Each term (composite, cryogenic, conformal, etc.) is explained. The fabrication method for the CBAT is described, including challenges and their solutions. Near term and long term goals are discussed.

CASI

Aerogels; Bulkheads; Cryogenics; Reusable Launch Vehicles

20000110939 NASA Langley Research Center, Hampton, VA USA

Testing and Analysis of Composite Skin/Stringer Debonding Under Multi-Axial Loading

Krueger, Ronald, NASA Langley Research Center, USA; Cvitkovich, Michael K., NASA Langley Research Center, USA; O'Brien, T. Kevin, Army Research Lab., USA; Minguet, Pierre J., Boeing Co., USA; Journal of Composite Materials; 2000; Volume 34, No. 15, pp. 1263-1300; In English; Copyright; Avail: Issuing Activity

A consistent step-wise approach is presented to investigate the damage mechanism in composite bonded skin/stringer constructions under uniaxial and biaxial (in-plane/out-of-plane) loading conditions. The approach uses experiments to detect the failure mechanism, computational stress analysis to determine the location of first matrix cracking and computational fracture mechanics to investigate the potential for delamination growth. In a first step, tests were performed on specimens, which consisted

of a tapered composite flange, representing a stringer or frame, bonded onto a composite skin. Tests were performed under monotonic loading conditions in tension, three-point bending, and combined tension/bending to evaluate the debonding mechanisms between the skin and the bonded stringer. For combined tension/bending testing, a unique servohydraulic load frame was used that was capable of applying both in-plane tension and out-of-plane bending loads simultaneously. Specimen edges were examined on the microscope to document the damage occurrence and to identify typical damage patterns. For all three load cases, observed failure initiated in the flange, near the flange tip, causing the flange to almost fully debond from skin. In a second step, a two dimensional plane-strain finite element model was developed to analyze the different test cases using a geometrically nonlinear solution. For all three loading conditions, computed principal stresses exceeded the transverse strength of the material in those areas of the flange where the matrix cracks had developed during the tests. In a third step, delaminations of various lengths were simulated in two locations where delaminations were observed during the tests. The analyses showed that at the loads corresponding to matrix ply crack initiation computed strain energy release rates exceeded the values obtained from a mixed mode failure criterion in one location, Hence. Unstable delamination propagation is likely to occur as observed in the experiments.
Author

Axial Loads; Stress Analysis; Debonding (Materials); Stringers; Composite Materials; Fracture Mechanics; Skin (Structural Member)

20000111073 NASA Johnson Space Center, Houston, TX USA

Production and Characterization of Carbon Nanotubes and Nanotube-Based Composites

Nikolaev, Pavel, Lockheed Martin Corp., USA; Arepalli, Sivaram, Lockheed Martin Corp., USA; Holmes, William, Lockheed Martin Corp., USA; Gorelik, Olga, Lockheed Martin Corp., USA; Files, Brad, NASA Johnson Space Center, USA; Scott, Carl, NASA Johnson Space Center, USA; Santos, Beatrice, NASA Johnson Space Center, USA; Mayeaux, Brian, NASA Johnson Space Center, USA; Victor, Joe, NASA Johnson Space Center, USA; [1999]; 1p; In English; Developing Space Operations, Technology, and Utilization, 28 May 1999, Houston, TX, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Nobel Prize winning discovery of the Buckuball (C60) in 1985 at Rice University by a group including Dr. Richard Smalley led to the whole new class of carbon allotropes including fullerenes and nanotubes. Especially interesting from many viewpoints are single-walled carbon nanotubes, which structurally are like a single graphitic sheet wrapped around a cylinder and capped at the ends. This cylinders have diameter as small as 0.5 - 2 nm (1/100,000th the diameter of a human hair) and are as long as 0.1 - 1 mm. Nanotubes are really individual molecules and believed to be defect-free, leading to high tensile strength despite their low density. Additionally, these fibers exhibit electrical conductivity as high as copper, thermal conductivity as high as diamond, strength 100 times higher than steel at one-sixth the weight, and high strain to failure. Thus it is believed that developments in the field of nanotechnology will lead to stronger and lighter composite materials for next generation spacecraft. Lack of a bulk method of production is the primary reason nanotubes are not used widely today. Toward this goal JSC nanotube team is exploring three distinct production techniques: laser ablation, arc discharge and chemical vapor deposition (CVD, in collaboration with Rice University). In laser ablation technique high-power laser impinges on the piece of carbon containing small amount of catalyst, and nanotubes self-assemble from the resulting carbon vapor. In arc generator similar vapor is created in arc discharge between carbon electrodes with catalyst. In CVD method nanotubes grow at much lower temperature on small catalyst particles from carbon-containing feedstock gas (methane or carbon monoxide). As of now, laser ablation produces cleanest material, but mass yield is rather small. Arc discharge produces grams of material, but purity is low. CVD technique is still in baby steps, but preliminary results look promising, as well as perspective of scaling the process up. We are also working on necessary purification of nanotubes. Applications of nanotubes are in such various fields as lightweight composites, molecular electronics, energy storage (electrodes in Li ion batteries), flat panel displays, conductive polymers, etc. JSC nanotube team is focused on development of lightweight materials. We work on the injection thermoset epoxies reinforced with nanotubes. Early results show good wetting of nanotube surface with epoxy, which is very important. More research will be possible as more nanotubes become available.
Author

Carbon; Nanotubes; Production Engineering; Composite Materials

20000111375 Brussels Univ., Belgium

International Conference on Recent Developments in Durability Analysis of Composite Systems: Booklet of Abstracts

Jul. 14, 1999; 332p; In English

Contract(s)/Grant(s): N68171-99-M-5598

Report No.(s): AD-A378715; ARDSG-R/D-8646-AN-02; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The papers are concerned with several specific applications. There are separate sections that deal with marine applications; physical and chemical aging processes in high temperature applications; applications of damage mechanics to durability; infra-

structure applications; manufacturing, processing and durability; and emerging technologies. The book presents a comprehensive cross section of the state of the art in the field of the durability of polymer-based, composite, and adhesive systems. It is of special value to researchers concerned with the frontier of the field, to students concerned with the substance of the subject, and to the applied community concerned with finding methodologies that make it possible to design safe and durable engineering components using material systems.
CASI
Composite Materials; Aging (Materials); Composite Structures; Durability; High Temperature Environments; Fatigue (Materials)

20000111376 Louisiana State Univ., Baton Rouge, LA USA
The International Conference on Multiscale Materials Phenomena in Harsh Environments (1st) Held in Limassol, Cyprus on 19-24 June 2000
Kalia, Rajiv K.; Nakano, Aiichiro; Razis, Panos; Vashishta, Priya; Voyiadjis, George; Jun. 24, 2000; 39p; In English
Contract(s)/Grant(s): N68171-00-M-5676
Report No.(s): AD-A378520; R&D-8916-EE-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This stated purpose of this meeting was to provide a forum in which the continuum mechanics modeling community could begin to establish a rapport with the atomistic materials modelers and vice versa. Given that the meeting was organized largely by members of the current LSU Challenge Project on high temperature structural materials (i.e., Rajiv Kalia, Priya Vashishta and Aiichiro Nakano), one might have expected the program to focus primarily on semiconductors and ceramics (their speciality), but the actual itinerary was very mixed on the materials front, with work ranging from metals and alloys, to composites, to nanotubes, semiconductors and glasses. The range of properties being examined were largely on the mechanical end (stress/strain, fracture toughness, elastic/plastic regimes, etc.) but also ventured into the realm of surface reactivity, conductivity and magnetism.
CASI
Composite Materials; Computerized Simulation; Quantum Theory; Fracture Mechanics; Ceramics; Continuum Mechanics; Conferences

20000113048 Budd Co., Plastics Div., Troy, MI USA
Thermoset Composites (SMC and RRIM) For Automotive Components
Rusch, Ken C., Budd Co., USA; Budde, Bruce, New Mexico State Univ., USA; Hamilton, Carolyn, New Mexico Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 267-296; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche
This presentation reviews the following: 1. What is Sheet Molding Composite (SMC)? 2. Composition, Manufacture and Molding of SMC; 3. What is Reinforced Reaction Injection Molding (RRIM)? 4. Composition and Molding of RRIM; 5. Annual Production of Composites for Automotive Components; 6. Why Use SMC/RRIM Composites for Automotive Components? 7. Typical Automotive Components in Production Today Grille Opening Panel/Reinforcement (GOPIGOR); 8. Recycling and Recycled Content in Composites; 9. Next Generation of Composite Materials for Automotive. The document is in viewgraph format.
Author
Automobiles; Structural Design; Sheet Molding Compounds; Composite Materials; Injection Molding; Molding Materials; Engine Parts; Structural Members

20000113850 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Synthesis on the durability of composite fiberglass/epoxy resin structures
Thevenin, P.; Dec. 31, 1997; 117p; In French; In English
Report No.(s): DE98-616890; EDF-97-NB-00084; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this paper is to collect together in a systematic way information and results relating to the durability of composite fiberglass/ epoxy resin structures. First it is a matter of assessing the average level of understanding the long term behaviour of these structures which change under the combined effects of varied mechanical loading and stresses of a physico- chemical type linked to the environment. Looking at phenomena encountered and facts from current analyses, it will then be advisable to specify a methodology which can be applied to industrial piping used in PWR cooling systems for transporting raw water under pressure. In fact assessment of their service life is at present based on long and costly testing (ASTM D 2992 B standard), the appearance of which is inherited from metal piping testing.. Therefore it appears essential to study substitution test procedures, more composite specific and at the same time which can be conducted in reasonable time. For this purpose, by coherently acceler-

ating and combining them in order not to underestimate their effects, ageing tests shall reproduce mechanisms representative of operating conditions.
NTIS
Composite Structures; Epoxy Matrix Composites; Epoxy Resins; Glass Fibers

20000114424 Michigan Univ., Dept. of Materials Science and Engineering, Ann Arbor, MI USA
The Mechanics and Mechanical Behavior of High-Temperature Intermetallic Matrix Composites ***Final Report, 1 May 1993 - 30 Apr. 2000***
Gibala, Ronald; Ghosh, Amit K.; Srolovitz, David J.; Holmes, John W.; Kikuchi, Noboru; Jun. 30, 2000; 70p; In English; Prepared in cooperation with California Univ., Berkeley, CA.
Contract(s)/Grant(s): F49620-93-1-0289
Report No.(s): AD-A382602; AFRL-SR-BL-TR-00-0454; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This program has examined mechanics analyses and mechanical behavior of advanced intermetallic matrix composites based on the matrix materials MoSi2. Nb5Si3, NiAl, and TiAl, including Ti-based metal matrix composites. There has been a major focus on determination of strength of interfaces in composites under simple and complex loading configurations involving constrained deformation. Interface strength properties have been determined by use of novel experiments (e.g., asymmetric-notch shear testing of model laminates), finite element simulations, homogenization analysis, and first- principles calculations. Additional focus involved investigation of crack growth, process zone formation, and damage accumulation processes during creep. fatigue. shear, tension, and compression of monolithic matrix materials and ductile phase toughened composites. These experiments have been developed in conjunction with methods of theoretical modeling, e.g.. by macroscopic mechanics of composite interfaces (finite elements, homogenization), analytical theory of eutectic microstructural evolution, and first-principles calculations of MoSi2-Mo and NiAl-Cr/Mo interfaces. Damage generation by thermal fatigue, thermal shock, and thermal misfit stresses has also been investigated experimentally and modeled analytically. The experimental program has included development of processing techniques to produce novel composites and microstructures for mechanical investigations: directional solidification of NiAl, Nb5Si3, and MoSi2-based alloy composites, powder processing of MoSi2 toughened with particulates and uniquely shaped (e.g., wire-mesh) second phase dispersoids, hot pressing methods to form macrolaminates of MoSi2, Nb5Si3, and NiAl-based composites. and physical vapor deposition to produce finer scale micro-laminates of TiAl.
DTIC
Mechanical Properties; High Temperature; Intermetallics; Matrix Materials; Metal Matrix Composites; Composite Materials; Composite Structures; Molybdenum Compounds; Silicides

20000114826 NASA Goddard Space Flight Center, Greenbelt, MD USA
Pre-Launch Testing of GPS Receivers for Geodetic Space Missions
Davis, George, Orbital Sciences Corp., USA; Davis, Edward, NASA Goddard Space Flight Center, USA; Luthcke, Scott, Raytheon Information Technology and Scientific Services, USA; Hawkins, Kimberly, Hammers Co., USA; [2000]; 10p; In English; Global Positioning Systems, 2000, Salt Lake City, NV, USA; Sponsored by Institute of Navigation, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The methodology used and the results obtained in the pre-flight testing of the Blackjack Global Positioning System (GPS) space receiver for the Vegetation Canopy Lidar Mission (VCL) and the Ice, Cloud, and Land Elevation Satellite (ICESat) spacecraft is described. Both real and simulated signals were used to: (1) assess the accuracy and coverage of the navigation solutions, (2) assess the accuracy and stability of the 1-PPS timing signal, (3) assess the precision of the carrier phase observable, and (4) measure the cold-start time to first fix. In addition, an anechoic chamber was used to measure the antenna phase centers with millimeter-level precision. While the test results have generally been excellent and are discussed in this paper, emphasis is placed on describing the test methodology. It is anticipated that future geodetic satellite missions using GPS for navigation, timing, and precise orbit determination (POD) can employ the same tests for pre-launch performance assessment of their particular receiver.
Author
Geodesy; Receivers; Global Positioning System; Space Missions; Prelaunch Tests

20000114864 Virginia Polytechnic Inst. and State Univ., Dept. of Materials Engineering, Blacksburg, VA USA
Acquisition of a Computation/Visualization Server for the Center for Modeling and Simulation in Materials Science ***Final Report, 1 May 1997 - 30 Apr. 1998***
Farkas, Diana; Apr. 30, 1998; 8p; In English
Contract(s)/Grant(s): F49620-97-1-0305
Report No.(s): AD-A382525; AFRL-SR-BL-TR-00-0464; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The computation/visualization server for the Center for Modeling and Simulation in Materials Science (CMSMS) will support extensive computational research in fundamental areas of materials science that have an impact on the development and processing of novel materials. DOD-supported research to be enhanced by the server will address the design and performance of novel materials from first principles quantum mechanical calculations and non-equilibrium thermodynamic theories through the microstructure scale and up to the macroscopic level. Specifically, the research uses numerical simulation methods to investigate (i) the influence of crystal structure, defects, phase evolution, and interfaces on material properties, (ii) the mechanical properties of polycrystalline and fiber composites including the stochastic geometry and constituent material properties, (iii) the failure mode transition in the dynamic fracture of steels and (iv) the penetration of depleted uranium and tungsten heavy alloys into steel targets.
DTIC
Fiber Composites; Mathematical Models; Computerized Simulation; Mechanical Properties; Crystal Structure; Stochastic Processes; Fracturing; Polycrystals

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20000109784 Oak Ridge National Lab., TN USA
Low-Waste Electrospray Method for Applying Chemicals and Finishing Agents to TextilesZh
Alexander, D. A.; Zhang, X.; Aug. 01, 1999; 6p; In English
Report No.(s): DE00-010167; C/ORNL94-0256; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This electrospray technology works by applying the desired chemicals onto a substrate as electrically generated, charged sprays. by imposing a potential difference between the application nozzle and the target, it is possible to precisely direct and control the spray. This electrospray method of application gives a small droplet size and a relatively uniform size distribution, with the added advantage of an easily controllable spray angle. It potentially offers substantial improvement over traditional methods in the area of application uniformity, resulting in improved product quality. Additionally, since the chemicals are electrically directed straight onto the fiber with a minimum of overspray, the electrospray method holds promise in the area of waste reduction, resulting in lowered production cost.
NTIS
Sprayers; Spraying

20000109807 Nevada Univ., Dept. of Physics, Reno, NV USA
Application of Resonant Ultrasound Spectroscopy to Inhomogeneous Materials ***Final Report, 1 Jun 1999-31 May 2000***
McCall, Katherine R.; Aug. 10, 2000; 78p; In English
Contract(s)/Grant(s): N00014-99-1-0708
Report No.(s): AD-A381149; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Resonant Ultrasound Spectroscopy (RUS) has been used successfully to determine the elastic properties of single crystal and homogeneous materials. We have attempted to answer the following question. Under what conditions is RUS a useful tool for determining the moduli of macroscopic, inhomogeneous samples. We concentrated on identifying a sample geometry that will maximize success with RUS. The work consisted of numerical modeling of sample resonances under varying conditions, and empirical testing of rock samples. Numerical modeling and empirical testing indicate that RUS is a viable technique for characterizing the average isotropic elastic moduli of inhomogeneous materials, although larger RMS errors can be expected than for single crystal materials. Success with RUS can optimized by ensuring that the sample size is large compared to the scale of inhomogeneity and by using a high aspect ratio parallelepiped sample.
DTIC
Spectroscopy; Single Crystals; Inhomogeneity; Ultrasonics; Elastic Properties; Materials Tests

20000109843 National Academy of Sciences - National Research Council, Huntsville, AL USA
Cryo-Trapping the Distorted Octahedral Reaction Intermediate of Manganese Superoxide Dismutase
Borgstahl, Gloria, National Academy of Sciences - National Research Council, USA; Snell, Edward H., National Academy of Sciences - National Research Council, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Superoxide dismutase protects organisms from potentially damaging oxygen radicals by catalyzing the disproportion of superoxide to oxygen and hydrogen peroxide. We report the use of cryogenic temperatures to kinetically trap the 6th ligand bound

to the active site of manganese superoxide dismutase. Using cryocrystallography and synchrotron radiation, we describe at 1.55A resolution the six-coordinate, distorted octahedral geometry assumed by the active site during catalysis and compare it to the room temperature, five-coordinate trigonal-bipyramidal active site. Gateway residues Tyr34, His30 and a tightly bound water molecule are implicated in closing off the active site and blocking the escape route of superoxide during dismutation.
Author
Cryogenic Temperature; Enzyme Activity; Hydrogen Peroxide; Inorganic Peroxides; Oxygen

20000110016 NASA Johnson Space Center, Houston, TX USA
Calcium Solubility In Zeolite Synthetic-Apatite Mixtures
Beiersdorfer, R., Youngstown State Univ., USA; Ming, D. W., NASA Johnson Space Center, USA; [1999]; 1p; In English; Science Serving Agriculture and Natural Resources, Past/Present, 30 Oct. - 4 Nov. 1999, Salt Lake City, UT, USA; Sponsored by American Society of Agronomy, USA
Contract(s)/Grant(s): RTOP 131-50-20-23; No Copyright; Avail: Issuing Activity; Abstract Only

Life support systems at a lunar or martian outpost will require the ability to produce food growing in 1) treated lunar or martian regolith; 2) a synthetic soil, or 3) some combination of both. Zeoponic soil, composed of NH4 (-) and K-exchanged clinoptilolite (Cp) and synthetic apatite (Ap), can provide slow-release fertilization via dissolution and ion-exchange. Equilibrium studies indicate that KNH4, P, and Mg are available to plants at sufficient levels, however, Ca is deficient. Ca availability can be increased by adding a second Ca-bearing mineral: calcite (Cal); dolomite (Dol); or wollastonite (Wol). Additions of Cal, Dol, and Wol systematically change the concentrations of Ca and P in solution. Cal has the greatest effect, Dol the least, and Wol is intermediate.
Author
Calcium; Calcium Phosphates; Solubility; Zeolites; Mixtures

20000110388 NASA Goddard Space Flight Center, Greenbelt, MD USA
High-Resolution Spectroscopy of Mars: Recent Results and Implications for Atmospheric Evolution
Krasnopolsky, V. A., NASA Goddard Space Flight Center, USA; Owen, T. C., Hawaii Univ., USA; Maillard, J. P., Institute d'Astrophysique de Paris, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It is believed that Earth, Venus, and Mars were formed by the same rocky and icy planetesimals, which resembled meteorites and comets in their composition, respectively. These planets are thus expected to have initially had the same chemical and isotope composition. Scaling the mass of the terrestrial ocean by the planetary mass ratio, the expected initial H2O abundance on Mars is a layer of about 1 km thick. Scaling the abundance of CO2 on Venus, the expected initial CO2 abundance on Mars is 15 bars. Evidently, significant parts of the initial H2O and CO2 abundances have been lost. Intense meteorite impact erosion and hydrodynamic escape of hydrogen (which could drag to escape more heavy species) were dominant loss processes in the first 0.8 Byr. Later, atmospheric sputtering by O+ ions resulted in the dissociation of CO2 and massive losses of O, C, and H. Formation of carbonates also reduced CO2 to its present abundance which currently exists in the atmosphere, on the polar caps, and is absorbed by regolith. Water loss is currently due to thermal escape of H and nonthermal escape of O, both formed by photodissociation of H2O. All loss processes resulted in fractionation of the H, O, and C isotopes. Therefore, the current isotope ratios in H2O and CO2 are clues to the history of volatiles on Mars. There are three tools to study H2O and CO2 isotopes in the martian atmosphere: (i) mass spectrometry from landing probes, (ii) analyses of Mars' gases trapped in the SNC meteorites which were ejected from Mars, and (iii) high-resolution spectroscopy of the H2O andCO2 bands. Method (i) is the best but is the most expensive. Mass spectrometers to be used should be designed for high-precision isotope measurements. Method (ii) makes it possible to reach an uncertainty +/- 0.1%. However, the obtained results are affected by some uncontrolled interactions: isotope fractionations of (1) trapped gases and (2) those released in pyrolysis, (3) contribution of the impactor, isotope exchanges (4) in the terrestrial environment and (5) with the host rock during pyrolysis. Therefore, the spectroscopic data are of great interest, though their formal accuracy is lower. High-resolution spectroscopy is also a tool to study the current atmosphere of Mars by mapping of some photochemically important species and searching for some minor constituents and their variations. Additional information is contained in the original extended abstract.
Author
Atmospheric Composition; Mars (Planet); Mars Atmosphere; Planetary Evolution; Gas Composition; Cosmochemistry; Meteoritic Composition

20000110520 State Univ. of New York, Dept. of Mechanical and Aerospace Engineering, Buffalo, NY USA

Velocity - Scalar Filtered Density Function (VSFDF) for Large Eddy Simulation of Turbulent Combustion

Givi, Peyman, State Univ. of New York, USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 58; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We have previously developed a methodology, termed the filtered density function (FDF) for large eddy simulation of turbulent reacting flows. The basic element of the FDF is to account for the effects of subgrid scales (SGS) in a probabilistic manner, and to simulate the large scales deterministically. Our previous work indicate that the FDF provides a powerful means of facilitating LES of scalar transport in reactive flows. The objective of the present work is to extent the FDF methodology to also include the velocity transport. This is accomplished by considering the joint velocity-scalar (VSFDF). A transport equation is developed for the VSFDF in which it is shown that the effects of convection and chemical reaction appear in a closed form. The equivalent Langevin form of the stochastic differential equations (SDEs) which yield a transitional probability density function (PDF) equation compatible with the VSFDF is constructed. The unknown terms in the VSFDF is modeled. The marginal velocity FDF (VFDF) is, at least, as accurate as a second-order conventional SGS closure. The VSFDF transport equation is solved numerically by a Lagrangian Monte Carlo scheme. The consistency, convergence, and accuracy of the FDF and the Monte Carlo solution of its equivalent SDEs are assessed. These results are being appraised by comparisons with direct numerical simulation (DNS) and laboratory data.

Author

Large Eddy Simulation; Turbulent Combustion; Velocity Distribution; Probability Density Functions

20000110619 Oak Ridge National Lab., TN USA

Performance of the HRIBF Recoil Mass Spectrometry

Ginter, T. N.; Nov. 13, 1998; 11p; In English; Perspectives in Nuclear Physics, 13-17 Nov. 1998, Paradise Island, Bahamas, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): DE00-003740; ORNL/CP-101374; No Copyright; Avail: Department of Energy Information Bridge

The Recoil Mass Spectrometer (RMS) is a mass separator located at the Holifield Radioactive Ion Beam Facility (HRIBF) at Oak Ridge National Laboratory. This paper describes the RMS, its performance, its detector systems, and discusses some experiments to illustrate its capabilities.

NTIS

Mass Spectrometers; Mass Spectroscopy; Separators

20000111082 NASA Marshall Space Flight Center, Huntsville, AL USA

Characterizing the Use of Ultrasonic Energy in Promoting Uniform Microstructural Dispersions in Immiscible Mixtures

Grugel, R. N., NASA Marshall Space Flight Center, USA; Fedoseyev, A. I., Alabama Univ., USA; [2000]; 1p; In English; Aerospace Science Meeting, 8-12 Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Gravity driven separation and preferential wetting precludes uniform microstructural distributions during solidification processing of immiscible, liquid-liquid mixtures. Historically, it is, however, established that liquid/liquid suspensions can be established and maintained by utilizing ultrasound. Following a brief introduction the results of experiments on immiscible mixtures subjected to ultrasonic energy during solidification processing will be compared and evaluated in view of a recently developed mathematical model. The presentation continues by discussion of scaling the model to commercial viability and concludes with the implications of such processing in a microgravity environment.

Author

Gravitation; Microstructure; Solidification; Dispersing

20000113038 California Univ., Dept. of Chemical Engineering and Materials Science, Davis, CA USA

Ionic Bonding: An Introduction to Materials and to Spreadsheets

Meier, Mike L., California Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 151-166; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

In this experiment the energies and forces involved in ionic bonding plus selected physical properties will be computed. The energy-spacing and force-spacing results will be graphed and the calculated properties will be compared to the values available in the literature. All calculations plus the graphing will be done using a spreadsheet. This spreadsheet program will be constructed using a logical, progressive approach which allows one to carefully examine each aspect of the program as it is being built. This

spreadsheet will also be somewhat generalized, allowing one to calculate the bonding energies and forces for a number of ionic substances. This exercise will involve first performing these calculations for KCI and, when you are sure your program works correctly, repeating the calculations for at least one of the other compounds listed. A good place to start the study of engineering materials is with the nature of the energies and forces involved in the bonding between atoms in a crystalline lattice. When we do we find that there are four principle types of bonds: ionic, metallic, covalent and Van der Waals. While bonding in most materials involves several of types of bonds it is still convenient to think of materials in terms of their dominant type of bonding. For example, ceramics, whose bonding is primarily ionic but may also have covalent traits, tend to be brittle, chemically inert, poor electrical conductors and may be optically transparent while metals, due to their primarily metallic bonding, are ductile, shiny and have high thermal and electrical conductivities. Certain covalently bonded materials are among the hardest (diamond) and have the highest melting points. The chemical bonds in the well known semiconductors silicon and germanium are almost purely covalent. Clearly when we know something about a material's bonding we are in a better position to predict and even control its structure and properties. Fortunately we can also make a number of generalizations regarding properties such as its melting point, stiffness and coefficient of thermal expansion even without having to consider the details of the band structure of inner and outer electron shells (the outer shells are most important in bonding and in the material's electrical properties). In fact, the methods of calculating these bonding energies and properties can be quite simple.
Author
Chemical Bonds; Tables (Data); Materials Tests; Mechanical Properties

20000113039 Idaho Univ., Mechanical Engineering Dept., Moscow, ID USA
Tabletop Experiments for Material Properties Determination
Smelser, Ronald E., Idaho Univ., USA; Odom, Edwin M., Idaho Univ., USA; Beyerlein, Steve W., Idaho Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 167-186; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The determination of mechanical properties of materials can be a dull and sterile activity. Specimens are instrumented and loaded into testing machines. Machine parameters are set, buttons are pushed, and data are recorded. The data are subsequently analyzed and material properties are determined. This process removes the student from interaction with the material and a connection to the equipment. to increase student involvement and engage the student in the laboratory experience, we have designed a series of tabletop experiments to determine the elastic modulus, the shear modulus, Poisson's ratio, and the plastic response of engineering materials. These experiments are part of the introductory course in the laboratory sequence in the Mechanical Engineering Department at the University of Idaho. The experiments are designed to introduce the student to the fundamental behavior of materials and structures through experiential learning. The experiments are also designed to help the student bridge the gap between the materials science courses and mechanics of materials courses. The laboratories also move the student from the prescribed experiments found in chemistry and physics courses to defining the experimental procedures that will be required in an engineering environment.
Author
Mechanical Engineering; Modulus of Elasticity; Poisson Ratio; Shear Properties; Compressive Strength; Elastic Properties; Tensile Strength; Materials Tests

20000113063 Winona State Univ., Dept. of Composite Materials Engineering, Winona, MN USA
Teaching The Principles of Materials Science Using our Natural Surroundings: Spider Silk
Scheer, Robert J., Winona State Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 513-518; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The objective of this experiment is to help students incorporate new concepts in materials science into their knowledge base using their understanding of our natural surroundings. This demonstration/workshop hopes to increase students' understanding of the concepts of stiffness and toughness using simple models and the example of spider silk.
Derived from text
Silk; Mechanical Properties; Stiffness; Toughness

20000113065 Michigan Technological Univ., Dept. of Metallurgical and Materials Engineering, Houghton, MI USA

Artifacts in X-Ray Diffraction Experiments

Pletka, Bruce J., Michigan Technological Univ., USA; Kramer, Ruth I. Schultz, Michigan Technological Univ., USA; Laitila, Edward A., Michigan Technological Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 529-542; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

An experiment is described in which alloys within the Pb-Bi system are prepared and used to demonstrate that non-equilibrium structures can be obtained even when slow cooling rates (i.e., furnace cooling) are employed from the liquid state. The non-equilibrium structures occur for alloys on the Pb-rich side of the phase diagram. These alloys are then used to demonstrate that improper preparation of specimens can lead to erroneous conclusions regarding the microstructure present within a specimen. Two different etches are used to prepare the alloys for examination with optical microscopy and x-ray diffraction. X-ray diffraction experiments performed after using these different etches reveal dramatically different relative amounts of the phases that exist in the microstructure. Observations of the specimens using optical and scanning electron microscopy show that this artifact results from differential etching of the phases within the microstructure.

Author

X Ray Diffraction; Experiment Design; Nonequilibrium Conditions; Lead Alloys

20000113074 Texas A&M Univ., Dept. of Mechanical Engineering, College Station, TX USA

Measurement of Viscosity: Classroom Demonstration

Griffin, Richard B., Texas A&M Univ., USA; Terrill, Lance, Texas A&M Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 655-663; In English; See also 20000113027

Contract(s)/Grant(s): NSF EEC-92-21460; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The objective of this experiment is to demonstrate viscous behavior and to determine the activation energy for a thermally activated process. One of the concepts that students struggle with is the idea of viscoelastic behavior. Generally, they are comfortable with elastic behavior, and for many of them they have a reasonable idea of how a component made from metal is suppose to behave. However, when discussing plastics and the idea of a material relaxing under a strain or continuing to elongate under a load is not quite so intuitive. In an effort to increase the understanding of this behavior, a viscosity experiment was developed. The approach is to use a rotational viscometer and to measure the viscosity of the test fluid at several different temperatures. The educational objective is to measure the viscosity of a fluid at several temperatures and to calculate the activation energy associated with the process.

CASI

Activation Energy; Plastics; Viscoelasticity; Viscosity; Heat; Experiment Design

20000113821 Minnesota Univ., Dept. of Aerospace Engineering and Mechanics, Minneapolis, MN USA

Simulation of Nonequilibrium Aerothermochemistry Using Continuum and Particle Methods ***Final Report, 1 Apr. 1993-30 Jun. 1998***

Candler, Graham V., Minnesota Univ., USA; Boyd, Iain D., Minnesota Univ., USA; Apr. 20, 2000; 14p; In English; Prepared in cooperation with Cornell University, Mechanical and Aerospace Engineering, Ithaca, NY.

Contract(s)/Grant(s): DAAH04-93-G-0089

Report No.(s): AD-A379158; ARO-31565.19-EG-SDI; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

We are developing improved models for low-density, high temperature flows of reacting air, and using these models to study recent re-entry flight experiment data. We have used computational chemistry methods to obtain the first accurate data for the primary nitric oxide formation reaction under thermal conditions. We have also carefully studied the internal energy state of the nitric oxide formed by this reaction. This model will be implemented in continuum and particle flow field methods; this approach gives significantly higher levels of dissociation under strongly nonequilibrium conditions. These new models will greatly enhance our ability to predict the radiative emission from re-entry flows.

Author

Aerothermochemistry; Continuum Flow; Continuums; Dissociation; High Temperature; Internal Energy; Low Density Flow; Nonequilibrium Conditions; Simulation

20000114841 NASA Ames Research Center, Moffett Field, CA USA

NIRS in Space?

Peterson, David L., NASA Ames Research Center, USA; [2000]; 4p; In English; The History and Future of NIR Spectroscopy, 29 Mar. 2000, London, UK

Contract(s)/Grant(s): RTOP 622-93-31-10; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Proponents of near infrared reflectance spectroscopy (NIRS) have been exceptionally successful in applying NIRS techniques to many instances of organic material analyses. While this research and development began in the 1950s, in recent years, stimulation of advancements in instrumentation is allowing NIRS to begin to find its way into the food processing systems, into food quality and safety, textiles and much more. And, imaging high spectral resolution spectrometers are now being evaluated for the rapid scanning of foodstuffs, such as the inspection of whole chicken carcasses for fecal contamination. The imaging methods are also finding their way into medical applications, such as the non-intrusive monitoring of blood oxygenation in newborns. Can these scientific insights also be taken into space and successfully used to measure the Earth's condition? Is there an analog between the organic analyses in the laboratory and clinical settings and the study of Earth's living biosphere? How are the methods comparable and how do they differ?

Author

Exobiology; Biosphere; Imaging Spectrometers; Infrared Spectroscopy; Reflectance; Spectrometers; Spectroscopy

20000114874 National Inst. of Standards and Technology, Physical and Chemical Properties Div., Gaithersburg, MD USA

An ab Initio Study of the Kinetics of the Reactions of Halomethanes with the Hydroxyl Radical, Part 1, CH2Br2

Lous, Florent; Huie, Robert E.; Kurylo, Michael J.; Apr. 06, 2000; 25p; In English

Report No.(s): AD-A382639; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ab initio calculations using the Molier-plesser perturbation theory were carried out on the H-atom abstraction reaction from dibromomethane by hydroxyl radical attack. Geometry optimization and vibrational frequency calculations at the MP2 level were performed on all reactants, products and the transition state with both the 6-311G(d,p) and 6-311G(2d,2p) basis sets. Utilizing the geometry parameters optimized at the MP2/6-311G(2d,2p) level of theory, single point energy calculations were carried out with increasing basis set sizes, from 6-311G(2d,2p) to 6-311++G(3d,3p) and with both the MP2 and MP4SDTQ methods. Canonical transition state theory was used to predict the rate constants as function of the temperature (240-380 K). For the kinetic parameters of this reaction, reasonable agreement with the experimental values was obtained at the PMP2/6-311F(3df,2p)//Mp2/6-311G(2d,2p) level of theory. With the largest basis set, 6-311++G(3df,3pd), the calculated rate constants are in very good agreement with their experimental counterparts.

DTIC

Reaction Kinetics; Enthalpy; Computational Chemistry

26
METALS AND METALLIC MATERIALS

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

20000109782 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Fracture Toughness Evaluation of Unirradiated Mn-Mo-Ni Low Alloy Steel

Seok, C. S.; Won, J. I.; Park, J. S.; Yoon, B. G.; Nov. 30, 1997; 42p; In Korean

Report No.(s): DE99-727790; KAERI-CM-180/97; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objects of this report are to obtain fracture toughness values of unirradiated CT specimen, Mn-Mo-Ni low alloy steel base and weld metal for Ulchin 1 and 2 power plant, in room temperature(20 deg C), middle temperature(149 deg C), operating temperature (286 deg C) and low temperature (- 20 deg C). K(sub IC) test was performed in accordance with ASTM E99 and J(sub IC) test was performed in accordance with ASTM E813. The specimen of this test was 0.5 inch(thickness) CT specimen and the testing machine was 25 ton capacity universal electro hydraulic material testing system (Instron model 1332) and the displacement of load-load line was measured by using COD gauge(Capacitec model B) and Amplifier(Capacitec model SP3200). J(sub Q) and K(sub Q) from the test were not satisfied with thickness condition suggested by ASTM, so they were not determined as K(sub IC) and J(sub IC).

NTIS

Fracture Strength; High Strength Steels; Manganese Alloys; Molybdenum Alloys; Nickel Alloys; Welded Joints

20000109824 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Design of Zr-Nb Alloys

Hwang, S.; Kim, M.; Chun, Y.; Jeong, G.; Kwun, S.; Jul. 31, 1997; 36p; In Korean

Report No.(s): DE99-727802; KAERI-CM-129/96; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Zirconium-base alloys were designed and evaluated for pressure tube application in HWR. Chemical compositions of the alloys consisted of more than 90% Zr and small add this of Nb, Sn, Mo and Cr in combination. A total of 30 compositions were initially designed and screened down to 6 through the first-step evaluations, and then were reduced to 2 in the final evaluation. The two final compositions were Zr-1Nb-1Sn-0.5Mo and Zr-1Nb-0.5Mo. Laboratory scale fabrication process for the experimental alloys was developed to simulate the actual manufacturing schedule for pressure tubes. Electron beam melting and plasma are melting were used to make nuclear grade ingot buttons, each weighing 200-300g. Ingot buttons were hot forged and beta-heat treated prior to hot rolling. Hot rolling was conducted in place of industrial production hot extrusion. Hot rolled buttons were then cold rolled and heat treated at various temperatures for either stress relaxation or recrystallization. A final stabilization heat treatment or aging heat treatment was also conducted. Microstructure (optical as well as TEM and SEM), texture, tensile properties (room temperature and 300 deg C) and creep properties were evaluated and corrosion resistance for a selected alloy composition is currently in progress. Addition of Mo proved effective in grain refining and improving the yield strength and the creep property. Furthermore, the Mo-containing alloy showed a potential for texture control through heat treatment. Overall the present work has established a direction of alloy design in the next-stage materials development for either improved quality pressure tubes in HWR or high burn-up nuclear fuel cladding in PWR.

NTIS

Zirconium Alloys; Niobium Alloys; Arc Melting; Plasmas (Physics); Electron Beams; Heat Treatment; Recrystallization

20000109841 Bhabha Atomic Research Centre, Bombay, India

Electrochemical noise from corroding carbon steel and aluminium

Singh, P. R.; Gaonkar, K. B.; De, P. K.; Banerjee, S.; May 31, 1997; 32p; In English

Report No.(s): DE98-625989; BARC-1997/E/012; No Copyright; Avail: Department of Energy Information Bridge

Electrochemical noise measurements were conducted on carbon steel and aluminium in sodium chloride solutions. Noise parameters like standard deviation of potential and current, noise resistance, pitting index, noise power were studied for the purpose of measuring corrosion rate. These parameters compared well with the corrosion rate. Pitting index was not very reliable. Current noise was more close to the corrosion rates. General corrosion gave rise to white noise type of power spectrum while flicker noise type of spectrum was obtained from pitting attack. Sodium nitrite is shown to inhibit the corrosion of carbon steel. Aluminium corrodes in the early period of exposure and passivates during long exposure.

NTIS

Electrochemical Corrosion; Noise Measurement

20000109931 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium

European Fusion Programme. ITER task T23: Beryllium characterisation; Tensile tests on neutron irradiated and reference beryllium

Moons, F.; Feb. 28, 1996; 38p; In English

Report No.(s): DE98-626863; BLG-709; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

As part of the European Technology Fusion Programme, the irradiation embrittlement characteristics of the more ductile and isotopic grades of beryllium manufactured by Brush Wellman has been investigated using modern powder production and consolidation techniques. This study was initiated in support of the development and evaluation of beryllium as a neutron multiplier for the solid breeder blanket design concepts proposed for a DEMO fusion power reactor. Four different species of beryllium: S200 F (vacuum hot pressed, 1.2 wt% BeO), S-200FH (hot isostatic pressed, 0.9 wt% BeO), S-65 (vacuum hot pressed, 0.6 wt% BeO), S-65H (hot isostatic pressed, 0.5 wt% BeO) have been compared. Three batches of the beryllium have been investigated, a neutron batch, a thermal control batch and a reference batch. Neutron irradiation has been performed at temperatures between 175 and 605 Celsius up to a neutron fluence of 2.1 x 10(exp 25) n.m(exp -2) (equal or greater than 1 MeV) or 750 appm He. The results of the tensile tests are summarized.

NTIS

Beryllium; Embrittlement; Fusion Reactors; Neutron Irradiation; Nuclear Power Reactors; Powder (Particles); Tensile Properties; Thermonuclear Reactions; Fracturing; Tensile Tests

20000110174 Oak Ridge National Lab., TN USA

Fracture in Bulk Amorphous Alloys

Horton, J. A.; Wright, J. L.; Nov. 30, 1998; 8p; In English, 30 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): DE00-003653; ORNL/CP-101115; No Copyright; Avail: Department of Energy Information Bridge

The fracture behavior of a Zr-based bulk amorphous alloy, Zr10Al5Ti(17.9)Cu(14.6)Ni, was examined by transmission electron microscopy (TEM) and x-ray diffraction for any evidence of crystallization preceding crack propagation. No evidence for crystallization was found in shear bands in compression specimens or at the fracture surface in tensile specimens. In-situ TEM deformation experiments were performed to more closely examined actual crack tip regions. During the in-situ deformation experiment controlled crack growth occurred to the point where the specimen was approximately 20 micron thick at which point uncontrolled crack growth occurred. No evidence of any crystallization was found at the crack tips or the crack flanks. Subsequent scanning microscope examination showed that the uncontrolled crack growth region exhibited ridges and veins that appeared to have resulted from melting. Performing the deformations, both bulk and in-situ TEM, at liquid nitrogen temperatures (LN2) resulted in an increase in the amount of controlled cracked growth. The surface roughness of the bulk regions fractured at LN2 temperatures corresponded with the roughness of the crack propagation observed during the in-situ TEM experiment, suggesting that the smooth-appearing room temperature fracture surfaces may also be result of localized melting.

NTIS

Fracture Mechanics; Fracturing; Crack Propagation; Crack Tips; Cracks; Amorphous Materials; Alloys

20000110175 Oak Ridge National Lab., TN USA

Elevated-Temperature Mechanical Properties of an Advanced Type 316 Stainless Steel

Brinkman, C. R.; Aug. 01, 1999; 10p; In English; Pressure and Piping Conference, Boston, MA, August 1-5, 1999, 1-5 Aug. 1999, Boston, MA, USA; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): DE00-003624; ORNL/CP-101053; No Copyright; Avail: Department of Energy Information Bridge

Type 316FR stainless steel is a candidate material for the Japanese Demonstration Fast Breeder Reactor Plant to be built in Japan early in the next century. Like type 316L(N), it is a low-carbon grade of stainless steel with a more closely specified nitrogen content and chemistry optimized to enhance elevated-temperature performance. Early in 1994, under sponsorship of The Japan Atomic Power Company, work was initiated at Oak Ridge National Laboratory (ORNL) aimed at obtaining an elevated-temperature mechanical-properties database on a single heat of this material. The product from was 50-mm plate manufactured by the Nippon Steel Corporation. Data include results from long-term creep-rupture tests conducted at temperatures of 500 to 600 C with test times up to nearly 40,000 h, continuous-cycle strain-controlled fatigue test results over the same temperature range, limited creep-fatigue data at 550 and 600 C, and tensile test properties from room temperature to 650 C. The ORNL data were compared with data obtained from several different heats and product forms of this material obtained at Japanese laboratories. The data were also compared with results from predictive equations developed for this material and with data available for type 316 and type 316L(N) stainless steel.

NTIS

High Temperature; Mechanical Properties; Stainless Steels; Low Carbon Steels

20000110177 Oak Ridge National Lab., TN USA

Intermetallic-Based High-Temperature Materials

Sikka, V. K.; Apr. 25, 1999; 23p; In English; International Corrosion 1999, 25-30 Apr. 1999, San Antonio, TX, USA; Sponsored by National Association of Corrosion Engineers, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): DE00-003553; ORNL/CP-101117; No Copyright; Avail: Department of Energy Information Bridge

The intermetallic-based alloys for high-temperature applications are introduced. General characteristics of intermetallics are followed by identification of nickel and iron aluminides as the most practical alloys for commercial applications. An overview of the alloy compositions, melting processes, and mechanical properties for nickel and iron aluminides are presented. The current applications are commercial producers of nickel and iron aluminides are given. A brief description of the future prospects of intermetallic-based alloys is also given.

NTIS

Intermetallics; High Temperature; Refractory Materials

20000110203 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium

Embrittlement and annealing of reactor pressure vessel steels: comparison of BR3 surveillance and vessel plates to the surrogate plates representative of the Yankee Rowe vessel

Fabry, A.; Chaouadi, T.; Puzzolante, J. L.; Vande elde, J.; Biemiller, E. C.; Jul. 31, 1996; 29p; In English

Report No.(s): DE98-626867; BLG-717; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The sister pressure vessels at the BR3 and Rowe Yankee PWR plants were operated at a lower-than-usual temperature (260 Celsius) and their plates were austenitized at higher-than-usual temperature (970 Celsius). A heat treatment leading to a coarser microstructure than typical for the fine grain plates that are considered in development of USNRC Regulatory guide 1.99. This material displayed outlier behaviour characterized by a 41J CVN- shift significantly larger than predicted by Regulatory Guide 1.99. Because lower radiation temperature and nickel alloying are generally considered detrimental to irradiation sensitivity, there was a major concern that the nickel-modified lower Rowe plate and the nickel-modified BR3 plate may become too embrittled to satisfy the toughness requirements enbodied in the PTS screening criterion. This paper compares three complementary studies undertaken to clarify these uncertainties: (1) the accelerated irradiation and test program launched in 1990 by Yankee Atomic Electric Company using typical vessel plate materials containing 0.24% copper at two nickel levels: YAl, 0.63% (A533-B) and YA9, 0.19% (A302-B). These were heat-treated to produce the coarse and fine grain microstructures representative of the Yankee/BR3 and the Regulatory Guide plates, respectively, (2) the BR3 surveillance and vessel testing program: this vessel was wet-annealed in 1984, relicensed for operation till the plant shutdown in 1987, ANCL was trepanned in early 1995, (3) the accelerated irradiations in the Belgian BR2 test reactor of the Yankee coarse grain plates YA1 and YA9 together with BR3 vessel specimens extracted at nozzle elevation, a location with negligible radiation exposure. It is shown that the PTS screening criterion was never attained by the BR3 and Rowe plates, and that the BR3 vessel anneal was neither necessary nor sufficient. Finally, the sensitivity of embrittlement, annealing and post-annealing reembrittlement to irradiation temperature, nickel and other alloying or impurity elements is discussed with a view to justify reducing the conservatism of regulatory prescriptions for these materials.

NTIS

Pressure Vessels; Cracks; Embrittlement; Accelerated Life Tests; Irradiation; Nickel Plate; Annealing; Reactors; High Strength Steels

20000110213 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy

Investigation of thermodynamic and transport properties of liquid transition metals using Wills-Harrison potentials

Khaleque, M. A.; Bhuiyan, G. M.; Rashid, R. I. M.; Jan. 31, 1998; 9p; In English

Report No.(s): DE98-626008; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thermodynamic properties such as entropy, specific heat capacity at constant pressure and isothermal compressibility have been calculated for liquid 3d, 4d and 5d transition metals near melting temperature. The hard sphere diameter for all such systems is estimated from the potential profile generated from the Wills and Harrison's prescription using linearized WCA theory of liquid. Evaluated values of entropy and specific heat capacity are found to be in good agreement with the experimental data. Transport property like shear viscosity for these liquid metals is obtained using the same potential profile. Lack of experimental data at melting temperatures hampers detailed comparison for all such systems. However, for the case of transport property, the results obtained are found to compare qualitatively well with the available experimental data.

NTIS

Thermodynamic Properties; Transition Metals; Transport Properties; Liquid Metals

20000110242 Oak Ridge National Lab., TN USA

Improving the Oxidation Resistance in Advanced Single Crystal Nickel-Based Superalloys for Turbine Applications

Alexander, K. B.; Kenik, E. A.; Miller, M. K.; Lin, L. S.; Cetel, A. D.; Jul. 01, 1999; 13p; In English

Report No.(s): DE00-009241; ORNL/TM-1999/126; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The focus of this project was the examination of the role of yttrium and other alloying elements on the microstructure and oxidation performance of improved single crystal nickel-based superalloys for advanced turbine applications. The microstructure and microchemistry of both base and modified alloys and their surface oxides have been measured with state-of-the-art microanalytical techniques (atom probe field ion microscopy) and then correlated with identifying the partitioning behavior of the elemental additions in these superalloys before and after burner rig and engine-test oxidation performance. The overall technical goals included: (1) identifying the partitioning behavior of the elemental additions in these superalloys before and after burner rig and engine tests and the effect on the misfit energy between the phases in the alloys; (2) examining the oxidation performance of these newly-developed alloys; (3) identifying the influence of pre-oxidation processing on the subsequent oxidation performance; and (4) relating the microstrutural and microchemical observations to the observed performance of these superalloys. The comparison

of the base and modified alloys will produce a better understanding of the interaction between chemistry, structure, and performance in superalloys. In addition, it will lead to optimized alloys with improved performance including enhanced durability in the operating environments at the elevated temperature required to improve energy efficiency. The availability of alloys capable of higher temperature operation will minimize the need for expensive coatings in extreme temperature applications.
NTIS
Oxidation Resistance; Single Crystals; Gas Turbines; Heat Resistant Alloys; Metal Surfaces; Microanalysis; Nickel Alloys

20000110564 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Report of the results of the fiscal 1997 regional consortium R and D project. Regional consortium energy saving metal forming technology (first fiscal year)
Mar. 31, 1998; 158p; In Japanese; In English
Report No.(s): DE99-746855; ETDE/JP-99746855; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Out of the development of metal forming technology by a new energy saving process, the paper described the fiscal 1997 result. In the development of high-hard tool steels by composite carbide dispersion carburization (CDC) method, high speed steels containing V and Mo were manufactured to observe the texture and measure the hardness. From carburized materials, the texture in which more homogeneous and finer carbide disperses than from dissolved materials can be obtained. Hardness of CDC materials is dependent on alloy concentration and texture, and specimens exceeding the maximum Vickers hardness, 1000, were manufactured. The texture of carburized materials is predictable from the calculation state chart, and a relational equation was introduced of the crystal grain growth of the particle dispersion texture. After carburization, quenching and tempering were conducted under various conditions, and the maximum Vickers hardness, 1000, was almost achieved. The large ball mill which enables mechanical alloying was newly installed. High temperature rotating bending fatigue experimental equipment was installed. The sintering method was established, and spattering target for trial manufacture was manufactured. The joining experiment using various inserting materials was carried out, appropriate joining conditions and inserting materials were selected, and the joining experiment on ion gun parts.
NTIS
Energy Technology; Metal Working; Forming Techniques; Energy Conservation

20000110565 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Report of the results of the fiscal 1997 regional consortium R and D project. Regional consortium energy field / R and D mesoscopic organ control heat-resistant / wear-resistant metal group composite material (first fiscal year)
Mar. 31, 1998; 174p; In Japanese; In English
Report No.(s): DE99-746853; ETDE/JP-99746853; No Copyright; Avail: Department of Energy Information Bridge

Out of the R and D of mesoscopic metal group composite materials, the paper described the fiscal 1997 results. In the in-situ method as a composite material making method, elucidated to some degree were chemical composition of Fe-C-Cr-V-Nb-Mo-W-Ni base multi-dimensional alloys, and wear resistance and oxidation resistance of MC type carbide dispersion multi-phase texture crystallizing as primary crystal and eutectic. In the composite material making with ceramic fiber and alloy by the pressure infiltration method, the paper clarified the texture formation mechanism in solidification/heat treatment by a combination of Al alloys and alumina long fiber, and the relation between fiber configuration and wear resistance. by MA and MG methods as the powder metallurgy composite material making method, a composed body of (alpha)-stainless steel of Fe-12%Cr composition and M23C6 of 40-90vol% are designed for alloy composition, and powder of amorphous or hyperfine texture was fabricated. by hot pressing this, fine texture mixed with M23C6 of 1(mu)m and ferrite was obtained. Further, by mechanically alloying the powder composed of high speed steel, TiN powder and TiC powder, hyperfine texture mixed powder was fabricated. Conditions of HIP treatment of large members were also discussed.
NTIS
Wear Resistance; Carbides; Amorphous Materials; Thermal Resistance

20000110570 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Technology for Advanced Treatment of High Melting Point Metal-Based Material, local research and development of important technology for fiscal 1997. Development of materials creation technology for high efficiency power generator components
Mar. 31, 1998; 124p; In Japanese; In English
Report No.(s): DE99-736795; ETDE/JP-99736795; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Efforts are made for the creation of high melting point metal-base materials to replace the currently-used Ni-base superalloys for the turbine to withstand higher operating temperatures. The main efforts made in fiscal 1997 are outlined. As in fiscal 1996,

Nb-base solution alloys, in which solution reinforcement elements such as Mo and W are alloyed, are manufactured by button arc melting and tested for mechanical properties and texture/characteristics. In the designing and evaluation for a strongest Nb-base composite material, Nb-base composite materials are manufactured by use of particle dispersion-strengthening attained by addition of intermetallic compounds or elements to contribute to the formation of oxides, carbides, or nitrides. Nb-base composite materials may also be manufactured by use of eutectic-strengthening attained by utilizing crystallization in the process of coagulation. The resultant Nb-base composite materials are evaluated for their dynamic characteristics at high temperatures. In the development and evaluation of technologies for creating Nb- base materials for high-temperature components, larger specimens as heavy as several kg are tested in line with small specimens for basic studies, and the results are utilized for alloy designing for high-temperature materials.
NTIS
Melting Points; Composite Materials; Refractory Materials; Electric Generators

20000110602 Bettis Atomic Power Lab., West Mifflin, PA USA
Comparison of Internal Hydrogen Embrittlement and Hydrogen Environment Embrittlement of X-750;Engineering Fracture Mechanics
Symons, D. M.; Dec. 01, 1999; 49p; In English
Report No.(s): DE00-755396; B-T-3256; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Hydrogen has been shown to degrade the mechanical properties of nickel-base alloys. This degradation occurs whether the material is in a hydrogen producing environment or if the material has dissolved hydrogen in the metal due to prior exposure to hydrogen. Materials behave differently under these two conditions. Therefore, the degradation due to hydrogen has been split into two categories, internal hydrogen embrittlement (IHE) and hydrogen environment embrittlement (HEE). IHE may be defined as the embrittlement of a material that has been charged with hydrogen prior to testing or service while HEE may be defined by the embrittlement of a material in a hydrogen environment where the hydrogen may come from gaseous hydrogen or generated from a corrosion reaction. This work will compare IHE and HEE of fracture mechanics specimens. Different fugacities of hydrogen for HEE and hydrogen concentrations for IHE were examined for Alloy X-750, a nickel-base super alloy. The test results were analyzed and the role fo hydrogen in IHE and HEE was evaluated. A model based on a critical grain boundary hydrogen concentration will be proposed to describe the behavior in both HEE and IHE conditions.
NTIS
Hydrogen Embrittlement; Mechanical Properties; Nickel Alloys; Metal-Gas Systems; Fracture Mechanics

20000110605 Bettis Atomic Power Lab., West Mifflin, PA USA
Fracture Toughness of Alloy 690 and EN52 Weld in Air and Water
Brown, C. M.; Mills, W. J.; Jun. 01, 1999; 40p; In English
Report No.(s): DE00-755362; B-T-3265; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The effect of low and high temperature water with high hydrogen on the fracture toughness of Alloy 690 and its weld, EN52, was characterized using elastic-plastic J(sub IC) methodology. While both materials display excellent fracture resistance in air and elevated temperature (greater than 93 C) water, a dramatic degradation in toughness is observed in 54 C water. The loss of toughness is associated with a hydrogen-induced intergranular cracking mechanism where hydrogen is picked up from the water. Comparison of the cracking behavior in low temperature water with that for hydrogen-precharged specimens tested in air indicates that the critical local hydrogen content required to cause low temperature embrittlement is on the order of 120 to 160 ppm. Loading rate studies show that the cracking resistance is significantly improved at rates above ca. 1000 MPa(radical)m/h because there is insufficient time to produce grain boundary embrittlement. Electron fractographic examinations were performed to correlate cracking behavior with microstructural features and operative fracture mechanics.
NTIS
Cracking (Fracturing); Degradation; Embrittlement; Fracture Mechanics; Microstructure; Toughness; Alloys; Welded Structures; Welding

20000110607 Bettis Atomic Power Lab., West Mifflin, PA USA
Fracture Behavior of Nickel-Based Alloys in Water
Mills, W. J.; Brown, C. M.; Aug. 01, 1999; 10p; In English; 9th; 9th International Conference on Environmental Degradation of Materials in Nuclear Power Systems - Water Reactors, 1-5 Aug. 1999, Newport Beach, CA, USA
Report No.(s): DE00-755341; B-T-3240; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The cracking resistance of Alloy 600, Alloy 690 and their welds, EN82H and EN52, was characterized by conducting tests in air and hydrogenated water. All test materials displayed excellent toughness in air and high temperature water, but Alloy 690

and the two welds were severely embrittled in low temperature water. In water with 150 cc values were typically 70% to 95% lower than their air counterparts. The toughness degradation was associated with a fracture mechanism transition from microvoid coalescence to intergranular fracture. Comparison of the cracking response in water with that for hydrogen-precharged specimens tested in air demonstrated that susceptibility to low temperature cracking is due to hydrogen embrittlement of grain boundaries. The effects of water temperature, hydrogen content and loading rate on low temperature crack propagation were studied. In addition, testing of specimens containing natural weld defects and as-machined notches was performed to determine if low temperature cracking can initiate at these features. Unlike the other materials, Alloy 600 is not susceptible to low temperature cracking as the toughness in 54 C water remained high and a microvoid coalescence mechanism was operative in both air and water.
NTIS
Fracture Mechanics; Degradation; Nickel Alloys; Welded Joints; Hydrogen Embrittlement; Fracturing; Metal-Water Reactions; Cracks

20000110608 Bettis Atomic Power Lab., West Mifflin, PA USA
Corrosion Behavior of Hafnium in High-Temperature-Water Environments; Journal of Nuclear Materials
Rishel, D. M.; Smee, J. D.; Kammenzind, B. F.; Oct. 01, 1999; 48p; In English
Report No.(s): DE00-755333; B-T-3232; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The high-temperature-water corrosion performance of hafnium is evaluated. Corrosion kinetic data are used to develop correlations that are a function of time and temperature. The evaluation is based on corrosion tests conducted in out-of-pile autoclaves and in out-of-flux locations of the Advanced Test Reactor (ATR) at temperatures ranging from 288 to 360 C. Similar to the corrosion behavior of unalloyed zirconium, the high-temperature- water corrosion response of hafnium exhibits three corrosion regimes: pretransition, posttransition, and spalling. In the pretransition regime, cubic corrosion kinetics are exhibited, whereas in the posttransition regime, linear corrosion kinetics are exhibited. Because of the scatter in the spalling regime data, it is not reasonable to use a best fit of the data to describe spalling regime corrosion. Data also show that neutron irradiation does not alter the corrosion performance of hafnium. Finally, the data illustrate that the corrosion rate of hafnium is significantly less than that of Zircaloy-2 and Zircaloy-4.
NTIS
Hafnium; Corrosion Tests; Advanced Test Reactors; Corrosion; High Temperature Environments; Water; Autoclaves

20000110616 Oak Ridge National Lab., TN USA
Non-Heat Treatable Alloy Sheet Products
Hayden, H. W.; Barthold, G. W.; Das, S. K.; Aug. 01, 1999; 18p; In English
Report No.(s): DE00-009841; C/ORNL95-0396; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

ALCAR is an innovative approach for conducting multi-company, pre-competitive research and development programs. ALCAR has been formed to create a partnership of aluminum producers, the American Society of Mechanical Engineers Center for Research and Technology Development (ASME/CRTD), the United States Department of Energy (USDOE), three USDOE National Laboratories, and a Technical Advisory Committee for conducting cooperative, pre-competitive research on the development of lower-cost, non-heat treated (NHT) aluminum alloys for automotive sheet applications with strength, formability and surface appearance similar to current heat treated (HT) aluminum alloys under consideration. The effort has been supported by the USDOE, Office of Transportation Technology (OTT) through a three-year program with 50/50 cost share at a total program cost of $3 million. The program has led to the development of new and modified 5000 series aluminum compositions. Pilot production-size ingots have been melted, cast, hot rolled and cold rolled. Stamping trials on samples of rolled product for demonstrating production of typical automotive components have been successful.
NTIS
Aluminum Alloys; Research and Development; Metal Sheets; Mechanical Properties

20000110621 Oak Ridge National Lab., TN USA
Modeling of Microstructure Evolution in Austenitic Stainless Steels Irradiated Under Light Water Reactor Conditions
Gan, J.; Stoller, R. E.; Was, G. S.; Nov. 30, 1998; 8p; In English, 30 Nov. - 4 Dec. 1999, Boston, MA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): DE00-003656; ORNL/CP-101210; No Copyright; Avail: Department of Energy Information Bridge

A model for the development of microstructure during irradiation in fast reactors has been adapted for light water reactor (LWR) irradiation conditions (275 - 325 C, up to approximately 10 dpa). The original model was based on the rate-theory, and included descriptions of the evolution of both dislocation loops and cavities. The model was modified by introducing in-cascade

interstitial clustering, a term to account for the dose dependence of this clustering, and mobility of interstitial clusters. The purpose of this work was to understand microstructural development under LWR irradiation with a focus on loop nucleation and saturation of loop density. It was demonstrated that in-cascade interstitial clustering dominates loop nucleation in neutron irradiation in LWRs. Furthermore it was shown that the dose dependence of in-cascade interstitial clustering is needed to account for saturation behavior as commonly observed. Both quasi-steady-state (QSS) and non-steady-state (NSS) solutions to the rate equations were obtained. The difference between QSS and NSS treatments in the calculation of defect concentration is reduced at LWR temperature when in-cascade interstitial clustering dominates loop nucleation. The mobility of interstitial clusters was also investigated and its impact on loop density is to reduce the nucleation term. The ultimate goal of this study is to combine the evolution of microstructure and microchemistry together to account for the radiation damage in austenitic stainless steels.
NTIS
Austenitic Stainless Steels; Irradiation; Interstitials; Nucleation; Metal Clusters

20000113032 University of Southern Maine, School of Applied Science, Gorham, ME USA
Shape Memory Alloys
Marshall, John A., University of Southern Maine, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 69-73; In English; See also 20000113027; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

Motors and solenoids are two very common ways to create motion from electricity. The majority of the machines and equipment used in industries and homes today make extensive use of these two devices. Both of these devices rely on magnetic fields to produce the mechanical motion that is utilized for linear and rotary power transmission. Due to recent advancements in Shape Memory Alloys (SMAs), another method of creating motion has become available that does not rely on magnetic fields. SMAs are special metals that undergo changes in shape and hardness when heated or cooled, and do so with a great amount of force. When made into wires, SMAs can be stretched from five to eight percent and will recover their original, shorter length when heated. This is formally referred to as the materials "deformation-to-recovery ratio." Research during the 1960's and 70's was focused on devices such as: satellite antennas (NASA) that would unfold and expand when exposed to the heat of the sun; engines that would run on hot and cold water-automatic temperature-controlled greenhouse windows; and car fan clutches that would engage only when the engine warmed-up. One of the primary applications of SMAs today are in the medical arena with devices such as filters that are inserted into a patient's vein or artery to trap stroke-causing blood clots. It is inserted cold, and as it warms, it opens to form a filter. Other applications include highly reliable coupling connections for aircraft hydraulic lines, air valves, fuse protectors, and even a six axis computer-controlled robotic arm!
Author
Shape Memory Alloys; Temperature Effects; Nitinol Alloys

20000113044 Alcan Global Automotive Products, Kingston, Ontario Canada
Aluminum Materials For Environmentally Friendly Vehicles
Wheeler, Michael J., Alcan Global Automotive Products, Canada; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 225-233; In English; Environmental Vehicles and Alternative Fuels, 15-17 Jun. 1998, Ypsilanti, MI, USA; Sponsored by Engineering Society of Detroit, USA; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The energy consumption of vehicles is largely determined by their weight. Therefore, reduction in weight for environmentally friendly vehicles is particularly important, not only for conventionally powered vehicles which generate exhaust emissions but also for electric and alternative energy powered vehicles since their range is critically dependent on weight. Aluminum, because of its low density and availability in a wide range or product forms, is already an important automotive material for saving weight. However, by using, aluminum for the body structures and frames of vehicles, significantly more weight can be saved. This paper will describe the aluminum materials and enabling technologies that have been developed for building Aluminum intensive vehicles and will illustrate the application of Aluminum for vehicle structures through the prototype and production vehicles that have been developed by the auto companies during the last few years. The paper will conclude on the activities of the aluminum industry to ensure an appropriate supply of material for the automotive industry.
Author
Aluminum; Automobiles; Energy Consumption; Exhaust Emission; Weight Reduction

20000113047 Aluminum Association, Inc., Washington, DC USA

Opportunities For Recycling of Aluminum From End-of-Life Vehicles

Thomas, M. P., Aluminum Association, Inc., USA; Wood, C. L., Jr., Aluminum Association, Inc., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 255-266; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Around 250 lbs (115 kg) of aluminum are used on current North American vehicles. When these vehicles are scrapped, the aluminum will be recycled by a highly successful industry that thrives on free market economics. Aluminum is an attractive candidate for use in future powertrain, chassis and structural applications, including body structures and closure panels. Aluminum's many product forms can help the designer to reduce tooling cost and assembly cost through parts consolidation. As the use of aluminum grows, and particularly with the increasing use of wrought alloys, there will be opportunities for methods to enhance the value of end-of-life vehicles, and particularly to optimize the recovery of the aluminum from these vehicles. The aluminum industry is working together to ensure that these methods are developed and implemented, and this paper will extend previous discussion of these activities in relation to existing and future recycling systems for automotive aluminum.

Author

Aluminum; Automobiles; Recycling

20000113052 Costa Rica Univ., Dept. of Materials, San Jose, Costa Rica

Galvanostatic Polarization Curves For Teaching Purposes, Part 2

Umana, Carlos E., Costa Rica Univ., Costa Rica; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 329-340; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The first part of this experiment was presented at the NEW:Update 98. In this second part polarization curves for mild steel are obtained following the same basic steps as in the first part but including the current range from 1 to 10 microA/sq cm. The low range data is used to introduce and apply the polarization resistance method. This method consists in plotting on a linear scale the lower anodic and cathodic overpotential values (Epsilon) versus applied current density (i(sub appl)) in order to obtain graphically the Delta epsilon/delta i(sub appl) slope as Epsilon approaches zero. This slope value is related with both the anodic and the cathodic Tafel slopes (Beta(sub a) and Beta(sub c)) and the corrosion current density (i(sub corr) by the polarization resistance equation as follows: R(sub p) = Delta epsilon/delta i(subappl) (as epsilon approaches 0) = Beta(sub a) Beta(sub c)/2.3i(sub corr) (Beta(sub a) + Beta(sub c) Where: R(sub p)= polarization resistance The demonstration of this equation i's presented in the Appendix. The polarization resistance method is a technique normally used to estimate the corrosion current density without knowing the actual Tafel slopes. This is done by assuming common Tafel values. However in this work polarization resistance will be used to improve the exactness of the anodic Tafel slope by assuming that the cathodic Tafel slope, the corrosion current density and the slope Delta epsilon/delta i(subappl) (as epsilon approaches 0) are more reliable experimental values than the anodic Tafel slope. From the earlier equation an expression for Beta(sub a) is obtained as shown below: Beta(sub a) = 2.3R(sub p)i(sub corr)Beta(sub c)/(Beta(sub c) - 2.3R(sub p)i(sub corr)) In this way the main electrochemical techniques used in corrosion evaluation and control are introduced by performing simple but well based laboratory experiments.

Derived from text

Activation; Tafel Law; Polarization (Charge Separation)

20000113055 Purdue Univ. Calumet, Dept. of Engineering, Hammond, IN USA

Mechanical Properties of Sheet Steels Used in Stamping and Drawing

Abramowitz, Harvey, Purdue Univ. Calumet, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 391-421; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This document presents an exercise to introduce students to automotive sheet steels. The students measure mechanical properties and compare their measurements with published values. The properties of different steels are compared.

CASI

Mechanical Properties; Metal Sheets

20000113059 Michigan Univ., Dept. of Industrial and Manufacturing Systems Engineering, Dearborn, MI USA

Visio-Plastic Modeling of Metal Forging and Extrusion

Kridli, Ghassan T., Michigan Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 475-480; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Visio-plastic modeling is a technique that uses soft materials, such as plasticine, to demonstrate material flow, and to study the strain distribution in plane strain and axisymmetric upset forgings and extrusions. This technique is a useful tool that can be used during die design, especially in the case of progressive dies. Due to the low stress requirements necessary to cause deformation in plasticine, testing dies are inexpensive to machine and may be machined in short periods of time. During the experiment, plasticine strips of equal thickness and of two different colors, are stacked with alternating color, so as to represent the initial shape of the forging stock or extrusion billet. The plasticine is then placed in the die and formed. Sections of severe deformation and material folding may be observed. Strain can be evaluated by comparing the initial and final strip thicknesses at different regions in the formed piece. Keywords Extrusion, visio-plastic modeling.
Author
Extruding; Forging; Models; Experiment Design; Plastics

20000113818 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Influence of surface finish on fatigue properties of metallic materials: a bibliographic study
Akamatsu, M.; Dec. 31, 1997; 34p; In French; In English
Report No.(s): DE98-616878; EDF-97-NB-00046; No Copyright; Avail: Department of Energy Information Bridge

The investigation of a fatigue failed component very often shows that cracks initiated at the surface. It is actually well known that the surface finish notably influences the fatigue strength of a component. We have carried out a bibliographic study in order to clarify the influence of the different surface parameters. The analysis of the literature has shown that most of the data concerns high cycle fatigue. Three aspects of the surface finish have been examined: geometry (roughness), residual stresses and microstructure. In a general way, the influence of geometrical surface finish is tackled either empirically, with a factor assessing the fatigue limit decrease when the roughness and the tensile strength increase, or theoretically, with approaches modelling geometrical irregularities as notches or cracks. In all cases, the effect of roughness on fatigue strength depends on the material, through mechanical properties or microstructural features. The theoretical approaches seem particularly interesting, but their use is not straightforward and requires further development. The creation of residual stresses at the surface of a component can just as well reduce as improve its fatigue strength. In a first approach, these stresses can be regarded as a mean service stress. In fact, mechanical and metallurgical gradients near the surface have to be taken into account, which affect the relaxation of residual stresses during fatigue cycling. Actually, the effect of residual stresses can hardly be isolated, because these stresses are associated with geometrical and microstructural modifications. Microstructural features (metallurgical structure, grain size, inclusions, strain hardening) have an undoubted influence on fatigue strength, but the quantification of the effects remains tricky. The influence of the microstructure of surface layers on fatigue strength generally depends on the mechanical properties of materials. In short, fatigue strength predictions through a limited number of surface parameters have to be considered very carefully.
NTIS
Metals; Surface Finishing; Bibliographies; Fatigue (Materials)

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.

20000109783 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Dynamic J-R Characteristics of RCS Pipe Materials for Ulchin Unit 3/4. (Evaluation of Dynamic Strain Aging Effects)
Hong, J. H.; Lee, B. S.; Yoon, J. H.; Oh, J. M.; Kim, J. W.; Sep. 30, 1997; 51p; In Korean
Report No.(s): DE99-727786; KAERI-CR-35/97; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

5 materials (45 1T-CT specimens) were tested to evaluate dynamic J-R characteristics of RCS Pipe Materials for Ulchin Unit 3/4 (Evaluation of Dynamic Strain Aging Effects). The tests were performed by DCPD method at 316 deg C and 25 deg C. The loading rates were 1000mm/min and 2000mm/min. The objectives of this project were to obtain the dynamic J-R curves data of ferritic steels for application of LBB to the RCS pipes of Ulchin Unit 3/4. The test results showed that all of the tested dynamic J-R curves of 5 materials were above the lower bound curve of static J-R curve of pipe materials for Ulchin Unit 3/4.
NTIS
Nuclear Research and Test Reactors; Aging (Materials); Strain Hardening; Precipitation Hardening

20000109790 Pennsylvania State Univ., Materials Research Lab., University Park, PA USA
Acoustic Transduction Materials and Devices, Volume 4 ***Annual Report, 1 Jan.-31 Dec. 1999***
Uchino, Kenji; Jun. 12, 2000; 178p; In English
Contract(s)/Grant(s): N00014-96-1-1173
Report No.(s): AD-A381270; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

A primary objective of this MURI grouping was to help shorten the time constant for new materials and device concepts to be applied in practical Navy Systems. We believe this has now been realized in joint work on the composite cymbal type flextensional arrays for large area projectors, and in the progress made towards a micro-tonpilz array system. Original work on new step and repeat piezoelectric high strain systems continues to make good progress now using commercial motion rectifiers to produce both linear and rotary systems with high torque capability. New composite designs are pushing toward 1 mm diameter motors in the size regimen where there are real difficulties for conventional electromagnetic designs. A new area of activity this year is in piezoelectric transformers where a circular symmetry design in conjunction with controlled inhomogeneous poling is shown to offer capabilities which are of real interest for energy recovery actuator power systems. Basic studies have evolved a new environmental SEM technique for high resolution domain wall studies without changing problems. Work is continuing on reliable measurements of electrostrictive constants in simple solids confirming by both direct and converse methods and permitting the first generalization of trends in these fundamentally important coupling constants.
DTIC
Acoustic Properties; Polymers; Ceramics; Piezoelectric Transducers; Electrostriction

20000109791 Pennsylvania State Univ., Materials Research Lab., University Park, PA USA
Acoustic Transduction Materials and Devices, Volume 3 ***Annual Report, 1 Jan.-31 Dec. 1999***
Uchino, Kenji; Jun. 12, 2000; 201p; In English
Contract(s)/Grant(s): N00014-96-1-1173
Report No.(s): AD-A381271; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A primary objective of this MURI grouping was to help shorten the time constant for new materials and device concepts to be applied in practical Navy Systems. We believe this has now been realized in joint work on the composite cymbal type flextensional arrays for large area projectors, and in the progress made towards a micro-tonpilz array system. Original work on new step and repeat piezoelectric high strain systems continues to make good progress now using commercial motion rectifiers to produce both linear and rotary systems with high torque capability. New composite designs are pushing toward 1 mm diameter motors in the size regimen where there are real difficulties for conventional electromagnetic designs. A new area of activity this year is in piezoelectric transformers where a circular symmetry design in conjunction with controlled inhomogeneous poling is shown to offer capabilities which are of real interest for energy recovery actuator power systems. Basic studies have evolved a new environmental SEM technique for high resolution domain wall studies without changing problems. Work is continuing on reliable measurements of electrostrictive constants in simple solids confirming by both direct and converse methods and permitting the first generalization of trends in these fundamentally important coupling constants.
DTIC
Polymers; Ceramics; Piezoelectric Transducers; Composite Structures; Acoustic Properties; Electrostriction

20000109792 Pennsylvania State Univ., Materials Research Lab., University Park, PA USA
Acoustic Transduction Materials and Devices, Volume 5 ***Annual Report, 1 Jan.-31 Dec. 1999***
Uchino, Kenji; Jun. 12, 2000; 162p; In English
Contract(s)/Grant(s): N00014-96-1-1173
Report No.(s): AD-A381272; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A primary objective of this MURI grouping was to help shorten the time constant for new materials and device concepts to be applied in practical Navy Systems. We believe this has now been realized in joint work on the composite cymbal type flextensional arrays for large area projectors, and in the progress made towards a micro-tonpilz array system. Original work on new step and repeat piezoelectric high strain systems continues to make good progress now using commercial motion rectifiers to produce both linear and rotary systems with high torque capability. New composite designs are pushing toward 1 mm diameter motors in the size regimen where there are real difficulties for conventional electromagnetic designs. A new area of activity this year is in piezoelectric transformers where a circular symmetry design in conjunction with controlled inhomogeneous poling is shown to offer capabilities which are of real interest for energy recovery actuator power systems. Basic studies have evolved a new environmental SEM technique for high resolution domain wall studies without changing problems. Work is continuing on reliable mea-

surements of electrostrictive constants in simple solids confirming by both direct and converse methods and permitting the first generalization of trends in these fundamentally important coupling constants.
DTIC
Polymers; Ceramics; Piezoelectric Transducers; Composite Structures; Electrostriction; Acoustic Properties

20000109804 Materials Research Society, Warrendale, PA USA
Materials Research Society Symposium Proceedings Volume 600, Electroactive Polymers (EAP) Symposium Held in Boston, Massachusetts on November 29-December 1, 1999
Zhang, Q. M.; Furukawa, Takeo; Bar-Cohen, Yoseph; Scheinbeim, J.; Dec. 01, 1999; 341p; In English
Contract(s)/Grant(s): N00014-00-1-0166
Report No.(s): AD-A381226; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

For many years, electroactive ceramic, magnetostrictive material and shape memory alloys have been the primary source of actuation materials for manipulation and mobility systems. Electroactive polymers (EAP) received relatively little attention due to their limited capability. In recent years, effective EAP materials have emerged changing the paradigm of these materials' capability and potential. Their main attractive characteristic is the operation similarity to biological muscles where under electrical excitation a large displacement is induced. The potential to operate biologically inspired mechanisms using EAP as artificial muscles and organs is offering exciting applications that are currently considered science fiction. This MRS symposium, "Electroactive Polymers," held November 29-December 1 at the 1999 MRS Fall Meeting in Boston, Massachusetts, was initiated for the first time this year in an effort to promote technical exchange of EAP research and development as well as provide a forum for progress reports. The symposium has the input from the international mix in participation. Eminent EAP researchers from the U.S.A., Japan, and Europe presented Invited Papers covering the cutting edge of their material state of the art capabilities and limitations. Generally, two groups of materials were covered: Dry including electrostrictive, electrostatic, piezoelectric, and ferroelectric; as well as Wet including IPMC, nanotubes, conductive polymers, gels, etc. While overall the dry types require high voltage for their operation, they provide larger mechanical energy density and they can hold a displacement under a DC voltage, and some of the DRY EAP are capable of operating to high frequencies (>10 kHz). On the other hand, the WET EAP are superior in requiring low actuation voltage (approx. a few volts) with high strain generation capabilities, but are sensitive to drying, and some have difficulties holding a displacement under DC activation.
DTIC
Polymers; Ceramics; Ferroelectric Materials; Piezoelectricity; Conferences

20000109806 Materials Research Society, Warrendale, PA USA
Materials Research Society Symposium Proceedings Volume 604. Materials for Smart Systems III, Held November 30-December 2, 1999, Boston, Massachusetts, USA
Wun-Fogle, Marilyn; Uchino, Kenji; Ito, Yukio; Gotthardt, Rolf; Dec. 02, 1999; 362p; In English
Contract(s)/Grant(s): N00014-00-1-0113
Report No.(s): AD-A381141; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This volume represents a record of the proceedings of Symposium LL, "Smart Materials," held November 30 - December 2 at the 1999 MRS Fall Meeting in Boston, Massachusetts, the third symposium in the series on "Smart Materials." In addition to the conventional piezoelectric, magnetostrictive and shape memory materials, the symposium was expanded to include electro-/magnetorheological fluids and mechanochemical actuators. Seventy-one papers were presented over the course of three days. of the fifty-one papers in this volume, twenty-one (or roughly 41%) came from outside the U.S. reported.
DTIC
Piezoelectric Transducers; Conferences; Shape Memory Alloys; Magnetostriction

20000109810 Materials Research Society, Warrendale, PA USA
Materials Research Society Symposium Proceedings Volume 581, Nanophase and Nanocomposite Materials III Symposium Held in Boston, Massachusetts on November 29-December 2, 1999
Komarneni, Sridhar; Parker, John C.; Hahn, Horst; Dec. 02, 1999; 682p; In English
Contract(s)/Grant(s): N00014-00-1-0029
Report No.(s): AD-A381228; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This volume contains the proceedings of Symposium F, "Nanophase and Nanocomposite Materials III," held November 29-December 2, at the 1999 MRS Fall Meeting in Boston, Massachusetts. This symposium is the third one of this series which began at the 1992 MRS Fall Meeting. The objective of this third symposium was to provide a forum to review the recent advances in nanophase and nanocomposite materials and to address the future prospects for these materials. Scientists from many parts of

the world participated to present and discuss synthesis, processing, properties and applications of nanophase and nanocomposite materials. A total of about 240 papers from 23 countries were presented from academic institutions, government research organizations, and private industries. The 107 papers published in this proceedings have been refereed and presented as nine chapters. DTIC

Conferences; Nanotechnology; Composite Materials; Nanostructure (Characteristics)

20000109826 AZ Technology, Huntsville, AL USA

Assessment of Thermal Control and Protective Coatings ***Final Report, 3 May 1995 - 30 Apr. 2000***

Mell, Richard J., AZ Technology, USA; Apr. 30, 2000; 53p; In English

Contract(s)/Grant(s): NAS8-40199; RTOP 478-12-31

Report No.(s): Rept-95-1-281-025; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This final report is concerned with the tasks performed during the contract period which included spacecraft coating development, testing, and applications. Five marker coatings consisting of a bright yellow handrail coating, protective overcoat for ceramic coatings, and specialized primers for composites (or polymer) surfaces were developed and commercialized by AZ Technology during this program. Most of the coatings have passed space environmental stability requirements via ground tests and/or flight verification. Marker coatings and protective overcoats were successfully flown on the Passive Optical Sample Assembly (POSA) and the Optical Properties Monitor (OPM) experiments flown on the Russian space station MIR. to date, most of the coatings developed and/or modified during this program have been utilized on the International Space Station and other spacecraft. For ISS, AZ Technology manufactured the 'UNITY' emblem now being flown on the NASA UNITY node (Node 1) that is docked to the Russian Zarya (FGB) utilizing the colored marker coatings (white, blue, red) developed by AZ Technology. The UNITY emblem included the US American flag, the Unity logo, and NASA logo on a white background, applied to a Beta cloth substrate.

Derived from text

Protective Coatings; Thermal Control Coatings

20000109888 Societe Francaise des Thermiciens, Chatenay-Malabry, France

Electrical infrared in the baking of paints and the drying of coatings

Dec. 31, 1998; 24p; In French; In English

Report No.(s): DE99-750731; ETDE-FR-99750731; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This conference day was organized by the 'industrial electro-thermal engineering' section of the French association of thermal engineers. This book of proceedings contains 11 papers entitled: 'recalls about infrared emitters and furnaces technology'; 'experimental study of transfer phenomena and of the thermophysical properties of paints during baking under infrared radiation'; 'synthetic report of a theoretical and experimental study about drying and reticulation under infrared radiation of a aqueous-based epoxy-amine-type paint on metal support'; 'short IR baking as viewed by the paint manufacturer'; 'influence of texture and impurities on the radiative properties of materials'; 'contribution of modeling to the dimensioning of IR furnaces'; 'IR baking of paints'; 'experimental studies and testing means of EdF'; 'presentation of ABB Capponi Alesina company'; 'presentation report of the Infrarouge System company'; 'the choice of heat transfer technologies'.

NTIS

Conferences; Transport Theory; Thermophysical Properties; Radiative Heat Transfer

20000110243 Oak Ridge National Lab., TN USA

AnGa2O4 Thin-Film Phosphors Grown by Pulsed Laser Ablation

Lee, Y. E.; Rouleau, C. M.; Park, C.; Norton, D. P.; Apr. 05, 1999; 9p; In English, 5-9 Apr. 1999, San Francisco, CA, USA; Sponsored by Materials Research Society, USA

Report No.(s): DE00-006909; ORNL/CP-103097; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The growth and properties of undoped and Mn-doped ZnGa thin-film phosphors on (100)MgO and glass substrates using pulsed laser ablation were investigated. Blue-white and green emission were observed for as-deposited undoped and Mn-doped films, respectively. Luminescent properties as well as crystallinity were considerably affected by processing conditions and film stoichiometry. Films with enhanced luminescent characteristics were obtained on single crystal substrates without post-annealing.

NTIS

Phosphors; Thin Films; Doped Crystals; Single Crystals; Laser Ablation; Pulsed Lasers; Glass; Crystal Growth; Gallium Compounds

20000110346 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Thermal Emission Spectroscopy of Synthetic Igneous Glasses

Hamilton, V. E., Arizona State Univ., USA; Wyatt, M. B., Tennessee Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Initial results from the Thermal Emission Spectrometer (TES) experiment indicate that a significant portion of the Martian surface is covered by basaltic material. Recent results suggest that at least two compositions are present, one of which may contain a significant glassy component. Glassy components may present problems for the deconvolution of surface spectra if there are no glass endmember spectra available. Because the Arizona State University (ASU) spectral library currently does not contain any glass samples, it is important to obtain and analyze several for use in analyzing TES data. Additional information is contained in the original extended abstract.

Author

Emission Spectra; Thermal Emission; Spectrometers; Basalt

20000110392 NASA Johnson Space Center, Houston, TX USA

Spectral Behavior of Hematite at Visible/Near Infrared and Midinfrared Wavelengths

Lane, M. D., NASA Johnson Space Center, USA; Morris, R. V., NASA Johnson Space Center, USA; Christensen, P. R., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The oxide mineral hematite alpha-Fe2O3) is present on Mars as evidenced by spectroscopy using visible/near infrared (VNIR) and midinfrared (MIR) wavelengths. The physical nature of this surficial hematite varies from fine-grained, crystalline red hematite (red-Hm) in certain martian bright regions, to coarser-grained, crystalline gray hematite (gray-Hm) in the Sinus Meridiani equatorial site discovered in the Mars Global Surveyor Thermal Emission Spectrometer (MGS-TES) data. The VNIR spectra require that the red hematite is present in amounts subordinate to a second ferric pigment, which accounts for the general shape and position of the martian ferric absorption edge. by analogy with palagonitic tephra and synthetic samples, the pigment is a nanophase ferric oxide, possibly nanophase hematite (np-Hm). The purpose of this abstract is to document the physicospectral properties of hematite in the VNIR (0.35 to 2.2 mm) and MIR (5 to 25 mm) with respect to the terms ”nanophase” and ”crystalline”, ”red” and ”gray”, and ”fine-grained” and ”coarse-grained”. We will show that different ”types” of hematite (np-, red-, and gray-Hm) have different spectral responses in the VNIR and MIR regions and that these differences are important for inferring the types of hematite and their relative proportions from remotely sensed spectra of Mars. Because hematite is an alteration product that forms through many different geologic processes, determination of the type of hematite provides important clues about the style and diversity of martian weathering processes. Additional information is contained in the original extended abstract.

Author

Hematite; Mars Surface; Remote Sensing; Spectroscopy; Mineralogy

20000110457 Brown Univ., Geological Sciences, Providence, RI USA

Generation and Dispersal of Impact Glasses on Mars: Implications for the Nature of Mobile Dark Materials and Buried Dark Horizons

Schultz, P. H., Brown Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dark mobile material on Mars is widely considered to be volcanic or volcanically derived wind-blown particulates. Such a conclusion is supported by obvious volcanic source regions and the assumption that a volatile-rich crust would not favor melt products. Several post-Viking discoveries, however, provide a new perspective for reconsidering the impact origin of at least some of the mobile dark veneers and materials at the Path-finder landing site. Here we reconsider the effect of target material on the generation of impact glass and suggest that they could contribute to the dark markings of Mars and materials at the Pathfinder landing site. Additional information is contained in the original extended abstract.

Author

Crusts; Dispersing; Glass; Volcanoes; Wind Effects

20000110514 Mary Washington Coll., Dept. of Chemistry, Fredricksburg, VA USA

Synthesis of Monomers and Polymers for Piezoelectric Applications

Gratz, Roy F., Mary Washington Coll., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 60; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Piezoelectric organic polymers have potential for applications in sensing and control devices for aircraft and space vehicles. Most piezoelectric materials currently in use are ceramics or organic or inorganic salts, which are brittle and difficult to process. Although many polymers exhibit piezoelectric behavior, only polyvinylidene fluoride (PVDF) and some related copolymers are used for commercial applications. The structural feature that gives these polymers their piezoelectric activity is the presence in the polymer backbone of strong dipoles that can be forced into alignment by applying an external electrical field while the polymer is above its glass transition temperature. The dipoles retain their alignment after the polymer is cooled. Squaric acid (3,4-dihydroxy-3-cyclobutene-1,2-dione) and compounds derived from it containing the 3-cyclobutene-1,2-dione unit exhibit a high degree of polarity due in part to resonance involving a 2 pi electron aromatic system. There are reports of dyes and polymers derived from squaric acid, which have formal separation of charge in their structures. These types of structures appeared to be good candidates for incorporation into polymers that would exhibit piezoelectric properties. Most of the research during this period involved the synthesis of 3,4-bis(4-fluorophenyl)-3cyclobutene-1,2-dione, 1, and attempts to prepare poly(arylene ethers) from it. Compound 1 was prepared by a Friedel-Crafts reaction between squaryl chloride and fluorobenzene. The reaction was done in one flask without isolating squaryl chloride. Compound 1 is reported to form poly(arylene ethers) with several bisphenols, and two of these reactions were repeated several times using either dimethylacetamide or sulfolane as the solvent. The resulting polymers were either low molecular weight materials, or they exhibited broad molecular weight distributions. One of the polymers derived from bisphenol A was subjected to fractionation in an effort to isolate the higher molecular weight material. In addition to the homopolymers several copolymers were made by substituting 75-80% 4-fluorophenylsulfone for compound 1 in the reaction with bisphenol A; the results were similar to those obtained for the homopolymers. One potentially useful modification of the polymers was tested on compound 1. The cyclobutenedione ring is reported to open when heated above 160 C in a high boiling alcohol to form a diester. The reaction was performed on compound 1 using refluxing cyclohexanol, and the diester was recovered. Its infrared and proton magnetic resonance spectra were consistent with the structure proposed. Several attempts were made to synthesize diamine monomers from compound 1 containing bis(anminophenoxy) groups. Three reactions were attempted. An amino or nitro substituted phenol was converted to its phenoxide ion, and compound 1 was added to the reaction mixture, which was then heated for varying lengths of time. Although reactions had clearly occurred, no identifiable bisethers were recovered. Finally, an attempt was made to polymerize squaric acid with bis(3-aminophenoxy)benzene. The reaction gave an intractable black polymer.

Author

Synthesis (Chemistry); Monomers; Piezoelectricity; Copolymers; Organic Compounds

20000110515 Marywood Univ., Dept. of Science, Scranton, PA USA

Temperature Independent Pressure Sensitive Paints

Carey, Deborah H., Marywood Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 52; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Pressure sensitive paints (PSPs) are used to provide a continuous pressure mapping of aerodynamic surfaces in wind tunnels. The PSP, which consists of a polymer and luminophore, is capable of providing a detectable qualitative method for surface flow visualization. When the paint is irradiated with a light source in vacuo, the luminophore molecules contained in the polymer matrix will luminesce. In the presence of oxygen, however, the luminophore molecules can become ”quenched” that interferes with the luminescent process. It has been demonstrated experimentally that the partial pressure of oxygen through the polymer matrix is inversely proportional to the emission intensity of the luminophore, which is the parameter that can be used to measure changes in pressure under airflow. The polymer matrix, therefore, is an important component of the paint mixture because it must be permeable to oxygen. In addition, the polymer must also possess certain physical properties that allow for easy application to the model surface, and that it cures to a smooth, transparent finish. The purpose of this research project was to synthesis a polymer that could maintain a constant luminescence intensity at atmospheric pressure that was independent of temperature changes above 25 C. For each of the polymer samples, the Stern-Volmer constant (A(sub 1)), which describes how sensitive the paint is to changes in the partial pressure of oxygen, was determined by the slope (K) of the linear equation: I(sub ref)/I = A(sub 0) + A(sub 1) (P/P(sub ref). In our calculations, P(sub ref) was the pressure set to a reference point of 10 psia and the Stern-Volmer reference constant, A(sub 0) had been normalized to equal 1.00. A plot of the ratioed luminescence emission intensities of the PSP against the change in partial pressure of oxygen at any given temperature should yield a linear line, where the slope is equal to A(sub 1). In these

experiments, if the PSP showed a temperature independence, then the series of Stern-Volmer plots yielded linear lines that were superimposable. In most cases, however, the polymer sample did show a temperature dependence that was most likely due to the mobility of the polymer chains above room temperature, thus altering the permeability properties of the PSP.
Author
Paints; Temperature Dependence; Pressure; Sensitivity

20000110522 Hampton Univ., Dept. of Chemistry, VA USA
Synthesis of Monomer Precursors for Piezoelectric Polymers
Bump, Charles M., Hampton Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 51; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Polar groups in polymers may be aligned in the same direction by heating the polymer above its glass transition temperature T(sub g) in the presence of an electric field. Polymers thus treated may exhibit piezoelectric properties, viz. a deformation of the polymer may generate an electric potential. Such a property would permit the polymer to serve as a sensor to detect changes in the shape of aircraft or spacecraft. Diamine monomers containing bis aryl ethers with a nitrile functional group have shown promise of affording piezoelectric polymers when coupled with dicarboxylic acids. The present investigation has focused in the preparation of the following diamines: (1) 2,5-diamino benzonitrile (2) 6-cyano-1,3-bis (3-aminophenyl) benzene (3a) 5-acetamido-2-cyano-1,3-bis(3-aminophenyl) benzene (3b) 5-(1-methylethoxy)-2-cyano-1,3-bis(3-aminophenyl) benzene.
Derived from text
Piezoelectricity; Synthesis (Chemistry); Monomers; Copolymers; Organic Chemistry

20000110527 Hampton Univ., Dept. of Mathematics, VA USA
A Mixture Model for Resin Flow and Fiber Deformation In Composite Processing
Hou, Jiashi, Hampton Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 65; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The design of manufacturing device and procedure of fiber-reinforced composites requires deep understanding of the resin flow, temperature distribution, pressure and deformation and their co-relations during the process. Computer simulation based on models provides an economical and timesaving tool for the designing process. A continuum mixture model is adopted to the composite processing in this project. The models proposed so far considered only one or several characteristics using separate submodels, such as Darcy's law, heat transfer and curing model. The deformation of the fiber network and non-uniformity of fiber density in the products as a result have been reported, but it has yet to be accounted for. The deformation is usually small, but it may have significant effect on other aspects, such as resin flow and pressure, especially in pultrusion. A thermodynamic mixture model considers all those aspects and their coupling effects. Equations of motion and energy are derived. Special and simplified models can be reduced from the set of general equations according to different geometric, material and processing conditions.
Derived from text
Deformation; Fiber Composites; Manufacturing; Continuum Modeling; Flow Distribution; Thermoplastic Resins; Mixtures

20000110538 Florida Inst. of Tech., Aerospace Engineering Program, Melbourne, FL USA
Intensity Biased PSP Measurement
Subramanian, Chelakara S., Florida Inst. of Tech., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 78; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The current pressure sensitive paint (PSP) technique inherently assumes a linear relationship (Stern-Volmer Equation) between intensity ratio (Io/I) and pressure ratio (P/Po) over a wide range of pressures (vacuum to ambient or higher). Although this may be valid for some custom made PSPs, in most other PSPs the relationship is nonlinear particularly at low pressures (less than 0.014 atm when the oxygen level is low). This non-linearity can be attributed to variations in the non-oxygen quenching (deactivation) rates (which otherwise is assumed constant) at these pressures, as well as by some heterogeneous (non-uniform) oxygen quenching. Therefore to minimize the measurement uncertainties due to such non-linearities in the calibration relationship an in-situ intensity correction method is developed. A non-oxygen quenched paint (which provides a constant intensity at all pressures, called as non-pressure sensitive paint NPSP is used for the reference intensity (INPSP) with respect to which all the PSP intensities (1) are measured. The advantages of this method over the current method are; an a-priori calibration can be used for

wind tunnel testing, a wide range of pressures, including subsonic flow pressures, can be resolved better and, intensity variations due to temperature, photo-degradation of paints and tunnel flow contaminants can be compensated.
Derived from text
Paints; Sensitivity; Luminous Intensity; Correction; Pressure Dependence

20000110617 Oak Ridge National Lab., TN USA
Properties and Performance of Ceramic Composite Components
Case, S. W.; Halverson, H. G.; Carter, R. H.; Wone, M.; Reifsnider, K. L.; Aug. 09, 1999; 36p; In English
Report No.(s): DE00-009749; ORNL/SUB/87-SA946/07; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of the Fossil Energy Advanced Research and Technology Development (AR&TD) Materials program is to conduct research and development on materials for longer-term fossil energy applications as well as for generic needs of various fossil fuel technologies. These needs have prompted research aimed toward a better understanding of material behavior in fossil energy environments and the development of new materials capable of substantial enhancement of plant operations, reliability, and efficiency.
NTIS
Ceramics; Composite Materials; Research and Development; Fossil Fuels

20000110938 Lockheed Martin Michoud Space Systems, New Orleans, LA USA
Critical Surface Cleaning and Verification Alternatives
Melton, Donald M., Lockheed Martin Michoud Space Systems, USA; September 2000; 14p; In English; 4th; Aerospace Materials Processes and Environmental Technology, 18-20 Sep. 2000, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-36200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A viewgraph presentation outlines the goal, scope, and background of the cleaning solvent HCFC 225G. HCFC 225G is compared to other cleaning solvents such as Freon 113 and HFE 7100. Test results of hardware submersion in HCFC 225G and Freon 113 are shown. Project accomplishments, average cleaning efficiency, and hardware qualification are discussed. Results show HCFC 225G is an excellent cleaning and verification solvent for industrial contaminants.
CASI
Cleaning; Solvents

20000113029 University of Eastern Illinois, School of Technology, Charleston, IL USA
Study of Molecular Degradation of Polymers by Intrinsic Viscosity
Liu, Ping, University of Eastern Illinois, USA; Ciesielska, Danuta, Poznan Technical Univ., Poland; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 27-36; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Polymeric degradation causes deterioration in materials properties of polymers in various environments. Thus, understanding the degradation in molecular structure of polymers is of critical importance for many applications. This paper presents a method of evaluating molecular degradation of recycled polystyrene in terms of intrinsic viscosity. Fundamental relationship between molecular weight and intrinsic viscosity, as well as the experimental procedures are discussed. Key Words: Polymers, Recycling, Degradation, Molecular Weight, Intrinsic Viscosity.
Author
Degradation; Deterioration; Polystyrene; Viscosity; Polymer Chemistry

20000113033 Loyola Coll., Dept. of Electrical Engineering and Engineering Science, Baltimore, MD USA
Accelerated Aging Study of ABS Copolymer
Elban, Wayne L., Loyola Coll., USA; Hornung, Scott N., Loyola Coll., USA; Reinhardt, Matthew C., Loyola Coll., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 75-100; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A procedure is described for measuring the mechanical deformation/fracture properties and dimensional stability of tensile specimens of acrylonitrile-butadiene-styrene (ABS) copolymer exposed to several accelerated aging environments. A bench-top universal testing machine is used to obtain room temperature determinations of ultimate tensile and fracture strengths, and corresponding elongations, as a function of specimen conditioning/aging temperatures: 23 (room temperature), 50, 75, 90, and 105 C. Resultant fracture surfaces are visually inspected to determine brittle/ductile character. Subsequently, the exterior specimen surfaces immediately behind the fracture surfaces are examined using a reflected light microscope. Experimental determinations of

mechanical properties are compared to values appearing in the literature. Dimensions of recovered specimens are measured, using a dial caliper, to study their dimensional stability for the same temperatures.
Author
Accelerated Life Tests; Acrylonitriles; Aging (Materials); Butadiene; Copolymers; Mechanical Properties; Styrenes

20000113036 Loyola Coll., Dept. of Electrical Engineering and Engineering Science, Baltimore, MD USA
Effect of Temperature on The Impact Behavior and Dimensional Stability of Thermoplastic Polymers
Elban, Wayne L., Loyola Coll., USA; Elban, Matthew J., Carroll Christian High School, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 121-143; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A procedure is described for evaluating the brittle-ductile transition behavior of two thermoplastic polymers: acrylonitrile-butadiene-styrene (ABS) copolymer and recycled high density polyethylene (HDPE). A bench-top Charpy impact tester is used to make a quantitative evaluation of impact strength as a function of specimen conditioning (testing) temperature, which ranged from -196 to 120 C for ABS and to 135 C for HDPE. Additionally, the notch sensitivity of both materials is assessed by determining the impact strength of room temperature specimens with and without standard V-notches. The resultant fracture surfaces are visually inspected to determine its brittle/ductile character. The fracture surface and region immediately behind it are examined for stress whitening. The experimental determinations of impact strength are compared to values appearing in the literature for both materials. Thicknesses of recovered samples are measured, using a dial caliper, to study the dimensional stability of both polymers for the same temperature ranges.
Derived from text
Charpy Impact Test; Dimensional Stability; Ductile-Brittle Transition; Thermoplasticity; Thermoplastic Resins; Experiment Design; Polymer Blends; Brittleness

20000113051 College of Western New England, Dept. of Mechanical Engineering, Springfield, MA USA
Stretchy "Elastic " Bands 3 Contaminant Effects
Karplus, Alan K,, College of Western New England, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 313-328; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Near constant rate loading and unloading of traditional number 33 rubber bands shows features which are unique to these elastic products, especially when a band is coated with a common household chemical. Tensile load - deflection tests are performed on a series of three and one half inch long rubber bands of 1/8 inch width in the "as-received" condition, coated with machine oil, castor oil, water, liquid hand soap, and talcum powder, respectively. Comparisons made include: 1. shape of loading and unloading paths for load/deflection plots, and 2. areas under stress/strain plots found by approximation. The applied load - deflection plots on the same graph show common features as well as differences due to coatings.
Author
Contaminants; Rubber; Tensile Tests; Elastic Properties

20000113054 NASA Langley Research Center, Hampton, VA USA
LARC(tm) RP46 Polyimide Low Cost High Temperature Technology
Pater, Ruth H., NASA Langley Research Center, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 387-389; In English; See also 20000113027; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

The LARC(tm) RP46 polyimide was developed in 1991 at NASA Langley Research Center as an ultra-high-performance composite matrix resin for use in aircraft engine components, as well as a more environmentally friendly alternative to commercially available high temperature matrix resins. The LARC(tm) RP46 polyimide is prepared with non-toxic 3,4'-oxyldianiline(ODA). This chemistry has led to several improved performance characteristics over similar high temperature polyimides. These improvements include: (1) 700 F use temperature; (2) Significantly less moisture absorption; (3) Better chemical corrosion resistance; (4) Greater microcracking resistance; (5) Higher structural durability. The 700 F use temperature LARC(tm) RP46 is 150 F higher than that of commonly used PMR-type high temperature resins. In addition, it features significantly less moisture absorption and is therefore less susceptible to moisture induced damage. It also has better corrosion resistance to chemicals, greater microcracking resistance, and higher durability with regard to structural integrity.
Author
High Temperature; Matrix Materials; Polyimides; Resin Matrix Composites; Polyimide Resins

20000113061 Michigan Univ., Dept. of Mechanical Engineering, Dearborn, MI USA

A Simple Experiment for Determining Elastic Properties of Polymers

Mallick, P. K., Michigan Univ., USA; Sengupta, Subrata, Michigan Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 489-498; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The objective of this paper is to describe a simple experiment for determining the modulus of elasticity and Poisson's ratio of polymers using Hooke's Law for a two-dimensional stress condition.

Author

Elastic Properties; Modulus of Elasticity; Polymer Physics; Experiment Design

20000113071 Norfolk State Univ., VA USA

Introduction to EMSET2

Jacobs, James A., Norfolk State Univ., USA; McKenney, Alfred E., McKenney (Alfred E.), USA; Sanders, Matthew, Norfolk State Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 617-631; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This presentation reviews a multimedia tool of experiments and demonstrations, Experiments in Materials Science, Engineering & Technology (EMSET) contains instructional aids developed by educators and industry specialists; "hands-on" activities that cover the full range from traditional to advanced materials, including processing, structure, properties and evaluation. The emphasis is on low-cost, multi-concept exercises in recognition of the many settings in which materials education occurs. The EMSET2 CD ROM contains over 300 peer-reviewed experiments/demonstrations on both basic concepts and emerging materials science and engineering all presented at National Educators' Workshops over the last decade.

CASI

Education; Materials Science; Data Bases

20000113075 American Plastics Council, Automotive Learning Center, Troy, MI USA

The Role of Plastics in The Automobile

Cundiff, Bruce T., American Plastics Council, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 665-678; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This presentation reviews the use of plastic in the automobiles of the future. There are several reasons for the increasing use of plastics in automobiles; they include: the importance of weight reduction which can lead to reduced fuel consumption.

CASI

Automobiles; Plastics; Molding Materials; Structural Members

20000113672 Korea Advanced Inst. of Science and Technology, Dept. of Materials Science and Engineering, Taejon, Korea, Republic of

Proceedings of The Second Asian-Australasian Conference on Composite Materials (ACCM-2000) Composites Technologies for the New Millennium, Volume 1

Hong, Chang-Sun, Korea Advanced Inst. of Science and Technology, Korea, Republic of; Kim, Chun-Gon, Korea Advanced Inst. of Science and Technology, Korea, Republic of; Aug. 2000; 668p; In English, 18-20 Aug. 2000, Kyongju, Korea, Republic of

Contract(s)/Grant(s): F62562-00-M-9036

Report No.(s): AD-A381848; EOARD-CSP-99-17; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

There has been active discussion about the formation of the so-called "Asian-Australasian Association for Composite Materials (AACM)" as an equivalent ICCM in the Asian-Australasian region. The AACM was established after active discussion during ICCM-11 meeting in Gold Coast. The objective of the AACM is to encourage the free interchange of information on all aspects related to composite materials, which are of interest to the scientific and engineering community. Therefore, the ACCM (Asian-Australasian Conference on Composite Materials) is organised to provide an Asian-Australian-wide forum for the discussion of such topics. Following the success of the first Conference held in Osaka, Japan, The ACCM will be held biannually as an exciting forum for reporting and discussing the latest progress in composite technologies. This series of ACCM meetings will provide high quality technical programs related with manufacturing and design based on polymer, metal, and ceramic composite materials. As noted in the conference title of ACCM-2000, this conference will focus on the applications of composite materials and structures for the new millennium. The Proceedings of the Second Asian-Australasian Conference on Composite Materials contains over 200 technical papers that are to be presented at the conference. With over 15 countries represented by authors and delegates, the

present conference is truly an international forum for specialists in this important area of technology for the new millennium. We would like to keep up the good tradition and create a welcome environment for a pleasant get-together.
DTIC
Composite Structures; Conferences; Manufacturing; Fiber Composites

20000114816 Pohang Univ. of Science and Technology, Dept. of Mechanical Engineering, Pohang, Korea, Republic of
International Conference on Fracture and Strength of Solids, Part 2, Behavior of Materials and Structure
Hwang, W., Editor; Han, K. S., Editor; Sep. 01, 2000; 708p; In English; 4th; Fracture and Strength of Solids, 16-18 Aug. 2000, Pohang, Korea, Republic of
Contract(s)/Grant(s): F62562-99-M-9182
Report No.(s): AD-A382020; AOARD-CSP-99-06; No Copyright; Avail: CASI; A06, Microfiche; A99, Hardcopy

Part 1: Fracture Mechanics of Materials. Includes: Fracture Mechanics; Dynamic Fracture; Computational Mechanics; and Damage Mechanics. Part II: Behavior of Materials and Structure: Includes: Fracture Physics; Fatigue and Creep; Polymer and Polymer Composites; Metals, MMCs, Ceramics, and CMCs; and Welding.
DTIC
Conferences; Fracture Mechanics

20000114819 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA
Transparent Barrier Urethanes Based on Polyethylene Soft Segments ***Final Report***
BeckTan, Nora C.; Napadensky, Eugene; Sloan, James M.; Ma, Sharon; Cooper, Stuart L.; Aug. 2000; 33p; In English
Contract(s)/Grant(s): DA Proj. 611102.H42
Report No.(s): AD-A382417; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A series of polyurethane elastomers has been synthesized through co-polymerization of polyethylene soft segments and methylene bis(4-phenylisocyanate) (MDI) and hydrogenated MDI (H(12)MDI). Polyethylene soft segments were prepared by the hydrogenation of polybutadiene polyols, either before or after copolymer synthesis. Polyols from three different suppliers were used as precursors and ranged in branch content from 15% to 90%. Flexible, transparent materials were produced. The mechanical and barrier properties of these urethanes were evaluated for comparison with the performance of traditional flexible barrier materials (e.g., butyl rubber). Solvent uptake and swelling measurements were used to evaluate barrier performance. Branch content in the soft segment was found to affect both mechanical properties and solvent resistance, with low branch content leading to superior performance. Solvent diffusion coefficients for the materials were in the 10(exp -8)sq cm/s range, comparable to those exhibited by flexible high barrier materials.
DTIC
Polyurethane Resins; Urethanes; Elastomers; Copolymers; Polybutadiene; Polymerization; Polyethylenes

20000114866 Southwest Research Inst., Dayton, OH USA
High Solids Primers Enhancement ***Final Report, 1 Oct. 1997 - 30 Apr. 2000***
Wallace, Elah; Apr. 2000; 70p; In English
Contract(s)/Grant(s): F09603-95-D-0176-RZ01
Report No.(s): AD-A382547; AFRL-ML-WP-TR-2000-4119; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of this task was to monitor the flight testing of coating systems identified by the HPACS project conducted by Battelle to offer improved film properties of weatherability and cleanability. All tested coatings compiled with the 1998 National Emissions Standard for Hazardous Air Pollutants (NESHAP). This project provided a tool for ALCs to implement the best performing commercial ”off the shelf” (COTS) coating system available, utilizing the results of these KC-135 flights tests.
DTIC
Primers; Weathering; Flight Tests; Coating

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.

20000109993 Defence Science and Technology Organisation, Weapons Systems Div., Melbourne, Australia
Ab Initio Calculation of Intermolecular Potential Parameters for Gaseous Decomposition Products of Energetic Materials
White, A., Defence Science and Technology Organisation, Australia; Zerilli, F. J., Naval Surface Warfare Center, USA; Jones, H. D., Naval Surface Warfare Center, USA; August 2000; 53p; In English; Original contains color illustrations
Report No.(s): DSTO-TR-1016; DODA-AR-011-531; Copyright; Avail: Issuing Activity

This document describes the results obtained using two methods for ab initio calculation of intermolecular potential parameters for gaseous decomposition products of energetic materials: a Multipole Expansion method, suitable for axially symmetric molecules, and a Monte Carlo method, which can be used to obtain temperature dependent average potential energy parameters for any molecule.
Author
Decomposition; Intermolecular Forces; Procedures; Gaseous Diffusion

20000110025 Defence Science and Technology Organisation, Weapons Systems Div., Melbourne, Australia
Assessment of a Melt-Castable NTO/TNT Formulation
Cliff, Matthew D., Defence Science and Technology Organisation, Australia; Smith, Matthew W., Defence Science and Technology Organisation, Australia; July 2000; 31p; In English; Original contains color illustrations
Report No.(s): DSTO-TR-0998; DODA-AR-011-497; Copyright; Avail: Issuing Activity

Melt-castable NTO/TNT explosive formulations have been identified as possible candidates to replace RDX/TNT to meet Australian Insensitive Munitions obligations. Such formulations could be processed in existing ADI industrial facilities with minimal alterations to plant. A baseline 50:50 NTO/TNT formulation, designated ARX-4002, has been developed. ARX-4002 can be processed using traditional melt-cast techniques and exhibits reduced sensitiveness in comparison to Composition B and H-6. The molten slurry is less prone to sedimentation problems, however, viscosities are increased and lower solid loadings possible than for Grade A RDX. Velocity of detonation and detonation pressure were experimentally determined at 7370 m/s and 22.6 GPa respectively. Performance of ARX-4002 is thus less than for Composition B, however, the intrinsic sensitivity of ARX-4002 is expected to be greatly reduced as indicated by the large critical diameter (22.5-25.5 mm).
Author
Detonation; Slurries; RDX

20000110026 Defence Science and Technology Organisation, Weapons Systems Div., Melbourne, Australia
Evaluation of 1,3,3-Trinitroazetidine (TNAZ): A High Performance Melt-Castable Explosive
Watt, Duncan S., Defence Science and Technology Organisation, Australia; Cliff, Matthew D., Defence Science and Technology Organisation, Australia; July 2000; 38p; In English; Original contains color illustrations
Report No.(s): DSTO-TR-1000; DODA-AR-011-500; Copyright; Avail: Issuing Activity

The melt-castable explosive 1,3,3-trinitroazetidine (TNAZ) has been assessed as a potential high energy replacement for TNT that could be processed in existing Australian industrial plant. TNAZ was produced using a five step synthetic route to give the target material in a maximum overall yield of 37%. The synthetic route chosen proved troublesome, with the Mitsunobu reaction employed to synthesize the azetidine ring non-reproducible and low yielding. Thermal analysis of neat and formulated TNAZ (60:40 RDX/TNAZ, designated ARX-4007) showed it to have high volatility and rapidly evaporated from the liquid phase (less than 101 C). Hazards assessment showed TNAZ to have an increased sensitiveness over TNT, while ARX-4007 showed sensitiveness levels similar to pentolite. TNAZ castings appeared to solidify from the melt to give lavered plates and formed large numbers of shinkage voids. Shinkage problems were evident in both neat TNAZ and ARX-4007 castings, whilst mechanical properties were poor. Performance assessment of ARX-4007 as a general purpose metal accelerating explosive gave excellent VoD (8660 m/s) and Pcj (33.0 GPa). It is concluded, however, that problems associated with synthesis, volatility, sensitiveness and casting make TNAZ unsuitable as a TNT replacement in melt-cast systems at this time.
Author
Castings; Liquid Phases; Mechanical Properties; Thermal Analysis; Explosives

20000110066 NASA White Sands Test Facility, NM USA

Catalytic Decomposition of Propellant Hydrazines, N-Nitrosodimethylamine, and N-Nitrodimethylamine

Greene, Ben, Allied-Signal Technical Services Corp., USA; Johnson, Harry T., NASA White Sands Test Facility, USA; [2000]; 1p; In English; 29th; 18th; PDC, 8-12 May 2000, Cocoa Beach, FL, Cocoa Beach, FL, USA, USA; Sponsored by Department of the Army, USA

Contract(s)/Grant(s): NAS9-99100; No Copyright; Avail: Issuing Activity; Abstract Only

Remediation of propellant hydrazine spills, waste treatment, or cleanup of water contaminated with these propellants and/or their oxidation products is a subject of great concern for safety and the environment. Current remediation technologies typically employ oxidative methods, such as chlorination or ozonation. Methylated hydrazines, in particular 1,1-dimethythydrazine (UDMH) and to some degree monomethy1hydrazine (MMH), form N-Nitrosodimethylamine (NDMA) and N-Nitrodimethylamine (DMNM) during oxidation. These compounds are highly toxic and may persist if oxidative conditions are not sufficiently harsh. Since NDMA and DMNM may also be formed from exposure of MMH or UDMH to air, a need exists for a method that will remediate hydrazine, MMH, UDMH, NDMA, and DMNM. In this work, aqueous solutions of propellant hydrazines, NDMA, and DMNM were found to degrade by catalytic reduction with nickel-aluminum (Ni-Al) alloy under basic conditions. The reaction is based upon dissolution of At from Ni-Al alloy in aqueous media to form aluminum ion and hydrogen gas; and the resultant finely divided nickel catalyzes reduction of the hydrazine, nitrosoamine, or nitroamine by the hydrogen produced. Greater than 99 percent of hydrazine, MMH, UDMH, NDMA, and DMNM in aqueous solutions were degraded under laboratory conditions when reacted with Ni-Al alloy. UDMH was identified as an intermediate reduction product of NDMA and DNNM. NDMA and UDMH were identified as intermediate reduction products of DMNM. Control experiments without nickel showed no degradation of hydrazine, MMH or UDMH, while NDMA and DMNM were reduced to UDMH. Spill pillows containing Ni-Al alloy and solid sodium hydroxide were also found effective in absorption and degradation of UDMH. The application of chemical reduction as a means to propellant hydrazines, NDMA, and DMNM spill remediation, waste treatment, and water decontamination appears highly attractive.

Author

Propellant Decomposition; Methylhydrazine; Dimethylhydrazines; Methyl Compounds

20000110563 NASA Johnson Space Center, Houston, TX USA

Microreactor System Design for a NASA In Situ Propellant Production Plant on Mars

TeGrotenhuis, W. E., NASA Johnson Space Center, USA; Wegeng, R. S., NASA Johnson Space Center, USA; Vanderwiel, D. P., Pacific Northwest National Lab., USA; Whyatt, G. A., Pacific Northwest National Lab., USA; Viswanathan, V. V., Pacific Northwest National Lab., USA; Schielke, K. P., Pacific Northwest National Lab., USA; Sanders, G. B., Pacific Northwest National Lab., USA; Peters, T. A., NASA Johnson Space Center, USA; [2000]; 1p; In English; 4th; 4th International Conferenc eon Microreaction Technology, 5-9 Mar. 2000, Atlanta, GA, USA; Sponsored by Dechema-Inst., Germany

Contract(s)/Grant(s): RTOP 953-20-632-70; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA In Situ Resource Utilization (ISRU) program is planning near-term missions to Mars that will include chemical processes for converting the carbon dioxide (CO2) and possibly water from the Martian environment to propellants, oxygen, and other useful chemicals. The use of indigenous resources reduces the size and weight of the payloads from Earth significantly, representing enormous cost savings that make human exploration of Mars affordable. Extraterrestrial chemical processing plants will need to be compact, lightweight, highly efficient under reduced gravity, and extraordinarily reliable for long periods. Microchemical and thermal systems represent capability for dramatic reduction in size and weight, while offering high reliability through massive parallelization. In situ propellant production (ISPP), one aspect of the ISRU program, involves collecting and pressurizing atmospheric CO2, conversion reactions, chemical separations, heat exchangers, and cryogenic storage. A preliminary system design of an ISPP plant based on microtechnology has demonstrated significant size, weight, and energy efficiency gains over the current NASA baseline. Energy management is a strong driver for Mars-based processes, not only because energy is a scarce resource, but because heat rejection is problematic; the low pressure environment makes convective heat transfer ineffective. Energy efficiency gains are largely achieved in the microchemical plant through extensive heat recuperation and energy cascading, which has a small size and weight penalty because the added micro heat exchangers are small. This leads to additional size and weight gains by reducing the required area of waste heat radiators. The microtechnology-based ISPP plant is described in detail, including aspects of pinch analysis for optimizing the heat exchanger network. Three options for thermochemical compression of CO2 from the Martian atmosphere, adsorption, absorption, and cryogenic freezing, are presented, as well as three options for water decomposition, low temperature electrolysis, high temperature electrolysis, and thermochemical decomposition. Other elements of the plant include Sabatier and reverse water gas shift reactors, water recovery, chemical separations, and cryogenic

storage. Data are presented supporting preliminary sizing of components, and results of the system design are compared to the existing NASA baseline that is based on conventional technologies.
Author
Propellants; Industrial Plants; Mars (Planet); Systems Engineering; Chemical Reactions; Reactor Technology

20000113407 Defence Science and Technology Organisation, Weapons Systems Div., Melbourne, Australia
Nomenclature and Cataloguing of Experimental Explosive Compositions
Cliff, Matthew D., Defence Science and Technology Organisation, Australia; Dexter, Richard M., Defence Science and Technology Organisation, Australia; May 2000; 22p; In English
Report No.(s): DSTO-TN-0284; DODA-AR-011-471; Copyright; Avail: Issuing Activity
This technical note describes the Australian Research eXplosive (ARX) nomenclature system and the supporting Propellant/Explosives Processing Sheet database used by DSTO to name and record experimental explosive compositions and their properties.
Author
Research and Development; Technology Assessment; Explosives; Nomenclatures

20000114818 Parsons Engineering Science, Inc., Austin, TX USA
Plan A Assessment Report for Jet Fuel Storage Tank Number 20, Randolph AFB, Texas. LPST ID Number: 104626, Facility ID Number: 32523
Mar. 27, 1996; 213p; In English
Contract(s)/Grant(s): F41624-92-D-8036
Report No.(s): AD-A382393; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
This report includes a revised Site Closure Request Form as attachment 20, in accordance with new guidance issued by the TNRCC in December 1996. Our recommendation for this LPST case number is to close the site from any additional action. No post-closure restoration or abandonment actions are proposed because it would jeopardize the integrity of synthetic liner recently installed around the tank berm and dike structure. The monitoring wells will be maintained to provide coverage of the tank #20 portion of the entire IRP site.
DTIC
Fuel Tanks; Jet Engine Fuels; Environment Effects; Soil Pollution

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.

20000109844 National Academy of Sciences - National Research Council, Huntsville, AL USA
Fluid Physics and Macromolecular Crystal Growth in Microgravity
Helliwell, John R., Manchester Univ., UK; Snell, Edward H., NASA Marshall Space Flight Center, USA; Chayen, Naomi E., Imperial Coll. Field Station, UK; Judge, Russell A., NASA Marshall Space Flight Center, USA; Boggon, Titus J., Manchester Univ., UK; Pusey, M. L., NASA Marshall Space Flight Center, USA; 20000822; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only
The first protein crystallization experiment in microgravity was launched in April, 1981 and used Germany's Technologische Experimente unter Schwerelosigkeit (TEXUS 3) sounding rocket. The protein P-galactosidase (molecular weight 465Kda) was chosen as the sample with a liquid-liquid diffusion growth method. A sliding device brought the protein, buffer and salt solution into contact when microgravity was reached. The sounding rocket gave six minutes of microgravity time with a cine camera and schlieren optics used to monitor the experiment, a single growth cell. In microgravity a strictly laminar diffusion process was observed in contrast to the turbulent convection seen on the ground. Several single crystals, approx 100micron in length, were formed in the flight which were of inferior but of comparable visual quality to those grown on the ground over several days. A second experiment using the same protocol but with solutions cooled to -8C (kept liquid with glycerol antifreeze) again showed laminar diffusion. The science of macromolecular structural crystallography involves crystallization of the macromolecule followed by use of the crystal for X-ray diffraction experiments to determine the three dimensional structure of the macromolecule. Neutron protein crystallography is employed for elucidation of H/D exchange and for improved definition of the bound solvent

(D20). The structural information enables an understanding of how the molecule functions with important potential for rational drug design, improved efficiency of industrial enzymes and agricultural chemical development. The removal of turbulent convection and sedimentation in microgravity, and the assumption that higher quality crystals will be produced, has given rise to the growing number of crystallization experiments now flown. Many experiments can be flown in a small volume with simple, largely automated, equipment - an ideal combination for a microgravity experiment. The term ”protein crystal growth” is often historically used to describe these microgravity experiments. This is somewhat inaccurate as the field involves the study of many varied biological molecules including viruses, proteins, DNA, RNA and complexes of those structures. For this reason we use the term macromolecular crystal growth. In this chapter we review a series of diagnostic microgravity crystal growth experiments carried out principally using the European Space Agency (ESA) Advanced Protein Crystallization Facility (APCF). We also review related research, both experimental and theoretical, on the aspects of microgravity fluid physics that affect microgravity protein crystal growth. Our experiments have revealed some surprises that were not initially expected. We discuss them here in the context of practical lessons learnt and how to maximize the limited microgravity opportunities available.
Author
Crystallization; Crystallography; Fluid Dynamics; Gravitational Effects; Microgravity; Protein Crystal Growth

20000109896 NASA Marshall Space Flight Center, Huntsville, AL USA
Current Experiments in Microgravity
Gillies, Donald C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; High Temperature Materials, Processing, and Diagnostics, 26 Jul. 2000, Plymouth, NH, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Materials Science program within NASA’s Microgravity Research Division will be outlined. Particular emphasis will be placed on those experiments slated for the International Space Station which pertain to high temperature materials. These include experiments designed to examine theories pertaining to solidification and pattern selection, coarsening and phase transformation.
Author
Microgravity; Materials; Materials Handling; Low Gravity Manufacturing; Space Processing

20000109946 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermophysical Property Measurement and Materials Research in the NASA/MSFC Electrostatic Levitator
[2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Containerless processing is an important tool for thermophysical property measurements and materials research. The freedom from a crucible allows processing of liquid materials in a metastable undercooled state, as well as allowing processing of high temperature and highly reactive melts. Electrostatic levitation (ESL) is a containerless method which provides a number of unique advantages, including the decoupling of positioning force from sample heating, the ability to operate in ultra-high vacuum or at moderate gas pressure (approximately 3 atm), and the ability to process non-conducting materials. ESL also has the potential to reduce internal flow velocities below those possible with electromagnetic, acoustic, or aero-acoustic techniques. The ESL facility at NASA’s Marshall Space Flight Center (MSFC) is in use for thermophysical property measurements and materials research by a number of different internal and external investigators. The methods for obtaining access to the facility, as well as a summary of current capabilities and some future directions will be discussed. In electrostatic levitation, the acceleration of gravity (or residual acceleration in reduced gravity) is opposed by the action of an applied electric field on a charged sample. This positioning method is applicable to any material which can be electrically charged, whether solid or liquid, conducting, or insulating. Because the position of the sample is unstable, a 3-dimensional active control loop rapidly adjusts the applied field to maintain levitation and minimize motion of the sample. Heating lasers melt the sample, and may be adjusted to maintain specified thermal profiles. Microgravity allows electrostatic levitation to work even more effectively. With the need to cancel less than 1 milli-g, the applied field required is reduced from approximately 10 MV/m to approximately 10 kV/m. Alternatively, a microgravity ESL can position larger samples than is possible on the ground, or it can position samples which maintain their charge poorly. Microgravity also reduces the effects of buoyant convection and sedimentation. In the MSFC ESL, many different classes of experiments and measurements have been demonstrated in collaboration with many investigators. These capabilities include heat capacity measurement, phase diagram determination, and nucleation and growth experiments including nucleation rate, TTT curves, and phase selection. We have demonstrated the capability of triggering recalescence of an undercooled liquid sample without loss of levitation. Currently under development are techniques for measuring the surface tension, viscosity, and density of levitated samples, as well as other thermophysical properties. Expanded levitation capabilities including various gas environments for sample processing, sample rotation control and management of thermal gradients are under development for the MSFC ESL. Containerless processing allows research on materials which may not be processed any other way. Electrostatic levitation extends the range of

containerless processing to include many materials and classes of materials which cannot be processed by conventional electromagnetic, acoustic, or aerodynamic levitation techniques.
Author
Thermophysical Properties; Maser Materials; Space Processing; Acoustic Levitation; Containerless Melts; Levitation Melting; Microgravity; Liquid Metals

20000111083 NASA Marshall Space Flight Center, Huntsville, AL USA
BUNDLE: A Novel Furnace for Performing Controlled Directional Solidification Experiments in a Microgravity Environment
Carrasquillo, Edgar J., NASA Marshall Space Flight Center, USA; Griffin, Mark R., Tec-Masters, Inc., USA; Hammond, Monica S., NASA Marshall Space Flight Center, USA; Johnson, Martin L., NASA Marshall Space Flight Center, USA; Grugel, R. N., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Aerospace Science Meeting, 8-12 Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA Marshall Space Flight Center has developed a novel directional solidification furnace prototype for processing metals and alloys experiments in a microgravity environment. The BUNDLE (Bridgman Unidirectional Dendrite in Liquid Experiment) furnace is intended to accommodate the science requirements of Flight Definition Principle Investigators studying cellular/dendritic growth in aluminum and lead alloys at processing temperatures up to 1200 C. The furnace implements a number of innovative features to achieve high thermal gradients and quench rates in a low-power, light-weight design. These include a pyrolytic boron nitride/graphite composite heating element surrounded by layers of self-supporting refractory metal shielding, and a graphite fiber enhanced cold zone allowing high levels of heat extraction from the sample crucible. Novel to the BUNDLE design is an in-situ helium gas quench capability that ensures rapid freezing of the solidifying region (mushy zone) of the metal sample within the furnace without sample disturbance prior to quenching; this is a stringent requirement for subsequent analysis and understanding of microstructural development. The experiment hardware concept features multiple furnaces that may be ”bundled” together so many samples, currently up to eight, can be processed at one time. The design of BUNDLE is flexible enough to be implemented on the Shuttle and Space Station in a number of locations (SpaceHab, Express Rack, MPESS, ISPR, etc). BUNDLE prototype furnaces have directionally solidified and quenched 1cm diameter lead - 5.8 weight percent antimony and aluminum - 4 weight percent copper alloys. Quenching of the mushy zone, as recorded by in-situ thermocouples, occurred on the order of 0.5 seconds or less, a rate within the PI’s requirements. Subsequent metallographic examination revealed the solidified microstructure to be, as expected, unidirectional. Both the dendrite tips and the eutectic reaction were planar in nature indicating uniform axial heat flow. Delineation between the growing dendrites and eutectic structure with the ”quenched-in” liquid was sharp, attesting to the efficacy of the helium quench. BUNDLE’s conception, development, capability, and adaptability are presented (in view of Flight PI’s needs and science requirements) through viewgraphs depicting actual hardware, generated thermal analysis, and micrographs prepared from BUNDLE processed, flight-like samples.
Author
Bridgman Method; Aluminum Alloys; Lead Alloys; Crystal Growth; Directional Solidification (Crystals); Furnaces; Fabrication; Microgravity; Solidification

20000111084 NASA Johnson Space Center, Houston, TX USA
Increased Arginine and Ornithine Flux in Islets of Langerhans Cultured in a Microgravity Model System
Tobin, B. W., Mercer Univ., USA; Sams, C. F., NASA Johnson Space Center, USA; Smith, S. M., NASA Johnson Space Center, USA; [2000]; 1p; In English; Experimental Biology 2000, 15-18 Apr. 2000, San Diego, CA, USA; Sponsored by Federation of American Societies for Experimental Biology, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Microgravity is associated with alterations in protein metabolism of both muscle and bone. That pancreas-derived insulin is essential to the normal maintenance of body protein balance is well known. The importance of altered endocrine pancreas function in microgravity is not yet established. We proposed to examine the influence of a microgravity model system, the High Aspect Ratio Vessel (HARV) upon islets of Langerhans from Wistar Furth rats. Islets were cultured in the HARV for 48 hr in Medium-199 and contrasted to static control islets (PLATE). Nitrogenous compounds elaborated into the media (micromoles/ml) were analyzed at 0 and 48 hr of culture and compared to PLATE with a 2-way ANOVA (HARV vs Hour).
Author
Protein Metabolism; Muscles; Bones; Pancreas

20000112941 NASA Johnson Space Center, Houston, TX USA
Biotechnology Facility: An ISS Microgravity Research Facility
Gonda, Steve R., NASA Johnson Space Center, USA; Tsao, Yow-Min, Wyle Life Sciences, USA; [2000]; 9p; 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 2000-0430; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The International Space Station (ISS) will support several facilities dedicated to scientific research. One such facility, the Biotechnology Facility (BTF), is sponsored by the Microgravity Sciences and Applications Division (MSAD) and developed at NASA's Johnson Space Center. The BTF is scheduled for delivery to the ISS via Space Shuttle in April 2005. The purpose of the BTF is to provide: (1) the support structure and integration capabilities for the individual modules in which biotechnology experiments will be performed, (2) the capability for human-tended, repetitive, long-duration biotechnology experiments, and (3) opportunities to perform repetitive experiments in a short period by allowing continuous access to microgravity. The MSAD has identified cell culture and tissue engineering, protein crystal growth, and fundamentals of biotechnology as areas that contain promising opportunities for significant advancements through low-gravity experiments. The focus of this coordinated ground- and space-based research program is the use of the low-gravity environment of space to conduct fundamental investigations leading to major advances in the understanding of basic and applied biotechnology. Results from planned investigations can be used in applications ranging from rational drug design and testing, cancer diagnosis and treatments and tissue engineering leading to replacement tissues.
Author
Biotechnology; Research Facilities; Culture Techniques; Diagnosis; Protein Crystal Growth

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.

20000109881 Societe Francaise des Thermiciens, Chatenay-Malabry, France
Innovations and research perspectives
Dec. 31, 1997; 24p; In French; In English
Report No.(s): DE99-750724; ETDE-FR-99750724; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This conference day was organized by the air-conditioning engineering section of the French association of thermal engineers. This book of proceedings contains 7 papers entitled: 'Clima 2000: conclusions and perspectives'; 'normative approach of the different aspects of ambience comfort'; 'progress of the local discomfort evaluation methods'; 'towards a global approach of air conditioning of buildings'; 'simulation of the energy behaviour of industrial entities. Statement of real actions and methodological evolutions'; 'modeling and simulation: state-of-the-art'; 'automatized generation of a thermal and aeraulic simulation in buildings'.
NTIS
Conferences; Heat Transfer; Air Conditioning; Buildings

20000110567 Technische Univ., Munich, Germany
Determination of the N2O composition parameters on a three way catalyst in a synthesis gas reactor
Meyer-Pittroff, R.; Gifhorn, A.; Rabl, H. P.; Oct. 31, 1998; 166p; In German; In English
Report No.(s): DE99-741549; ETDE-DE-772; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The determination of the N2O composition parameters on three-way catalysts (TWC) took place on an engine bench and in a high temperature flow reactor. The influences of exhaust gas components, temperature, air fuel ratio, gas hour space velocity, precious metal loading, catalyst aging and oxygen storage capacity were checked with transient and intransient experiments. 16 different catalyst samples were tested. The experiments show that the N2O formation is a function of the catalyst temperature and the air fuel ratio. Under rich conditions N2O formed in a temperature range that is limited by the beginning of the NO conversion at lower temperatures and by the oxidation of all reducing components at higher temperatures; under rich conditions range is limited by the beginning of the NO conversion and the dissociation of N2O at TWC. It is a result of catalyst aging that at aged TWC samples the NO conversion and the N2O formation is shifted up to higher temperatures. Another important influence is the TWC coating. The investigations show that the absolute as well as the selective N2O formation at TWC samples coated with Pt/Pd/Rh-

and Pd/Rh is higher than the N2O formation at TWC samples coated with Pt/Rh. Simultaneously it could be observed that Pt/Pd/Rh samples show a higher oxygen storage capacity than Pt/Rh.
NTIS
Nitrogen Oxides; Catalysts; Synthesis (Chemistry); Chemical Reactors

20000113043 Alcan Global Automotive Products, Kingston, Ontario Canada
Design Practices For Automotive Light Truck Aluminum Bodies
Wheeler, Michael J., Alcan Global Automotive Products, Canada; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 213-223; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Aluminum has about one third the density of steel and about one third its elastic modulus so that both materials have essentially the same mass-specific elastic modulus. On the face of it therefore, for passenger car and truck body structures, where stiffness---and particularly torsional stiffness--is critical for achieving predictable handling and good driveability, there is little to be achieved in terms of weight saving by substituting aluminum for steel. However, in designing vehicles, we are concerned with three dimensional structures of beams and panels rather than just the material properties. What we need to examine and understand in looking at aluminum for vehicle structures is how the overall stiffness is governed by the dimensions and configuration of these beams and panels. In this plenary session therefore, I am going to cover briefly the material property and mechanical design aspects that govern the use of aluminum in achieving vehicle structures. I will then go on to illustrate how these principles have been applied in developing both sheetbased monocoque (body-frame integral) and space frame vehicle structures in aluminum.
Author
Aluminum; Automobiles; Mechanical Engineering; Weight Reduction; Structural Weight; Modulus of Elasticity

20000113045 Alcan Global Automotive Products, Kingston, Ontario Canada
The Drive For Light Weight Vehicles in North America
Wheeler, Michael J., Alcan Global Automotive Products, Canada; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 235-247; In English; Materials for Lean Weight Vehicles, Nov. 1997, Gaydon, UK; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper will summarize the underlying reasons for the drive for lighter weight passenger vehicles in North America and the response of the major North American vehicle manufacturers to government-imposed regulations and also to the joint government-industry initiative to develop lightweight, high mileage passenger cars under the so-called clean car or PNGV (Partnership for a New Generation of Vehicles) program. Some of the aluminium intensive vehicles that have been developed under the various programs and the respective materials and technologies will be described. In addition, a summary will be presented of the efforts being undertaken by the North American aluminium companies, working jointly through the Automotive and Light Truck Committee of the Aluminum Association, to highlight the value of aluminium for light weighting vehicles and also to remove the real and/or perceived barriers to the high volume use of aluminium in aluminium intensive vehicles.
Author
Aluminum; Automobiles; Weight Reduction

20000113057 American Iron and Steel Inst., Southfield, MI USA
Engineering Plan Behind The Ultra Light Steel Auto Body and AISI/CARS 1998 Overview
Martin, Darryl, American Iron and Steel Inst., USA; Errera, Samuel K., American Iron and Steel Inst., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 431-460; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This presentation reviews the use of ultra lightweight steel in the design of automobile components. Specific attention is paid to the engineering software which assists in the design of these components.
CASI
Steels; Automobiles; Computer Aided Design; Structural Members; Structural Design

20000113130 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA
On the Design of an Apparatus for Screening Liquid Fire Suppressants
Yang, Jiann C.; Donnelly, Michelle K.; Prive, Nikki; Grosshandler, William L.; Jan. 1999; 7p; In English, 29 Jun. - 1 Jul. 1999, Unknown
Report No.(s): AD-A382685; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper discusses the design and use of an apparatus for evaluating the effectiveness of liquid fire suppression agents as possible replacement for halon 1301. The apparatus consists of a porous cylindrical burner located in the test section of a vertical wind tunnel and a droplet generation system. Liquid droplets are injected into the flow stream and entrained upward toward the burner for evaluation. The suppression effectiveness is ranked based on the conditions at the transition from one mode of flame (enveloped) to the other (wake) established at the burner for a given fluid application rate. The apparatus is currently being used to test a variety of fluids.
DTIC
Flame Retardants; Fire Extinguishers; Fire Fighting

20000114427 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA
Recent Results from the Dispersed Liquid Agent Fire Suppressant Screen
Yang, Jiann C.; Prive, Nikki C.; Donnelly, Michelle K.; Grosshandler, William L.; Jan. 1999; 11p; In English; Presented at Halon Options Technical Working Conference, 27-29 Apr 1999.
Report No.(s): AD-A382668; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Most of the current methods for fire suppression efficiency screening (e.g., cup burners) are designed for evaluating gaseous fire suppression agents. Potential uses of liquid agents as halon replacements have been recently proposed in several applications (e.g., shipboard machinery spaces, engine compartments in armored vehicles). Under the auspices of the US Department Defense Next Generation Fire Suppression Technology Program (NGP), the National Institute of Standards and Technology (NIST) has been tasked to design, construct, and demonstrate a laboratory-scale apparatus that can perform the screening of liquid agents in well-controlled conditions.
DTIC
Flame Retardants; Fire Extinguishers; Fire Fighting; Fire Prevention

20000114490 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA
Next Generation Fire Suppression Technology Program ***Annual Report***
Gann, Richard G.; Aug. 2000; 36p; In English; Original contains color illustrations
Report No.(s): PB2000-108101; NISTIR-6479; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Halon 1301 (CF3Br) has long been the choice for fire extinguishment in most weapon systems and mission-critical facilities. However, due to its high ozone-depletion potential, halon 1301 was banned from production as of January 1, 1994, under the Copenhagen Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer. As part of its effort to eliminate its dependence on holon 1301, in FY1997 the Department of Defense (DoD) initiated its Next Generation Fire Suppression Technology Program (NGP). The goal of the 9-year, $46 million research program was to develop and demonstrate, by 2005, retrofitable, economically feasible, environmentally acceptable and user-safe processes, techniques, and fluids that meet the operational requirements currently satisfied by halon 1301 systems in aircraft, ships, land combat vehicles, and critical mission support facilities. The results are to be specifically applicable to fielded weapons systems. If successful, the NGP would eliminate DoD dependence on a substance no longer in national production, minimize and readiness impacts that could result if halon 1301 use restrictions were imposed in the future, and achieve these at greatly reduced cost.
NTIS
Fires; Retarding; Technology Utilization

32
COMMUNICATIONS AND RADAR

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

20000109860 Air Force Research Lab., Space Vehicle Directorate, Hanscom AFB, MA USA
IBSS Low Light Level Television Baffle Design
Thorn, Willard F., Air Force Research Lab., USA; Dec. 13, 1998; 18p; In English
Contract(s)/Grant(s): Proj. 2303
Report No.(s): AFRL-VS-TR-1999-1573; IP-350; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report describes the design and construction process for the IBSS Low Light Level television camera baffles. IBSS is short for Infrared Background Signature Survey, a space shuttle experiment. This design was done as a result was done as a result of an earlier design

that did not conform to the required specifications for off-axis radiation rejection. The description of the design process is followed by a description of the improvements made to increase the performance of the baffles.
Derived from text
Baffles; Infrared Radiation; Television Cameras; Design Analysis; Light (Visible Radiation)

20000109871 Tokyo Denki Univ., Faculty of Engineering, Japan
Gamma Notch Antenna
Sato, Akiomi, Tokyo Denki Univ., Japan; Houjyo, Akito, Tokyo Denki Univ., Japan; Miwa, Susumu, Tokyo Denki Univ., Japan; Research Reports of The Faculty of Engineering, Tokyo Denki University; Dec. 1999; ISSN 0389-617X, No. 47, pp. 1-9; In Japanese; Copyright; Avail: Issuing Activity

Applicability of the ”Gamma notch antenna” to the mobile radio equipment is discussed both from the experimental and the theoretical standpoints. The suitable breadth and length ratio, the minimum metal sizes and the feed point of the antenna were determined by the experiments. This paper shows only the final results of the impedance characteristics and the radiation patterns. The influences of cases, a battery and a printed board of a radio equipment over these characteristics are also shown. A printed board results in an adverse effect if it is placed adjacent to the antenna. The basic characteristics of the antenna, and the effects of the base dielectric materials are analysed using the FDTD method. The analyses show good agreement with the above written experiments, and prove the FDTD to be a useful tool for the antenna design.
Author
Antenna Design; Conditions; Notches; Data Acquisition; Numerical Analysis

20000109891 Tokyo Denki Univ., Dept. of Electronics Engineering, Japan
The Effect of A Multi-Pole Magnetic Field On the Discharge Characteristics for a Coaxial Cylindrical Barrier Discharge Reactor
Chang, J. S., McMaster Univ., Canada; Monteiro, K. M. P. F., McMaster Univ., Canada; Ferrera, J. L., Brasilia Univ., Brazil; Kaneda, T., Tokyo Denki Univ., Japan; Research Reports of The Faculty of Engineering, Tokyo Denki University; Dec. 1999; ISSN 0389-617X, No. 47, pp. 21-28; In English; Copyright; Avail: Issuing Activity

The effect of an external magnetic field on the discharge characteristics has been studied experimentally for a coaxial cylindrical barrier discharge reactor. The experiments are conducted for 60 Hz AC applied voltage from 0 to 16 kV, the dc magnetic field intensity from 0 to 0.1 T and the coaxial electrode gap distances from 2.5 to 7 mm for smooth surface and multi-pyramidal shaped surface electrodes at atmospheric gas pressure dry air. The results show that the corona discharge on-set voltage decreases with decreasing electrode gap distance and increasing magnetic field strength. The effect of magnetic fields on the discharge current increase is significant near the corona discharge on-set voltage and non-monotonic current-voltage characteristics were observed.
Author
Magnetic Fields; Atmospheric Composition; Cylindrical Bodies; Electric Potential; Magnetic Effects; Experimentation

20000109967 National Environmental Satellite Service, Camp Springs, MD USA
NOAA-L and NOAA-M AMSU-A Antenna Pattern Corrections
Mo, Tsan, National Environmental Satellite Service, USA; August 2000; 36p; In English
Report No.(s): NOAA-TR-NESDIS-98; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A procedure for making antenna pattern corrections to antenna temperatures of the Advanced Microwave Sounding Unit-A (AMSU-A) is presented. Antenna efficiencies, fractions of total power, over three different solid-angle regions subtended at the satellite by the Earth, cold space, and the satellite platform were calculated at thirty Earth views and four possible cold space calibration positions. These calculated results simplify the process for correcting antenna temperature measurements to retrieve the true brightness temperatures from AMSU-A data.
Author
Antenna Radiation Patterns; Correction; Advanced Microwave Sounding Unit; NOAA Satellites; Temperature Measurement

20000110028 Defence Science and Technology Organisation, Communications Div., Salisbury, Australia

The Theatre Broadcast System

Cocks, Christopher, Defence Science and Technology Organisation, Australia; Arbon, Edward, Defence Science and Technology Organisation, Australia; Burford, Trevor, Defence Science and Technology Organisation, Australia; OShea, Greg, Defence Science and Technology Organisation, Australia; Khuu, Binh, Defence Science and Technology Organisation, Australia; Blackmore, Perry, Defence Science and Technology Organisation, Australia; Coutts, Andrew, Defence Science and Technology Organisation, Australia; Stimson, Philip, Defence Science and Technology Organisation, Australia; July 2000; 30p; In English

Report No.(s): DSTO-TN-0287; DODA-AR-011-480; Copyright; Avail: Issuing Activity

The Theatre Broadcast System is a DSTO developed Concept Technology Demonstrator communications system comprising a high data rate satellite broadcast capability matched with low/medium data rate request channels. The system has the potential to enhance the effectiveness of data dissemination to deployed forces in a cost effective manner. This document provides an overview of the system concept, the principles of operation and details of the initial implementation.

Author

Broadcasting; Product Development; Communication Networks

20000110099 NASA Johnson Space Center, Houston, TX USA

Higher Order Modeling In the BEM/FEM Hybrid Formulation

Fink, Patrick W., NASA Johnson Space Center, USA; Wilton, Don R., Houston Univ., USA; [2000]; 1p; In English; National Radio Science Meeting, 4-8 Jan. 2000, Boulder, CO, USA; Sponsored by International Union of Radio Science, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Hybrid formulations using low order curl-conforming bases to represent the total electric field within a finite element region and low order divergence-conforming bases to represent equivalent electric and magnetic currents on the boundary are well known. However, higher-order divergence and curl-conforming bases have been shown to provide significant benefits in convergence rates and accuracy when employed in strictly integral equation and strictly finite element formulations. In this paper, a hybrid electric field formulation employing higher order bases is presented. The paper addresses benefits and issues associated with using higher order divergence-and curl-conforming bases in the hybrid finite element/boundary element electric field formulation. The method of singularity subtraction may be used to compute the self terms of the boundary integral when the bases are of low order. But this method becomes laborious and requires great care when the divergence conforming bases are of higher order. In order to handle these singularities simply and accurately, a generalized Gaussian quadrature method is employed in which the expansion functions account for the singularity. In preliminary tests of the higher order hybrid formulation, the equivalent electric current induced by scattering of a plane wave from a square dielectric cylinder is examined. Accurate results are obtained using only a two-triangle mesh when the current basis is of order 4 or 5. Additional results are presented comparing the error obtained using higher order bases to that obtained using lower order bases when the number of unknowns is approximately equal. Also, convergence rates obtained with higher order bases are compared to those obtained with lower order bases for selected sample problems.

Author

Finite Element Method; Boundary Element Method; Mathematical Models; Electric Fields; Numerical Analysis; Hybrid Computers

20000110207 Bergen Univ., Norway

Focusing of electromagnetic waves

Dhayalan, V.; Dec. 31, 1996; 212p; In English

Report No.(s): DE98-626452; NEI-NO-890; ISBN 82-993933-0-2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The focusing of electromagnetic waves inside a slab has been examined together with two special cases in which the slab is reduced to a single interface or a single medium. to that end the exact solutions for the fields inside a layered medium have been used, given in terms of the outside current source in order to obtain the solutions for the focused electric field inside a slab. Both exact and asymptotic solutions of the problem have been considered, and the validity of the latter has been discussed. The author has developed a numerical algorithm for evaluation of the diffraction integral with special emphasis on reducing the computing time. The numerical techniques in the paper can be readily applied to evaluate similar diffraction integrals occurring e.g. in microstrip antennas.

NTIS

Electromagnetic Radiation; Dielectrics; Focusing; Asymptotic Series; Microstrip Antennas; Slabs

20000112932 Air Force Occupational Measurement Center, Occupational Analysis Program, Randolph AFB, TX USA
Communications - Computer Systems Planning and Implementation, AFSC 3C3X1
Jun. 2000; 76p; In English
Report No.(s): AD-A379860; OSSN-2401; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Communications-Computer Systems Planning and Implementation career ladder was surveyed to provide current job and task data for use in updating career ladder documents and training programs. Survey results are based on responses from 571 Active Duty (AD) and Air National Guard (ANG) members accounting for 56 percent of the total surveyed population. Four clusters and four independent jobs were identified in the 3C3Xl structure analysis accounting for 84 percent of the total sample. The remaining 16 percent did not fall into any of the identified jobs and clusters. The Plans/Implementations Cluster encompassed the largest percentage of this career ladder. Respondents from this cluster perform the core work of the 3C3X1 specialty, from planning and implementation to requirements analysis and identification. The second largest group identified was the Automated Data Processing Equipment (ADPE) Management Cluster. Members from this cluster are predominantly ANG and perform tasks largely set apart from the rest of the career ladder. Other groups identified include the Unit Deployment Manager Cluster, Financial/Contracting Cluster, CSIR Monitor Job, Requirements Processing Job, Training Superintendent Job, and Architecture/Integration Superintendent Job. AFSC 3C3Xl personnel progress atypically through the career ladder. Only a small number of DAFSC 3C33 1 members are in this career ladder (most jobs require at least a 5-skill level). Mainly 5- and 7-skill level members perform the core work. There is some broadening into management and supervisory tasks for the 7-skill levels, but not as pronounced as in other career ladders. At the 9-skill level, members perform high-level planning and coordination activities and spend a low amount of time supervising. ANG 9-skill level members perform many training tasks as well.
DTIC
Armed Forces (USA); Education; Occupation; Personnel Development

20000113030 State Univ. of Southeast Missouri, Physics Dept., Cape Girardeau, MO USA
Microwave Dielectric Response of Water as a Function of Frequency
Dahiya, J. N., State Univ. of Southeast Missouri, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 37-49; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

In general materials expand when heated but there are a few exceptions and water is one of them. At 4 C the volume vs temperature curve shows a minima indicating a maximum density value for that temperature. It is very interesting to study the microwave dielectric response of water near this temperature of 4 C. The anomalous dielectric dispersion of water at various frequencies has been widely investigated. There is no doubt in the main qualitative features of the phenomenon, but there are wide divergencies in the quantitative analysis of the problem. The fundamental importance of this problem lies in the theoretical analysis of the structure of water that is very significant in terms of its technical and biological interest. A detailed knowledge of the dielectric behavior of water at various microwave frequencies is needed for a partial solution of this problem. A cylindrical resonant cavity in TEO(sub 011) mode is used in a microwave spectrometer to do the dielectric analysis of water. The dielectric relaxation studies of water are performed as a function of temperature at three different frequencies of 10.2, 10.6, and 11.4 GHz. A sensitive thermal bath is used to vary the temperature of the sample under study very precisely. A dramatic change in the dielectric response is seen near 4 C, the temperature at which density of water is maximum rather than the phase transition temperature of 0 C. Slater's perturbation equations are used to calculate the real and imaginary parts of the dielectric constant. The activation energy of this molecule is calculated using Eyring's rate equations and Debye's theory of polar molecules is used to calculate the relaxation times at different frequencies used in this experiment.
Author
Dielectric Properties; Dielectrics; Microwave Frequencies; Water

20000113035 Springfield Technical Community Coll., Northeast Center for Telecommunications Technologies, Springfield, MA USA
Experiments in Magnetics For Telecommunications: Organic and Sol-Gel
Masi, James V., Springfield Technical Community Coll., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 109-120; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The objectives of these experiments are to show the area of fabrication of sol-gel magnetic ceramic materials and magnetic polymer (organic molecular materials), especially the similarities associated with the apparently disparate materials. These experiments contain all of the elements of good design, with the caveat that a novelty in structure is sometimes a part of design. The students learn the process of designing materials for the world of telecommunications, analyze those already used, and suggest

possible solutions to the problems involved with present technology. New organic and sol-gel technologies have allowed the experimenter to turn designs into a world of size control, materials properties, and new materials hard to realize by other more arduous methods. The importance of size and crystallite perfection with respect to properties of finished devices has, only recently, been shown to be one of many critical parameters vital to high performance magnetic devices. The realm of very high and very low frequency devices seem to benefit most from the unique properties attainable from these sol-gel methods. Low temperature scenarios seem to benefit most from the use of the new organic materials. The advent of creating organic electromagnetic materials has raised the challenge of finding polymer (organic) materials in which there is sufficient electronic exchange as well as stability in both the thermal and chemical arena. This experiment gives an overview of how to build and synthesize promising new complex polymer building blocks and sol-gel nanoscale materials which can yield superparamagnetic materials for devices of the future in power, storage, displays, and communications devices. The underlying principles and formulations of molecular and sol-gel structures which either imitate conventional ferromagnetic materials or uniquely take advantage of the very small and very complex magnets offered by organic materials and sol-gel formulations. A wide variety of properties may be obtained, dependent on pH, concentrations, impurities, polymer type, dopants, etc. Applications of these materials to transformers and inductors are detailed, and the underlying principles and formulations of both equilibrium and nonequilibrium materials are explained. The experiments are simple to perform and make great demonstrations of ferro-ferri, and molecular magnetism.
Derived from text
Magnetic Materials; Magnetic Properties; Organic Materials; Sol-Gel Processes

20000113667 Vermont Univ., Coll. of Engineering and Mathematics, Burlington, VT USA
The Asymptotic Theory on Ultrawideband Pulse Propagation in Dispersive Media ***Final Report, 15 Nov. 1997-14 Nov. 2000***
Oughstun, Kurt E., Vermont Univ., USA; Jan. 2000; 4p; In English
Contract(s)/Grant(s): F49620-98-1-0067
Report No.(s): AD-A381798; AFRL-SR-BL-TR-00-0407; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This grant was used to continue support of our graduate level research program into the complete asymptotic description of ultrawideband signal, ultrashort pulse electromagnetic wave propagation in causally dispersive media and waveguiding systems. Our long-term research goal in this important area is to develop a rigorous, uniform asymptotic description of ultrawideband electromagnetic pulsed beam propagation, reflection, and transmission phenomena in both lossy dielectric and conducting dispersive media that is valid for arbitrarily sort rise-time spatial and temporal dynamics of the field as it propagates through the dispersive material.
DTIC
Asymptotic Series; Electromagnetic Wave Transmission; Electromagnetic Pulses; Broadband

20000113836 Mississippi Univ., Dept. of Electrical Engineering, University, MS USA
Applied Computational Electromagnetics Society Journal (ACES). Special Issue on Genetic Algorithms. Volume 15, Number 2
Haupt, Randy; Johnson, J. M.; Jan. 2000; 107p; In English
Report No.(s): AD-A380285; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This special issue of the ACES Journal is devoted to new developments in Genetic Algorithm (GA) applications in computational electromagnetics. Genetic Algorithms have become extremely popular in the computational electromagnetics literature. The papers included in this special issue are very arcane, so I decided to include an unreviewed tutorial overview at the last minute as an introduction for those of you who are at a more basic level. GAs model natural selection and genetics on a computer to optimize a wide range of problems.
Derived from text
Genetic Algorithms; Artificial Intelligence; Neural Nets; Computational Electromagnetics

20000113918 Technische Hogeschool Twente, Centre for Telematics and Information Technology, Enschede, Netherlands
Introduction to TMN
Pras, Aiko, Technische Hogeschool Twente, Netherlands; vanBeijnum, Bert-Jan, Technische Hogeschool Twente, Netherlands; Sprenkels, Ron, Technische Hogeschool Twente, Netherlands; 2000; 32p; In English
Report No.(s): PB2000-104709; CTIT-TR-99-09; Copyright; Avail: Issuing Activity
The document contains information regarding Telecommunications Management Network (TMN).
NTIS
Information Management; Telecommunication; Communication Networks

20000114489 Department of the Treasury, Financial Management Service, Washington, DC USA
FMS Electronic Data Interchange Guidebook
Aug. 30, 1996; 158p; In English
Report No.(s): PB2000-108308; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

Public and private sector organizations have traditionally conducted business using paper documents and preprinted forms to exchange information with each other. These documents were sent by mail and manually processed by the recipient. Over the years, the number of these paper-based exchanges, and the amount of associated data, increased dramatically, forcing organizations to seek a more expedient way of communicating and processing business data. Electronic Data Interchange (EDI) emerged in the late 1960's when industry groups such as railroads, airlines, motor carriers, and shipping companies realized that processing the large volume of paper documentation accompanying the shipment of goods resulted in significant delays in settlement and product deliveries. Since then, companies in industries of all kinds have found that EDI makes economic sense. The Data Interchange Standards Association (DISA) estimates that more than 15,000 companies around the world currently conduct business using EDI. The list of industries in which EDI is actively used includes shipping, retail, grocery, apparel manufacturing and textiles, warehousing, aerospace, chemicals, construction, automotive, financial, electrical and electronics, utilities, health care, petroleum, pharmaceutical, metals, paper, entertainment, and higher education. This list continues to grow and, in recent years, Federal, state, and local governments have begun to conduct business electronically as well. This guidebook presents a methodology for planning and implementing EDI-based systems, and contains information on relevant functional and technical topics, including software, networks, financial EDI, procurement, and trading partner strategy. It is intended for use by Federal agencies, particularly smaller civilian agencies.
NTIS
Communicating; Handbooks; Information Systems; Financial Management

20000114491 International Trade Commission, Office of Industries, Washington, DC USA
Telecommunications Equipment: US Performance in Selected Major Markets ***Topical Report***
Carr, R.; Davitt, J.; Johnson, C.; Ki, S.; Kitzmiller, J.; Dec. 1998; 118p; In English
Report No.(s): PB2000-107672; USITC/PUB-3150; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The study assesses the performance of the US telecommunications equipment industry in the global market as a whole and in seven major US export markets: the European Union (EU), Canada, Japan, Korea, Mexico, China, and Taiwan. The industry encompasses transmission and switching equipment that comprise the telecommunications network as well as terminal equipment such as facsimile machines and telephone sets that attach to the network. The study covers the structure of the US and relevant foreign industries as well as trade patterns, trade agreements, nontariff barriers, and markets. It also addresses in detail factors affecting industry performance such as exchange rate fluctuations, technological innovation, labor productivity, infrastructure development, regulatory environment, installed base of equipment, and domestic market size.
NTIS
Market Research; Research and Development; Telecommunication; Technology Utilization

20000114807 Space and Naval Warfare Systems Command, Charleston, SC USA
21st Century C4ISR/IW Technology Insertion and Management
Iacovetta, Joseph; Balon, Jim; Bracewell, Joe; Auxter, Chuck; Burgess, Jim; Smith, Carol F.; Cullison, Mike; Hoffman, Glen; Tillman, Travis; Virnig, Michael; Mar. 21, 2000; 8p; In English; Engineering Total Ship, 2000, Gaithersburg, MD, USA
Report No.(s): AD-A377328; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper addresses the influences and process that Space and Naval Warfare (SPAWAR) Systems Command uses to introduce the latest Command, Control, Communications, Computers, Intelligence, Sensors, Reconnaissance and Information Warfare (C4ISR/IW) technologies to Naval Shipbuilding. This technology insertion affects both individual ships C4ISR/IW capability and that of the entire Battle Group/Amphibious Readiness Group (BG/ARG).
DTIC
Command and Control; Communication; Intelligence; Warfare; Reconnaissance

20000114828 NASA Goddard Space Flight Center, Greenbelt, MD USA
Spacecraft Communications System Verification Using On-Axis Near Field Measurement Techniques
Keating, Thomas, NASA Goddard Space Flight Center, USA; Baugh, Mark, NASA Goddard Space Flight Center, USA; Gosselin, R. B., NASA Goddard Space Flight Center, USA; Lecha, Maria C., NASA Goddard Space Flight Center, USA; [2000]; 34p; In English; 24th; Antenna Applications, Monticello, IL, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Determination of the readiness of a spacecraft for launch is a critical requirement. The final assembly of all subsystems must be verified. Testing of a communications system can mostly be done using closed-circuits (cabling to/from test ports), but the final connections to the antenna require radiation tests. The Tropical Rainfall Measuring Mission (TRMM) Project used a readily available 'near-fleld on-axis' equation to predict the values to be used for comparison with those obtained in a test program. Tests were performed in a 'clean room' environment at both Goddard Space Flight Center (GSFC) and in Japan at the Tanegashima Space Center (TnSC) launch facilities. Most of the measured values agreed with the predicted values to within 0.5 dB. This demonstrates that sometimes you can use relatively simple techniques to make antenna performance measurements when use of the 'far field ranges, anechoic chambers, or precision near-field ranges' are neither available nor practical. Test data and photographs are provided.
Author
Launching Bases; Near Fields; Spacecraft Communication; Spacecraft Launching; Prelaunch Tests

20000114851 Naval War Coll., Joint Military Operations Dept., Newport, RI USA
Nomadic Communications for the Joint Force Commander ***Final Report***
Scarborough, Sheila A.; May 16, 2000; 22p; In English
Report No.(s): AD-A381659; No Copyright; Avail: Defense Technical Information Center (DTIC)
Today's Joint Force Commander (JFC) has unique communications and information systems requirements. Often operating in austere, bare base areas without reliable fixed telecommunications infrastructure, the JFC must have "nomadic" communications systems which can be used by mobile forces in a variety of ways to communicate with military assets, interagency personnel and civilians. Success in network-centric warfare requires "anywhere, any time access to a network, by forces down to the unit and sometimes even individual level. The mobile, nomadic nature of military operations means that network connectivity is best achieved using a small, probably hand-held, personal digital assistant (FDA) type of multifunction device. of the seven joint doctrine principles for Command, Control, Communications and Computer (C4) systems that support the joint force, the most critical for nomadic, networked forces are interoperability, flexibility, mobility and survivability. Recent lessons learned, from joint forces which are becoming more networked, support this assertion. The civilian world is moving quickly toward nomadic, largely wireless systems; it is instructive to review how the JFC might take advantage of technical innovations such as Web browsing from a cellular telephone or Internet telephony. Certainly, problems do exist, particularly in the area of equipment interoperability. Moving to a concept of individual war fighter or unit level ubiquitous access to networks requires changing our approach to connectivity from fixed, large systems to a FDA type of small multifunction C4 device. With proper attention to those joint doctrine C4 principles that are most critical for a nomadic system, the war fighter will achieve success in a network-centric environment.
DTIC
Command and Control; Information Systems; Telecommunication

20000114857 Defence Science and Technology Organisation, Salisbury Australia
The Theatre Broadcast System
Cocks, Christopher; Arbon, Edward; Burford, Trevor; O'Shea, Greg; Khuu, Binh; Jul. 2000; 25p; In English
Report No.(s): AD-A381970; DSTO-TN-0287; DODA-AR-011-480; Copyright; Avail: Defense Technical Information Center (DTIC)
The Theatre Broadcast System (TBS) is a demonstration high bandwidth, tactical information delivery system developed by DSTO Communications Division. It is targeted at operations on the forthcoming Optus C1 satellite. The concept consists of uplinking ADF data, and both audio and video information, from an injection point. Users in the field receive the broadcast using a half metre diameter dish connected to a compact receive suite and laptop running Windows NT. Low bandwidth communications may be used to request information to be broadcast. User interfaces consist of standard PC applications such as web browsers, mail clients, in addition to any specialised applications required for user data display. The receive terminals may be operated standalone or connected to a local area network. DSTO has engineered a COTS-based hardware solution, developed an extensive software architecture and applied military grade security.
DTIC
Broadcasting; Information Systems

20000114858 Space and Naval Warfare Systems Center, San Diego, CA USA
Development of a Shipboard High Frequency Surface Wave Radar for Anti-Ship Missile Detection
Dinger, R. J.; Jancic, D. A.; Oct. 23, 1998; 14p; In English
Report No.(s): AD-A381980; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A shipboard high frequency surface wave radar (HFSWR), operating between 15 and 25 MHz,.can detect low-flying anti-ship missiles by virtue of diffraction beyond the horizon in a surface-attached wave. Following several successfully shore-side demonstrations, the Navy initiated a program in FY95 to demonstrate a shipboard HFSWR system. A system is currently under fabrication that will be tested in 1999 on the LSD-52 (Pearl Harbor) and on the US Navy's Self-Defense Test Ship. This paper describes the system and testing performed to date, as well as system trade studies and shipboard noise measurements.
DTIC
Search Radar; Surface Waves; Radar; High Frequencies; Fabrication; Ships; Guidance (Motion)

20000114859 TechniScan, Inc., Salt Lake City, UT USA
Theoretical and Experimental Research Studies of Full Vector, 3-D, Quantitative, Inverse Scattering, Ground Penetrating Radar ***Final Report, 1 Mar. 1995 - 1 Mar. 1998***
Bourp, David T.; Johnson, Steven A.; Wiskin, James W.; Berggren, Michael; Jul. 2000; 34p; In English
Contract(s)/Grant(s): F94620-95-C-0024
Report No.(s): AD-A382470; AFRL-SR-BL-TR-00-0466; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This final report describes the research work performed by TechniScan Inc. under Air Force Office of Scientific Research contract no. F94620-95-C-0024 for the period March 1, 1995 to March 1, 1998. The principal goal of the project was to advance the imaging capability of Ground Penetrating Radar (GPR) via the application of toll wave, vector, 3D inverse scattering (IS) methods and to demonstrate the utility of this approach with a laboratory scale (1/20 th scale, 1-18 GHz) GPR scanner. Inverse scatter imaging of complex 3D targets was not achieved due to laboratory equipment limitations. Nonetheless, we believe that the theoretical advances, the software written, the simulations completed and the 2D practical laboratory demonstrations, provided by this research contract, taken together as a whole, constitute a remarkable, significant and valuable contribution to basic science, to engineering know-how and to technology. This body of new knowledge has the potential for application to many commercial areas.
DTIC
Ground Penetrating Radar; Image Resolution; Imaging Techniques; Inverse Scattering

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.

20000109801 Texas Univ., Austin, TX USA
Polymer-Based Photonic Phased-Array Antenna System Based on Detector-Switched Optical Blass Matrix True-Time Delay Steering
Chen, Ray T.; Li, Bing; Chen, Yihong; Steier, W.; Dalton, L.; Jan. 2000; 14p; In English
Report No.(s): AD-A381214; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper reports progress on the substrate guided wave optical true-time delay technique for photonic phase array antenna. Presented is a new optical TTD module design, and the work for PAA system demo. Like other photonic PAA technique, our structure can provide ultra-wide instantaneous bandwidth for PAA, without beam squint, which means when you change microwave frequency, the steering angle will not change. In addition, the optical beamforming network will have very high package density (2.5 delay lines/cmA2) and low weight. It will be more reliable and be able to avoid the electromagnetic pulse attack. Can easily work at high RF frequency, especially at millimeter wave, which is very difficult for electrical method, because no practical microwave transmission line exists. Photonic PAA can let us put all the signal processing unit in some control center, and transfer the signal to remote antenna head through fiber optic link.
DTIC
Photonics; Phased Arrays; Signal Processing; Fiber Optics; Beamforming; Antenna Design; Antenna Arrays; Design Analysis; Microwave Transmission; Optical Equipment

20000109805 Texas Univ., Office of Sponsored Projects, Austin, TX USA
The Development of a Full Architecture For High Performance Actuators For Navy Applications ***Final Report, Jul. 1999-Jul. 2000***
Tesar, Delbert, Texas Univ., USA; Turner, Cameron J., Texas Univ., USA; Hatcher, Eric L., Texas Univ., USA; Finci, Bulent, Texas

Univ., USA; Bono, Michael V., Texas Univ., USA; Aug. 01, 2000; 10p; In English
Contract(s)/Grant(s): N00014-99-1-0898
Report No.(s): AD-A381029; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The research conducted under the auspices of this ONR Research Proposal represents a significant foundation for the development of high performance actuator systems. Collectively, this research addresses several major component technologies (Prime Movers, Sensors, and Software) within the actuator, as well as providing a foundation for the development of multi-criteria decision-making techniques to support actuator intelligence. Together, these technologies merit consideration for continued development and eventual inclusion in the development of SABBs to support future naval demands for high performance automation systems. Notably, while all of these reports describe promising technologies and approaches to the challenges facing automation systems, further research is required in numerous areas to realize their full potential as deployable components.
DTIC
Actuators; Systems Engineering; Software Engineering

20000109808 California Univ., Electronics Research Lab., Berkeley, CA USA
Fabrication of Sub-5nm Silicon Nano-Wires and Nano Devices, *1 Jun 1995-31 May 1998*
Bokor, Jeffrey; Mar. 28, 2000; 5p; In English
Contract(s)/Grant(s): F49620-95-C-0418
Report No.(s): AD-A381159; UCB/ERL-442427-23108; AFRL-SR-BL-TR-00-0323; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A reproducible process for fabricating silicon nanowires down to 4nm in diameter has been developed. The process, as described in previous reviews, relies on the stress limited oxidation of a thin silicon line. The initial line is fabricated by patterning an SOI wafer using electron beam lithography and a NiCr lift-off process. The post-oxidation wire was found to be very sensitive to crystallographic orientation of the line, its height/width aspect ration, and the presence of the supporting substrate.
DTIC
Nanotechnology; Fabrication; Nanostructures (Devices); Wire; SOI (Semiconductors)

20000109822 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Study of fabrication and properties of high-T(sub c) superconductor tapes
Joo, J. H.; Ji, B. K.; Kim, T. W.; Jul. 31, 1997; 69p; In Korean
Report No.(s): DE99-727844; KAERI-CM-117/96; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Superconductor tape with improved electrical and mechanical properties is needed for the application of high technology equipments. to this end, we evaluated the effects of processing variables on interface irregularity, microstructure, and resultant J(sub c) of tape. For the tapes made by PIT technique, the degree of interface irregularity was varied with powder packing methods and forming process variables. It was observed that the degree of interface irregularity of tapes by CIP method was more reduced, compared to that of tape by ram method. In addition, the degree of interface irregularity was promoted with decreasing the dimension of tape during forming process. As the dimension of wire/tape were changed from diameter of 3.25 mm to thickness of 0.20 mm during forming process, J(sub c) value, were observed to be increased by 10 times. It was likely that the improvement of J(sub c) was mainly result from the enhanced texturing of 2223 grain. Microstructural investigation showed the degree of texturing were degraded by the existence of both second phases and interface irregularity. If the interface were glat, larger grain size and better texturing near interface were developed compared to those inside superconducting core. The improvements of microstructure near interface may be result o reaction between Ag and superconductor phase.
NTIS
Fabrication; Mechanical Properties; Electrical Properties; High Temperature Superconductors; Superconductivity

20000109912 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR
ATLAS TileCal submodule B-field measurement
Budagov, Y.; Fedorenko, S. B.; Kalinichenko, V. V.; Lomakin, Y.; Vorozhtsov, S. B.; Dec. 31, 1997; 16p; In English
Report No.(s): DE98-618162; JINR-E-1-97-124; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The work was done to cross check of the previous measurement done at CERN and to simulate the magnetic structure in the vicinity of the symmetry plane of the TileCal. to perform magnetic measurements for submodule the magnet E2 was chosen. The magnetometer used in the magnetic test of the submodule consists of Hall current supply and Hall voltage measuring device. The indium antimonide Hall probe used in this measurement is a model PKhE 606. Experimental set-up provides a true measurement accuracy of order (+/-) 1%. External magnetic field measurements were conducted at the outer surface of the submodule. Two levels of the external field were applied: 108 Gs and 400 Gs. The result of this measurement in general confirms the data, obtained

at CERN, but the shielding capability of the submodule under consideration was (approx) 20% higher than there. The field at the tile location is < 150 Gs up to the external field level 500 Gs and the tile field grows much less than the external field level in this range. The data obtained in this measurement could be used as a benchmark when producing a computer model of the TileCal magnetic field distribution.
NTIS
Direct Current; Electromagnets; Magnetic Measurement; Data Processing; Computerized Simulation

20000109952 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Thin Film Li Ion Microbatteries for NASA Applications
West, W. C., Jet Propulsion Lab., California Inst. of Tech., USA; Ratnakumar, B. V., Jet Propulsion Lab., California Inst. of Tech., USA; Brandon, E., Jet Propulsion Lab., California Inst. of Tech., USA; Blosiu, J. O., Jet Propulsion Lab., California Inst. of Tech., USA; Surampudi, S., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Rechargeable thin film microbatteries have recently become the topic of widespread research for use in low power applications such as battery-backed CMOS memory, miniaturized implantable medical devices and smart cards. In particular, the Center for Integrated Space Microsystems (CISM) at NASA's Jet Propulsion Laboratory has interest in applying this technology for secondary power systems in miniaturized satellites, microsensors, microactuators and other remote MEMS applications. The general requirements of the microbatteries for these applications are high specific energy, wide range of temperature stability. low self-discharge rate, and flexibility of cell design. The thin film Li ion materials system using LiCoO2(LiPO(x)N(1-x))SnO is expected to fulfill these requirements.
Derived from text
Electric Batteries; Thin Films; Microminiaturization; Lithium; Ions

20000110536 New River Community Coll., Dept. of Electronics/Fiber Optics, Dublin, VA USA
Universal Wireless Alarm System
Shirvani, Mir S., New River Community Coll., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 76; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A research for the development and design of a Universal Wireless Alarm System that can notify both the deaf and hard of hearing as well as those without hearing impairment. This project was intended to be started under the fellowship and then to be completed under a grant or contract. Therefor the following represents only an interim report. This project focused on a number of major issues concerned primarily with the versatility in the functions, size, and NASA technology, including using NASA's new actuator/sensor (thin unimorph ferroelectric) devices as an integral part of this system.
Derived from text
Warning Systems; Wireless Communication

20000110566 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Report of the results of the fiscal 1997 regional consortium R and D project. Regional consortium field/ R and D on the technology to create new organic electroluminescence devices (first fiscal year)
Mar. 31, 1998; 187p; In Japanese; In English
Report No.(s): DE99-746851; ETDE/JP-99746851; No Copyright; Avail: Department of Energy Information Bridge

The paper develops the R and D having as core creative technical seeds on the design principle of organic electroluminescence (EL) devices, aims at producing as products a polychrome display and a new energy saving type light source, develops new high efficient luminescent materials which support the production of products with high liability, and develops protective coats universally applicable to optical and electronic devices and sealing technology. In fiscal 1997, the following are commenced: (1) development of luminescent devices, (2) development of new luminescent agents, and (3) development of the mounting technology. In (1), the following are conducted: R and D for improvement of durability of EL devices, development of the process technology for polychroism, multi-coloring, and development of the large picture thin film formation technology. For the development of energy saving type high efficiency light source devices, a method is established for producing organic layers by a new wet coating method. In (3), the R and D are carried out of a method to form inorganic protective coats at low temperature and a method to highly evaluate structural defects in the protective coat. For the sealing of devices, low melting point glass and the forming technology are developed.
NTIS
Electroluminescence; Display Devices; Organic Compounds

20000110591 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia
Stress Analysis of a Tuner for an Electromagnetic Reverberation Chamber
Weeks, Frank, Defence Science and Technology Organisation, Australia; Feb. 2000; 60p; In English
Report No.(s): AD-A380990; DSTO-TN-0272; DODA-R-011-423; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Structural analyses of a tuner for a large electromagnetic reverberation chamber are presented in this note. The analyses cover drive motor, highly stressed welds of the paddle assembly, torque in drive shafts, and weld fatigue life. The analyses have been conducted for normal operating conditions as well as for a variety of possible overload conditions. Recommendations for minor modifications are made, including the installation of a safety collar.
DTIC
Reverberation Chambers; Stress Analysis; Structural Analysis; Fatigue Life; Tuners; Electromagnetism

20000110592 Defence Science and Technology Organisation, Air Operations Div., Melbourne Australia
A Feasibility Study into Increasing the Rotational Speed of the Tuner in the DSTO Electromagnetic Reverberation Chamber
Weeks, Frank, Defence Science and Technology Organisation, Australia; Philp, Grant, Defence Science and Technology Organisation, Australia; Feb. 2000; 17p; In English
Report No.(s): AD-A380991; DSTO-TN-0273; DODA-AR-011-424; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This note presents a feasibility study into reducing the test time in the Defense Science and Technology Organization (DSTO) Electromagnetic Reverberation chamber by increasing the rotational speed of the tuner. The analyses cover the tuner's structural integrity, the drive motor capacity, and whether the drive motor software can be modified to accommodate the increased speed.
DTIC
Reverberation Chambers; Structural Failure; Tuners; Electromagnetism; Environmental Tests

20000112925 Adtech Systems Research, Inc., Beavercreek, OH USA
Nonlinear Optical (NLO) Materials and Device Development ***Final Report, 15 Aug 1998-15 May 1999***
Soni, Som R.; Skidmore, J. B.; Tiwari, Rajesh; McKellar, R. M.; Yancey, Perry P.; May 15, 1999; 32p; In English; Prepared in cooperation with the University of Dayton, School of Engineering, Dayton, OH.
Report No.(s): AD-A380784; AFRL-SR-BL-TR-00-0377; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effort in this program was directed towards developing material processing systems that posses the mechanical properties and processing characteristic for use in flexible electronic and photonic devices. The main goal was to demonstrate the feasibility of fabricating Mach-Zehnder (MZ) switch using LD-3 NLO polymer material as core and PEDOT/PSS conducting polymer as cladding layers.
DTIC
Nonlinear Optics; Electro-Optics; Electronic Equipment; Fabrication; Conducting Polymers; Optical Materials

20000113050 Norfolk State Univ., Dept. of Technology, VA USA
Microwave Driven Actuators Power Allocation and Distribution
Forbes, Timothy, Norfolk State Univ., USA; Song, Kyo D., Norfolk State Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 303-312; In English; See also 20000113027
Contract(s)/Grant(s): NCC1-280; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Design, fabrication and test of a power allocation and distribution (PAD) network for microwave driven actuators is presented in this paper. Development of a circuit that would collect power from a rectenna array amplify and distribute the power to actuators was designed and fabricated for space application in an actuator array driven by a microwave. A P-SPICE model was constructed initially for data reduction purposes, and was followed by a working real-world model. A voltage up - converter (VUC) is used to amplify the voltage from the individual rectenna. The testing yielded a 26:1 voltage amplification ratio with input voltage at 9 volts and a measured output voltage 230VDC. Future work includes the miniaturization of the circuitry, the use of microwave remote control, and voltage amplification technology for each voltage source. The objective of this work is to develop a model system that will collect DC voltage from an array of rectenna and propagate the voltage to an array of actuators.
Author
Actuators; Microwaves; Power Supply Circuits; Rectennas; Electric Potential

20000113853 Electricite de France, Direction des Etudes et Recherches, Clamart, France

Inter operability of smart field devices on an open field-bus: from laboratory tests to on-site applications

Piguet, M.; Favennec, J. M.; Dec. 31, 1997; 13p; In English

Report No.(s): DE98-616885; EDF-97-NB-00075; No Copyright; Avail: Department of Energy Information Bridge

The paper presents a field trial held in EDF's R and D laboratories concerning smart field instruments (sensors, I/O modules, transmitters) operating on the WorldFIP field-bus. The trial put into operation a supervisory control and data acquisition (SCADA) system on the field-bus with available industrial field devices and software tools. The field trial enables EDF's teams to address the inter-operability issue regarding smart field devices and to prepare the forthcoming step from analog to fully digital measurement technology by evaluating new services and higher performances provided. Possible architectures for process control and on-site testing purposes have been identified. A first application for a flow-measuring rig is under way. It implements a WorldFIP field-bus based DCS with FIP/HART multiplexers, FIP and HART smart devices (sensors and actuators) and a field management system.

NTIS

Control Equipment; Transmitters; Management Systems

20000114854 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Characterization of Silicon Carbide and Commercial Off-the-Shelf Components for High-g Launch and Electromagnetic Applications *Final Report*

Katulka, Gary L.; Hepner, David J.; Davis, bradford S.; Irwin, Eric S.; Ridgley, Melvin B.; Aug. 2000; 23p; In English; Prepared in collaboration with Cornell Univ., Ithaca, NY.

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A381935; ARL-TR-2278; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent experiments with die-level silicon carbide (SiC) transistors are described. The objective of these experiments was to determine the behavior of SiC field effect transistors (FET) in a high-g environment typical of conventional guns, missiles, or electric launchers. The results of the experiments have shown for the first time that die-level SiC FETs can survive mechanical forces as much as 12,000 times the force of gravity (12,000 g's) without the mechanical support and protection of microelectronics encapsulation materials (e.g., plastic encapsulation material or PEM). A second series of experiments was performed with commercial off-the-shelf (COTS) sensors that rely upon standard sensor technology, including silicon (Si) semiconductors. These experiments provided details of several COTS sensors previously qualified for high- G environments, which are characterized here under harsh electromagnetic interference (EMI) conditions. The sensors tested included an Si optical solar cell, an accelerometer, and a magnetometer. The output response of the sensors was recorded during the EMI event to ascertain the effect of coupled electromagnetic radiation on the sensors.

DTIC

Field Effect Transistors; Silicon Carbides; Microelectronics; Radiation Effects; Semiconductors (Materials); Solar Cells; Transistors

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.

20000109828 Rensselaer Polytechnic Inst., Howard P. Isermann Dept. of Chemical Engineering, Troy, NY USA

A Study of the Constrained Vapor Bubble Thermosyphon, *21 Apr. 1996 - 21 Oct. 2000*

Wayner, Peter C., Jr., Rensselaer Polytechnic Inst., USA; Plawsky, J. L., Rensselaer Polytechnic Inst., USA; Oct. 21, 2000; 12p; In English

Contract(s)/Grant(s): NAG3-1834; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this effort is to better understand the physics of evaporation, condensation, and fluid flow as they affect the heat transfer processes in a constrained vapor bubble heat exchanger (CVBHX). This CVBHX consists of a small enclosed container with a square cross section (inside dimensions. 3 x 3 x 40 mm) partially filled with a liquid. The major portion of the liquid is in the corners, which act as arteries. When a temperature difference is applied to the ends of the CVBHX, evaporation occurs at the hot end and condensation at the cold end resulting in a very effective heat transfer device with great potential in space applica-

tions. Liquid is returned by capillary flow in the corners. A complete description of the system and the results obtained to date are given in the papers listed.
Author
Fluid Flow; Heat Transfer; Thermosiphons; Evaporation

20000109880 Societe Francaise des Thermiciens, Chatenay-Malabry, France
Activities of the Ameth laboratories network
Dec. 31, 1997; 24p; In French; In English
Report No.(s): DE99-750723; ETDE-FR-99750723; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thermal exchanges are of prime importance in industrial processes, space heating and air conditioning, cooling processes or heat exchangers design. University research laboratories and engineering schools created the Ameth network in order to share their means and competences in heat transfer research, to draw bridges between different subjects and to organize coordinated projects. In 1997 the Ameth laboratories have carried out 10 projects grouped into three themes: the thermal hydrodynamic instability and the limit boundary control, the transfers with liquid/vapor phase change and the transfers with solid/liquid phase changes. These projects and their first results are reported in this book of proceedings. This conference day was jointly organized by the thermal engineering university group (GUT) and the French society of thermal engineers. The ten communications presented in this book deal successively with: 'the active control of a Poiseuille flow in the presence of volume heating'; 'the control of instabilities, transition and thermo-convective flow transfers in cavities: application to the ventilation of rooms'; 'the control of heat transfers during space-time flow disturbances in cylindrical channels'; 'the characterization of surface heat transfers using transient methods improved for boiling in pool applications'; 'the intensification of heat exchanges during boiling in confined medium'; 'the evaporation and boiling in porous media'; 'the characterization of heat transfers in micro-heat pipes'; 'the AmETh 3-1 operation: experimental and numerical analysis of thermal resistances at the polymer-mould contact and developing during solidification'; 'the analysis of solidification phenomena at the interface between a substrate and a melted medium'; and 'the heat transfers with solid-liquid phase change'.
NTIS
Heat Transfer; Heat Exchangers; Cooling; Air Conditioning; Space Heating (Buildings)

20000109882 Societe Francaise des Thermiciens, Chatenay-Malabry, France
Temperature measurements in fluid flows (eventually reactive, multi- phase) using optical methods ***Temperature measurements in fluid flows***
Dec. 31, 1998; 24p; In English
Report No.(s): DE99-750725; ETDE-FR-99750725; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This conference day was organized by the 'radiations' section of the French association of thermal engineers. This book of proceedings contains 8 papers entitled: 'simultaneous temperature and NO concentration measurements in a hydrogen-air turbulent flame'; 'application of iodine laser induced fluorescence to temperature, pressure and velocity measurements'; 'Doppler phase measurement of refractive index and temperature'; 'experimental and numerical study of temperature fields of particulates in plasma jets'; 'measurement and determination of temperatures and concentrations of hot exhaust gases with FTIR emission spectroscopy'; 'combustion control in gas turbines using CO2 emission spectroscopy'; 'analysis of gases temperature fields and particulate jets. Application to hydrogen-air, kerosene stato-reactors and to solid propellant jets'; 'restitution of temperature and species profiles in pre-mixing flames by inversion of transmission and IR emission data.
NTIS
Conferences; Particulates; Aerosols; Exhaust Gases; Carbon Dioxide; Combustion Products; Gas Turbines; Gas Composition; Atmospheric Composition

20000109884 Societe Francaise des Thermiciens, Chatenay-Malabry, France
Non-linear thermal engineering, chaotic advection and mixing
Dec. 31, 1998; 24p; In English
Report No.(s): DE99-750727; ETDE-FR-99750727; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This conference day was jointly organized by the 'university group of thermal engineering (GUT)' and the French association of thermal engineers. This book of proceedings contains 7 papers entitled: 'energy spectra of a passive scalar undergoing advection by a chaotic flow'; 'analysis of chaotic behaviours: from topological characterization to modeling'; 'temperature homogeneity by Lagrangian chaos in a direct current flow heat exchanger: numerical approach'; ' thermal instabilities in a mixed convection phenomenon: nonlinear dynamics'; 'experimental characterization study of the 3-D Lagrangian chaos by thermal analogy';

'influence of coherent structures on the mixing of a passive scalar'; 'evaluation of the performance index of a chaotic advection effect heat exchanger for a wide range of Reynolds numbers'.
NTIS
Conferences; Chaos; Advection; Mixing; Mixing Layers (Fluids)

20000109922 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Influence of the compressibility effects on the spectra of strongly anisotropic developed turbulence
Antonov, N. V.; Nalimov, M.; Hnatich, M.; Dec. 31, 1997; 20p; In Russian; In English
Report No.(s): DE98-618204; JINR-R-17-97-146; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A statistical model of strongly anisotropic developed turbulence of compressible fluid is investigated by means of quantum-field renormalization group method. The Kolmogorov hypothesis that inertial range behavior of velocity correlation functions is independent of kinematic viscosity has been confirmed in the lowest non-trivial order of expansion in powers of the Mach number.
NTIS
Quantum Theory; Field Theory (Physics); Turbulence; Compressible Fluids; Renormalization Group Methods

20000109945 NASA Marshall Space Flight Center, Huntsville, AL USA
Turbulent Transition in Electromagnetically Levitated Drops
Hyers, Robert W., Massachusetts Inst. of Tech., USA; Trapaga, G., Massachusetts Inst. of Tech., USA; Abedian, B., Tufts Univ., USA; Matson, D. M., Massachusetts Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Electromagnetic levitation (EML) is an important tool in materials research. Because a sample can be processed without contact with a container, experiments may be performed on high temperature, highly reactive, and undercooled liquid metals. Many of these experiments are affected by fluid flow in the sample, driven by the electromagnetic positioning force. Despite the importance of convection in these experiments, the transition to turbulence is not well understood in this system. However, we have observed a transition from laminar to turbulent flow in EML droplets in the course of microgravity experiments in TEMPUS on the Space Shuttle (STS-94). The transition occurs repeatably and over a narrow range of conditions. These experimental observations are compared with two competing theories about the transition to turbulence. Also, the results of a particle tracking study of the instabilities leading up to the transition to turbulence are presented.
Author
Electromagnetic Properties; Levitation Melting; Liquid Metals

20000109947 NASA Marshall Space Flight Center, Huntsville, AL USA
Effect of beta-ADrenergic Agonist on Cyclic AMP Synthesis in Chicken Skeletal Muscle Cells in Culture
Young, R. B., NASA Marshall Space Flight Center, USA; Bridge, K. Y., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; American Society for Cell Biology, 10 Dec. 2000, San Francisco, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Several beta-adrenergic receptor (bAR) agonists are known to cause hypertrophy of skeletal muscle tissue. Because it seems logical that these agonists exert their action on muscle through stimulation of cAMP synthesis, five bAR agonists encompassing a range in activity from strong to weak were evaluated for their ability to stimulate cAMP accumulation in embryonic chicken skeletal muscle cells in culture. Two strong agonists (epinephrine and isoproterenol), one moderate agonist (albuterol), and two weak agonists known to cause hypertrophy in animals (clenbuterol and cimaterol) were studied. Dose response curves were determined over six orders of magnitude in concentration for each agonist, and values were determined for their maximum stimulation of cAMP synthesis rate (Bmax) and the agonist concentration at which 50% stimulation of cAMP synthesis (EC50) occurred. Bmax values decreased in the following order: isoproterenol, epinephrine, albuterol, cimaterol, clenbuterol. Cimaterol and clenbuterol at their Bmax levels were approximately 15-fold weaker than isoproterenol in stimulating the rate of cAMP synthesis. In addition, the EC50 values for isoproterenol, cimaterol, clenbuterol, epinephrine, and albuterol were 360 nM, 630 nM, 900 nM, 2,470 nM, and 3,650 nM, respectively. Finally, dose response curves show that the concentrations of cimaterol and clenbuterol in culture media at concentrations known to cause significant muscle hypertrophy in animals had no detectable effect on stimulation of CAMP accumulation in chicken skeletal muscle cells.
Author
Adrenergics; Cyclic Amp; Synthesis (Chemistry)

20000110103 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Development of low flow critical heat flux correlation for HANARO

Park, C.; Chae, H. T.; Hang, G. Y.; Jul. 31, 1997; 43p; In English

Report No.(s): DE98-622129; KAERI/TR-905/97; No Copyright; Avail: Department of Energy Information Bridge

A low flow CHF correlation was developed for the safe operation of HANARO during the natural circulation cooling and the assessment of safety during the low flow condition of accident. The analytical model was applied to estimate the heat flux and the temperature distributions along the periphery of the fin at CHF conditions, and the predicted wall temperature at the sheath between the fins by the model agreed well with the measured one. The parametric trends of the CHF data for the finned geometry agreed with the general understanding from the previous studies for the unfinned annulus or tube geometries. It is revealed that the fin does not affect the CHF for low flow condition, although it increase the critical power due to larger heat transfer area. As the existing CHF correlation is proposed to predict the CHF for both finned and unfinned geometries at low flow and low pressure conditions. The developed correlation predicts the experimental CHF data with RMS errors of 13.7%.

NTIS

Heat Transfer; Heat Flux; Correlation

20000110447 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

Cascading Lakes, Spillways, and Subaqueous Debris Flows: Models for Martian Paleolakes

Rice, J. W., Jr., Arizona Univ., USA; Baker, V. R., Arizona Univ., USA; Scott, D. H., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Newly acquired MOLA profiles, over the northern lowland plains region of Mars, indicate that the regional flatness (less than 1 deg slopes) and low surface roughness (less than 2m over 100 km baseline rms variation) is consistent with large-scale terrestrial depositional environments such as fluviolacustrine basins and the oceanic abyssal plains. However, the origin of the flatness of the northern hemisphere is unknown. Current explanations to account for both the extraordinary flatness and smoothness of the northern plains calls for the formation of vast lakes or oceans. Recent MOLA results supply additional evidence to corroborate these earlier geomorphic studies which indicated that large standing bodies of water occupied the northern plains of the planet. Additional information is contained in the original extended abstract.

Author

Flatness; Lakes; Mars Surface; Northern Hemisphere; Slopes; Surface Roughness

20000110517 Old Dominion Univ., Dept. of Mechanical Engineering, Norfolk, VA USA

Parallel Computations of Complex 3D Turbulent Free Jets

Demuren, Ayodeji O., Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 55; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Three-dimensional turbulent free jets issuing from non-circular orifices or pipes have been observed to exhibit complex geometrical evolutions in the near-to-medium field such as repeated switching of major and minor axes which is accompanied by entrainment rates which are far in excess of those for plane or axi-symmetric jets. A major application of topical interest and national priority in aeronautics is the prediction and minimization of jet noise. The increased entrainment of complex jets should lead to decreased acoustic radiation. It is believed that both the directivity pattern and intensity of acoustic radiation can be altered by passive manipulation of the large scale structures by geometrical modifications. The prerequisite for these is the resolution of the large-scale turbulent structures in the jets via large-eddy simulation (LES) which then act as acoustic sources for computational aero-acoustics (CAA) to simulate the far-field sound radiation. Acoustic radiation from the small scales is modeled in a manner analogous to the sub-grid scale (SGS) for the turbulent simulation. Thus two sets of large scale computations are required: LES to generate the turbulence field and CAA to generate the sound field. Both computations use the same suite of codes, but solve different systems of equations over different domain sizes, and using different mesh sizes. Problem sizes dictate extensive use of parallelization. In particular, the acoustic problem requires solution over very large domains, but the system of equations can be linearized, which will facilitate massive parallelization suitable for solution on distributed memory machines. The research task was to convert a previously developed higher-order-accurate numerical formulation for the simulation of complex jets to enable parallel simulation via domain decomposition, both in the LES mode and in the CAA mode. This involved the parallelization of the code to run on multiple processors on distributed memory machines such as the SGI Origin 2000 or Beowulf cluster systems. MPI library calls are used for communication between processors or between domains. Stability of the multi-domain simulation is assured by use of difference operators which satisfy summation by parts (SBP) criteria. The numerical formulation used for serial computations is not guaranteed to be stable in parallel mode using domain decomposition with inter-domain com-

munication via message passing. The requirement for stability is that the difference schemes, including boundary conditions and operators should satisfy summation by parts criteria. Thus formal stability criteria can be derived. Multi-domain solutions are then coupled together via penalty functions and are guaranteed not to drift apart.
Author
Turbulent Jets; Free Jets; Three Dimensional Models; Parallel Processing (Computers)

20000110537 Wyoming Univ., Mechanical Engineering, Laramie, WY USA
A Study of Zero-Mass-Flux Actuator Arrays for Flow Control applications
Smith, Douglas R., Wyoming Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 77; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The aerospace community has identified the understanding and control of turbulent and separated flows as vital to the development of innovative strategies for expanding the boundaries of flight. Currently, the design and operation of aircraft are made in such a way as to ensure that undesirable turbulent or separated flows do not occur. For example, during the landing of an airplane, the need to maintain smooth, unseparated flow over the wing requires that a certain air-speed be maintained in the descent. In addition, aircraft have complex, multi-segmented wings that allow landings to occur at the lowest and consequently safest speed. With a better understanding of turbulent flows and a means to control them, airplane designers could reduce the complexity and the weight of wings while retaining or improving the wing performance. This lighter, simpler wing will make the overall aircraft lighter and will allow it to land at yet lower speeds in even safer landings. This work evaluates one type of turbulent flow control device that may ultimately allow lighter, simpler wings to be designed.
Derived from text
Actuators; Control Equipment; Separated Flow; Turbulent Flow; Aerospace Industry

20000110609 Bettis Atomic Power Lab., West Mifflin, PA USA
Elastic-Perfectly Plastic Flow Model for Finite Element Analysis of Perforated Materials
Jones, D. P.; Gordon, J. L.; Hutula, D. N.; Banas, D.; Newman, J. B.; Feb. 01, 1999; 11p; In English; 1999 ASME Pressure Vessels and Piping Conference, 1-5 Aug. 1999, Boston, MA, USA
Report No.(s): DE00-755313; B-T-3251; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes the formulation of an elastic-perfectly plastic flow theory applicable to equivalent solid (EQS) modeling of perforated materials. An equilateral triangular array of circular penetrations is considered. The usual assumptions regarding geometry and loading conditions applicable to the development of elastic constants for EQS modeling of perforated plates are considered to apply here. An elastic-perfectly plastic (EPP) EQS model is developed for a collapse surface that includes fourth-order stress terms. The fourth order yield function has been shown to be appropriate for plates with a triangular array of circular holes. A complete flow model is formulated using the consistent tangent modulus approach based on the fourth order yield function.
NTIS
Elastic Properties; Finite Element Method; Flow Theory; Perforated Plates; Plastic Flow; Mathematical Models

20000110942 NASA Langley Research Center, Hampton, VA USA
Force, Surface Pressure and Flowfield Measurements on Slender Missile Configurations at Supersonic Speeds
Birch, T. J., Defence Evaluation Research Agency, UK; Allen, J. M., NASA Langley Research Center, USA; Wilcox, F. J., NASA Langley Research Center, USA; [2000]; 14p; In English; 18th; Applied Aerodynamics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-4207; Copyright; Avail: Issuing Activity

This paper describes a series of wind tunnel experiments carried out with the aim of providing data suitable for evaluating the performance of Computational Fluid Dynamics (CFD) codes. The configurations and flow conditions studied are most relevant to slender supersonic missiles. However, the data obtained, which includes forces and moments, surface pressures, flowfield surveys and a selection of flow visualization images, should he of interest to other CFD practitioners. Results for three test cases are presented and discussed in this paper. These cases have been the subject of a collaborative study concerned with the evaluation of Navier-Stokes solvers for missiles, carried out under the auspices of The Technical Cooperation Programme (TTCP).
Author
Computational Fluid Dynamics; Flow Distribution; Supersonic Speed; Wind Tunnel Tests; Force Distribution; Pressure; Missile Configurations

20000112930 NASA Marshall Space Flight Center, Huntsville, AL USA

Observations on Rotating Cavitation and Cavitation Surge From The Development of the Fastrac Engine Turbopump

Zoladz, Thomas F., NASA Marshall Space Flight Center, USA; [2000]; 14p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-3403; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effects of rotating cavitation and cavitation surges on the Fastrac Engine Turbopump are described in a viewgraph presentation format. The bent inducer blade dilemma and observations of unsteady data and oscillation components are discussed. The pump-feed system stability modeling assessment is outlined. Recommendations are made urging further investigation.

CASI

Cavitation Flow; Rotation; Turbine Pumps

20000112940 NASA Langley Research Center, Hampton, VA USA

A Solution Adaptive Technique Using Tetrahedral Unstructured Grids

Pirzadeh, Shahyar Z., NASA Langley Research Center, USA; [2000]; 13p; In English; 22nd; Congress, 27 Aug. - 1 Sep. 2000, Harrogate, UK; Sponsored by International Council of the Aeronautical Sciences, Unknown; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An adaptive unstructured grid refinement technique has been developed and successfully applied to several three dimensional inviscid flow test cases. The method is based on a combination of surface mesh subdivision and local remeshing of the volume grid Simple functions of flow quantities are employed to detect dominant features of the flowfield The method is designed for modular coupling with various error/feature analyzers and flow solvers. Several steady-state, inviscid flow test cases are presented to demonstrate the applicability of the method for solving practical three-dimensional problems. In all cases, accurate solutions featuring complex, nonlinear flow phenomena such as shock waves and vortices have been generated automatically and efficiently.

Author

Technology Utilization; Computational Grids; Unstructured Grids (Mathematics); Steady State; Inviscid Flow

20000113816 Electricite de France, Direction des Etudes et Recherches, Clamart, France

Introduction to turbulence modelling: Applications of Reynolds Averaged Navier Stokes Equations (RANSE) to engineering problems

Laurence, D.; Dec. 31, 1997; 38p; In English

Report No.(s): DE98-616883; EDF-97-NB-00073; No Copyright; Avail: Department of Energy Information Bridge

The k-(epsilon) model and Reynolds stress transport model are set out in a few words. Limitations of models are shown, particularly for turbulence generation in the turbulent viscosity context, and, more generally, the uncertainties and miscellaneous changes made to the dissipation equation. The performances of models are then compared, using results of the three latest ERCOFTA/IAHR workshops. It is shown that algebraic constraints which can be derived exactly by assuming asymptotic limits (rapid distortion, homogeneous shear at infinite time, 2D turbulence) have inhibited a better tuning of the models for real life flow where these limits are not encountered. A more pragmatic approach could be taken by allowing the constants to be functions of invariant parameters. But these functions, making the models non-linear, can lead to bifurcations or instability. One essential parameter is the distance to the wall, which recent models have tried to eliminate, although this parameter appears indirectly through the Poisson equation for the fluctuating pressure. A possible indirect model is the elliptic relaxation. Progress was recently achieved in near-wall low Re modelling, but these advances do not always result in benefits to industry since only the 'wall function' approaches can be used in the high Re, 3D flows that we need to study. With the knowledge gained from near-wall modelling, it might be profitable to revisit the 'wall functions' devised 20 years ago.

NTIS

Reynolds Number; Turbulent Flow; Turbulence; Navier-Stokes Equation; Reynolds Averaging; Stress Analysis

20000113817 Electricite de France, Direction des Etudes et Recherches, Clamart, France

Particle image velocimetry - Principles and first results

Laporta, A.; Marechal, J. P.; Dec. 31, 1997; 30p; In French; In English

Report No.(s): DE98-616879; EDF-97-NB-00054; No Copyright; Avail: Department of Energy Information Bridge

Particle Image Velocimetry (PIV) is a measurement technique elaborated towards the end of the 1970's, but which has developed considerably in recent years. The general principle of PIV is very simple and enables access to instantaneous velocity fields. It consists in recording images of tracer- particles injected into the flow and determining the distance covered by these particles. Since we know the time lapse between successive images of the same particle, we can derive the local fluid velocity. Among the

many existing image acquisition and processing methods, the image inter-correlation analysis techniques, used with a pulsed laser source, is the most effective. Since we know the influence of different parameters (number of particles, beam power, time lapse between two successive images, size of query zones, etc.) on the quality of the final result, we can optimize practical adjustment of the PIV measurement scheme. The PIV was tested on the LAVITA hydraulic mockup (simulating the operation of a tangential fan). First results are, all in all, highly satisfactory. These have enabled the rapid drafting of instantaneous mean velocity field maps (20 images acquired in less than 90 seconds, with a post-processing time of about 10 minutes). Observation of the instantaneous fields has evidenced the presence of low frequency non-stationary phenomena which are not revealed by Laser Doppler Velocimetry (LDV). Quantitative comparison between LDV and PIV, concerning average fields, showed close results, with, however, local divergences which could be relatively marked. It must nevertheless be noted that the PIV measurements performed on LAVITA have not been optimized with a view to obtaining a consistently good accuracy level. Priority in the present case was given to the scope of the field explored, with a view to observing the large non-stationary structures within a flow. The PIV measurement technique is thus operational for prompt flow characterization. However, concerning conclusions on the accuracy of the measurements, further comparisons will be required.
NTIS
Flow Visualization; Image Processing; Velocity Distribution; Particle Image Velocimetry

20000113820 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Turbulence modelling
Laurence, D.; Dec. 31, 1997; 63p; In French; In English
Report No.(s): DE98-616874; EDF-97-NB-00036; No Copyright; Avail: Department of Energy Information Bridge
This paper is an introduction course in modelling turbulent thermohydraulics, aimed at computational fluid dynamics users. No specific knowledge other than the Navier Stokes equations is required beforehand. Chapter I (which those who are not beginners can skip) provides basic ideas on turbulence physics and is taken up in a textbook prepared by the teaching team of the ENPC (Benque, Viollet). Chapter II describes turbulent viscosity type modelling and the 2k-(epsilon) two equations model. It provides details of the channel flow case and the boundary conditions. Chapter III describes the 'standard' (R(sub ij)-(epsilon)) Reynolds tensions transport model and introduces more recent models called 'feasible'. A second paper deals with heat transfer and the effects of gravity, and returns to the Reynolds stress transport model.
NTIS
Fluid Mechanics; Thermodynamic Properties; Turbulence; Computational Fluid Dynamics; Mathematical Models

20000113852 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Modeling and numerical analysis of non-equilibrium two-phase flows
Rascle, P.; El Amine, K.; Dec. 31, 1997; 159p; In English
Report No.(s): DE98-616887; EDF-97-NB-00078; No Copyright; Avail: Department of Energy Information Bridge
We are interested in the numerical approximation of two-fluid models of nonequilibrium two-phase flows described by six balance equations. We introduce an original splitting technique of the system of equations. This technique is derived in a way such that single phase Riemann solvers may be used: moreover, it allows a straightforward extension to various and detailed exchange source terms. The properties of the fluids are first approached by state equations of ideal gas type and then extended to real fluids. For the construction of numerical schemes , the hyperbolicity of the full system is not necessary. When based on suitable kinetic unwind schemes, the algorithm can compute flow regimes evolving from mixture to single phase flows and vice versa. The whole scheme preserves the physical features of all the variables which remain in the set of physical states. Several stiff numerical tests, such as phase separation and phase transition are displayed in order to highlight the efficiency of the proposed method. The document is a PhD thesis divided in 6 chapters and two annexes. They are entitled: 1. - Introduction (in French), 2. - Two-phase flow, modelling and hyperbolicity (in French), 3. - A numerical method using upwind schemes for the resolution of two-phase flows without exchange terms (in English), 4. - A numerical scheme for one-phase flow of real fluids (in English) , 5. - An upwind numerical for non-equilibrium two-phase flows (in English), 6. - The treatment of boundary conditions (in English), A.1. The Perthame scheme (in English) and A.2. The Roe scheme (in English). 136 refs. This document represents a PhD thesis in the speciality Applied Mathematics presented par Khalid El Amine to the Universite Paris 6.
NTIS
Numerical Analysis; Simulation; Models; Two Phase Flow; Nonequilibrium Flow; Two Fluid Models; Equilibrium Flow

20000114284 Tsinghua Univ., Dept. of Engineering Mechanics, Bejing, China

Numerical Correlation of Convections in an Enclosure Under Micro-Gravity and Terrestrial Gravity

Ji, Chao-Yue, Tsinghua Univ., China; Ren, Jian-Xun, Tsinghua Univ., China; Liang, Xin-Gang, Tsinghua Univ., China; Chen, Ze-Jing, Tsinghua Univ., China; Xu, Xiang-Hua, Tsinghua Univ., China; Guo, Zeng-Yuan, Tsinghua Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 281-285; In Chinese; Copyright; Avail: Issuing Activity

To apply the ground-based heat transfer experimental results to the spacecraft in micro-gravity. The flow and heat transfer characteristics in a square cavity were investigated numerically, for a symmetric interval 45 deg. oblique air inlet pattern and vertical air inlet pattern, with boundary conditions of uniform temperature and uniform heat flux at vertical walls. The results in conditions of gravity and micro-gravity were compared. First, the heat transfer correlation formula in spacecraft were presented under the condition of uniform wall temperature. Second, the data of numerical simulation were fitted with the Least Square Method. and the correlation for cases under gravity and micro-gravity were obtained. Finally, for the boundary condition of uniform heat flux, the fitting equations of maximum wall temperature in the condition of gravity and micro-gravity were given and the values of maximum wall temperature were listed in a table. The heat transfer characteristics in the spacecraft under microgravity can be predicted from those correlation obtained from ground-based results.

Author

Numerical Analysis; Convection; Microgravity; Heat Transfer; Data Simulation; Boundary Conditions

20000114844 NASA Goddard Space Flight Center, Greenbelt, MD USA

Temperature Oscillations in Loop Heat Pipe Operation

Ku, Jentung, NASA Goddard Space Flight Center, USA; Ottenstein, Laura, NASA Goddard Space Flight Center, USA; Kobel, Mark, NASA Goddard Space Flight Center, USA; Rogers, Paul, Army Tank-Automotive Research and Development Command, USA; Kaya, Tarik, International Univ., France; [2000]; 8p; In English; Space Technology and Applications, 11-14 Feb. 2000, Alberquerque, NM, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Loop heat pipes (LHPs) are versatile two-phase heat transfer devices that have gained increasing acceptance for space and terrestrial applications. The operating temperature of an LHP is a function of its operating conditions. The LHP usually reaches a steady operating temperature for a given heat load and sink temperature. The operating temperature will change when the heat load and/or the sink temperature changes, but eventually reaches another steady state in most cases. Under certain conditions, however, the loop operating temperature never really reaches a true steady state, but instead becomes oscillatory. This paper discusses the temperature oscillation phenomenon using test data from a miniature LHP.

Author

Heat Transfer; Geothermal Energy Conversion; Heat Pipes; Heat Sinks

20000114855 Johns Hopkins Univ., Dept. of Mechanical Engineering, Baltimore, MD USA

Instrumentation for 2D and 3D Holographic Particle Image Velocimetry in Axial Turbomachines ***Final Report, 1 Mar. 1997-28 Feb. 1998***

Katz, Joseph, Johns Hopkins Univ., USA; Meneveau, Charles, Johns Hopkins Univ., USA; Feb. 28, 1998; 3p; In English

Contract(s)/Grant(s): F49620-97-1-0136; AF Proj. 3484

Report No.(s): AD-A381937; AFRL-SR-BL-TR-00-0443; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This DURIP grant provided the instrumentation needed for measuring the flow structure and turbulence in axial turbomachines. The main components are: i. A dual head, injection seeded, 300 mi/pulse, Nd YAG laser; ii. The optical components for assembling two dimensional Particle Image Velocimetry (PIV) and three dimensional holographic PIV systems; iii. The components for a dedicated holographic PIV reconstruction system, including the optics and image acquisition systems. These instruments are integral ports of our effort to develop a laboratory for measuring the flow structure within axial turbomachines and to use the data for addressing a series of turbulence modeling issues.

DTIC

Holography; Particle Image Velocimetry; Turbomachinery; Flow Visualization

35
INSTRUMENTATION AND PHOTOGRAPHY

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

20000109773 Tri-Univ. Meson Facility, Vancouver, British Columbia Canada
500 MHz transient digitizers based on GaAs CCDs
Bryman, D. A.; Constable, M.; Cresswell, J. V.; Daviel, A.; LeNoble, M.; Nov. 30, 1996; 15p; In English
Report No.(s): DE98-625513; TRI-PP-96-51; No Copyright; Avail: Department of Energy Information Bridge

A system of 500 MHz transient digitizers based on gallium arsenide resistive gate charged coupled devices has been developed for an experiment studying rare K decays. CCDs with dynamic range of 8-bits and 128 or 320 pixels are used as analog pipelines. The CCD's are driven by a single phase transport system. Data readout and manipulation occurs at 15.6 MHz.
NTIS
Analog to Digital Converters; Charge Coupled Devices

20000109780 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Very fast fission fragment detector
Zejnalov, S.; Smirnov, V. I.; Stempinski, M.; Szalanski, P.; Florek, M.; Dec. 31, 1997; 11p; In Russian; In English
Report No.(s): DE98-621548; JINR-R-13-97-222; No Copyright; Avail: Department of Energy Information Bridge

The results of investigations intended to development of fission fragment detector for measurements with samples of high (alpha)-activity are presented in this report. The detector was constructed on the basis of parallel plate ionization chamber combined with current-to-voltage amplifier.A high (alpha)-suppression factor (better than 10(sup 10)) was obtained. The detector works with efficiency better than 95% so that only a few hundreds (mu)g of sample material are required for resonance neutron induced fission cross-section and fission width measurements.
NTIS
Fission; Fragments

20000109842 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Visual experimental data express-analysis during a measurement at the NSHR and the SKAT spectrometers
Kirilov, A. S.; Heinitz, J.; Dec. 31, 1997; 15p; In Russian; In English
Report No.(s): DE98-621547; JINR-R-13-97-219; No Copyright; Avail: Department of Energy Information Bridge

Nowadays the spectrometer control systems at the IBR-2 reactor (FLNP, JINR) based on PC and CAMAC are replaced with the ones based on the modular VME computers with the OS-9 operating system. This replacement makes these systems more powerful, easy to extend, stable, reliable and have modern graphical user interface. This work is devoted to the description of the VSP task - one of the tasks of the software complex for the accumulation, control and supervising system at the NSHR and the SKAT spectrometers. The Vsp task is intended to visualize and perform a primary analysis of experimental data during a measurement. The main features of the task as well as its user interface are considered.
NTIS
Personal Computers; Numerical Control

20000109886 Societe Francaise des Thermiciens, Chatenay-Malabry, France
Thermal measurements and sensors. Recent developments
Dec. 31, 1998; 24p; In French; In English
Report No.(s): DE99-750729; ETDE-FR-99750729; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This conference day was organized by the 'thermo-kinetics' section of the French association of thermal engineers. This book of proceedings contains 6 papers entitled: 'non-intrusive temperature control using microwave radiometry'; 'bicolor pyroreflectometer and optical fiber directional reflectometer applied to the in-situ thermophysical diagnosis of surfaces'; 'non-cooled IR detectors. State-of-the-art and and development at the LETI/LIR'; 'laser probes for temperature and surface deformation measurements at the micron scale. Application to the study of the thermal behaviour of integrated circuits'; 'parietal flux micro-sensors. Sensitivity study and improvement'; 'thermal measurements and sensors. Recent developments'.
NTIS
Conferences; Thermometers; Temperature Measurement; Temperature Control; Thermal Diffusivity; Kinetics

20000109921 Joint Inst. for Nuclear Research, Division of Radiation and Radiobiological Research, Dubna, USSR

Comparative investigation of gas-filled neutron detectors operated in fields with high-level gamma-radiation background

Alejnikov, V. E.; Arkhipov, V. A.; Beskrovnaya, L. G.; Timoshenko, G. N.; Dec. 31, 1997; 15p; In Russian; In English

Report No.(s): DE98-618203; JINR-R-16-97-158; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The comparative investigation of gas-filled neutron detectors using either He-3 or B-10 and operating in proportional or coronal modes was performed for purpose of its application in technical nuclear materials safeguard system. The optimisation of different parameters of neutron counters in these systems was carried out as well. It is shown, that corona counters developed in Russia, has a indisputable advantage in fields with high-level gamma-radiation background (up to several kR/h) as compared with proportional counters commercially available in Western countries.

NTIS

Gamma Rays; Gas Detectors; Neutron Counters; Proportional Counters

20000110095 Solid State Scientific Corp., Hollis, NH USA

Photonic and EO Device Characterization ***Final Report, 6 Jun. 1995 - 1999***

An, M.; Callahan, M.; Kierstad, J.; Lancto, R.; Tedrow, P.; Jul. 2000; 63p; In English

Contract(s)/Grant(s): F19628-95-C-0083; AF Proj. 4600, \ 2305

Report No.(s): AD-A381770; AFRL-SN-HS-TR-2000-002; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report represents the work of eight (8) researchers providing support for six (6) ongoing programs at AFRL/SNH. The research topics include: (1) Optical properties of turbulent media. (2) InP based HEMPTs, MISFETs, and MSMs. (3) Bulk crystal growth of ZnO and GaN substrates. (4) Bulk crystal growth of InP substrates. (5) Mathematics of chromotomography. (6) Thermionic emission based thermal detectors. In order to establish the context of the work, this report is best read alongside the published papers and presentations of the primary AFRL scientists conducting the research. Among the new concepts and achievements that emerged from this work are: a new class of uncooled thermal infrared imagers based on Schottky diodes, two orders of magnitude improvement in the convergence rate of chromotomography algorithms, a new amenothermal growth technique for GaN substrates, and a 25 GHz InP wafer lined optical receiver.

DTIC

Turbulence; Crystal Growth; Infrared Detectors

20000110231 Defence Science and Technology Organisation, Maritime Operations Div., Melbourne, Australia

Transcription Method Used for P-3C AQH4 Tapes

Clarke, Paul A., Defence Science and Technology Organisation, Australia; Jackson, Trevor, Defence Science and Technology Organisation, Australia; Wade, Peter, Defence Science and Technology Organisation, Australia; July 2000; 42p; In English; Original contains color illustrations

Report No.(s): DSTO-GD-0248; DODA-AR-011-524; Copyright; Avail: Issuing Activity

Sonobuoy data is regularly obtained using the RAAF P-3C aircraft during DSTO trials. This data is recorded on the aircraft using 28 track AQH4 tapes and needs to be transcribed onto CDs for storage and analysis. The method used to transcribe analogue sonobuoy data was recently upgraded. This document describes the equipment used and the steps involved in transcribing this data.

Author

Sonobuoys; Data Processing; Signal Processing

20000110254 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR

Study on possibility of expanding the energy range of the electron spectrometer RFS-2 for developing the conversion electron spectroscopy technique

Panov, A.; Dec. 31, 1994; 28p; In Russian; In English

Report No.(s): DE98-628560; IAE-5810/14; No Copyright; Avail: Department of Energy Information Bridge

On example of RFS-2 electron spectrometer, it is demonstrated that for electrostatic spectrometers with preliminary retardation of electrons and constant energy analyzing there exist those modes of the electron optics, that produced a resolution of about 1 eV and better for electrons with energies in region of 10-20 keV with rather good transmission and for species with dimension up to 1 x 5 mm.

NTIS

Spectrometers; Electric Fields; Electric Potential

20000110300 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

MECA Electrometer: Initial Experimental Results

Buehler, M., Jet Propulsion Lab., California Inst. of Tech., USA; Cheng, L.-J., Jet Propulsion Lab., California Inst. of Tech., USA; Orient, O., Jet Propulsion Lab., California Inst. of Tech., USA; Gompf, R., NASA Kennedy Space Center, USA; Bayliss, J., NASA Kennedy Space Center, USA; Rauwerdink, J., NASA Kennedy Space Center, USA; Marshall, J., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars ’01 lander contains an electrometer designed to evaluate the electrostatic nature of the Martian regolith (soil) and atmosphere. The electrometer is part of MECA (Mars Environmental Compatibility Assessment) project. The objective is to gain a better understanding of the hazards related to the human exploration of Mars The sensor has an electric field sensitivity of 35 kV/cm V and room temperature drift of approx. 3 micro V/sec. The sensor has been operated as low as - 60 C where the drift is undetected. Additional information is contained in the original extended abstract.

Author

Electric Fields; Electrometers; Electrostatics; Mars Surface

20000110328 Chicago Univ., Lab. for Astrophysics and Space Research, Chicago, IL USA

Some Aspects of the Calibration of the Mars Pathfinder Alpha Proton X-Ray Spectrometer

Economou, T. E., Chicago Univ., USA; Foley, C. N., Chicago Univ., USA; Dietrich, W., Chicago Univ., USA; Hernas, C., Chicago Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The previously published APXS results indicated that all the Martian soil samples analyzed at the Pathfinder site showed remarkable resemblance to those analyzed by the Viking at two different sites several thousand kilometers apart. It is not unreasonable therefore to assume that, due to the mixing mostly by eolian processes, all of the soils of martian surface are of the same composition. There are, however, some differences between the Pathfinder and Viking soil samples, mostly in the amount of sulfur content, and some differences even among the Pathfinder soils that probably reflect, to some degree, the local rock contribution. The martian rocks that were analyzed by the APXS on the Pathfinder site, however, reveal a different story. All analyzed rocks are high in silica and iron and low in Mg, similar to those of terrestrial basaltic andesites or andesites, but completely different from those of SNC meteorites. These findings have significant implication about the origin and history of the planet Mars. Additional information is contained in the original extended abstract.

Author

Calibrating; Mars Pathfinder; Mars Surface; Mars Surface Samples; Planetary Geology; X Ray Spectrometers

20000110335 Centre d’Etude Spatiale des Rayonnements, Toulouse, France

Simulations and Calibrations of the Mars Surveyor 2001 Gamma-Ray Spectrometer Performances

Gasnault, O., Centre d’Etude Spatiale des Rayonnements, France; d’Uston, C., Centre d’Etude Spatiale des Rayonnements, France; Barthe, H., Centre d’Etude Spatiale des Rayonnements, France; Veyan, J. F., Centre d’Etude Spatiale des Rayonnements, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Like every wavelengths of the electromagnetic spectrum, the gamma-ray astronomy brings pieces of information in the knowledge of the universe. It is a space science which deal with a low photon intensity and with a high background level. Nevertheless the results of LUNA and APOLLO missions, as well as theoretical works and simulations show the power of this method for planetary surface investigations. Gamma-ray spectroscopy provide in-formation on the abundance of major elements in the first tens of centimeters below the surface. Mainly, it allows to measure the abundance of H, O, Mg, Al, Si, S, Ni, Cl, K, Ca, Fe, Th and U. Today several planetary missions combine high energy gamma ray detectors and neutron spectrometers to explore the surface composition of the Moon with at present LUNAR PROSPECTOR then later with SELENE in 2003, of Mars with MARS SURVEYOR 2001, of the asteroid Eros with NEAR in 2000 and possibly of a comet with DS4-CHAMPOLLION mission. The development of such detectors requires the use of computer simulation to characterize the performances of the instrument in the space next to its target. We have developed such a numerical code and applied it to the gamma-ray spectrometer (GRS) of MARS

SURVEYOR 2001 (MS'01) spacecraft which is planed to map the Martian surface in 2002. Additional information is contained in the original extended abstract.
Author
Simulation; Calibrating; Gamma Ray Spectrometers; Surface Layers; Planetary Surfaces; Planetary Mapping; Computerized Simulation

20000110385 Los Alamos National Lab., NM USA
Development of a Prototype Instrument for Stand-Off Elemental Analysis for Use on a Mars Rover
Knight, A. K., Los Alamos National Lab., USA; Cremers, D. A., Los Alamos National Lab., USA; Ferris, M. J., Los Alamos National Lab., USA; Scherbarth, N. L., Los Alamos National Lab., USA; Wiens, R. C., Los Alamos National Lab., USA; Blacic, J. D., Los Alamos National Lab., USA; Calvin, W. M., Geological Survey, USA; Nordholt, J. E., Los Alamos National Lab., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the most fundamental pieces of information about any planetary body is the elemental composition of its surface materials. Most space probes to date have acquired such fundamental geochemical data by passive remote sensing at orbital or fly-by ranges of hundreds of kilometers, resulting in relatively low resolution coverage on a partial-to-complete global scale. Future advances in solar system exploration will require much higher spatial resolutions based on observations and analyses at much closer ranges. On the other hand, the Viking landers employed an XRF (x-ray fluorescence) unit and the Mars Pathfinder mission used an APXS (alpha-proton x-ray spectrometer) unit on board a rover to supply elemental composition information for soils and rocks to which direct contact was possible. Although providing high resolution analysis in relation to orbital or fly-by measurements, these in-situ analyses require that the craft or rover be immediately adjacent to the target sample. Intermediate between remote and in-situ are measurements that may be termed stand-off analyses. In this case, measurements can be carried out at some distance from the instrument while preserving a high degree of spatial discrimination. The main advantage of such types of analyses is obvious: the sensing element does not need to be in contact or even adjacent to the target sample. This opens up new sensing capabilities. For example, targets which cannot be reached by a rover due to impassable terrain or targets positioned on a cliff face can now be accessed using stand-off analysis. In addition, the duty cycle of stand-off analysis can be much greater than that provided by in-situ measurements by eliminating the need for the rover to actually move to the target. This can be seen by considering the small number of analyses described in the mission model proposed by Arvidson et al. for the 2001 Mars Rover/Athena payload using the APXS instrument. Additional information is contained in the original extended abstract.
Author
Chemical Composition; Mars Surface; Remote Sensing; Mars (Planet); Mars Environment; Mission Planning; Mars Missions

20000110446 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
A Revised Target Calibration Procedure for Imager for Mars Pathfinder and Surface Stereo Imager for Mars Polar Lander Datasets
Reid, R. J., Arizona Univ., USA; Smith, P. H., Arizona Univ., USA; Lemmon, M. T., Arizona Univ., USA; Yingst, R. A., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Imager for Mars Pathfinder (IMP) returned over 16,000 high-quality images from the surface of Mars in 1997. The Surface Stereo Imager (SSI), a near duplicate of IMP on the Mars Polar Lander, will acquire images near the South Pole of Mars beginning December 3, 1999. Most scientific analyses of these datasets require some level of calibration, either into radiance units, or into units of reflectance. The instrument calibration algorithm, called CCDCAL during the Mars Pathfinder mission (MPF), removed instrument-dependent sources of noise based on the laboratory calibration, such as flat field, dark current, bad pixels, and electronic shutter. This algorithm was improved to version 2, which includes correction to intensity units based on the absolute responsivity, better handling of pixel averaging, and the elimination of known bugs in the original version. The target calibration algorithm, called SPECTCAL during MPF, uses measurements of radiometric targets (RT) to calibrate scene images to reflectance units. The RTs have a bull's eye design, with a inner white, middle gray, and outer black ring with a shadow post in the center. The original SPECTCAL was intended to provide a first-order calibration of scene images to reflectance units in order to facilitate spectrophotometric analysis. Since it was designed to be used during operations, several simplifications were required so that real-time analysis could be performed. Now, in order to improve the rigorousness of the Pathfinder calibration, and to prepare for upcoming Mars Polar Lander operations, the target calibration procedure is undergoing significant revision. The revision of the IMP/SSI target calibration procedure falls into three categories: 1) Elimination of software bugs in the original calibration; 2)

Revision of correction algorithms used in the original calibration; 3) Addition of new algorithms to correct for sources of uncertainty that were ignored or unknown in the original calibration. The primary changes to the SPECTCAL v1 procedure are described. Additional information is contained in the original extended abstract.
Author
Calibrating; Mars Pathfinder; Mars Photographs; Mars Surface; Pixels; Spectrophotometry

20000110454 NASA Glenn Research Center, Cleveland, OH USA
Progress of the Mars Array Technology Experiment (MATE) on the '01 Lander
Scheiman, D. A., Ohio Aerospace Inst., USA; Baraona, C. R., Ohio Aerospace Inst., USA; Jenkins, P., Ohio Aerospace Inst., USA; Wilt, D., NASA Glenn Research Center, USA; Krasowski, M., NASA Glenn Research Center, USA; Greer, L., NASA Glenn Research Center, USA; Lekki, J., NASA Glenn Research Center, USA; Spina, D., NASA Glenn Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Future missions to Mars will rely heavily on solar power from the sun, various solar cell types and structures must be evaluated to find the optimum. Sunlight on the surface of Mars is altered by air-borne dust that fluctuates in density from day to day. The dust affects both the intensity and spectral content of the sunlight. The MATE flight experiment was designed for this purpose and will fly on the Mars 2001 Surveyor Lander as part of the Mars In-Situ Propellant Production Precursor (MIP) package. MATE will measure the performance of several solar cell technologies and characterize the Martian environment in terms of solar power. This will be done by measuring full IV curves on solar cells, direct and global insolation, temperature, and spectral content. The Lander is is scheduled to launch in April 2001 and arrive on Mars in January of 2002. The site location has not been identified but will be near the equator and last from 100 to 300 days. The intent of this of this paper is to describe and update the progress on MATE. MATE has four main objectives for its mission to Mars. First is to measure the performance of solar cells daily on the surface of Mars, this will determine the day to day fluctuations in sunlight and temperature and provide a nominal power output. Second, in addition to measuring solar cell performance, it will allow for an intercomparison of different solar cell technologies. Third, It will study the long term effects of dust on the solar cells. Fourth and last, it will characterize the mars environment as viewed by the solar cell, measuring spectrum, insolation, and temperature. Additional information is contained in the original extended abstract.
Author
Arrays; Mars Environment; Solar Energy; Solar Cells; Long Term Effects; Mars Surface; Temperature Measurement

20000110510 Old Dominion Univ., Norfolk, VA USA
Prediction of the transition front for Pegasus transition flight experiments
Balakumar, Ponnampalam, Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 46; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Successful flight experiments were conducted using the Pegasus vehicle to obtain the transition fronts and other characteristics of the transition process in three-dimensional hypersonic boundary layers. The objectives of the experiments are to validate the existing computational transition prediction methods against the experimentally obtained transition fronts in flight conditions. At present, there exist three possible methods of predicting transition onset points in flows over aerodynamic bodies. One is the empirical e(sup N) method, the second is the Parabolized Stability Equations (PSE) approach, and the third is the Direct Numerical Simulation (DNS) approach. The DNS approach, at this time, is not practical and is only used to investigate the transition process in simple model problems. The PSE approach can currently predict the transition process accurately and very efficiently in two-dimensional and in quasi three-dimensional problems. The eN method is an empirical method based on the linear stability theory and a correlation technique. This is the widely used method in predicting transition and our objectives of this work are: 1) to compute the transition fronts over the glove part of the wing using the e(sup N) method and to compare them with the experimentally obtained results. to this effort, we will use the transition prediction code e(sup Malik). It is assumed that the mean boundary layer profiles are available at the start of the project or the mean flow profiles will be computed as part of the project. 2) to compare the transition front using the early developed three-dimensional stability code. In this method, the meanflow variations in the normal and in the azimuthal directions are included in the stability analysis and is expected to predict the transition better than the current methods.
Author
Bristol-Siddeley Bs 53 Engine; Three Dimensional Boundary Layer; Transition Flight; Prediction Analysis Techniques

20000110512 Old Dominion Univ., Dept. of Electrical and Computer Engineering, Norfolk, VA USA

A Study of Data Compression for the GIFTS Instrument

Belfore , Lee A., II, Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 49; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Satellite based instrumentation is capable of providing extensive and detailed data for use in weather forecasting, earth science, and space science. Analysis of infrared spectral data and the subsequent retrieval of atmospheric conditions form the foundation for weather prediction at a wide range of geographic scales. The proposed New Millennia Project, the Geostationary Imaging Fourier Transform Spectrometer (FTS) [GIFTS], will incorporate FTS technology. The GIFTS instrument will collect hyperspectral images that can be used in forecasting weather patterns and in performing remote sensing on the effect of both natural and man made atmospheric perturbations, The GIFTS instrument can generate a huge volume of data. For example, one measurement mode requires, every 25 seconds, a hyperspectral image of 128 x 128 pixels with 5000 spectral components per pixel. Assuming 14 bits per sample, the required data rate is 46 million bits per second (MBPS). Given a satellite link of 6 MBPS, a compression rate in the neighborhood of 8:1 is necessary. If raw data is desired, the compression rate required is more than 40:1. Due to the large data volume, several options are available, some desirable and some not. Ideally, no information is desired to be lost, but the best available space qualified lossless compression for science data is the USES chip designed by a team at the University of New Mexico. The USES chip will compress data to 4:1 under the best of circumstances and more realistically 1.5:1 for expected hyperspectral data produced by the GIFTS instrument. Consequently, the two possible options are to employ lossy data compression or to select specific data products. Since it was desired to receive information over the entire range of measurements, lossy data compression approaches were investigated.

Derived from text

Data Compression; Fourier Transformation; Synchronous Satellites; Satellite Instruments; Remote Sensing; Imaging Spectrometers

20000110516 Oklahoma State Univ., School of Mechanical and Aerospace Engineering, Stillwater, OK USA

Calibration of Hot Wire Anemometer Probes for Applications in Very Low Density Subsonic and Transonic Flow

Chambers, Frank W., Oklahoma State Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 54; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The ”Mars Flyer” exploratory vehicle is designed to fly in the very low density carbon dioxide atmosphere of Mars. The very low chord Reynolds numbers for the airfoil may make it susceptible to leading edge separation and stall. Wind tunnel tests to define the acceptable flight envelope must include measurements that identify separation regions and the laminar or turbulent character of the flow downstream. Furthermore, the wind tunnels used to perform these tests will operate at unusual conditions at which the turbulence reduction screens designed to reduce test section turbulence for higher density flows may prove much less effective. The tunnel turbulence intensity must be measured to insure accurate test results. The hot wire anemometer is a device that long has been used to measure turbulent flows and to evaluate wind tunnel test section flow quality. The hot wire anemometer uses a probe with a very fine, electrically-heated wire. The heat transfer from the wire to the flow must be correlated with the local velocity, density and temperature through an individual probe calibration. The anemometer is well suited to subsonic measurements at near atmospheric densities and to supersonic measurements. For such subsonic flows, the hot wire calibrations provide local flow velocity and velocity fluctuations, while for supersonic flows, the probe senses the product of density and velocity, the local mass flow. For transonic flows and for low density flows, the hot wire loses sensitivity to velocity and increases sensitivity to flow density. For very low density flows, the flow regime of the probe shifts from continuum flow through slip flow to free molecule flow. The objective of the project was to perform hot wire anemometer probe calibrations at flow conditions corresponding to the flight regimes of the Mars Flyer and to evaluate the use of such calibrations for measurements of airfoil flow fields and wind tunnel test section flow quality.

Derived from text

Calibrating; Hot-Wire Anemometers; Low Density Flow; Subsonic Flow; Transonic Flow; Wind Tunnel Tests

20000110585 NASA Marshall Space Flight Center, Huntsville, AL USA

Characterization of a Fabry - Perot - Based electrooptic Modulator

Banks, C., Alabama A & M Univ., USA; Yelleswarapu, C., Alabama A & M Univ., USA; Sharma, A., Alabama A & M Univ., USA; Frazier, D., NASA Marshall Space Flight Center, USA; Penn, B., NASA Marshall Space Flight Center, USA; Abdeldayem, H., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Interdisciplinary Laser Science, 23 Oct. 2000, Providence, RI, USA; Sponsored by Optical Society of America, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An electrooptic modulator using a thin slice of LiNbO3 within the cavity of a Fabry-Perot interferometer is designed and fabricated. The modulator is operated with 633 nm light from a He-Ne laser. Results related to characterization of this modulator are presented.
Author
Electro-Optics; Fabrication; Fabry-Perot Interferometers; Modulators; Design Analysis; Lithium Niobates

20000111079 NASA Marshall Space Flight Center, Huntsville, AL USA
Imaging Calorimeter for ACCESS Simulations with GEANT/FLUKA
Lee, Jeongin, National Academy of Sciences - National Research Council, USA; Watts, John, NASA Marshall Space Flight Center, USA; Howell, Leonard, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Imaging Calorimeter for ACCESS (ICA) is a candidate of the calorimeter for the NASA's ACCESS program. The ICA studies the origin and acceleration mechanism of cosmic rays by measuring the elemental composition of the cosmic rays in the energy up to 10(exp 16) eV. For the past year, Monte Carlo simulation study for the ICA has been conducted to predict the detector performance and to design the system for match the scientific objectives. Simulation results show that the detector response resembles a Gaussian distribution and the energy resolution with ICA can be achieved about 40%. In addition, simulations of the detector's response to an assumed bent power law spectra in the region where the knee occurs have been conducted and clearly show that this detector can provide sufficiently accurate estimates of the spectral parameters that are a science goal of ACCESS.
Author
Research; Calorimeters; Imaging Techniques; Simulation; Galactic Cosmic Rays

20000112949 Norwegian Defence Research Establishment, Kjeller, Norway
Strain Measurements: A Comparison of Strain Gauge and Fiber Bragg Grating Measurements on KNM Skjold
Farsund, Oystein, Norwegian Defence Research Establishment, Norway; Pran, Karianne, Norwegian Defence Research Establishment, Norway; Sagvolden, Geir, Norwegian Defence Research Establishment, Norway; Wang, Gunnar, Norwegian Defence Research Establishment, Norway; Dec. 28, 1999; 24p; In English; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 711/116
Report No.(s): FFI/RAPPORT-99/06462; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Strain measurements by means of resistive strain gauges and fiber optic Bragg gratings during the sea-keeping tests of KNM Skjold have been analyzed and compared. The resistive strain gauge measurements were severely affected by noise. The signals have been filtered, synchronized and compared using extreme values as well as vector analysis. Results indicate that the two techniques measure the same strain levels, however fiber optic sensor measurements are superior concerning low noise and reliability
Author
Bragg Gratings; Fiber Optics; Strain Gages; Strain Measurement; Finite Element Method; Optical Fibers; Vector Analysis

20000113069 RJ Lee Group, Inc., Monroeville, PA USA
Use of a WEBSEM (Remote Scanning Electron Microscope) to Characterize Automotive Wear Debris
Kennedy, Stephen K., RJ Lee Group, Inc., USA; Gaston, Michael, West Greene High School, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 597-604; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The goal of this research is to illustrate characterization of wear particulate in automotive oil filters through the use of a remote scanning electron microscope. Wear debris particulate is present in a wide variety of systems, (e.g., lubricating, cooling, hydraulic). Analysis of such particulate can be used in an ongoing program of wear monitoring to predict or prevent failure (in the field or in the design/testing stage), or can be used in postfailure determination of probable cause. Particle size and morphology help to assess mode of wear, and particle composition can assist in the identification of the component undergoing wear. Images obtained using a scanning electron microscope (SEM) can be used to characterize such features. In addition, the SEM with an energy dispersive spectrometer (EDS) is capable of determining elemental composition and can be used to identify source of debris. This model is relevant for use in education because modern SEMs are simple to use with point and click interfaces, and students regard them as fun to operate. Furthermore, the Internet now permits the SEM to be operated from distant locations. This laboratory model was developed as a cooperative exercise for high school and voc-tech students, and illustrates one example of using the SEM to characterize debris in automotive oil filter. This model can be modified to examine debris in other systems.
Author
Automobiles; Debris; Scanning Electron Microscopy; Wear; World Wide Web

20000113819 Electricite de France, Direction des Etudes et Recherches, Clamart, France

Synthesis of the evaluations of electromagnetic flowmeters based on vortex, Coriolis and thermal effects in the framework of SIREP-WIB-EXERA associations

Fortin, T.; Jacq, F.; Dec. 31, 1997; 95p; In French; In English

Report No.(s): DE98-616877; EDF-97-NB-00042; No Copyright; Avail: Department of Energy Information Bridge

Electronic flowmeters such as electromagnetic flowmeters based on vortex, mass (Coriolis) and thermal effects are being used more and more in industry (water distribution, petrochemicals, food processing). Some of them are used by EDF. A study has been therefore conducted on the main types of flowmeters which in the last years (1988-1995) were the object of an evaluation within the framework of the SIREP-WIB-EXERA users. This document synthesizes the tests conducted, and highlights the generic weaknesses linked with different methods of measurement, equipment and test methods. It meets a triple objective: 1 - up dating the EDF's knowledge on these different products; 2 -better knowledge of the diversity of problems connected with measuring flows (type and characteristics of fluids, flow ranges, environmental constraints etc.); 3 - showing the advantages and disadvantages associated with these methods and lining up different technologies with one another. As a whole from the metrological standpoint the equipment tested complies with the manufacturers' specifications. Most of this equipment highly sensitive to electromagnetic perturbations. When the European CEM directives are applied this defect should disappear. Other environmental tests do not reveal generic faults. For all the technologies evaluated it may be stated that the ranges of tests are very standardized. Unfortunately, a certain number of well thought out tests (according to the technology) are not, or rarely conducted. For instance, one can quote the vibration influence tests for vortex effect flowmeters. Advanced research has been carried out. It mainly concerns cavitation phenomena (Coriolis effect flowmeters) and the influence of viscosity and conductivity of fluids (electromagnetic and Coriolis effect flowmeters).

NTIS

Flowmeters; Evaluation; Electromagnetism; Decision Theory

20000113841 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR

Spectrometer for neutron inelastic scattering investigations of microsamples

Balagurov, A. M.; Kozlenko, D. P.; Platonov, S. L.; Savenko, B. N.; Glazkov, V. P.; Dec. 31, 1997; 15p; In Russian; In English

Report No.(s): DE98-627237; JINR-R-13-97-312; No Copyright; Avail: Department of Energy Information Bridge

A new neutron spectrometer for investigation of inelastic neutron scattering on polycrystal microsamples under high pressure in sapphire and diamond anvils cells is described. The spectrometer is operating at the IBR-2 pulsed reactor in JINR. Parameters and methodical peculiarities of the spectrometer and the examples of experimental studies are given.

NTIS

Neutron Scattering; Neutron Spectrometers; Inelastic Scattering

20000113849 Institute of Nuclear Chemistry and Technology, Warsaw, Poland

Calibration method of type RGR-40 radiometer by means of radium Ra-226 source

Radoszewski, T.; Dec. 31, 1997; 11p; In Polish; In English

Report No.(s): DE98-616897; INCT-1/B/97; No Copyright; Avail: Department of Energy Information Bridge

Calibration method of type RGR-40 radiometer by use of radium Ra-226 source has been presented. Standard Ra-226 solution was used to prepare the source in a form of a flat disc which was firmly closed in plexiglas capsule. All requirements concerning the (sup 226)Ra standard source in equilibrium with radon Rn-226, for two detectors; one for (gamma)- radiation and one for (alpha)-particles, as well as for necessary electronic equipment have been given. The calibration process was also precisely determined.

NTIS

Radiometers; Radium 226; Calibrating

20000114285 Institute of Space Medico-Engineering, Beijing, China

A Dual Channel Simultaneous Impedance Plethysmograph

Hu, Mao-Qi, Institute of Space Medico-Engineering, China; Cai, Ming-Yong, Institute of Space Medico-Engineering, China; Yan, Hong, Institute of Space Medico-Engineering, China; Guo, Jian-Ping, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 286-289; In Chinese; Copyright; Avail: Issuing Activity

A multi-purpose impedance plethysmograph was developed. The hardware contained two impedance measurement channels, an ECG amplifier, a computer and a printer. The impedance channels could work alone or synchronously. Two electrodes

or four electrodes could be chosen for different purpose. The hardware adopted isolation technique which assured safety for clinical use.
Author
Plethysmography; Technology Assessment; Hardware; Impedance Measurement

20000114821 Wayne State Univ., Office of Research and Sponsored Programs, Detroit, MI USA
High-speed, High-Resolution Focal Plane Array Imaging System ***Final Report, 1 Apr. 1999 - 28 Aug. 2000***
Han, Xiaoyan; Thomas, R. L.; Favro, L. D.; Aug. 28, 2000; 26p; In English
Contract(s)/Grant(s): F49620-99-1-0163
Report No.(s): AD-A382437; AFRL-SR-BL-TR-00-0455; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have developed a high-resolution, high-speed InSb Focal Plane Array Imager which was built and delivered by Indigo Systems, Inc., of Santa Barbara, CA for use in research and development of thermal wave imaging and nondestructive inspection (NDE) aircraft structures. The design team included Indigo Engineers and faculty from Wayne State. The imager was designed with features intended specifically for use in hangar and field conditions. It includes a sunlight readable monitor, and a 50 foot cable for remote operation. Furthermore, facilities are provided at the camera end of the cable for control of the image acquisition of the computer, so that it can be used as a single-operator system. The camera itself has a very fast, large-area focal plane array (640 x 512 pixels), a 14-bit dynamic range digitizer, and is capable of acquiring image data a rate of 40 Mpixels/s. The dynamic range can be extended even further by use of a novel switchable array integration time.
DTIC
Focal Plane Devices; Images; Nondestructive Tests; Aircraft Maintenance; Cracks; Aircraft Structures; Imaging Techniques; Inspection

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.

20000109825 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Fabrication of Portable Laser Doppler Velocimetry and Speckle Velocimetry
Jo, J. H.; Chang, S.; Kim, B.; Lee, J.; Choi, W.; Jul. 31, 1997; 71p; In Korean
Report No.(s): DE99-727800; KAERI-CM-147/96; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The laser power stability and laser frequency stability of various liquid lasers and gas lasers were affected by the fluid velocity of a laser active medium. The control of laser cavities in order to reduced the fluctuation of laser powers have been studied. However, inspite of these methods, the power instability of the multi-step dye laser system for high power was 5-10%. The main reason was the flow instabilities of laser active medium. Then we have been studied the measurement of fluid velocities and velocity distributions of the dye fluid in a dye cell by using a ready-made laser Doppler velocimeter (LDV), which is a good sensor for the measurement of fluid velocities with high accuracy. However, the ready-made LDV has a several disadvantages of big sizes, large optical probes, high prices, difficulties of the moving, etc.. In this study, we have studies for the fabrication of small potable LDV with small optical probes using a high power DRB laser diode and single mode optical fibers for the measurement of fluid velocities from 1 cm/s to 1 m/s.
Author(NTIS)
Fabrication; Portable Equipment; Laser Doppler Velocimeters; Laser Anemometers; Velocity Measurement

20000111072 NASA Goddard Space Flight Center, Greenbelt, MD USA
Lidar Technology at the Goddard Laser and Electro-Optics Branch
Heaps, William S., NASA Goddard Space Flight Center, USA; [2000]; 2p; In English; 20th International Laser Radar Conference, Jul. 2000, Vichy, France; No Copyright; Avail: Issuing Activity; Abstract Only

The Laser and Electro-Optics Branch at Goddard Space flight Center was established about three years ago to provide a focused center of engineering support and technology development in these disciplines with an emphasis on spaced based instruments for Earth and Space Science. The Branch has approximately 15 engineers and technicians with backgrounds in physics, optics, and electrical engineering. Members of the Branch are currently supporting a number of space based lidar efforts as well as several technology efforts aimed at enabling future missions. The largest effort within the Branch is support of the Ice, Cloud,

and land Elevation Satellite (ICESAT) carrying the Geoscience Laser Altimeter System (GLAS) instrument. The ICESAT/GLAS primary science objectives are: 1) to determine the mass balance of the polar ice sheets and their contributions to global sea level change; and 2) to obtain essential data for prediction of future changes in ice volume and sea-level. The secondary science objectives are: 1) to measure cloud heights and the vertical structure of clouds and aerosols in the atmosphere; 2) to map the topography of land surfaces; and 3) to measure roughness, reflectivity, vegetation heights, snow-cover, and sea-ice surface characteristics. Our efforts have concentrated on the GLAS receiver component development, the Laser Reference Sensor for the Stellar Reference System, the GLAS fiber optics subsystems, and the prelaunch calibration facilities. We will report on our efforts in the development of the space qualified interference filter [Allan], etalon filter, photon counting detectors, etalor/laser tracking system, and instrument fiber optics, as well as specification and selection of the star tracker and development of the calibration test bed. We are also engaged in development work on lidar sounders for chemical species. We are developing new lidar technology to enable a new class of miniature lidar instruments that are compatible with small Discovery-class orbiters now in the NASA planetary program. The purpose of the lidar is to continuously profile the water vapor and dust in the Mars atmosphere from orbit in order to quantify its dynamics, their relationship in the diurnal cycles, and to infer water vapor exchange with the Mars surface. to remotely measure the water-vapor height profiles, we will use the differential absorption lidar (DIAL) technique. We are also developing a laser sensor for measuring the total column content of CO2 in the atmosphere of the earth. CO2 is the principal greenhouse gas and has increased by roughly 80 ppm in the last century and a half. We will report our efforts in the development of the laser transmitter and photon counting detector components for a Mars Orbiting DIAL system and for the CO2 sounder.
Author
Electro-Optics; Lasers; Satellite Instruments; Remote Sensing; Differential Absorption Lidar; Spaceborne Lasers; Mars Atmosphere

20000113668 Institute of Optoelectronics S.A., Bucharest, Romania
Sixth Symposium on Optoelectronics
Necsoiu, Teodor, Editor, Institute of Optoelectronics S.A., Romania; Robu, Maria, Editor, Institute of Optoelectronics S.A., Romania; Dumitras, Dan C., Editor, Institute of Optoelectronics S.A., Romania; Jan. 1999; 863p; In English, 22-24 Sep. 1999, Bucharest, Romania
Contract(s)/Grant(s): F61775-99-W-F061
Report No.(s): AD-A381805; EOARD-CSP-99-5061; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche
The Final Proceedings for The 6th Symposium of Optoelectronics SIOEL'99, 22 September 1999 - 24 September 1999. This is an interdisciplinary conference. Topics include materials for optoelectronics; optoelectronic components and devices, and optoelectronic applications to communications, analytical instrumentation, and medicine.
DTIC
Conferences; Electro-Optics; Optoelectronic Devices; Nonlinear Optics

20000113671 Academy of Sciences (USSR), General Physics Inst., Moscow, USSR
9th International Workshop on Laser Physics
Jan. 2000; 73p; In English; 9th; - LPHYS 2000 - Posters, 17-21 Jul. 2000, Bordeaux, France
Contract(s)/Grant(s): F61775-00-W-F034
Report No.(s): AD-A381844; EOARD-CSP-00-5034; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy
This is an interdisciplinary conference. Topics include quantum nucleonics and short wavelength lasers, intense short pulse propagation & material interactions, strong field phenomena, physics of cold atoms, physics of lasers, and laser methods in medicine and biology.
DTIC
Conferences; Lasers; Laser Applications; Quantum Optics

20000114425 Maryland Univ., Dept. of Electrical and Computer Engineering, College Park, MD USA
Spectral Processing on Wavelength Encoded Signals in Semiconductor Laser Amplifiers ***Final Report, 1 May 1997 - 31 Oct. 1998***
Dagenais, Mario; Aug. 2000; 10p; In English
Contract(s)/Grant(s): F49620-97-1-0362; AF Proj. 1651
Report No.(s): AD-A382648; AFRL-SR-BL-TR-00-0449; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
BER measurements at 2.5 Gbit/s on wavelength converted signals using double pump FWM in a semiconductor optical amplifier have been performed experimentally for both single- and multiple-input wavelengths. These results were presented at

an OSA sponsored conference entitled: Advanced Semiconductor Lasers and their applications" and the results have appeared in print in Trends in Optics and Photonics.
DTIC
Spectra; Spectrum Analysis; Signal Processing; Semiconductor Lasers; Light Amplifiers

20000114492 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Efficiency Enhancement, Sideband Suppression, and Optical Pulse Generation in Strongly Tapered Free-Electron Lasers ***Final Report, 1 Apr. 1996 - 31 Mar. 1999***
Bhattacharjee, Amitava; Mar. 31, 1999; 4p; In English
Contract(s)/Grant(s): F49620-96-1-0068
Report No.(s): AD-A381596; AFRL-SR-BL-TR-00-0402; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

We have carried out fully self-consistent simulations of FEL dynamics in strongly tapered amplifiers. These are one-dimensional initial-value studies in which the electrons obey the single particle Hamiltonian equations that include the magnetic field of the wiggler as well as the space and time-dependent radiation field. The radiation field obeys Maxwell's equation (in the paraxial approximation), with the source current calculated self-consistently by summing over the electrons. The results of this simulation for the strong linear taper confirms the predictions of our earlier analytical theory on strong sideband suppression.
DTIC
Sidebands; Free Electron Lasers; Pulse Generators; Retarding

20000114856 Army Space and Missile Defense Command, Huntsville, AL USA
Laser Test Facility. Environmental Assessment ***Final Report, 1999-2005***
Craven, Tom; Dec. 1999; 433p; In English
Report No.(s): AD-A381945; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

The purpose of the Laser Test Facility (LTF) is to test laser hardware in an integrated manner. The LTF would be a unique facility designed to meet the testing and technology requirements of laser systems similar to the Readiness Demonstrator developed under the Zenith Star contract as well as other potential laser systems. The LTF is needed because no existing test facility has the required combination of capabilities, such as the management of a high energy, large cross-section beam, that would allow this scale of demonstration testing. The general facility would consist of a Performance Test Chamber Complex (approximately 6 hectares (15 acres) with a 4-hectare (10 acre) construction lay down area) surrounded by a 1.2-kilometer (0.75 mile) radius safety zone and an Integration and Test Complex (approximately 10 hectares (25 acres)) located outside the safety zone. The four alternative locations under consideration for development of the LTF are Cape Canaveral Air Station, Florida; Kennedy Space Center, Florida; Redstone Arsenal, Alabama; and Stennis Space Center, Mississippi.
DTIC
Lasers; Test Facilities; Test Chambers; Performance Tests; Construction

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.

20000109785 Oak Ridge National Lab., TN USA
Investigation of Iron Aluminide Weld Overlays
Banovic, S. W.; DuPont, J. B.; Levin, B. F.; Marder, A. R.; Aug. 02, 1999; 210p; In English
Report No.(s): DE00-010159; ORNL/SUB/95-SU604/02; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Conventional fossil fired boilers have been retrofitted with low NO(x) burners in order for the power plants to comply with new clean air regulations. Due to the operating characteristics of these burners, boiler tube sulfidation corrosion typically has been enhanced resulting in premature tube failure. To protect the existing panels from accelerated attack, weld overlay coatings are typically being applied. by depositing an alloy that offers better corrosion resistance than the underlying tube material, the wastage rates can be reduced. While Ni-based and stainless steel compositions are presently providing protection, they are expensive and susceptible to failure via corrosion-fatigue due to microsegregation upon solidification. Another material system presently under consideration for use as a coating in the oxidation/sulfidation environments is iron-aluminum. These alloys are relatively inexpen-

sive, exhibit little microsegregation, and show excellent corrosion resistance. However, their use is limited due to weldability issues and their lack of corrosion characterization in simulated low NO(x) gas compositions. Therefore a program was initiated in 1996 to evaluate the use of iron-aluminum weld overlay coatings for erosion/corrosion protection of boiler tubes in fossil fired boilers with low NO(x) burners. Investigated properties included weldability, corrosion behavior, erosion resistance, and erosion-corrosion performance.
NTIS
Iron; Aluminides; Aluminum Alloys; Aluminum Coatings; Weldability

20000109793 Allied-Signal Technical Services Corp., Las Cruces, NM USA
Status of WSTF Pyrovalve Handbook Development in Year 2000
Howard, Julien L., Allied-Signal Technical Services Corp., USA; Hart, Matthew, Allied-Signal Technical Services Corp., USA; Smith, William, Allied-Signal Technical Services Corp., USA; Saulsberry Regor L., NASA Johnson Space Center, USA; [1999]; 1p; In English; 36th; 36th Joint Propulsion Conference, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS9-99100; No Copyright; Avail: Issuing Activity; Abstract Only

Significant data have been generated through various spacecraft propulsion system projects involving the use of pyrotechnically operated valves (pyrovalves). These data need to be analyzed, interpreted, summarized, associated, and formatted so they can be made available for spacecraft propulsion system design involving pyrovalves and used to specify test procedures in the performance evaluation and qualification of these systems. To meet this need, a Pyrovalve Handbook is being developed at the NASA White Sands Test Facility. Standards of performance for pyrovalve applications are being formulated under the sponsorship of the NASA Technical Standards Program, as are pyrovalve testing standards under the sponsorship of the NASA Safety and Risk Management Program. The ultimate goal is to have the Handbook adopted as a voluntary standard under the guidance of the AIAA Energetic Components and Systems Technical Committee and, in a more restrictive format, become an integral part of ISO standards for Explosive Systems and Devices Used on Space Vehicles. Feedback from both Government and industry is encouraged and will be the focus of the presentation. It is especially critical that feedback be received on content and formatting of the Handbook to maximize benefit to the technical community. Submission of validated data from organizations outside of NASA is also encouraged.
Author
Valves; Handbooks; Spacecraft Propulsion; Propulsion System Configurations; Systems Engineering

20000109872 NASA Marshall Space Flight Center, Huntsville, AL USA
Application of Rapid Prototyping and Wire Arc Spray to the Fabrication of Injection Mold Tools (MSFC Center Director's Discretionary Fund) ***Final Report***
Cooper, K. G., NASA Marshall Space Flight Center, USA; August 2000; 22p; In English
Contract(s)/Grant(s): Proj. 99-05
Report No.(s): NASA/TM-2000-210558; M-993; NAS 1.15:210558; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Rapid prototyping (RP) is a layer-by-layer-based additive manufacturing process for constructing three-dimensional representations of a computer design from a wax, plastic, or similar material. Wire arc spray (WAS) is a metal spray forming technique, which deposits thin layers of metal onto a substrate or pattern. Marshall Space Flight Center currently has both capabilities in-house, and this project proposed merging the two processes into an innovative manufacturing technique, in which intermediate injection molding tool halves were to be fabricated with RP and WAS metal forming.
Author
Computer Design; Three Dimensional Models; Arc Spraying; Fabrication; Forming Techniques

20000109877 Allied-Signal Technical Services Corp., Las Cruces, NM USA
Mars Observer Propulsion and Pyrotechnics Corrective Actions Test Program Status-1999
Saulsberry, Regor, NASA White Sands Test Facility, USA; Ramirez, Joseph, NASA White Sands Test Facility, USA; Julien, Howard L., Allied-Signal Technical Services Corp., USA; Hart, Matthew, Allied-Signal Technical Services Corp., USA; Smith, William, Allied-Signal Technical Services Corp., USA; [1999]; 1p; In English; 35th; 35th Joint Propulsion Conference, 20-23 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An extensive propulsion and pyrotechnic test program has been in progress at the NASA White Sands Test Facility since 1995. This program created the capabilities to: accurately measure and characterize pyrovalve combustion product blow-by into

propellant systems; characterize valve operation using a Velocity Interferometer System for Any Reflector (VISAR); and evaluate hydrazine and monomethylhydrazine thermal decomposition initiated by blow-by. These capabilities were further utilized and refined this year. Low blow-by pyrovalves manufactured by Conax Florida Corporation continued to be evaluated as a potential corrective measure for blow-by induced propellant explosions. Development and testing of various advanced pyrovalves and investigation of explosion mechanisms also continued. Current and near-term testing includes: evaluation of 3/8 in. Conax pyrovalves and other commercially available valves; development and testing of advanced pyrovalve subcomponent technologies including a zero blow-by pyrovalve ram, composite overwrapped ram cylinder, and a zero particulate generating poppet; investigation of non-destructive evaluation techniques to evaluate pyrovalve ram seals; and testing and modeling of pyrotechnically induced explosive hydrazine decomposition. Evaluation of 3/8 in. Conax valves will include operational margin testing to be accomplished at NASA Langley Research Center. The test program also seeks to compile and format significant amounts of data from this and other pyrovalve test programs to generate a pyrovalve applications handbook. The handbook will facilitate formation of standards that ensure safe spacecraft applications. Current data and future plans are discussed, and community interaction is encouraged.
Author
Mars Observer; Propulsion; Pyrotechnics; Technology Utilization

20000109897 NASA Marshall Space Flight Center, Huntsville, AL USA
High Head Unshrouded Impeller Pump Stage Technology
Williams, Robert W., NASA Marshall Space Flight Center, USA; Skelley, Stephen E., NASA Marshall Space Flight Center, USA; Stewart, Eric T., NASA Marshall Space Flight Center, USA; Droege, Alan R., NASA Marshall Space Flight Center, USA; Prueger, George H., Boeing Co., USA; Chen, Wei-Chung, Boeing Co., USA; Williams, Morgan, Boeing Co., USA; [2000]; 11p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Contract(s)/Grant(s): NRA8-21; RTOP 713-23-57
Report No.(s): AIAA Paper 2000-3243; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
A team of engineers at NASA/MSFC and Boeing, Rocketdyne division, are developing unshrouded impeller technologies that will increase payload and decrease cost of future reusable launch vehicles. Using the latest analytical techniques and experimental data, a two-stage unshrouded fuel pump is being designed that will meet the performance requirements of a three-stage shrouded pump. Benefits of the new pump include lower manufacturing costs, reduced weight, and increased payload to orbit.
Author
Manufacturing; Impellers; Technology Assessment

20000110035 National Inst. for Fusion Science, Nagoya, Japan
NIFS workshop on application of micro-indentation technique to evaluation of mechanical properties of fusion materials. Proceedings
Kurishita, H.; Katoh, Y.; Nov. 30, 1996; 177p; In Japanese; In English; Japanese. INFS workshop on application of micro-indentation technique to evaluation of mechanical properties of fusion materials
Report No.(s): DE98-744706; NIFS-PROC-30; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
NIFS workshop on 'Application of Micro-Indentation Technique to Evaluation of Mechanical Properties of Fusion Materials' were help in Toki on October 9, 1996, as a part of the activity of NIFS collaborative research on 'Advanced Technologies for Small-Volume Mechanical Property Testing of Fusion Reactor Materials'. The major topics at the workshop included the application of micro- (and nano-) indentation technique to evaluation of tensile stress-strain property, interfacial mechanical property of composite and joining materials and hardening of this layers in ion-irradiated materials. This report compiles the abstract and viewgraphs for each presentation.
NTIS
Conferences; Mechanical Properties; Fusion Reactors; Reactor Materials

20000110036 Japan Atomic Energy Research Inst., Tokyo, Japan
DSCu/SS joining techniques development and testing
Sato, S.; Hatano, T.; Furuya, K.; Kuroda, T.; Enoeda, M.; Jan. 31, 1998; 88p; In Japanese; In English
Report No.(s): DE98-744704; JAERI-RESEARCH-97-092; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Joining techniques of alumina dispersion strengthened copper alloy (DSCu) and type 316L stainless steel (SS) has been investigated aiming at applying to the fabrication of the ITER first wall/blanket. As the joining method, Hot Isostatic Pressing (HIP)

of solid plates and/or blocks has been pursued. by a screening test including HIP temperatures of 980-1050 C, it was concluded that the HIP temperature of 1050 C would be optimum for the simultaneous HIPping of DSCu/DSCu, DSCu/SS and SS/SS. With DSCu/SS joint specimens HIPped at 1050 C, tensile, impact, fatigue, crack propagation, and fracture toughness tests were performed as well as mechanical test of structural model with one SS circular tube embedded. Typically, the properties of the joints were almost the same as those of DSCu or SS base metal with the same heat treatment of the HIP process, thus good joints were obtained, though parts of properties were decreased at elevated test temperature. Typical results of the mechanical test of structural mode indicated that a crack initiated at the inner surface of the SS tube under cyclic operation, and the lifetime of the first wall structure could be evaluated by existing SS fatigue data. Two HIPped first wall panel mock-ups were successfully fabricated with built-in coolant tubes: one was 300 mm long and the other 800 mm long. The former was thermo-mechanically tested with high heat fluxes corresponding to the ITER operation conditions. The mock-up showed good heat removal performance during the high heat flux tests. In addition, there were no cracks and delaminations found at HIPped interfaces by microscopic observation after all tests. Ultrasonic testing have been tried as a non-destructive examination method, and detectable defect size at SS/SS, DSCu/DSCu and DSCu/SS joint interfaces were estimated.
NTIS
Aluminum Oxides; Dispersion Strengthening; Copper Alloys; Stainless Steels; Tokamak Devices; Fusion Reactors

20000110038 Japan Atomic Energy Research Inst., Tokyo, Japan
Test of the O-ring deformation for a large sized vacuum optical window
Tsukahara, Y.; Neyatani, Y.; Sunaoshi, H.; Shitomi, M.; Nagashima, A.; Jan. 31, 1998; 27p; In Japanese; In English
Report No.(s): DE98-744699; JAERI-TECH-98-004; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Test of the viton O-ring deformation has been performed for a new type of large sized vacuum window having a diameter of more than 80 mm. to prevent a vacuum leak mainly caused by the crack of optical window, a new standard for the viton O-ring has been proposed. The size of the O-ring was determined by the requirement to keep the finite gap between the optical window and the supported metal flange at any time. The validity of this new standard was confirmed by the deformation test for the O-ring under the condition of vacuum pumping and the baking.
NTIS
Viton Rubber (Trademark); O Ring Seals; Vacuum Systems

20000110170 Oak Ridge National Lab., TN USA
Prediction of the Inert Strength Distribution of Si3N4 Diesel Valves
Andrews, M. J.; Breder, K.; Wereszczak, A. A.; Jan. 25, 1999; 10p; In English; 23rd; 23rd Annual Cocoa Beach Conference and Exposition, 25-29 Jan. 1999, Cocoa Beach, FL, USA
Report No.(s): DE00-004594; ORNL/CP-102035; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Censored Weibull strength distributions were generated with NT551 silicon nitride four-point flexure data using the ASTM C1161-B and 5.0 mm diameter cylindrical specimens. Utilizing finite element models and Allied Signal's life prediction codes, the inert or fast fracture strength failure probability of a ceramic diesel valve was estimated from these data sets. The failure probability prediction derived from each data set were found to be more conservative than valve strength data. Fractographic analysis of the test specimens and valves showed that the cylindrical specimens failed from a different flaw population than the prismatic flexure bars and the valves. The study emphasizes the prerequisite of having coincident flaw populations homogeneously distributed in both the test specimen and the ceramic component. Lastly, it suggests that unless material homogeneity exists, that any meaningful life prediction or reliability analysis of a component may not be possible.
NTIS
Weibull Density Functions; Valves; Silicon Nitrides; Reliability Analysis; Finite Element Method; Failure Analysis; Cylindrical Bodies

20000110571 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 survey report. Subtask 8: hydrogen utilization worldwide clean energy system technology) (WE-NET) (R and D of hydrogen combustion turbines/development of ultra-high temperature materials
Mar. 31, 1998; 314p; In Japanese; In English
Report No.(s): DE99-736790; NEDO-WE-NET-9785; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

For the application to hydrogen combustion turbines, the R and D were continued of heat resistant alloys, ceramic composite materials, and carbonaceous composite materials. In the development of highly efficient super alloy single crystal materials, as

to the single crystal alloy (Ni-5.3Al-0.5Ti- 6.0Mo-4.8W-6.0Re) and an alloy made by adding 0.15% Si to the above alloy and an alloy made by adding 2.0% Hf to the above alloy, data on high temperature tensile property and creep rupture property were obtained, and it was confirmed that Hf added alloys were excellent in strength. Relating to the development of fiber reinforced ceramics, materials for trial fabrication were fabricated by the CVI method using SiC fiber, and the evaluation test was conducted to obtain the basic data. Besides, the following were carried out: study of coating for heat resistant alloy cooled blades, development of ceramic composite materials, development of ceramic multi-structure materials and analysis of fracture behaviors under the ultra-high composite environment, development of 3D fiber reinforced composite materials, development of technology to evaluate basic properties of ultra-high temperature materials, etc.
NTIS
Hydrogen; Clean Energy; Energy Technology; Ceramic Matrix Composites; Heat Resistant Alloys; Fiber Composites; Carbonaceous Materials

20000110572 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 survey report. Subtask 8: hydrogen utilization worldwide clean energy system technology) (WE-NET) (development of hydrogen combustion turbines/development of combustion control technology
Mar. 31, 1998; 193p; In Japanese; In English
Report No.(s): DE99-736789; NEDO-WE-NET-9782; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Concerning the development of hydrogen combustion turbines, the paper described the fiscal 1997 results. As a hydrogen/oxygen combustor, the annular combustor was studied. Based on the results obtained by the last fiscal year, a combustor for the evaluation test was designed/fabricated. Oxygen is mixed with vapor at the portion of the burner, rotated/jetted (flame held by the circulation flow generated) and made to burn with hydrogen (porous injection). The smooth ignition and equilibrium wall temperature distribution were made possible. Concentrations of the residual hydrogen/oxygen in the stoichiometric mixture ratio combustion were both less than 1%. Further, can type combustor I is a type in which hydrogen and oxygen are burned near the burner and then are diluted by vapor. Improved of the burner structure and diluted vapor hole, it was tested. In can type combustor II, a mixture of oxygen and vapor is supplied and burned with hydrogen. The appropriate supply of oxygen was 20% distribution to the primary scoop and 80% to secondary. In both combustors, smooth ignition was possible, and concentrations of the residual hydrogen/oxygen in the stoichiometric mixture ratio combustion were controlled at minimum (approximately 1%). The evaluation method for the optimum hydrogen/oxygen combustor was studied.
NTIS
Hydrogen; Energy Technology; Clean Energy; Combustion Control

20000111075 NASA Marshall Space Flight Center, Huntsville, AL USA
Flow in the Proximity of the Pin-Tool in Friction Stir Welding and Its Relation to Weld Homogeneity
Nunes, Arthur C., Jr., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 37th; 37th Annual Techniocal Meeting, 23-25 Oct. 2000, Columbia, SC, USA; Sponsored by Society of Engineering Science, USA; No Copyright; Avail: Issuing Activity; Abstract Only

In the Friction Stir Welding (FSW) process a rotating pin inserted into a seam literally stirs the metal from each side of the seam together. It is proposed that the flow in the vicinity of the pin-tool comprises a primary rapid shear over a cylindrical envelope covering the pin-tool and a relatively slow secondary flow taking the form of a ring vortex about the tool circumference. This model is consistent with a plastic characterization of metal flow, where discontinuities in shear flow are allowed but not viscous effects. It is consistent with experiments employing several different kinds of tracer: atomic markers, shot, and wire. If a rotating disc with angular velocity w is superposed on a translating continuum with linear velocity omega, the trajectories of tracer points become circular arcs centered upon a point displaced laterally a distance v/omega from the center of rotation of the disc in the direction of the advancing side of the disc. In the present model a stream of metal approaching the tool (taken as the coordinate system of observation) is sheared at the slip surface, rapidly rotated around the tool, sheared again on the opposite side of the tool, and deposited in the wake of the tool. Local shearing rates are high, comparable to metal cutting in this model. The flow patterns in the vicinity of the pin-tool determine the level of homogenization and dispersal of contaminants that occurs in the FSW process. The approaching metal streams enfold one another as they are rotated around the tool. Neglecting mixing they return to the same lateral position in the wake of the tool preserving lateral tracer positions as if the metal had flowed past the tool like an extrusion instead of being rotated around it. (The seam is, however, obliterated.) The metal stream of thickness approximately that of the tool diameter D is wiped past the tool at elevated temperatures drawn out to a thickness of v/2(omega) in the wiping zone. Mixing

distances in the wiping zone are multiplied in the unfolded metal. Inhomogeneities on a smaller scale than the mixing length are obliterated, but structure on a larger scale may be transmitted to the wake of a FSW weld.
Author
Friction Welding; Cylindrical Bodies; Flow Distribution; Viscous Flow; Metal Cutting

20000112928 Lockheed Martin Michoud Space Systems, Program and Technology Development, New Orleans, LA USA
Friction Plug Weld Repair Geometric Innovations
Coletta, Edmond R., Lockheed Martin Michoud Space Systems, USA; Cantrell, Mark A., Lockheed Martin Michoud Space Systems, USA; [2000]; 30p; In English; Aerospace Materials, 26 Jun. 2000, Seattle, WA, USA
Contract(s)/Grant(s): NAS8-36200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A viewgraph presentation outlines the fundamentals of friction plug welding. A process overview is given for friction push plug welding, including different uses and strengths of push plug welding. Details are given for friction pull plug welding, including welding parameters, details on observed defects, expected benefits, and test results.
CASI
Friction Welding; Plugs

20000112953 NASA Marshall Space Flight Center, Huntsville, AL USA
Application of Overset Technology on SIMPLEX Turbopump Design
Vu, Bruce, NASA Marshall Space Flight Center, USA; Griffin, Lisa, NASA Marshall Space Flight Center, USA; Dorney, Dan, NASA Marshall Space Flight Center, USA; [2000]; 21p; In English; 5th; Overset Grid and Solution Technology, 18-20 Sep. 2000, Davis, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A viewgraph presentation shows computer generated images of the Simplex Turbopump. Machine schematics are shown with scaled details of the nozzle ring assay and the turbine gas flow path. Grid generation is used to show nozzle grids, blade contours, blade grids and simplex full configuration and geometry. A flow simulation shows mach contours in absolute and relative frames.
CASI
Computer Graphics; Contours; Grid Generation (Mathematics); Image Processing; Turbine Pumps

20000112954 NASA Marshall Space Flight Center, Huntsville, AL USA
Aluminum Lithium Alloy 2195 Fusion Welding Improvements with New Filler Wire
Russell, Carolyn, NASA Marshall Space Flight Center, USA; Bjorkman, Gerry, Lockheed Martin Michoud Space Systems, USA; [2000]; 23p; In English; Aerospace Materials, Processes and Environmental Technology, 18-20 Sep. 2000, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A viewgraph presentation outlines NASA Marshall Space Flight Center, Lockheed Martin Michoud Space Systems, and McCook Metals' development an aluminum-copper weld filler wire for fusion welding 2195 aluminum lithium. The aluminum-copper based weld filler wire has been identified as B218, which is the result of six years of weld filler wire development funded by NASA, Lockheed Martin, and McCook Metals. The Super Lightweight External Tank for the NASA Space Shuttle Program consists of 2195 welded with 4043 aluminum-silicon weld filler wire. The B218 filler wire chemistry was developed to produce enhanced 2195 weld and repair weld mechanical properties. An initial characterization of the B218 weld filler wire was performed consisting of initial weld and repair weld evaluation comparing B218 and 4043. The testing involved room temperature and cryogenic tensile testing along with fracture toughness testing. B218 weld filler wire proved to produce enhanced initial and repair weld tensile and fracture properties over 4043. B218 weld filler wire has proved to be a superior weld filler wire for welding 2195 and other aluminum lithium alloys over 4043.
Author
Aluminum Alloys; Fillers; Copper; Fusion Welding; Tensile Properties; Welding; Wire

20000113034 Columbia Univ., Dept. of Mechanical Engineering, New York, NY USA
Friction and Lubrication of Highly Deformable Porous Bearings: Learning From The Articular Cartilage of Human Joints
Soltz, Michael A., Columbia Univ., USA; Ateshian, Gerard, Columbia Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 101-107; In English; See also 20000113027
Contract(s)/Grant(s): NIH-AR-43628; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Diarthrodial joints such as the knee, hip, or elbow provide the wide range of motion between body segments required for activities of daily living. Diarthrodial joints share a common structure with a joint cavity surrounded by capsular ligaments that

provide stability to the joint. The inner lining of the capsule secretes synovial fluid as well as absorbs waste products from cellular activity. The synovial fluid is a clear, yellowish, viscous fluid which aids in the nutrition of the avascular articular cartilage which is the bearing material lining the end of the bones; it is also believed to act as a lubricant for the joint. Articular cartilage is a deformable porous hydrated connective tissue, 1 to 6 mm in thickness, able to provide smooth, nearly frictionless motion under large time-varying loads (upwards of 3 to 5 times body weight) at low sliding articular speeds. Despite the harsh loading conditions of diarthrodial joints, cartilage normally remains functional for nearly seventy to eighty years in humans, due its remarkable tribological properties. When mechanical breakdown of the cartilage does occur, the joint progresses toward osteoarthritis, which is a common joint degenerative disease. Thus, understanding the tribology of diarthrodial joints provides insight into the osteoarthritic process which can potentially improve existing clinical treatment modalities. A number of theories have been proposed over the past several decades to explain the frictional properties of articular cartilage, though the precise mechanism of cartilage lubrication has not been fully elucidated. This paper briefly reviews the previous literature and summarizes some of our advances in this field which can provide a clearer understanding of the mode of lubrication inside our joints.
Derived from text
Lubricants; Lubrication; Joints (Anatomy); Connective Tissue; Musculoskeletal System; Human Body

20000113674 NASA Marshall Space Flight Center, Huntsville, AL USA
High Head Unshrouded Impeller Pump Stage Technology
Williams, Robert W., NASA Marshall Space Flight Center, USA; Skelley, Stephen E., NASA Marshall Space Flight Center, USA; Stewart, Eric T., NASA Marshall Space Flight Center, USA; Droege, Alan R., NASA Marshall Space Flight Center, USA; Prueger, George H., Boeing Co., USA; Chen, Wei-Chung, Boeing Co., USA; Williams, Morgan, Boeing Co., USA; [2000]; 20p; In English; Joint Propulsion, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Contract(s)/Grant(s): NRA8-21; RTOP 713-23-57
Report No.(s): AIAA Paper 2000-3243; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Objective to develop an unshrouded impeller design, which a meets the performance requirements of a 3-stage fuel pump with a 2-stage pump design, has been accomplished. Performance of the baseline unshrouded impeller has been experimentally verified. Unshrouded impeller trade study and final 6+6 unshrouded impeller configuration has been presented. Structurally viable, 6+6-impeller design concept has been produced. Based on results presented in this study, at a nominal 10% tip-clearance, the 6+6 impeller design would increase payload to orbit by almost 625 lbs. per engine. The RLV vehicle requires 7 engines, therefore, application of high head unshrouded technology would increase payload capability by as much as 4,375 lbs. per vehicle.
Derived from text
Fuel Pumps; Design Analysis; Performance Prediction; Impellers

20000113851 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Study of the hydro-mechanical behaviour of expanded graphite gaskets
Patron, E.; Dec. 31, 1997; 65p; In French; In English
Report No.(s): DE98-616889; EDF-97-NB-00083; No Copyright; Avail: Department of Energy Information Bridge

The poro-mechanical behaviour models developed by O. Coussy permit to consider various phenomena observed experimentally: thermo-hydro-mechanical couplings, plasticity, etc. The aim of this study is to implement the simplest poro-mechanical model (i.e. the isotropic linear poro-elastic model) to model the gasket hydro-mechanical behaviour. First, isotropic poro-elastic characteristics of expanded graphite have been estimated from these tests conducted at Departement Mecanique et Technologie des Composants (MTC) and data from literature. Then, analytical solutions of the tightness tests developed at the MTC Department have been carried out. These calculations provide a first estimation of porosity variations during a tightness tests with metal/metal contact or in elastic recovery, and during a 'hot thermal transient'. Thickness controlled numerical calculations have proved the analytical calculations relevance. With regard to simulation of tests with metal/metal contact or 'hot thermal transient', stress controlled numerical calculations have pointed out: - a greater vertical displacement on the inner side of the graphite ring and - a z dependence of the radial displacement and thus a porous differential variation between the upper and lower faces of the ring.
NTIS
Gaskets; Mechanical Properties; Hydromechanics; Graphite; Thermal Stresses

38
QUALITY ASSURANCE AND RELIABILITY

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

20000112960 Science Applications International Corp., Arlington, VA USA
Advanced Risk Reduction Tool (ARRT) Special Case Study Report: Science and Engineering Technical Assessments (SETA) Program ***Final Report***
Kirsch, Paul J., Science Applications International Corp., USA; Hayes, Jane, Science Applications International Corp., USA; Zelinski, Lillian, Science Applications International Corp., USA; Oct. 13, 2000; 25p; In English
Contract(s)/Grant(s): NAS2-98028
Report No.(s): Rept-8521.04.15.05.001013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This special case study report presents the Science and Engineering Technical Assessments (SETA) team's findings for exploring the correlation between the underlying models of Advanced Risk Reduction Tool (ARRT) relative to how it identifies, estimates, and integrates Independent Verification & Validation (IV&V) activities. The special case study was conducted under the provisions of SETA Contract Task Order (CTO) 15 and the approved technical approach documented in the CTO-15 Modification #1 Task Project Plan.
Author
Risk; Software Engineering; Software Development Tools; Technology Assessment

20000114832 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Adaptive Buddy Check for Observational Quality Control
Dee, Dick P., NASA Goddard Space Flight Center, USA; Rukhovets, Leonid, NASA Goddard Space Flight Center, USA; Todling, Ricardo, NASA Goddard Space Flight Center, USA; DaSilva, Arlindo M., NASA Goddard Space Flight Center, USA; Larson, Jay W., Argonne National Lab., USA; [2000]; 22p; In English; Original contains color illustrations
Contract(s)/Grant(s): nas5-32332; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An adaptive buddy check algorithm is presented that adjusts tolerances for outlier observations based on the variability of surrounding data. The algorithm derives from a statistical hypothesis test combined with maximum-likelihood covariance estimation. Its stability is shown to depend on the initial identification of outliers by a simple background check. The adaptive feature ensures that the final quality control decisions are not very sensitive to prescribed statistics of first-guess and observation errors, nor on other approximations introduced into the algorithm. The implementation of the algorithm in a global atmospheric data assimilation is described. Its performance is contrasted with that of a non-adaptive buddy check, for the surface analysis of an extreme storm that took place in Europe on 27 December 1999. The adaptive algorithm allowed the inclusion of many important observations that differed greatly from the first guess and that would have been excluded on the basis of prescribed statistics. The analysis of the storm development was much improved as a result of these additional observations.
Author
Algorithms; Maximum Likelihood Estimates; Quality Control; Statistical Tests; Mathematical Models

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STRUCTURAL MECHANICS

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

20000109781 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Measurement Method of Defects of Pressure Vessel by Using Shearography
Kim, C. J.; Jul. 31, 1997; 85p; In Korean
Report No.(s): DE99-727794; KAERI-CM-133/96; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A new experimental technique has been devised to measure residual stress in ductile materials with a combination of laser speckle pattern interferometry and spot heating. The technique to determine the residual stress is based on the well-known idea that when stressed material is heated, the stress may be relieved to a certain degree depending on the time and temperature of the heat treatment and the stress-strain characteristics of the material. In this study, the ANSYS finite-element computer program was employed to obtain the time and temperature of the heat treatment by the spot heating. We used the optical arrangement composed of the in-plane ESPI to obtain the interference fringe for visualization of displacement parallel to the direction of the observation.

This interference fringe pattern is transformed into the phase map, which is the phase information of specimen by using the phase shifting method. Finally, we showed the three dimension plot of the object surface deformations with residual stress.
NTIS
Pressure Measurement; Pressure Vessels; Residual Stress; Ductility; Heat Treatment; Temperature Distribution; Temperature Dependence

20000109795 NASA Langley Research Center, Hampton, VA USA
Effective Widths of Compression-Loaded Plates With a Cutout
Hilburger, Mark W., NASA Langley Research Center, USA; Nemeth, Michael P., NASA Langley Research Center, USA; Starnes, James H., Jr., NASA Langley Research Center, USA; October 2000; 24p; In English; 41st; 41st AIAA/ASME/ASCE/ASC/ASH Structures, Structural Dynamics, and Materials Conference, 3-6 April 2000, Atlanta, GA, USA
Contract(s)/Grant(s): RTOP 522-11-41-01
Report No.(s): NASA/TP-2000-210538; L-18004; NAS: 1.21:210538; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study of the effects of cutouts and laminate construction on the prebuckling and initial postbuckling stiffnesses, and the effective widths of compression-loaded, laminated-composite and aluminum square plates is presented. The effective-width concept is extended to plates with cutouts, and experimental and nonlinear finite-element analysis results are presented. Behavioral trends are compared for seven plate families and for cutout-diameter-to-plate-width ratios up to 0.66. A general compact design curve that can be used to present and compare the effective widths for a wide range of laminate constructions is also presented. A discussion of how the results can be used and extended to include certain types of damage, cracks, and other structural discontinuities or details is given. Several behavioral trends are described that initially appear to be nonintuitive. The results demonstrate a complex interaction between cutout size and plate orthotropy that affects the axial stiffness and effective width of a plate subjected to compression loads.
Author
Compression Loads; Metal Plates; Width; Buckling; Structural Design Criteria

20000109929 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium
Use of the instrumented Charpy-V impact signal for assessment of RPVS embrittlement
Fabry, A.; VanWalle, E.; VandeVelde, J.; Chauoadi, R.; Puzzolante, J. L.; Dec. 31, 1995; 26p; In English
Report No.(s): DE98-626860; BLG-702; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the context of LWR pressure vessel surveillance, the significance of the Cv notch impact test instrumented by strain gages has been revised. The load diagram (general yield, maximum, brittle fracture and arrest loads versus temperature) is the most fundamental feature of the test. It is directly correlated to the appearance (percentage shear) of the fracture surface and also constitutes a straightforward experimental expression of the Davidenkov diagram, by which ductile-brittle transition temperature shifts are linked to irradiation damage mechanisms. In combination with static uniaxial tensile tests, it allows quantification of strain rate effects on the yielding and work hardening capacity of the steel. by contrast, the bulk of the absorbed energy and lateral expansion stems from ductile stable crack growth associated with plastic deformation under conditions, unrepresentative of the constraints and stress-strain field near the tip of a sharp crack in a pressure vessel. It is shown that the temperature at which fixed energy is absorbed in the test (41 or 68 Joules) cannot always trace to acceptable accuracy the effect of steel service exposure on the ductile - brittle transition temperature and on cleavage fracture toughness. It is contented that this can be done more reliably by using characteristic temperatures of the load diagram. An attempt to determine the engineering and regulatory implications of this physically-grounded fracture toughness approach is made.
NTIS
Charpy Impact Test; Damage Assessment; Pressure Vessels; Fracturing; Radiation Damage; Static Tests; Radiation Effects; Degradation; Embrittlement; Irradiation

20000109930 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium
Precracking of round notched bars ***Progress Report***
Scibetta, M.; Feb. 28, 1996; 37p; In English
Report No.(s): DE98-626862; BLG-708; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Precracking round notched bars is the first step before fracture mechanics testing. This report gives an overview of the different techniques described in the literature. Difficulties generally encountered are linked to the crack length determination and the creation of eccentric cracks. As the compliance technique is often used, a detailed study of the stress intensity factor and the com-

pliance of the precracked bar under bending and tension is presented. Comparison with finite element calculations is made to validate the proposed analytical formulation. Finally a practical way for precracking is described.
NTIS
Fracture Mechanics; Finite Element Method; Cracks; Notches; Charpy Impact Test

20000109932 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium
Fracture toughness evaluation of circumferentially-cracked round bars
Scibetta, M.; May 31, 1996; 50p; In English
Report No.(s): DE98-626866; BLG-716; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The measure of the fracture toughness of a circumferentially-cracked round bar is generally performed through approximate formulae. Comparison of existing formulae to finite element results does not always show good agreement. Therefore an eta factor is introduced in order to improve the existing analytical formula. The axisymmetrical geometry is generally considered to be a high constrained geometry. Finite element calculations are performed to verify and quantify the constraint relative to the three point bending configuration (precracked Charpy).
NTIS
Charpy Impact Test; Finite Element Method; Fracture Strength; Cracks

20000109934 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium
Instrumented Impact Results on BCR Specimens *Interim Report*
VanWalle, E.; Puzzolante, J. L.; Vosch, R.; May 31, 1996; 35p; In English
Report No.(s): DE98-626874; BLG-727; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Software used for the analysis of the BCR tests was validated on a spectrum provided in ASCII format. The corrected dial energy for the 60J and 80J BCR specimens corresponds very well with the nominal energy value given by BCR. Although the integrated energy values are within the standard deviation of the nominal BCR-value, a systematic deviation between the integrated and experimental energy value has been observed for all tests. This effect is assigned to a dynamic effect on the calibration of the pot. It is also concluded that the yield force is not easy to define on the BCR-spectra.
NTIS
Charpy Impact Test; Impact Tests; Standardization

20000109935 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium
Instrumented testing of BCR Specimens
VanWalle, E.; Vosch, R.; Puzzolante, J. L.; Varma, B.; Dec. 31, 1996; 28p; In English; Prepared in part by NPL, Teddington, UK
Report No.(s): DE98-626875; BLG-728; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Two times two reference batches of BCR material with nominal energies of 80J and 160J were impact tested on an instrumented machine. A good agreement was found between the friction-corrected dial energy and the integrated energy. Systematic differences have been detected between the two 80J batches: these differences do not occur in the typical force values and are a consequence of a post-maximum event. A small calibration difference exists for the 80J batches: this seems a consequence of the higher impact forces involved and suggests the influence of dynamic effects on the calibration (static, in-situ). The next step is to test similar batches on a non-instrumented impact tester to detect an eventual influence of the physical presence of instrumentation on the impact pot. It is expected that this effect will be minor.
NTIS
Charpy Impact Test; Impact Tests; Standardization; Materials Tests

20000109936 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium
Characterization by notched and precracked Charpy tests of the in-service degradation of RPV steel fracture toughness
Fabry, A.; Jan. 31, 1997; 33p; In English
Report No.(s): DE98-626877; BLG-731; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The current engineering and regulatory practice to estimate fracture toughness safety margins for nuclear reactor pressure vessels (RPVs) relies heavily on the CVN impact test. Techniques to estimate in-service toughness degradation directly using a variety of precracked specimens are under development worldwide. Emphasis is on their miniaturization. In the nuclear context, it is essential to address many issues such as representativity of the surveillance programs with respect to the vessel in terms of materials and environment, transferability of test results to the structure (constraint and size effects), lower bound toughness certification, readibility relative to trends of existing databases. An enhanced RPV surveillance strategy in under development in Belgium. It combines state-of-the-art micromechanical and damage modelling to the evaluation of CVN load-deflection signals,

tensile stress-strain curves and slow-bend tests of reconstituted precracked Charpy specimens. A probabilistic micromechanical model has been established for static and dynamic transgranular cleavage initiation fracture toughness in the ductile-brittle transition temperature range. This model allows to project toughness bounds for any steel embrittlement condition from the corresponding CVN and static tensile properties, using a single scaling factor defined by imposing agreement with toughness tests in a single condition. The outstanding finding incorporated by this toughness transfer model is that the micro cleavage fracture stress is affected by temperature in the ductile-brittle transition and that this influence is strongly correlated to the flow stress: this explains the shape of the K(sub Ic)n K(sub Id) temperature curves as well as the actual magnitude of the strain rate and irradiation effects. Furthermore, CVN crack arrest loads and fracture appearance are also taken advantage of in order to estimate K(sub Ia) degradation. Finally, the CVN-tensile load- temperature diagram provides substantial information used for the modelling of in-service steel strenthening, intergranular fracture susceptibility and other irradiation-induced and ageing effects.
NTIS
High Strength Steels; Pressure Vessels; Embrittlement; Fracture Mechanics; Damage Assessment; Charpy Impact Test; Brittleness; Degradation; Fracture Strength; Irradiation; Micromechanics; Miniaturization; Radiation Effects

20000110121 Forest Products Lab., Madison, WI USA
Commentary on Factors Affecting Transverse Vibration Using an Idealized Theoretical Equation ***Topical Report***
Murphy, J. F.; Aug. 2000; 12p
Report No.(s): PB2000-108499; FPL-RN-0276; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An idealized theoretical equation to celebrate flexural stiffness using transverse vibration of a simply end-supported beam is being considered by the American Society of Testing and Materials (ASTM) Wood Committee DO7 to determine lumber modulus of elasticity. This commentary provides the user a quantitative view of six factors that affect the accuracy of using the idealized theoretical equation, idealized assumptions, and idealized boundary conditions. The six factors that affect the calculations of the flexural modulus of elasticity are ranked in order of importance, and recommendations are given. Not covered are the precision and accuracy of the physical measurements.
NTIS
Modulus of Elasticity; Wood; Flexural Strength; Transverse Oscillation

20000110573 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 survey report. Subtask 6: hydrogen utilization worldwide clean energy system technology) (WE-NET) (development of technology of low temperature materials
Mar. 31, 1998; 344p; In Japanese; In English
Report No.(s): DE99-736783; NEDO-WE-NET-976; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The paper described the results of the development of technology of low temperature materials in the fiscal 1997 WE-NET. Using experimental equipment for materials under the atmosphere of liquid hydrogen, an experiment on mechanical characteristics under the liquid hydrogen atmosphere (20 K) was conducted of the base materials of candidate steels (SUS304L, SUS316L and A5083) . In material evaluation experiments (tension/fracture toughness/fracture tests) , characteristic behaviors of the materials were shown which are different from those shown in the environment of liquid He (4 k), etc. Even if the amount of (delta) ferrite in the metal welded of the stainless steel is small, approximately 1%, the degradation of low temperature toughness occurred. Welded joints of stainless steel by submerged arc welding and MAG welding were in now way inferior in tension characteristic to those by TIG welding, but were inferior in toughness ranging from room temperature to extremely low temperature. As to aluminum alloys, materials excellent in extremely-low temperature toughness were able to be found. Under the low temperature hydrogen gas atmosphere, the lower the strain rate is, the higher the hydrogen brittleness susceptibility is around 220 K (extremely large hydrogen brittleness temperature) (SUS304L). In the hydrogen gas of 100 atm, hydrogen invades the material at 100 C, but does not at 77 k.
NTIS
Energy Technology; Clean Energy; Liquid Hydrogen; Liquefied Gases

20000110603 Bettis Atomic Power Lab., West Mifflin, PA USA
Stress Intensity Factor Solutions for Cracks in Threaded Fasteners
Oster, D. M.; Mills, W. J.; Feb. 01, 1999; 35p; In English; 2nd; Structural Integrity of Fasteners, 19 May 1999, Seattle, WA, USA
Contract(s)/Grant(s): DE-AC11-98PN-38206
Report No.(s): DE00-755395; B-T-3244; No Copyright; Avail: Department of Energy Information Bridge

Nondimensional stress intensity factor (K) solutions for continuous circumferential cracks in threaded fasteners were calculated using finite element methods that determined the energy release rate during virtual crack extension. Assumed loading conditions included both remote tension and nut loading, whereby the effects of applying the load to the thread flank were considered. In addition, K solutions were developed for axisymmetric surface cracks in notched and smooth round bars. Results showed that the stress concentration of a thread causes a considerable increase in K for shallow cracks, but has much less effect for longer cracks. In the latter case, values of K can be accurately estimated from K solutions for axisymmetric cracks in smooth round bars. Nut loading increased K by about 50% for shallow cracks, but this effect became negligible at crack depth-to-minor diameter ratios (a/d) greater than 0.2. An evaluation ot thread root acuity effects showed that root radius has no effect on K when the crack depth exceeds 2% of the minor diameter. Closed-form K solutions were developed for both remote-loading and nut-loading conditions and for a wide range of thread root radii. The solutions obtained in this study were compared with available literature solutions for threaded fasteners as well as notched and smooth round bars.
NTIS
Stress Intensity Factors; Crack Initiation; Crack Propagation; Surface Cracks; Threads; Fasteners

20000110611 Bettis Atomic Power Lab., West Mifflin, PA USA
Elastic-Plastic Analysis of the PVRC Burst Disk Tests With Comparison to the ASME Code-Primary Stress Limits
Jones, D. P.; Holliday, J. E.; Feb. 01, 1999; 15p; In English; 1999 ASME Pressure Vessels and Piping Conference, 1-5 Aug. 1999, Boston, MA, USA; Sponsored by American Society of Mechanical Engineers, USA
Report No.(s): DE00-754909; B-T-3249; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper provides a comparison between finite element analysis results and test data from the Pressure Vessel Research Council (PVRC) burst disk program. Testing sponsored by the PVRC over 20 years ago was done by pressurizing circular flat disks made from three different materials until failure by bursting. The purpose of this re-analysis is to investigate the use of finite element analysis (FEA) to assess the primary stress limits of the ASME Boiler and Pressure Vessel Code (1998) and to qualify the use of elastic- plastic (EP-FEA) for limit load calculations. The three materials tested represent the range of strength and ductility found in modern pressure vessel construction and include a low strength high ductility material. A medium strength medium ductility material, and a high strength low ductility low alloy material. Results of elastic and EP-FEA are compared to test data. Stresses from the elastic analyses are linearized for comparison of Code primary stress limits to test results. Elastic-plastic analyses are done using both best- estimate and elastic=perfectly plastic (EPP) stress-strain curves. Both large strain-large displacement (LSLD) and small strain-small displacement (SSSD) assumptions are used with the EP-FEA. Analysis results are compared to test results to evaluate the various analysis methods, models, and assumptions as applied to the bursting of thin disks.
NTIS
Pressure Vessels; Plastic Properties; Elastic Properties; Mechanical Properties; Finite Element Method; Burst Tests; Boilers

20000113040 Purdue Univ. Calumet, Hammond, IN USA
Accelerated Fatigue Test
Kin, Yulian, Purdue Univ. Calumet, USA; Holler, Dennis, Purdue Univ. Calumet, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 187-195; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

A long-term conventional fatigue test procedure requires the breaking of 30 to 60 identically prepared specimens and 15 days to 1 month to complete. Thus, manufacturers are often reluctant to perform a conventional fatigue test in spite of its obvious utility. Therefore, there is a definite need for an accelerated test that can be completed in approximately one shift. The accelerated fatigue test is also very useful to control technological process and in preliminary evaluation of the new designs. The Locaty's accelerated procedure was used in this experiment. This method is based on the concept of cumulative fatigue damage and we assumed that fatigue limit corresponds to sum of relative lives Sigma(n(sub i)/N(sub i) = 1, where n(sub i) is the number of cycles which a specimen worked in the specified testing regime, and N(sub i) is the number of cycles which a specimen could potentially work in accordance with the fatigue curve received from the long-term fatigue tests of the same type of specimens. The loading program and treatment of the results are given in details later. We conduct a conventional fatigue test using 16-20 standard specimens, plot S-N curve, plot family of fatigue curves with 5%, 50% and 95% probability of failures and determine necessary parameters for the accelerated fatigue test. Then conduct an accelerated fatigue test. Compare the endurance limits determined from conventional and accelerated tests.
Derived from text
Accelerated Life Tests; Fatigue Tests; Fatigue Life; Fatigue (Materials); Life (Durability); Metal Fatigue; Flexural Strength

20000113049 Southridge High School, Kennewick, WA USA

Simple and Inexpensive Method for Testing Shear Strength of Adhesive Bonds

Bunnell, L. Roy, Southridge High School, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 297-302; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

By testing adhesive bonds made under several different conditions, students develop an appreciation for the importance of proper batching of epoxy resins and the condition of surfaces to be bonded.

Author

Adhesion Tests; Adhesive Bonding; Shear Strength

20000113053 Oakland Univ., Mechanical Engineering Dept., Rochester, MI USA

Digital Shearography and Applications

Hung, Michael Y. Y., Oakland Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 341-385; In English; See also 20000113027

Contract(s)/Grant(s): NSF CMS-96-01778; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This article reviews shearography and its applications. Shearography is a laser-based technique for full-field, non-contacting measurement of surface deformation. Unlike holography, it does not require special vibration isolation; hence, it is a practical tool that can be used in a field/factory environment. Shearography has already received considerable industrial acceptance, in particular, for nondestructive testing. In nondestructive testing, shearography reveals defects in an object by identifying defect-induced deformation anomalies. Other applications of shearography include strain measurement, material characterization, residual stress evaluation. leak detection, vibration studies and 3-D shape measurement.

Author

Nondestructive Tests; Shearography; Strain Measurement; Stress Measurement

20000113126 Southampton Univ., Inst. of Sound and Vibration Research, UK

Mobility and Impedance Methods in Structural Dynamics: An Historical Review

Gardonio, P, Southampton Univ., UK; Brennan, M. J., Southampton Univ., UK; October 2000; 31p; In English

Report No.(s): ISVR-TR-289; Copyright; Avail: Issuing Activity

An historical review of the conception and evolution of impedance and mobility methods in structural dynamics is presented. As often happens in science, the concepts and ideas developed in one branch of science have inspired new approaches and theories in another branch. Indeed this was the case for mechanical mobility and impedance which has its origin in the field of electricity. The conception and formulation of both direct and inverse electromechanical analogies are described in this report together with the formulation of "ad hoc" impedance and mobility methods that were developed for mechanical systems. Also, the impedance, mobility and transmission matrix methods that evolved for flexible, distributed mechanical systems are discussed. Finally the analytical solutions of the various types of problems usually encountered in the study of structural vibration are presented in a consistent formulation based on the mobility/impedance terms. This historical review has been written with reference to a large number of published papers many of which have been listed in the reference and bibliography sections.

Author

Dynamic Structural Analysis; Mobility; Mechanical Impedance; Electrodynamics; Structural Vibration; Transport Properties

20000113824 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

A Shear Banding Model for Penetration Calculations ***Final Report, Oct. 1998-Jan. 2000***

Raftenberg, Martin N.; Apr. 2000; 67p; In English

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A377018; ARL-TR-2221; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A model for introducing the effects of adiabatic shear banding into a penetration calculation was installed into the EPIC wavecode. These effects are deemed to be reduction in the ratio of flow stress to the value predicted by the Johnson-Cook strength model and increase in spall pressure. A strain-rate- and temperature-dependent instability strain is determined from small-amplitude perturbation of constant-strain-rate simple shear. Imposed alterations in flow stress ratio and spall pressure commence at the "localization strain", separated from the instability strain by a fixed strain increment. The alterations proceed linearly with increasing effective plastic strain and terminate after an additional fixed strain increment, at the "failure strain." The values imposed on the flow stress ratio and the spall pressure at the failure strain are functions of local pressure at the time step when localization strain was reached. The nonzero value imposed on the flow stress ratio in the case of positive localization pressure reflects the phenomenon of fracture suppression within a fully formed shear band. The two fixed strain increments are evaluated from a torsional

Kolsky bar test. The pre-shear-banded spall pressure is evaluated from plate-on-plate impact data. The flow stress ratio and spall pressure at and beyond the failure strain introduce two currently ”free” parameters. The model was applied to a set of problems involving steel plate perforation by a tungsten rod, and reasonable agreement with experiment was obtainable in terms of the final target hole size and the length and speed of the tungsten residual.
DTIC
Shear Properties; Penetration; Armor; Adiabatic Conditions; Spallation; Metal Plates; Mathematical Models; Hole Geometry (Mechanics); Fracturing

20000114846 NASA Goddard Space Flight Center, Greenbelt, MD USA
Follow on Validation of Force-Limited Vibration Testing
Kaufman, Daniel S., Orbital Sciences Corp., USA; Worth, Daniel B., NASA Goddard Space Flight Center, USA; [2000]; 15p; In English; Aerospace Testing, 3-5 Oct. 2000, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A second sounding rocket experiment was performed in the summer of 1998 in a continuing effort to validate the force limits techniques used in random vibration tests. The accuracy of the force limiting prediction techniques has not clearly been sufficiently confirmed with in-flight data as of this time. The flight was on board one of the BlackBrant series of sounding rockets. This vehicle is the one most commonly used for suborbital scientific payloads by NASA. An aluminum double deck structure simulating a dynamic source and load was flown. The hardware was instrumented with accelerometers and force sensors that measured input acceleration, forces and acceleration responses on the load. Force limiting analysis methods are compared with the flight measurements in order to evaluate analysis predictions methods and test procedures. This sounding rocket flight is the second in a series of flights that will be performed.
Author
Random Vibration; Vibration Tests; Sounding Rockets; Rocket Sounding; Telemetry

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.

20000109889 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Wessling, Germany
Distribution law for relative humidity in the upper troposphere and lower stratosphere derived from three years of MOZAIC measurements
Gierens, K.; Schumann, U.; Helten, M.; Smit, H.; Marenco, A.; Nov. 30, 1998; 27p; In English
Report No.(s): DE99-750755; ETDE-DE-781; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Data of three years of MOZAIC measurements made it possible to determine a distribution law for the relative humidity in the upper troposphere and lower stratosphere. 13.5% of the data were obtained in regions with ice supersaturation. Troposphere and stratosphere are distinguished by an ozone concentration of 130 ppbv as threshold. The degree of ice supersaturation in the troposphere and the relative humidity in the stratosphere (both with respect to water and ice) are distributed exponentially. A model that can explain the exponential distribution is provided. Mean supersaturation in the troposphere is about 15%, whereas ice nucleation requires 30% supersaturation on the average. This explains the frequency of ice supersaturated regions which are only marked by persistent contrails, but are otherwise free of clouds. Ice supersaturated regions are 3-4 K colder and contain more than 50% more vapor than other regions in the upper troposphere. The stratosphere is dry, as expected, having mean relative humidity over water of 12% and over ice of 23%, respectively. However, 2% of the stratospheric data indicate ice supersaturation. Since water vapor is the most important greenhouse gas and since it might enhance the anthropogenic greenhouse effects via positive feedback mechanisms, it is important to represent its distribution correctly in climate models. The discovery of the distribution law of the relative humidity makes possible simple tests whether the hydrological cycle in climate models is represented in an adequate way or not.
NTIS
Humidity; Atmospheric Moisture; Troposphere; Stratosphere

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.

20000109856 NASA Marshall Space Flight Center, Huntsville, AL USA

High Spatial Resolution Airborne Multispectral Thermal Infrared Remote Sensing Data for Analysis of Urban Landscape Characteristics

Quattrochi, Dale A., NASA Marshall Space Flight Center, USA; Luvall, Jeffrey C., NASA Marshall Space Flight Center, USA; Estes, Maurice G., Jr., Universities Space Research Association, USA; [2000]; 1p; In English; Multi/Hyperspectral Sensors, Measurements, Modeling and Simulation, 7-9 Nov. 2000, Redstone Arsenal, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We have used airborne multispectral thermal infrared (TIR) remote sensing data collected at a high spatial resolution (i.e., 10m) over several cities in the USA to study thermal energy characteristics of the urban landscape. These TIR data provide a unique opportunity to quantify thermal responses from discrete surfaces typical of the urban landscape and to identify both the spatial arrangement and patterns of thermal processes across the city. The information obtained from these data is critical to understanding how urban surfaces drive or force development of the Urban Heat Island (UHI) effect, which exists as a dome of elevated air temperatures that presides over cities in contrast to surrounding non-urbanized areas. The UHI is most pronounced in the summertime where urban surfaces, such as rooftops and pavement, store solar radiation throughout the day, and release this stored energy slowly after sunset creating air temperatures over the city that are in excess of 2-4'C warmer in contrast with non-urban or rural air temperatures. The UHI can also exist as a daytime phenomenon with surface temperatures in downtown areas of cities exceeding 38'C. The implications of the UHI are significant, particularly as an additive source of thermal energy input that exacerbates the overall production of ground level ozone over cities. We have used the Airborne Thermal and Land Applications Sensor (ATLAS), flown onboard a Lear 23 jet aircraft from the NASA Stennis Space Center, to acquire high spatial resolution multispectral TIR data (i.e., 6 bandwidths between 8.2-12.2 (um) over Huntsville, Alabama, Atlanta, Georgia, Baton Rouge, Louisiana, Salt Lake City, Utah, and Sacramento, California. These TIR data have been used to produce maps and other products, showing the spatial distribution of heating and cooling patterns over these cities to better understand how the morphology of the urban landscape affects development of the UHI. In turn, these data have been used by government officials, urban planners, and other decision-makers, to make more informed decisions on how to mitigate the UHI and its subsequent impacts.

Author

Heat Islands; Remote Sensing; Cities; Climatology

20000110108 NASA Wallops Flight Facility, Wallops Island, VA USA

Five Year Changes in Surface Elevations of The Greenland Ice Sheet Measured by Aircraft Laser Altimetry

Krabill, W. B., NASA Wallops Flight Facility, USA; Frederick, E. B., EG and G Services, USA; Manizade, S. M., EG and G Services, USA; Martin, C. F., EG and G Services, USA; Sonntag, J. G., EG and G Services, USA; Swift, R. N., EG and G Services, USA; Thomas, R. H., EG and G Services, USA; Wright, C. W., EG and G Services, USA; Yungel, J. K., EG and G Services, USA; [2000]; 1p; In English; International Symposium on the Verification of Cryospheric Models, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Arctic Ice Mapping group (Project AIM) at NASA's Wallops Flight Facility has been conducting systematic topographic surveys of the Greenland Ice Sheet since 1993, using scanning airborne laser altimeters combined with GPS positioning technology. Flight lines were planned to cover all major ice drainage basins, with the intention to repeat the surveys after a 5-year interval in order to detect changes in the ice-sheet volume. The first resurvey was completed in June/July, 1998, along flight lines in the southern half of Greenland which had been first surveyed in 1993. The northern half of the ice sheet will be resurveyed in 1999. The resulting data sets will provide the first comprehensive examination of regional changes in the the surface elevation of the World's second largest ice sheet. This analysis includes the ice sheet fringe areas, which are expected to be much more climatically sensitive than the interior. Data will be presented which demonstrate the combination of the ATM (Airborne Topographic Mapper) sensors and GPS (Global Positioning System) yields measurements which are repeatable at the 10 cm level over baselines in excess of 1000 km.

Author

Elevation; Topography; Surveys; Ice Mapping; Greenland

20000110277 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA

FIDO/APEX/Athena-based Plans for Cartographic Products and Rover Localization Analyses

Arvidson, R., Washington Univ., USA; Squyres, S., Cornell Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In this abstract we preview the acquisition of stereo image data and resultant cartographic products and rover localization studies associated with the Athena Precursor Experiment (APEX) on the 2001 Mars Surveyor Lander and the Athena rover investigation on the Mars Sample Return (MSR) mission that begins in 2003. We also discuss ongoing experiments with the Field Integration Design and Operations (FIDO) Rover, developed by the Jet Propulsion Laboratory. Additional information is contained in the original extended abstract.

Author

Data Acquisition; Roving Vehicles; Planetary Mapping; X Ray Spectrometers

20000110301 Moscow State Univ., Geodesy and Cartography, Russia

Triaxial Ellipsoid as a Reference-Surface on Mars Mapping

Bugaevsky, L. M., Moscow State Univ., Russia; Shingareva, K. B., Moscow State Univ., Russia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

At the development of a mathematical basis of cartographic products the problems of selection of a reference-surface system, system of coordinates, and also selection and elaboration of cartographic projections are decided. The selection of a reference-surface, as a rule, is connected to use of some idealized (model) surface. At large-scale mapping of the very small areas for these purposes the plane approaches. However at increase of territories and application of middle, and especially of small scales, in which the celestial body is mapped as a whole, until recently it was considered sufficient to use a sphere of a given radius. Thus sup- posed, that the center of a reference-surface coincides center of mass of a planet or satellite, and polar axis coincides with rotation axis. For a long time during pre-space and transient periods of celestial bodies mapping the sphere remained practically unique model surface. With appearance of the new data updating the form and the sizes of the Solar system bodies other regular reference-surfaces came to use. First of all, a rotation ellipsoid having small polar compression (parameters of this ellipsoid were R(sub polar) = 3 376.3 km, R(sub equatorial) = 3 393.4 km) have applied to Mars. Then for the first time a triaxial ellipsoid was tested for Phobos. Last time some elements of mathematical base for irregular surfaces maximum approximated to an actual physical surface of the celestial bodies are developed. The strengthening of activity in researches of Mars gives the basis to suppose, that the flights to Mars will be regularly implement during nearest 10-15 years. In an outcome the large volume of information, both for researches generally, and for mapping of a planet, in particular, will be obtained. In this connection there is a problem on expediency for Mars at its mapping of transition from a rotation ellipsoid to a triaxial ellipsoid as a reference-surface. For the use of a triaxial ellipsoid, it is necessary to determine appropriate coordinate systems and to work out the theory and concrete formulae of projections for representation of a surface, to conduct calculation of their rectangular coordinates and characteristics, and also to analyze the calculated values, scales and distortions of an obtained projection. For the first time such development were made for the Moon. Then in full volume and at any polar and equatorial compression all these steps were made by development of an equiangular cylindrical and azimuthal projections of a triaxial ellipsoid for Phobos. The creation of Phobos map and Phobos globe was an outcome of this activity. Thus, some ways of determination of isometric coordinates of a surface of a triaxial ellipsoid are known, there are separate publications about separate projections of a triaxial ellipsoid and rules of the theory of distortions (disregarding of particular coordinate systems of considered surfaces). Recently it was offered the general theory of cartographic projections of regular surfaces including the generalized theory of cartographic projections of any regular surfaces, in which the projections of an ellipsoid of revolution and a sphere are determined as particular cases of the theory. The special attention in the theory should be given to consideration of such problems as the determination of isometric coordinates of regular surfaces, representation of infinitesimal trapezium of a triaxial ellipsoid on a plane, determination of partial scales of lengths and areas for projection, basic rules of the theory of distortions and conditions of representation of a surface of a triaxial ellipsoid on a plane and on a sphere, and also the theory of classes of projections in which the main formulae are given. We think expedient to take into account existing development connected to direct application of the theory of cartographic projections of regular surfaces, at scheduling on mapping of Mars.

Author

Mathematical Models; Planetary Mapping; Mars Surface; Cartesian Coordinates

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Ponds, Lakes, and Oceans: An Overview of Standing Bodies of Water on Mars

DeHon, R. A., University of Northeast Louisiana, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Wherever there is a surface flow of water across a previously uneroded surface there will be ponding in closed depressions. Lakes on Mars represent unique geological entities with unique geologic processes which produce distinctive landforms and distinctive sedimentary materials that record the history of the local environment. Additional information is contained in the original extended abstract.

Author

Geology; Mars Surface; Ponds

20000110327 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

MOLA: The Future of Mars Global Cartography

Duxbury, T. C., Jet Propulsion Lab., California Inst. of Tech., USA; Smith, D. E.; Zuber, M. T.; Frey, H. V.; Garvin, J. B.; Head, J. W.; Muhleman, D. O.; Pettengill, G. H.; Phillips, R. J.; Solomon, S. C.; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The MGS Orbiter is carrying the high-precision Mars Orbiter Laser Altimeter (MOLA) which, when combined with precision reconstructed orbital data and telemetered attitude data, provides a tie between inertial space and Mars-fixed coordinates to an accuracy of 100 m in latitude / longitude and 10 m in radius (1 sigma), orders of magnitude more accurate than previous global geodetic/ cartographic control data. Over the 2 year MGS mission lifetime, it is expected that over 30,000 MOLA Global Cartographic Control Points will be produced to form the basis for new and re-derived map and geodetic products, key to the analysis of existing and evolving MGS data as well as future Mars exploration. Additional information is contained in the original extended abstract.

Author

Mars Exploration; Mapping; Laser Altimeters; Coordinates

20000110330 Space Science Inst., Boulder, CO USA

Subpixel Detection and Mapping of Spectrally Unique Materials on Mars Using ISM Data

Farrand, William H., Space Science Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the primary goals in the exploration of Mars is the location of geologic deposits formed by, or associated with, liquid water. These types of deposits would include hot spring formed materials (silica and calcic sinters), cold spring formed materials (ferricretes, tufas, travertines), evaporites, carbonates, and mineral deposits formed by hydrothermal activity (containing sulfides, and sulfide alteration products). Many of these deposits, in particular spring-formed deposits, are spatially restricted in area. In fact, the ground instantaneous field of view (GIFOV) of current and planned Mars orbital multi- and hyperspectral sensors is greater than many of these types of deposits. Hence, in order to find these types of deposits using existing and planned sensors, sub-pixel detection techniques will be necessary. A number of techniques that can detect materials at spatial coverages of less than 10% of a pixel have been developed for terrestrial airborne multi- and hyperspectral sensors. These techniques can be applied against Mars multi- or hyperspectral data sets to very good effect. Anomalous pixels mapped with sub-pixel detection methods can be located on higher resolution panchromatic (Viking Orbiter or MGC MOC) imagery. In this paper the applicability of one of these techniques, Foreground / Background Analysis (FBA) will be tested against ISM data from the Phobos 2 mission. Additional information is contained in the original extended abstract.

Author

Detection; Mapping; Pixels; Geology; Mineral Deposits; Mars Exploration; Silicon Dioxide; Carbonates

20000110357 WNS GeoScience, Eltham, Australia

The Collapse Origin of Density Flows on Mars

Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The origin of outburst ”floods” on Mars is widely known to be associated with the collapsed chaos zones. Previous authors have concentrated on mechanisms for outbursts of water to provide the erosive and transport medium of the ”floods”. Within the White Mars paradigm it is now recognized that liquid water is an unlikely contributor to the flow and that gas-supported density flows are the most likely regime. In this section I discuss the failure mechanisms of layered regolith and the initial generation process for a gas-supported flow. Additional information is contained in the original extended abstract.
Author
Erosion; Failure; Gas Flow; Regolith; Water; Mars Surface

20000110359 WNS GeoScience, Eltham, Australia
Fluid-supported Density Flows on Earth and Mars, 1, Turbidite Analogs
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The similarity between terrestrial submarine turbidite flows and Martian outburst ”flood” channels has already been suggested, from the assumption that Mars’ lower gravity would be simulated by the buoyancy offered to sediment in a submarine flow. In this paper, the similarity is further explored from the different controlling principle that both are density flows involving an active fluid support. On Earth, that support comes from the water. On Mars, the fluid is gaseous CO2, liberated from icy regolith that is involved in the initial collapse event and subsequent transport. Examples of real Earth bathymetry are compared to Viking photomosaics in terms of scale, morphology, and process. Additional information is contained in the original extended abstract.
Author
Analogies; Bathymeters; Fluid Flow; Mars Surface; Morphology; Sediments

20000110360 WNS GeoScience, Eltham, Australia
Fluid-supported Density Flows on Earth and Mars, 2, Pyroclastic Analogs
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A number of authors have referred to the striking similarity between the surface deposits and morphology of Mars and those in terrestrial volcanic deposits such as pyroclastic flows and ignimbrite plains. That analogue has generally been discounted due to the lack of appropriate source vents for the material. Now that the White Mars paradigm explains the Amazonian outburst ”floods” as the generation of voluminous cold gas-supported density flows by catastrophic local collapse of layered icy regolith, the observational constraint is removed. Now, we understand that any locally steep terrain segment on Mars may potentially have given rise to these cryoclastic flows and can concentrate on the morphology and depositional textures of such flows. Additional information is contained in the original extended abstract.
Author
Analogies; Cold Gas; Fluid Flow; Gas Density; Mars Surface; Planetary Geology; Volcanoes; Earth (Planet)

20000110381 Geological Survey, Flagstaff, AZ USA
USGS Mapping of the Mars Pathfinder Landing Site: Progress and Plans
Kirk, R. L., Geological Survey, USA; Howington-Kraus, E., Geological Survey, USA; Hare, T., Geological Survey, USA; Barrett, J., Geological Survey, USA; Becker, K., Geological Survey, USA; Cook, D., Geological Survey, USA; Sucharski, T., Geological Survey, USA; Thompson, K., Geological Survey, USA; Blue, J., Geological Survey, USA; Galuszka, D., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This abstract describes progress in cartographic processing of data from the Imager for Mars Pathfinder (IMP) by the U. S. Geological Survey in the past year, and plans for advanced cartographic production. Additional information is contained in the original extended abstract.
Author
Mars Surface; Planetary Mapping; Topography; Mars Photographs; Mars (Planet)

20000110391 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institute of Space Sensr Technology and Planetary Exploration, Berlin, Germany

An Image Map of the Mars Pathfinder Landing Site

Kuschel, M., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Oberst, J., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Hauber, E., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Jaumann, R., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

On 4 July 1997, the Pathfinder spacecraft landed on Mars near the mouth of the outflow channel Ares Vallis, located in the southern part of Chryse Planitia. Between July 4 and September 27, 1997, the Imager for Mars Pathfinder (IMP) returned more than 16,000 single images including five panorama data sets. Depending on the degree of overlap, approximately 150 images of one filter form a complete monoscopic panorama. Here, we present the results of our efforts to compute a geometrically precise panoramic color image map and an ortho-image map of the landing site from these individual raw images. Printed versions of these maps will be presented at the meeting. Additional information is contained in the original extended abstract.

Author

Landing Sites; Maps; Mars Surface; Photomapping; Image Processing; Imaging Techniques; Mars (Planet); Planetary Mapping

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Global Mapping and Individual Map Sheets: The Topographic Image Map Series Mars 1:200 000

Lehmann, Hartmut, Technische Univ., Germany; Albertz, Joerg, Technische Univ., Germany; Waehlisch, Marita, Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Neukum, G., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

More than ever before the planet Mars is subject to exploration and mapping activities. Since 1992 the Technical University of Berlin was involved in the software development for photogrammetric and cartographic processing of image data of various planets and celestial bodies. As part of the camera experiment for the Mars96 Mission a digital production line for the Topographic Image Map Series Mars 1:200,000 was developed by the Technical University of Berlin in cooperation with German Aerospace Center (DLR), Berlin-Adlershof. With the disastrous accident of the Russian spacecraft Mars96 in November 1996, the entire project came to an abrupt end, a serious setback for the international research of our neighbouring Planet. Making use of the tremendous scientific achievements being invested in the German camera project a Topographic Image Map of the landing site of Mars Pathfinder was generated, based on existing Martian image data and latest scientific findings of the Mars Pathfinder Mission. Additional information is contained in the original extended abstract.

Author

Mars (Planet); Mars Surface; Planetary Mapping; Topography

20000110397 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

SSI/RAC: Imagers for Mars Polar Lander

Lemmon, M. T., Arizona Univ., USA; Yingst, R. A., Arizona Univ., USA; Reid, R. J., Arizona Univ., USA; Smith, P., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Volatiles and Climate Surveyor (MVACS) instrument payload on the Mars Polar Lander includes two imagers designed and constructed at the Lunar and Planetary Laboratory at the University of Arizona and the Max Planck Institute for Aeronomy. These are the Surface Stereo Imager (SSI) and the Robotic Arm Camera (RAC). These instruments will create a multispectral and visual record of the geology and environmental changes of the landing site and will document the progress of the mission. Additional information is contained in the original extended abstract.

Author

Cameras; Mars Polar Lander; Mission Planning; Mars Missions; Payload Integration

20000110414 Colorado Univ., Lab. for Atmospheric and Space Physics, Boulder, CO USA

High-Resolution Mapping of Thermal Inertia from Mars Global Surveyor Thermal Emission Spectrometer

Mellon, M. T., Colorado Univ., USA; Jakosky, B. M., Colorado Univ., USA; Kieffer, H. H., Geological Survey, USA; Christensen, P. R., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-

ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We use newly acquired Thermal Emission Spectrometer data from the Mars Global Surveyor spacecraft to derive and map the thermal inertia of the martian surface. Mapping mission data is providing a high spatial resolution of approx. 3 km (as apposed to approx. 100 km scale from Viking data analysis). This higher resolution will aid greatly in our understanding of the martian surface and geologic processes that act on similar scales. Additional information is contained in the original extended abstract. Author

Mapping; High Resolution; Thermal Emission; Mars Surface

20000110431 Colorado Univ., Cooperative Inst. for Research in Environmental Sciences, Boulder, CO USA

Multispectral Mapping of the Martian Polar Ice Caps

Nolin, A. W., Colorado Univ., USA; Farrand, W. H., Farr View Consulting, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Martian polar caps contain temporally and spatially varying amounts of water, CO2, and dust but the concentrations of these components are not well constrained. Improved estimates of the surface composition of the polar caps are needed for water, CO2, and dust budgets. Furthermore, accurate mapping of the layered terrains of the polar regions is also required for interpretation of geologic history. This new investigation, funded under the Mars Data Analysis Program (MDAP) will map the polar regions with a focus on providing better constraints on water ice, CO2 ice, and surface dust abundances. Additional information is contained in the original extended abstract.

Author

Mars Surface; Multispectral Photography; Ice; Polar Caps; Photomapping; Dust

20000110432 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Mars Surface Rock Abundance from Thermal Emission Spectrometer (TES)Mapping Data

Nowicki, S. A., Arizona State Univ., USA; Christensen, P. R., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The global abundance of rocks on the surface of Mars is being mapped using Thermal Emission Spectrometer (TES) data from the Mars Global Surveyor spacecraft in mapping orbit around Mars. The TES data can be directly compared to the Viking Infrared Thermal Mapper (IRTM) data previously used to map the abundance of rocks on Mars. TES provides hyperspectral information covering the 1700 to 200/ cm (wavenumber) range. The spatial resolution of TES data is an order of magnitude greater than IRTM, with a 3 km pixel at nadir, as compared to 30 km resolution in the IRTM observations. The method used to determine rock abundance in TES data is the same as was used on IRTM data, with only minor variations due to the different data type. The higher resolution rock abundance data should be able to differentiate surfaces of varying rock abundance on a scale that is comparable to geomorphic features observed in orbiter imagery. Due to the fact that previous rock abundance mapping was done with a different data type than is being returned from the TES instrument, a comparison of data is made here to show the variation and the steps that have been taken to produce a map that is more sensitive to surface rocks, and less subject to atmospheric and surface emissivity problems. Additional information is contained in the original extended abstract.

Author

Emissivity; Geomorphology; Mars Surface; Rocks; Thermal Mapping

20000110433 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Inst. of Space Sensor Technology and Planetary Exploration, Berlin, Germany

Geometrically Precise Maps and Their Applications

Oberst, J., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Zeitler, W., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Kuschel, M., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Jaumann, R., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We reanalyzed the Viking Mars control point network, an effort, which resulted in accurate pointing data for a list of 1138 Viking Orbiter images. From these images, which have resolutions between 900-1100 m, we derived maps at local, regional, and global scale tied to the Mars coordinate system with an accuracy of approx. 1-2 km. These maps exceed the geometric precision

of previous cartographic products by an order of magnitude (see companion abstract) and therefore constitute important bases for a variety of further geoscientific studies. Additional information is contained in the original extended abstract.
Author
Viking Mars Program; Precision; Mars Photographs; Mapping; Coordinates

20000110456 NASA Ames Research Center, Moffett Field, CA USA
Stereogrammetric Mapping of Mars: Promise, Progress, and Problems
Schenk, P. M., Lunar and Planetary Inst., USA; Moore, J. M., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

To assist in landing site selection, we are compiling a suite of stereo images of potential land-ing sites for the 1998 and 2001 Mars landers. From these, we are using automated stereogrammetry software to map the topography of these sites at higher resolution than previously available. One our tasks is to integrate stereo-based topography with MGS MOLA laser-based topography. These two data sets compliment each other and can lead to a higher level of understanding of Mars than would use of either dataset by itself. In this presentation, we report on the success of these efforts, and some of the lessons learned. Additional information is contained in the original extended abstract.
Author
Mapping; Planetary Mapping; Stereophotography; Mars Landing

20000110467 NASA Ames Research Center, Moffett Field, CA USA
Visualizing Mars Using Virtual Reality: A State of the Art Mapping Technique Used on Mars Pathfinder
Stoker, C., NASA Ames Research Center, USA; Zbinden, E., NASA Ames Research Center, USA; Blackmon, T., NASA Ames Research Center, USA; Nguyen, L., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We describe an interactive terrain visualization system which rapidly generates and interactively displays photorealistic three-dimensional (3-D) models produced from stereo images. This product, first demonstrated in Mars Pathfinder, is interactive, 3-D, and can be viewed in an immersive display which qualifies it for the name Virtual Reality (VR). The use of this technology on Mars Pathfinder was the first use of VR for geologic analysis. A primary benefit of using VR to display geologic information is that it provides an improved perception of depth and spatial layout of the remote site. The VR aspect of the display allows an operator to move freely in the environment, unconstrained by the physical limitations of the perspective from which the data were acquired. Virtual Reality offers a way to archive and retrieve information in a way that is intuitively obvious. Combining VR models with stereo display systems can give the user a sense of presence at the remote location. The capability, to interactively perform measurements from within the VR model offers unprecedented ease in performing operations that are normally time consuming and difficult using other techniques. Thus, Virtual Reality can be a powerful a cartographic tool. Additional information is contained in the original extended abstract.
Author
Display Devices; Geology; Mapping; Virtual Reality

20000110504 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Inst. of Space Sensor Technology and Planetary Exploration, Berlin, Germany
A New Viking-based Precise Global Map of Mars
Zeitler, W., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Niedermaier, G., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Oberst, J., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Hauber, E., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Jaumann, R., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We present a new global map of Mars based on images taken by the Viking Orbiters. Precise image position information and camera pointing data, needed to produce this map, were derived from a recent analysis of the Viking control point network. The resulting cartographic product is precisely tied to the Mars-fixed coordinate system with an accuracy of approx. 1-2 km, on average - and does not suffer from the severe geometric offsets of previous planetary cartographic products.
Author
Mars Surface; Mars (Planet); Planetary Mapping; Planetary Geology

20000110505 NASA Ames Research Center, Moffett Field, CA USA

An Open, Snow-based Hydrologic System on Noachian Mars

Zent, A. P., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Properties of Noachian valley networks on Mars suggest that the conditions under which they formed were marginal for liquid water formation. The networks are sparsely scattered, poorly dissected, and tend to be small; a majority occupy areas only a few hundred kilometers in extent. Models in which networks formed by mass wasting are contra-indicated by the discovery of channels within the valleys. Greenhouse hypotheses for the stability of liquid water have foundered on familiar problems: first, a very substantial CO2 atmosphere would be required to bring global average conditions to 273 K; the CO2 should still be present in extensive carbonate deposits that have not been detected. Explanations that call upon groundwater sapping are hampered by the need for a hydrologic system to recharge the groundwater system, which effectively reinstates the need for a heavy CO2 atmosphere. Based upon field experience and geomorphic similarities between drainage developed in the periglacial terrain in and around the Haughton impact structure, Devon Island, Nuunavuut, Canada, we have suggested that some of the channel networks may have formed either subglacially, or as ice marginal structures.

Derived from text

Mars Surface; Water; Geomorphology; Snow; Mars (Planet); Mars Atmosphere; Planetary Geology

20000110508 NASA Goddard Space Flight Center, Greenbelt, MD USA

Driving Stresses in Mars Polar Ice Caps and Conditions for Ice Flow

Zwally, H. Jay, NASA Goddard Space Flight Center, USA; Saba, Jack L., NASA Goddard Space Flight Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Measurements of the topography of the North polar ice cap by the Mars Orbiter Laser Altimeter (MOLA) show that the ice cap is 2950 +/- 200 meters thick. The volume of the cap is about 1.2 x 10(exp 6) cu km covering an area of 1.04 x 10(exp 6) sq km, which is about 40 percent of the Greenland ice sheet in volume and 62 percent in area. The composition of the Northern cap was previously concluded to be predominately H2O, rather than CO2 ice, based on thermodynamic considerations of the insustainablity of CO2 during summer. Principal questions about the cap are: does the ice move and at what rate, is the cap currently growing or depleting in volume, and how and when was the cap formed? Recent research on terrestrial ice sheets indicates that rates of ice deformation at the low stress values characteristic of ice sheets are significantly higher than the rates given by the classic viscous-plastic flow laws commonly used.

Derived from text

Polar Caps; Mars Surface; Deformation; Ice; Mars (Planet); Water

20000110581 Alabama Univ., Dept. of Engineering, Huntsville, AL USA

Thermographic Data Analyses for Karst Watersheds

Campbell, C. Warren, Alabama Univ., USA; [2001]; 1p; In English; 8th; Sinkholes and Engine Environmental Impact of karst, Apr. 2001, Louisville, KY, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Aerial thermography is an emerging technology unsurpassed for locating groundwater discharges. Thermography can be used to locate submerged discharges that are extremely difficult to find by other means. In two large projects, thermography was used to identify almost every significant spring at sites underlain by karst aquifers. This technology effectively converts Brown's Type 5 topology to types 1 or 2 (all discharges known), which has a significant impact on dye tracing. At a north Alabama site, springs located by thermography quadrupled the known groundwater discharge in and around the site. For submerged discharges, thermographic temperatures can be measured down the center of the groundwater plume that rises to the surface in the winter. Using the Cornell Mixing (CORMIX) model, flow rate for one submerged spring was estimated. Once identified, estimates of spring recharge area were desired. The size of the area of recharge was estimated by hydrograph separation of flow data from nearby, unregulated surface streams. Monthly recharge estimates were also made and used to show that in north Alabama the mean annual recharge/discharge occurs during May and December. Spring flow measurements for the same county of north Alabama were averaged to obtain mean flows. Then measurements for May only, were averaged. The two averages usually agreed to within 20 percent. This provides evidence that hydrograph separation determinations of recharge are valid.

Author

Data Processing; Karst; Thermography; Watersheds

20000114850 NASA Goddard Space Flight Center, Greenbelt, MD USA

A New Fast Algorithm to Completely Account for Non-Lambertian Surface Reflection of The Earth

Qin, Wen-Han, Raytheon Information Technology and Scientific Services, USA; Herman, Jay R., NASA Goddard Space Flight Center, USA; Ahmad, Ziauddin, Systems and Applied Sciences Corp., USA; [2000]; 32p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Surface bidirectional reflectance distribution function (BRDF) influences not only radiance just about the surface, but that emerging from the top of the atmosphere (TOA). In this study we propose a new, fast and accurate, algorithm CASBIR (correction for anisotropic surface bidirectional reflection) to account for such influences on radiance measured above TOA. This new algorithm is based on a 4-stream theory that separates the radiation field into direct and diffuse components in both upwelling and downwelling directions. This is important because the direct component accounts for a substantial portion of incident radiation under a clear sky, and the BRDF effect is strongest in the reflection of the direct radiation reaching the surface. The model is validated by comparison with a full-scale, vector radiation transfer model for the atmosphere-surface system. The result demonstrates that CASBIR performs very well (with overall relative difference of less than one percent) for all solar and viewing zenith and azimuth angles considered in wavelengths from ultraviolet to near-infrared over three typical, but very different surface types. Application of this algorithm includes both accounting for non-Lambertian surface scattering on the emergent radiation above TOA and a potential approach for surface BRDF retrieval from satellite measured radiance.

Author

Lambert Surface; Spectral Reflectance; Surface Properties; Distribution Functions; Algorithms; Radiance

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ENERGY PRODUCTION AND CONVERSION

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

20000110540 Middle Tennessee State Univ., Dept. of Chemistry, Murfreesboro, TN USA

Analysis of contamination on Solar Panels Returned from the Mir Space Station

Wilson, Linda A., Middle Tennessee State Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 80; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A segment of a solar array consisting of eight panels was removed from the Mr core module by cosmonauts, packaged in a protective bag, and returned by the space shuttle for analysis. After approximately ten years of space exposure in low Earth orbit, the segment was of interest for performance evaluation, micrometeoroid and orbital debris impact study and molecular contamination analyses. One panel was sent to NASA for analysis.

Derived from text

Contamination; Mir Space Station; Solar Cells; Solar Arrays; Chemical Analysis

20000112877 NASA Marshall Space Flight Center, Huntsville, AL USA

The 1999 NASA Aerospace Battery Workshop

Brewer, J. C., Compiler, NASA Marshall Space Flight Center, USA; May 2000; 610p; In English; 32nd; Aerospace Battery, 16-18 Nov. 1999, Huntsville, AL, USA; Sponsored by NASA, USA; See also 20000112878 through 20000112904

Report No.(s): NASA/CP-2000-209959; M-963; NAS 1.55:209959; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This document contains the proceedings of the 32nd annual NASA Aerospace Battery Workshop, hosted by the Marshall Space Flight Center on November 16-18, 1999. The workshop was attended by scientists and engineers from various agencies of the US Government, aerospace contractors, and battery manufacturers, as well as international participation in like kind from a number of countries around the world. The subjects covered included nickel-hydrogen, nickel-cadmium, lithium-ion, and silver-zinc technologies.

Derived from text

Conferences; Electric Batteries

20000112878 National Space Development Agency, Electronic and Information Technology Dept., Tsukuba, Japan

Status of the Space Battery R and D at Tsukuba Space Center, NASDA

Sone, Y., National Space Development Agency, Japan; Suzuki, T., National Space Development Agency, Japan; Liu, X., National Space Development Agency, Japan; Kusawake, H., National Space Development Agency, Japan; Kanno, K., National Space Development Agency, Japan; Kuwajima, S., National Space Development Agency, Japan; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 3-29; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the status of space batteries at National Space Development Agency. The common pressure vessel type Ni-H2 battery, the advanced Ni-Cd battery, and the lithium ion secondary cell battery are discussed. Details are included for specifications on capacity, energy density, total weight, total size, and permitted temperature. Test results are shown for the test sample, simulated orbit, charge and discharge time, depth of discharge, ambient temperature, charge and discharge current, and number of cells with series connections.

CASI

Electric Charge; Spacecraft Power Supplies; Performance Tests; Nickel Hydrogen Batteries; Nickel Cadmium Batteries; Lithium Batteries

20000112879 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Summary of JPL Activities

Timmerman, Paul J., Jet Propulsion Lab., California Inst. of Tech., USA; Surampudi, Subbarao, Jet Propulsion Lab., California Inst. of Tech., USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 31-64; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the Jet Propulsion Laboratory (JPL) flight programs, including past, present and future missions targeting Solar System exploration. Details, including launch dates and batteries used, are given for Deep Space 1 (Asteroid Rendezvous), Deep Space 2 (Mars Penetrator), Mars Global Surveyor, Mars Surveyor '98, Stardust, Europa Orbiter, Mars Surveyor 2001, Mars 2003 Lander and Rover, and Genesis (Solar Dust Return). Earth science projects are also outlined: Active Cavity Radiometer Irradiance Monitor (ARIMSAT), Ocean Topography Experiment (TOPEX/Poseidon), Jason-1 (TOPEX follow-on), and QuikScat/Seawinds (Ocean Winds Tracking). The status, background, and plans are given for several batteries: (1) 2.5 inch common pressure vessel (CPV), (2) 3.5 inch CPV, (3) Ni-H2, and (4) Li-Ion.

CASI

Spacecraft Power Supplies; Nickel Hydrogen Batteries; Lithium Batteries; Nickel Cadmium Batteries; Energy Storage

20000112880 NASA Goddard Space Flight Center, Greenbelt, MD USA

In-Orbit Earth Radiation Budget Satellite (ERBS) Battery Switch

Ahmad, Anisa, NASA Goddard Space Flight Center, USA; Enciso, Marlon, NASA Goddard Space Flight Center, USA; Rao, Gopalakrishna, NASA Goddard Space Flight Center, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 65-85; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the Earth Radiation Budget Satellite (ERBS) power system and battery history. ERBS spacecraft and battery cell failures are listed with the reasons for failure. The battery management decision and stabilization of the batteries is discussed. Present battery operations are shown to be successful.

CASI

Failure; Spacecraft Power Supplies; Switching; Nickel Cadmium Batteries; Power Efficiency

20000112881 NASA Marshall Space Flight Center, Huntsville, AL USA

Super Capacitor Development At NASA MSFC

Hall, David K., NASA Marshall Space Flight Center, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 87-109; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines super capacitor development at NASA Marshall Space Flight Center. The concept, proof of concept testing and the test set-ups are described. An overview of super capacitor classification is shown and several types of capacitors are detailed: Ni-C chemical double layer (CDL), Ru-Oxide pseudo-cap, and a Ru-Oxide 2 F 30 V capacitor.

CASI

Capacitors; Capacitance; Performance Tests

20000112882 NASA Johnson Space Center, Houston, TX USA

Calorimetric Measurements on a 32 Ah Li/MnO2 Cell for the X-38 Crew Return Vehicle

Darcy, Eric, NASA Johnson Space Center, USA; Johnson, Chris, Boeing Co., USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 111-130; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the batteries used for the X-38 crew return vehicle. Three battery systems are described: the 350 Ah Li/MnO2 battery module, the Li/MnO2 cell battery, and the battery string of 12 cells. First thermal vacuum test results are shown, and improvements for the battery thermal design are discussed. Preliminary findings for tests and future work are described.

CASI

Heat Measurement; Lithium Batteries; Spacecraft Power Supplies; Performance Tests

20000112883 Loral Skynet, Bedminster, NJ USA

Low Temperature Performance of Two Nickel Hydrogen Designs

Maurer, Dean W., Loral Skynet, USA; See, Dawn M., Imperial Coll. of Science, Technology and Medicine, UK; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 131-135; In English; See also 20000112877; Sponsored in part by Office of Research and Development, USA Government; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

The Telstar 5, 6 & 7 spacecraft owned and operated by Loral Skynet and built by Space Systems/Loral utilize the patented 3 Loral ”Cold Charge” protocol in their battery operation. This protocol provides an approximately 25 percent capacity enhancement by charging at a very low temperature and subsequently discharging while ramping the temperature up from the end of charge temperature to as high as 30 C. It was of interest to measure the relative effects of the low temperature charge and the temperature-ramped discharge on flight-quality cells of the two different cell designs used in the Telstar 4 program where this protocol is not used. The Telstar 401 cell is a conventional 3.5 inch communications satellite (COMSAT) design (50 AH) with asbestos separators and the Telstar 402R cell is a 3.5” modified Mantech design (45 AH) with a single layer of Zircar separator. The cell cycling facility used for the experimental work was designed and built some years ago by the AT&T Bell Labs (when Skynet was part of AT&T) for life testing of Telstar battery cells. When Skynet became part of Loral, this facility was donated to the University of South Carolina (USC). The work was carried out by one of us as part of a graduate study program. The data were also intended for use in model verification of the USC first-principles nickel-hydrogen cell model.

Author

Temperature Effects; Performance Tests; Nickel Hydrogen Batteries; Spacecraft Power Supplies

20000112884 Eagle-Picher Technologies, LLC, Joplin, MO USA

High DoD LEO Life Cycle Testing

Dermott, Jeff, Eagle-Picher Technologies, LLC, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 139-151; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the background, test set-up and test results for high depth of discharge (DOD) cells. The life test cycle regime is discussed, and the cells used in the test are described. Life test data is charted using capacity loss and cycle number and capacity data for the cells is given.

CASI

Life (Durability); Electric Discharges; Performance Tests; Nickel Hydrogen Batteries

20000112885 TRW Space and Electronics Group, Redondo Beach, CA USA

Launch and Early Orbit Phase Simulation Tests on Nickel Hydrogen Batteries

Johnson, P. J., TRW Space and Electronics Group, USA; Donley, S. W., TRW Space and Electronics Group, USA; Starritt, B., TRW Space and Electronics Group, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 153-170; In English; See also 20000112877; Sponsored in part by USA Government; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A series of experiments has been carried out with the objective of evaluating the performance of nickel-hydrogen batteries for a variety of scenarios that may be encountered pre-launch and during the early phases of launch and transfer orbit. Temperature of the battery was found to be a critical parameter. Excessive overcharge was found to be of no benefit for subsequent battery performance.

Author

Nickel Hydrogen Batteries; Computerized Simulation; Spacecraft Power Supplies; Performance Tests

20000112886 TRW Space and Electronics Group, Redondo Beach, CA USA

EOS-PM Nickel-Hydrogen Cell Initial Life Test Report

Tobias, R. F., TRW Space and Electronics Group, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 171-192; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the power sources for the descending node Earth Observing System (EOS-PM) spacecraft and its configuration. Details are given on the electrical power system and battery assembly. The cell design is pictured and described for the NiH2 160 AH cell. Experimental design, setup, and conditions are discussed and test results are shown.

CASI

Earth Observing System (EOS); Experiment Design; Nickel Hydrogen Batteries; Performance Tests; Spacecraft Power Supplies

20000112887 Eagle-Picher Technologies, LLC, Joplin, MO USA

High Conductivity Composite Sleeves for Nickel Hydrogen Cells

Snyder, K. C., Eagle-Picher Technologies, LLC, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 193-212; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This document is a viewgraph presentation which reviews the program to design, fabricate, and test high conductivity composite battery sleeves for rechargeable Nickel-Hydrogen batteries. The sleeves are made of K1100 with an Aluminum collar, which will result in a 330 g/sleeve weight savings over other types of sleeves. Graphs show the results of the test program. Illustrations show the makeup of the sleeves and show the set up prior to each of the tests. The three tests performed were a thermal vacuum test, a vibration test, and a DC isolation test.

CASI

Sleeves; Thermal Vacuum Tests; Vibration Tests

20000112888 Eagle-Picher Technologies, LLC, Joplin, MO USA

Progress in the Development of 5.5 Inch Nickel Hydrogen Battery Cells

Brill, Jack N., Eagle-Picher Technologies, LLC, USA; Brown, Robert, Eagle-Picher Technologies, LLC, USA; Sill, Fred, Eagle-Picher Technologies, LLC, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 213-228; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This document reviews the progress made in the design and fabrication of a 5.5 Inch Nickel Hydrogen Battery Cell. The design of the 5.5 inch cell is reviewed, and a table with the physical characteristics in included. Graphs of the charge and discharge curves are shown. The lifecycle testing is reviewed. This document is in viewgraph format.

CASI

Nickel Hydrogen Batteries; Performance Tests; Service Life; Life (Durability)

20000112889 Communications Satellite Corp., Clarksburg, MD USA

Dependence of Positive Plate Design and Temperature on the Performance of Nickel-Hydrogen Cells

Vaidyanathan, Hari, Communications Satellite Corp., USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 231-247; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This document is a viewgraph presentation which outlines the experiment and the results of tests to determine the dependence of positive plate design and temperature on the performance of Nickel-Hydrogen cells. Graphics include charts of voltage profiles in the overcharge region, pressure profile during extended charge at C/10, variations in End-of Discharge voltage, capacity variations with cycling, KOH absorbed and performance, tables with positive plate analysis comparison,capacity and voltage at low temperatures, capacity obtained at C/2 discharge at 10 C.

CASI

Electric Potential; Nickel Hydrogen Batteries; Temperature Effects; Charge Efficiency

20000112890 Naval Surface Warfare Center, Crane, IN USA

Comparison of Separation Performance for Four Variables in Rechargeable Silver/Zinc Cells

Lewis, Harlan, Naval Surface Warfare Center, USA; Caldwell, Norris, Naval Surface Warfare Center, USA; Himy, Albert, McMullen (John J.) Associates, Inc., USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 249-273; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The scope of this viewgraph presentation is to review cycle and wet life evaluations of model rechargeable Ag/Zn Cell separations. The intent of the work was to evaluate four parameters: (1) Split vs. Standard Separation Wrap, (2) Polyvinyl Alcohol (PVA)

Film for silver migration barrier, (3) PVA coating for silver migration barrier (4) Zircar as a substitute for asbestos as a fire retardant.
CASI
Polyvinyl Alcohol; Silver Zinc Batteries; Performance Tests

20000112891 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Thermal Aspects of Lithium Ion Cells
Frank, H., Jet Propulsion Lab., California Inst. of Tech., USA; Shakkottai, P., Jet Propulsion Lab., California Inst. of Tech., USA; Bugga, R., Jet Propulsion Lab., California Inst. of Tech., USA; Smart, M., Jet Propulsion Lab., California Inst. of Tech., USA; Huang, C. K., Jet Propulsion Lab., California Inst. of Tech., USA; Timmerman, P., Jet Propulsion Lab., California Inst. of Tech., USA; Surampudi, S., Jet Propulsion Lab., California Inst. of Tech., USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 275-286; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This viewgraph presentation outlines the development of a thermal model of Li-ion cells in terms of heat generation, thermal mass, and thermal resistance. Intended for incorporation into battery model. The approach was to estimate heat generation: with semi-theoretical model, and then to check accuracy with efficiency measurements. Another objective was to compute thermal mass from component weights and specific heats, and to compute the thermal resistance from component dimensions and conductivities. Two lithium batteries are compared, the Cylindrical lithium battery, and the prismatic lithium cell. It reviews methodology for estimating the heat generation rate. Graphs of the Open-circuit curves of the cells and the heat evolution during discharge are given.
CASI
Lithium Batteries; Mathematical Models

20000112892 Eagle-Picher Technologies, LLC, Advanced Electrochemical Systems Operation, Joplin, MO USA
Pulse Testing of the Eagle-Picher Lithium-Ion System
Kelly, Chad, Eagle-Picher Technologies, LLC, USA; Parmley, Beth, Eagle-Picher Technologies, LLC, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 287-301; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This viewgraph presentation reviews the pulse tests of Lithium ion cells. Lithium ion cells are very well suited to pulsing type loads.The tests were aimed at demonstrating pulse capabilities of the lithium-ion system, and compare pulse results of small cells to those of medium cells. The tests also evaluated the ultrasonic weld versus the pop rivet. The results of the test are shown in graphs. The tests demonstrated that Medium size cells (20 Ah) have overall lower resistance than small cells (250 mAh), but their resistance is more sensitive to the State of Charge (SOC). The tests also revealed that pop riveted and ultrasonic welded cells perform similarly under pulse loads.
CASI
Lithium Batteries; Storage Batteries; Pulse Charging; Performance Tests

20000112893 NASA Goddard Space Flight Center, Greenbelt, MD USA
Lithium-Ion Cell Storage Study
Lee, Leonine, NASA Goddard Space Flight Center, USA; Rao, Gopalkrishna M., NASA Goddard Space Flight Center, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 303-316; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This viewgraph presentation reviews the issues concerning storage of lithium ion batteries. The presentation outlines tests used to establish a best long term storage for the lithium ion cells. Another objective of the study was to determine the preferred solstice condition for the lithium ion chemistry (polymer and liquid electrolyte). It also compared voltage clamped with trickle charge storage. The tests and results are reviewed
CASI
Lithium Batteries; Storage; Performance Tests

20000112894 NASA Johnson Space Center, Houston, TX USA
Engineering and Abuse Testing of Panasonic Lithium-Ion Battery and Cells
Jeevarajan, Judith A., Lockheed Martin Space Operations, USA; Bragg, Bobby J., NASA Johnson Space Center, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 317-348; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This viewgraph presentation reviews the performance testing of Lithium Ion batteries and cells under different conditions of charge and discharge. The tests show that the 0.5 C rate of charge and discharge might be the ideal condition for long term cycling. It reviews the issues of overcharge and overdischarge of the cells. The cells and the battery have adequate protection under both conditions to prevent any catastrophic occurrences. Temperatures above 150 C are required to vent the cells or cause a thermal runaway, Since this situation is non-credible in the cabin of the Space Shuffle or ISS this should not pose a problem. The presentation includes graphs and charts showing the charge and discharge capacities of the battery and also the current and voltage profiles. A view of a circuit board which contains the controlling mechanism for the battery is also shown.
CASI
Performance Tests; Lithium Batteries; Electric Current; Electric Potential; Charge Efficiency; Storage Batteries

20000112895 TRW Space and Electronics Group, Redondo Beach, CA USA
Characterization and Simulated LEO Cycling of STRV Lithium-Ion Battery Modules
Lurie, Chuck, TRW Space and Electronics Group, USA; Johnson, Philip, TRW Space and Electronics Group, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 351-367; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the testing of Li-ion battery modules. Test equipment is shown and a test plan is described. Charge acceptance results are graphed as well as internal resistance. Simulated low Earth orbit (LEO) cycling results are discussed for different temperatures and varying pack numbers (six-cell pack, two-cell pack, single cell pack). A six-cell pack dispersion analysis is shown.
CASI
Characterization; Lithium Batteries; Performance Tests; Electric Charge

20000112896 Societe des Accumulateurs Fixes et de Traction, Defense and Space Div., Poitiers, France
SAFT Space Li-Ion Development Status
Borthomieu, Yannick, Societe des Accumulateurs Fixes et de Traction, France; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 369-409; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the industrial space Li-ion cell development and tests in progress. Prototype cell and industrial cell developments are described. The Li-ion cell specifications are listed and test results are shown for energy versus intensity. The geosynchronous Earth orbiting telecommunication satellite for in-orbit new technology testing (GEO STENTOR) cycling is discussed and test results for voltage versus cycles are graphed. The results for the Li-ion first cycle is presented for tests including cell voltage, negative capacity loss impact, cycling laws, life time evaluation, and internal resistance increase impact. The Calendar Effect Law and model results are shown.
CASI
Spacecraft Power Supplies; Lithium Batteries; Electrolytic Cells; Performance Tests; Life (Durability)

20000112897 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Performance Characteristics of Lithium-Ion Prototype Batteries for Mars Surveyor Program 2001 Lander
Smart, M. C., Jet Propulsion Lab., California Inst. of Tech., USA; Ratnakumar, B. V., Jet Propulsion Lab., California Inst. of Tech., USA; Whitcanack, L., Jet Propulsion Lab., California Inst. of Tech., USA; Surampudi, S., Jet Propulsion Lab., California Inst. of Tech., USA; Byers, J., Lockheed Martin Astronautics, USA; Marsh, R. A., Department of the Air Force, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 411-454; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the scientific payload, expected launch date and tasks, and an image of the Mars Surveyor 2001 Lander components. The Lander's battery specifications are given. The program objectives for the Li-ion cells for the Lander are listed, and results performance evaluation and cycle life performance tests are outlined for different temperatures. Cell charge characteristics are described, and test data is presented for charge capacity at varying temperatures. Capacity retention and storage characteristics tests are described and results are shown.
CASI
Evaluation; Performance Tests; Prototypes; Lithium Batteries; Spacecraft Power Supplies

20000112898 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Performance Characteristics of Lithium Ion Prototype Cells for 2003 Mars Sample Return Athena Rover
Ratnakumar, B. V., Jet Propulsion Lab., California Inst. of Tech., USA; Smart, M. C., Jet Propulsion Lab., California Inst. of Tech., USA; Ewell, R., Jet Propulsion Lab., California Inst. of Tech., USA; Surampudi, S., Jet Propulsion Lab., California Inst. of Tech.,

USA; Marsh, R. A., Department of the Air Force, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 455-494; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the mission objectives and power subsystem for the Mars Sample Return (MSR) Athena Rover. The NASA-DOD (depth of discharge) Interagency Li Ion program objectives are discussed. Evaluation tests performed at JPL are listed, and test results are shown for the Li-Ion cell initial capacity, charge/discharge capacity, voltage and ratio, specific energy, watt-hour efficiency, and cell voltage at various temperatures.

CASI

Lithium Batteries; Electrolytic Cells; Temperature Effects

20000112899 Eagle-Picher Technologies, LLC, Advanced Electrochemical Systems Operation, Joplin, MO USA

Development of a 70 Ah Li-Ion Cell for Aerospace Applications

DeGruson, Jim, Eagle-Picher Technologies, LLC, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 495-514; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the development of Li-ion cells at the Li-Ion Technology Center in Missouri. The Li-ion test area is described, as well as the aerospace design and cell construction equipment. Test results are shown for typical charge and discharge, pulse test, and calculated impedance at various temperatures. Near future activities are discussed, including the incorporation of an alternate electrolyte and the optimization of the anode and cathode.

CASI

Electrolytes; Impedance; Electrolytic Cells; Lithium Batteries

20000112900 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA

Computational Fluid Dynamics Modeling of Nickel Hydrogen Batteries

Cullion, R., Pennsylvania State Univ., USA; Gu, W. B., Pennsylvania State Univ., USA; Wang, C. Y., Pennsylvania State Univ., USA; Timmerman, P., Jet Propulsion Lab., California Inst. of Tech., USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 517-535; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

An electrochemical Ni-H2 battery model has been expanded to include thermal effects. A thermal energy conservation equation was derived from first principles. An electrochemical and thermal coupled model was created by the addition of this equation to an existing multiphase, electrochemical model. Charging at various rates was investigated and the results validated against experimental data. Reaction currents, pressure changes, temperature profiles, and concentration variations within the cell are predicted numerically and compared with available data and theory.

Author

Computational Fluid Dynamics; Nickel Hydrogen Batteries; Temperature Effects; Thermal Energy; Conservation Equations; Models

20000112901 Aerospace Corp., Energy Technology Dept., El Segundo, CA USA

Validation of the Static Model for Nickel-Hydrogen Cells

Thaller, Lawrence H., Aerospace Corp., USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 537-552; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation with narrative outlines the basics of static models and a model for Ni-H cells. Applications for a validated model are discussed, including the major assumptions of the model and an overview of earlier NASA studies on distribution and partitioning of the electrolyte. Details are given on checking and early attempts to validate the model and the steps taken in upgrading the model are shown. The sources of data for this study and the components that were studied are described. Test results of compression studies are shown.

CASI

Electrolytes; Static Models; Nickel Hydrogen Batteries; Compression Tests

20000112902 Eagle-Picher Technologies, LLC, Joplin, MO USA

Nickel-Hydrogen Life Modeling

Brown, Robert A., Eagle-Picher Technologies, LLC, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 553-565; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the Ni-H system and life test data. Test parameters are listed and test data is given on 60 percent depth of discharge voltage, capacity fade versus cycle life, sample mission requirements, and the rundown effect on state of charge. Revised mission requirements are described and a revised life modeling table is presented.
CASI
Nickel Hydrogen Batteries; Life (Durability); Electric Potential; Models; Service Life

20000112903 TRW Space and Electronics Group, Redondo Beach, CA USA
Nickel-Hydrogen Cell Positive Precharge Signatures
Lurie, Chuck, TRW Space and Electronics Group, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 567-584; In English; See also 20000112877; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A viewgraph presentation outlines the positive precharge characterization. The composition of precharge cells is discussed, detailing the possible balances of nickel and hydrogen electrode capacities. NiH2 cell chemistry equations are presented and the verification of nickel precharge (or preparation for storage) is described. Test results are shown for discharge into reversal for hydrogen and nickel precharge as well as results for precharge verification for H and Ni. A precharge history is graphed for a 22-cell 40Ah battery.
CASI
Characterization; Signatures; Nickel Hydrogen Batteries; Charge Efficiency

20000112904 Loral Skynet, Bedminster, NJ USA
Strain Gage Effect and the Van Der Waals' Equation
Maurer, Dean W., Loral Skynet, USA; The 1999 NASA Aerospace Battery Workshop; May 2000, pp. 585-590; In English; See also 20000112877; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

One of the many advantages of the nickel hydrogen battery is that it provides a direct and continuous measure of its available capacity. Since hydrogen gas is the active material of the negative electrode and its pressure is a direct measure of its quantity (with certain restrictions to be discussed later), a simple measurement of the pressure and temperature can be converted to capacity available (assuming an offset for the pressure remaining at cut-off). The pressure is measured with a strain gage which is bonded to the dome of the pressure vessel and responds to the microscopic reversible bulging of the dome with pressure (the cell wall is only 0.024" thick). In addition since hydrogen gas obeys Faraday's law and well known equations of state (gas laws), measures of the rate of change of pressure can be used to derive other parameters such as power levels or currents during charge and discharge. In attempting to do this for Telstar batteries, it became apparent that the strain gage output itself varied with temperature. This paper describes methods used to determine the cell free volume and to calibrate the strain gages for temperature effects.
Author
Calibrating; Nickel Hydrogen Batteries; Strain Gages; Temperature Effects

45
ENVIRONMENT POLLUTION

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

20000109885 Societe Francaise des Thermiciens, Chatenay-Malabry, France
Dispersion of effluents in the atmosphere
Dec. 31, 1998; 24p; In French; In English
Report No.(s): DE99-750728; ETDE-FR-99750728; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This conference day was organized by the 'convection' section of the French association of thermal engineers with the support of the environment and energy mastery agency (ADEME). This book of proceedings contains 10 papers entitled: 'physical modeling of atmospheric dispersion in wind tunnels. Some industrial examples'; 'modeling of the noxious effects of a fire on the environment of an industrial site: importance of thermal engineering related hypotheses'; 'atmospheric diffusion of a noxious cloud: fast evaluation method of safety areas around refrigerating installations that use ammonia'; 'modeling of atmospheric flows in urban areas in order to study the dispersion of pollutants'; 'use of a dispersion parameter to characterize the evolution of a diffusion process downstream of a linear source of passive contaminant placed inside a turbulent boundary layer'; 'elements of reflexion around the development of an analytical methodology applied to the elaboration of measurement strategies of air quality in ambient and outdoor atmospheres around industrial sites'; 'state-of-the-art about treatment techniques for VOC-rich gaseous effluents'; 'characteristics of the time variation of the atmospheric pollution in the Paris region and visualization of its space

distribution'; 'mass-spectrometry for the measurement of atmospheric pollutants'; 'volume variations in natural convection turbulence'.
NTIS
Conferences; Free Convection; Turbulent Flow; Atmospheric Chemistry

20000110007 Agency for Toxic Substances and Disease Registry, Atlanta, GA USA
Panel Study of Acute Respiratory Outcomes, Staten Island New York ***Final Report***
Berger, S.; Jones, P.; White, M. C.; Jul. 2000; 96p
Report No.(s): PB2000-105554; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In response to community concerns regarding landfill emissions and air pollution near Fresh Kills Municipal Landfill of Staten Island, New York, the Agency for Toxic Substances and Disease Registry (ATSDR) conducted a panel study to investigate whether odor and air pollutants emanating from the landfill were associated with respiratory health effects among persons diagnosed with asthma. The investigation was conducted during the summer when landfill emissions were presumed to be highest. Participants were a group of 148 persons, aged 15-65 years, who had been diagnosed with asthma and who lived near the landfill. During the 6-week study period, participants were asked to complete a daily diary and ambient air measurements were taken in their residential area. Hydrogen sulfide, wind direction, and odor were selected as indicators of landfill emissions. The primary response variables under investigation were respiratory symptoms (wheeze, cough, shortness of breath) and a change in participants' peak air flow (a measure of lung function) between the morning and evening. Information on particulate matter, ozone, pollen and meteorological data also were measured, because these variables have been shown to affect respiratory health. Two independent odor surveyors were hired to record the presence of odor in participants' residential areas.
NTIS
Air Pollution; Asthma; Landfills; Public Health

20000110071 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Applied research of environmental monitoring using instrumental neutron activation analysis
Chung, Y. S.; Moon, J. H.; Chung, Y. J.; Aug. 31, 1997; 130p; In Korean; In English
Report No.(s): DE98-622122; KAERI/TR-898/97; No Copyright; Avail: Department of Energy Information Bridge

This technical report is written as a guide book for applied research of environmental monitoring using Instrumental Neutron Activation Analysis. The contents are as followings; sampling and sample preparation as a airborne particulate matter, analytical methodologies, data evaluation and interpretation, basic statistical methods of data analysis applied in environmental pollution studies.
NTIS
Environmental Monitoring; Air Pollution

20000110087 Japan Atomic Energy Research Inst., Tokyo, Japan
Fundamental data on environmental gamma-ray fields in the air due to sources in the ground
Saito, K.; Jacob, P.; Feb. 28, 1998; 100p; In E
Report No.(s): DE98-744693; JAERI-DATA/CODE-98-001; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report documents the extensive results of calculations of gamma-ray fields due to sources distributed in the ground. Air kerma per unit source density at 12 heights up to 300 m above the ground was calculated using a Monte Carlo method for monoenergetic plane sources in and on the ground and for natural radionuclides uniformly distributed in the ground. In case of plane sources, calculations were performed for 18 photon energies from 10 keV to 5 MeV and for 22 source depths expressed in mass per unit area ranging from 0 to 200 g/sq cm. For natural nuclides, the whole lines compiled in a recent nuclear data file were taken into account. With respect to kerma in air and fluence of primary photon, the whole calculated results are shown in this report. For double-differential gamma-ray fields, several heights and source depths were selected to demonstrate the features. The calculated data for different soil compositions in energy range up to 100 keV were also shown to give the measure of the effect of soil compositions.
NTIS
Gamma Rays; Radioactivity; Photons; Energy Spectra

20000110109 Environmental Protection Agency, Office of the Chief Financial Officer, Washington, DC USA
Environmental Protection Agency Strategic Plan, September 2000
Sep. 2000; 112p; In English; Original contains color illustrations
Report No.(s): PB2001-100271; EPA/190/R-00/002; No Copyright; Avail: National Technical Information Service (NTIS)

The report presents the Environmental Protection Agency's Strategic Plan, which charts the course that it will follow in the coming years to protect human health and safeguard the environment. EPA's Strategic Plan describes our goals and objectives and discusses our strategies for achieving environmental results. It explains how we will work with our state, tribal, local government, and federal agency partners and with the many public and private organizations and individuals who support and contribute to environmental protection. Since EPA was created 30 years ago, we have made great progress toward a cleaner, healthier environment for the American people. Today, however, the challenges we face look far different than they did even a decade ago, and the Agency's work has changed to meet them. We have found innovative ways to use market forces, reduce regulatory burdens, and streamline processes so that we can achieve better environmental results with less cost and complexity. We are changing the way we interact with our partners in state, tribal, and local government, and together we are using new and different kinds of tools to solve environmental problems. and we are supporting communities as they address local environmental issues, for example by improving our ability to provide data and information in innovative, interactive ways. Building on these creative approaches and the progress we have made so far, this Strategic Plan continues to encourage innovation to enhance existing programs and develop new strategies for achieving better and more cost-effective results. EPA looks forward to working with all of our partners as we pursue the goals set out in this Plan. Together, we can continue our progress toward a clean and safe environment and make a real difference to our families and our communities.
NTIS
Environment Protection; Safeguard System; Health; Mission Planning; Project Management

20000110110 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Aggregation and Episode Selection Scheme for EPA's Models-3 CMAQ
Eder, B. K.; Cohn, R. D.; LeDuc, S. K.; Dennis, R. L.; 1999; 8p; In English
Report No.(s): PB2001-100157; No Copyright; Avail: National Technical Information Service (NTIS)

The development of an episode selection and aggregation approach, designed to support distributional estimation for use with the Models-3 Community Multiscale Air Quality (CMAQ) model, is described. The approach utilized cluster analysis of the 700 hPa u and v wind field components over the time period 1984-92 to define homogeneous meteorological clusters. Alternative schemes were compared using relative efficiencies and meteorological considerations. An optimal scheme was defined to include 20 clusters (five per season), and a stratified sample of 40 events was selected from the 20 clusters using a systematic sampling technique. The light-extinction coefficient, which provides a measure of visibility, was selected as the primary evaluative parameter for two reasons. First, this parameter can serve as a surrogate for PM-2.5, for which little observational data exist. Second, one of the air quality parameters simulated by CMAQ, this visibility parameter has one of the most spatially and temporally comprehensive observational data sets. Results suggest that the approach reasonably characterizes synoptic-scale flow patterns and leads to strata that explain the variation in extinction coefficient and other parameters (temperature and relative humidity) used in this analysis, and therefore can be used to achieve improved estimates of these parameters relative to estimates obtained using other methods. Moreover, defining seasonally based clusters further improves the ability of the clusters to explain the variation in these parameters.
NTIS
Air Quality; Environment Models; Pollution Monitoring

20000110111 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Addressing Human Exposures to Air Pollutants Around Buildings in Urban Areas with Computational Fluid Dynamics (CFD) Models
Huber, A.; Bolstad, M.; Freeman, M.; Rida, S.; Bish, E.; 1999; 6p; In English; 3rd; AMS Symposium on the Urban Environment, 14-18 Aug. 2000, Davis, CA, USA
Report No.(s): PB2001-100156; EPA/600/A-00/078; No Copyright; Avail: National Technical Information Service (NTIS)

Computational Fluid Dynamics (CFD) simulations provide a number of unique opportunities for expanding and improving capabilities for modeling exposures to environmental pollutants. The US Environmental Protection Agency's National Exposure Research Laboratory (NERL) has been conducting cooperative research with Fluent, Inc. to examine and evaluate the application of CFD models for simulating air pollution along the pathway from source to human exposures. The basic framework of population-based human exposure models separates a person's day into time spent in a series of exposure microenvironments. The environmental concentration in these exposure microenvironments is weighted by the time-spent in each microenvironment to provide

to a total daily exposure. The detailed spatial resolution of environmental pollution concentrations that is possible from CFD simulations can provide important information that is not available from a single point measurement. There are multiple potential roles for CFD simulations in supporting human exposure studies which will be presented outside of this brief abstract. In this study, the authors are examining in detail the urban buildings and roadway microenvironments of human exposure to ambient air pollutants. This abstract can present only a summary of some of the issues the authors are examining and a few examples of progress.
NTIS
Air Pollution; Computational Fluid Dynamics; Environment Protection

20000110113 Coast Guard, Office of Research and Development, Washington, DC USA
Boom Vane (Trademark) Field Tests ***Interim Report***
Hansen, K.; Jan. 2000; 36p; In English; Original contains color illustrations
Report No.(s): PB2001-100038; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report describes the evaluation of a new piece of oil pollution equipment called the Boom Vane TM in Marthas Vineyard and New York harbor. The equipment is designed to hold boom out in fast currents to recover oil without the use of heavy anchoring equipment. It was shown to be effective in a previous test on the Columbia River. This was the first attempt at using the Boom Vane TM in tidal estuaries. It was also deployed from two vessels as a possible replacement for the outriggers needed to hold boom away from the side of the vessel in Vessel of Opportunity Skimming Systems (VOSS). The Boom Vane TM does not appear to be useful in tidal estuaries when currents are not steady and uniform. The equipment can be used for parts of a tidal cycle but eddies and interrupted flow caused by changing tides prevent the equipment from being effective throughout the cycle. It still could be used on vessels larger than 50 feet, although a small outrigger boom may still be needed to control the system when a vessel turns. Recommendations are provided for use of this equipment on vessels or in areas with non-uniform current flow.
NTIS
Vanes; Field Tests; Oil Pollution; Equipment

20000110114 Environmental Protection Agency, National Center for Environmental Assessment, Research Triangle Park, NC USA
Air Quality Criteria for Particulate Matter. Volume 3
Comfort, B.; Ewald, W.; Garner, J. H. B.; Pinto, J. P.; Oct. 1999; 160p; In English
Report No.(s): PB2000-108518; NCEA-R-1072; EPA/600/P-99/002C; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This external review draft is an updated revision of the Air Quality Criteria for Particulate Matter, published by the USA EPA (EPA) in 1996, and it will serve as the basis for reevaluating the current National Ambient Air Quality Standards (NAAQS) for particulate matter (PM) set in 1997. The present external review draft critically assessed the latest scientific information relative to determining the health and welfare effects associated with exposure to various concentrations of PM in ambient air. The document is not intended as a complete and detailed literature review, but it does thoroughly evaluate information relevant to PM NAAQS criteria development based on pertinent literature available through mid 1999. Two sections of the Clean Air Act (CAA), (Sections 108 and 109, U.S. Code 1991) govern the establishment, review, and revision of NAAQS. Section 108 directs the Administrator of the EPA to list pollutants that may reasonably be anticipated to endanger public health or welfare, and to issue air quality criteria for them. The air quality criteria are to reflect the latest scientific information useful in indicating the kind and extent of all exposure-related effects on public health and welfare that may be expected from the presence of the pollutant in ambient air.
NTIS
Air Quality; Contaminants; Particulates; Aerosols; Air Pollution; Solid Suspensions; Atmospheric Circulation

20000110115 Environmental Protection Agency, National Center for Environmental Assessment, Research Triangle Park, NC USA
Air Quality Criteria for Particulate Matter. Volume 1
Chapman, R.; Comfort, B.; Ewald, W.; Folinsbee, L. J.; Garner, J. H. B.; Oct. 1999; 354p; In English
Report No.(s): PB2000-108516; NCEA-R-1072; EPA/600/P-99/002A; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This external review draft is an updated revision of the Air Quality Criteria for Particulate Matter, published by the USA EPA (EPA) in 1996, and it will serve as the basis for reevaluating the current National Ambient Air Quality Standards (NAAQS) for particulate matter (PM) set in 1997. The present external review draft critically assessed the latest scientific information relative to determining the health and welfare effects associated with exposure to various concentrations of PM in ambient air. The docu-

ment is not intended as a complete and detailed literature review, but it does thoroughly evaluate information relevant to PM NAAQS criteria development based on pertinent literature available through mid 1999. Two sections of the Clean Air Act (CAA), (Sections 108 and 109, U.S. Code 1991) govern the establishment, review, and revision of NAAQS. Section 108 directs the Administrator of the EPA to list pollutants that may reasonably be anticipated to endanger public health or welfare, and to issue air quality criteria for them. The air quality criteria are to reflect the latest scientific information useful in indicating the kind and extent of all exposure-related effects on public health and welfare that may be expected from the presence of the pollutant in ambient air.
NTIS
Air Quality; Particulates; Aerosols; Air Pollution; Atmospheric Circulation; Pollution Transport

20000110116 Science Applications International Corp., Raleigh, NC USA
Models-3 Installation Procedures for a PC with an NT Operating System (Models-3 Version 4.0)
Jul. 2000; 108p; In English
Report No.(s): PB2000-108511; EPA/600/R-00/061; No Copyright; Avail: National Technical Information Service (NTIS)
Models-3 is a flexible software system designed to simplify the development and use of air quality models and other environmental decision support tools. It is designed for applications ranging from regulatory and policy analysis to understanding the complex interactions of atmospheric chemistry and physics. The June 2000 release of Models-3 contains a Community Multi-Scale Air Quality (CMAQ) modeling system for urban to regional scale air quality simulation of tropospheric ozone, acid deposition, visibility, and fine particles. The principal feature of this release is the ability to install and run Models-3 on a stand-alone Windows-NT based computer. This Installation Manual includes an overview of the installation process, system requirements, procedures for installation of Models-3, and a description of system administration functions.
NTIS
Installation Manuals; Air Pollution; Air Quality; Environment Models; Systems Management; Computer Programs

20000110192 East-West Center, Honolulu, HI USA
Greenhouse Gases from Small-Scale Combustion Devices in Developing Countries, Phase 2A, Household Stoves in India *Final Report, Aug. 1994 - Aug. 1999*
Smith, K.; Zhang, J.; Uma, R.; Kishore, V.; Khalil, M.; Jun. 2000; 102p; In English
Report No.(s): PB2000-107719; EPA/600/R-00/052; No Copyright; Avail: National Technical Information Service (NTIS)
The report contains a systematic set of measurements of carbon dioxide (CO2), carbon monoxide, methane, total non-methane organic compounds, nitrous oxide, sulfur dioxide, nitrogen dioxide, and total suspended particulate emissions from the commonest combustion devices in the world, household stoves in developing countries. A number of different stoves using 8 biomass fuels, kerosene, liquefied petroleum gas, and biogas were examined-a total of 28 fuel/stove combinations. Since stove and fuel parameters were monitored as well, the measurements also allow examination of the trade-off of emissions per unit fuel mass, fuel energy, and delivered energy as well as constructed of complete carbon balances. Confirming preliminary results in a Manila pilot study, the measurements show that solid biomass fuels are typically burned with substantial production of products of incomplete combustion (PICs).
NTIS
Greenhouse Effect; Liquefied Gases; Air Pollution; Combustion Products; Pollution Control

20000110241 American Society for Testing and Materials, West Conshohocken, PA USA
Development of International Standards for Air Quality Monitoring and Control, *1 Jul. 1997 - 30 Jun. 2000*
Sep. 2000; 94p; In English
Report No.(s): PB2000-106995; EPA/600/R-00/064; No Copyright; Avail: National Technical Information Service (NTIS)
This report presents a description of the activities and accomplishments of the American Society for Testing and Materials' US Technical Advisory Group (TAG) to the International Standards Organization's Technical Committee 146 on Air Quality. The purpose of the Tag is to represent the USA of America on matters involving the development and implementation of international standards on air pollution measurement and control. The TAG, which consists of technical experts from industry, government and academia, participate in the development of standards by writing, reviewing, and voting on adoption. The TAG has been instrumental in producing a large number of international standards based on EPA methods and other methods acceptable for use in the USA. This report describes the organization of ISO TC 146 and summarizes the activities of the TAG over the three-year period of Cooperative Agreement Grant CR824457, which provided funding for non-government technical representatives from the

USA to travel to ISO and TAG meetings to participate in the development of standards to monitor and control air pollutants. Such standards help assure the maintenance of acceptable air quality for all nations.
NTIS
Air Pollution; Air Quality; Quality Control; Pollution Control; Pollution Monitoring; Standards

20000110280 McDonald Observatory, Austin, TX USA
Ground-based Observations of the Spatial and Seasonal Distribution of Martian Water Vapor: The 1999 Pre-Opposition Period
Barker, E. S., McDonald Observatory, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Our long term coverage of the behavior of Martian water vapor at McDonald Observatory has continued into the 1999 Martian apparition. We obtained high resolution (R is approximately 225,000) spectra of the water vapor band at 8200A between November 1998 and late March 1999 with scheduled observations in May, June and July of 1999. The abundance of Martian of water vapor has been monitored over 14 seasonal cycles since 1964. In recent years, this monitoring has been augmented by the Arizona group using similar techniques to the current CCD technology used at McDonald. Both groups have added an additional procedure to our standard setup. We are now also routinely obtaining concurrent observations of the 8689A CO2 band to allow a correction for dust opacity in calculating the effective path length in the Martian atmosphere. These CO2 spectra are obtained with the same 2DCoude cross-dispersed echelle spectrograph on the 2.7m telescope at McDonald observatory with a 2048x2048 Tektronics CCD (24micro pixels). The spatial scale along the 2DCoude slit was 0.13 arcseconds per pixel, resulting in seeing limited spatial resolution (approximately 1.0-1.5 arcseconds). Guidance on the Martian disk was accomplished via a TV monitor with a RG-850 filter. For those periods when the Martian disk is larger than 8 arcseconds, we are using an interference filter to isolate the echelle orders corresponding to the CO2 and H2O absorptions. Additional information is contained in the original extended abstract.
Author
Mars (Planet); Mars Atmosphere; Water Vapor; Geographic Distribution

20000110288 Centre National de la Recherche Scientifique, Verrieres-Le Buisson, France
Study of the Martian Atmospheric Composition by SPICAM Light Onboard the Mars Express Mission
Bertaux, J. L., Centre National de la Recherche Scientifique, France; Fonteyn, D.; Korablev, O.; Talagrand, O.; Dubouloz, N.; Sandel, B.; Stern, A.; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

During the Mars Express mission, SPICAM Light will investigate key questions of the atmosphere of Mars, present state, climate and evolution. The objectives of SPICAM Light will be presented with the instrument capabilities. The atmosphere of Mars contains ozone and water vapour, as does the Earth's atmosphere. However, the quantity of ozone is much smaller than on the Earth, and as a consequence the solar UV radiation reaches the ground. In addition, ozone on Mars is a strong source of oxidation at ground level, destroying very fast all organic molecules (together with the action of OH radicals produced by chemical reactions between O3 and H2O. When looking at nadir along track, the SPICAM UV spectrometer (118 - 320 nm on an intensified CCD, 3.8 kg) is essentially an Ozone detector, where its strongest UV absorption band at 250 nm is imprinted in the spectrum of the solar light scattered back from the ground. This very technique allowed the discovery of Ozone on Mars with Mariner 9, and is heavily used to map the total Ozone content of the Earth atmosphere from space. On Mars Express, the correlated study of ozone and water vapour will allow us to compute the quantities of ozone and other oxidants, and solar UV reaching the ground. This Mars environment needs to be understood for a better understanding of conditions in which life could have developed on Mars (or not), and the possible transformation of the some rocks by oxidation. The second major objective of the SPICAM UV is to determine the vertical profile of CO2, temperature, O3 and clouds and aerosols by the technique of stellar occultation. The instrument is oriented toward a star setting behind the horizon. From the atmospheric absorption imprinted progressively on the star spectrum, the density of CO2, O3 and dust are retrieved as a function of altitude, and also the temperature from scale height. Several (3-5) occultations per orbit are foreseen. Finally, spectroscopic UV observations of the upper atmosphere will allow to study the ionosphere through the emissions of CO, CO+, and CO2+, and its direct interaction with the solar wind, variable with solar activity. Also, it will allow a better understanding of escape mechanisms and magnitude estimates, crucial for the long-term evolution of the atmosphere.
Author
Mars Atmosphere; Mars Environment; Mars Missions; Ozone; Mars (Planet)

20000110290 NASA Goddard Space Flight Center, Greenbelt, MD USA

Climate-Rotation Feedback on Mars

Bills, Bruce G., NASA Goddard Space Flight Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A new model is presented for the coupled evolution of climate and rotation, as applied to Mars. It has long been appreciated that changes in the orbital and rotational geometry of Mars will influence the seasonal and latitudinal pattern of insolation, and this will likely dominate climatic fluctuations on time scales of 10(exp 5) to 10(exp 7) years. Equally important, but less widely appreciated, is the influence climatic change can have on rotational dynamics. The primary means by which climate influences rotation is via its influence on transport of mass (volatiles and dust) into and out of the polar regions. Many important issues remain unresolved: What are the ages of the polar caps? What climatic periods are recorded in the polar layered deposits? What is the long term obliquity history? Additional information is contained in the original extended abstract.

Author

Climate Change; Climatology; Mars (Planet); Planetary Rotation; Planetary Meteorology; Models

20000110305 Geological Survey, Menlo Park, CA USA

Global History of Water and Climate

Carr, M. H., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Despite acquisition of superb new altimetry and imagery by Mars Global Surveyor, most aspects of the water and climate story are likely to remain controversial. The relative roles of surface runoff and groundwater seepage in the formation of valley networks are yet to be resolved as are the climatic conditions required for their formation. Similarly, the fate of the floodwaters involved in formation of the outflow channels remains unresolved. While the MOC images provide little supporting evidence for proposed shorelines around an extensive global ocean, the altimetry suggests the presence of a bench at constant altitude around the lowest parts of the northern plains. Here I describe some of the attributes of the channels and valleys as seen in the early MOC images, summarize the evidence for climate change on Mars, and discuss some processes that might have affected the climate on early Mars. MOC images are referred to by a 5-digit number, the first three being the orbit, the last two being the sequence in that orbit. Individual images are available for viewing at ida.wr.usgs.gov Additional information is contained in the original extended abstract.

Author

Altimetry; Climate Change; Ground Water; Imagery; Mars Environment

20000110311 Space Science Inst., Bald Head Island, NC USA

Orbital and Interannual Variability of the Global Mars Atmosphere

Clancy, R. T., Space Science Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Studies of the Mars atmosphere over the past twenty years are largely based on a diverse set of Viking surface and atmospheric measurements collected between 1976-1981. The Viking-based view of the Mars atmosphere synthesized from these data is characterized by a constant background of vertically well mixed dust aerosol tau greater or = 0.5), which increases by factors of greater or = 3 during the perihelion dust storm season. Low-to-mid latitude atmospheric temperatures in all seasons are typically elevated by less than 15 K due to solar absorption by the suspended dust. The global distribution of the atmospheric water column exhibits strong annual variation, which is primarily due to annual release of water from the exposed water ice residual cap and the receding CO2 seasonal ice cap of the northern summer hemisphere. Polar sources of water vapor in the southern summer hemisphere are determined to be much smaller. The warm atmospheric temperatures of the Viking model yield sub-saturation conditions for water vapor in the low-to- mid latitude atmosphere, to altitudes above 25 km in all seasons. As a result, Mars atmospheric photochemistry is characterized by high levels of catalytic radicals from water vapor photolysis (HO(x)), and ice cloud formation is restricted to local phenomena (nighttime surface haze, topographic and wave driven discrete clouds) at low-to-mid latitudes. In the context of the Viking model, water ice clouds are not considered to influence the dynamical/radiative balance of the global Mars atmosphere. Additional information is contained in the original extended abstract.

Derived from text

Mars Atmosphere; Annual Variations; Atmospheric Chemistry; Atmospheric Sounding; Atmospheric Temperature; Carbon Dioxide; Climate; Dust Storms; Dynamic Characteristics

20000110332 Paris Univ., Lab. de Meteorologie Dynamique, France

Simulations of the Martian Seasonal Dust Cycle with a General Circulation Model

Forget, F., Paris Univ., France; Hourdin, F., Paris Univ., France; Hourdin, C., Paris Univ., France; Talagrand, O., Paris Univ., France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

To improve our understanding of the atmospheric dust cycle, key to the Mars climate, we have developed an interactive dust transport model within our 3D General Circulation Model (GCM) of the Martian atmosphere. This dust cycle model accounts for the lifting of the dust by near surface winds and dust devils, the vertical mixing in the turbulent boundary layer and by atmospheric convection, the advection by the general circulation, gravitational sedimentation and even a possible ”scavenging” by CO2 clouds in the polar regions. The transported dust is radiatively active. Multiple particle sizes are simultaneously taken into account. Such a complete model helps us to better understand the numerous aspect of the dust cycle which remains poorly understood and provides a powerful tool to interpret the observations. Additional information is contained in the original extended abstract.

Author

Dust; Climate; Turbulent Boundary Layer; Three Dimensional Models; Atmospheric General Circulation Models; Mars Atmosphere

20000110340 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Climate Change on Mars Inferred from Erosion Rates at the Mars Pathfinder Landing Site

Golombek, M. P., Jet Propulsion Lab., California Inst. of Tech., USA; Bridges, N. T., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The observation that the Mars Pathfinder landing site probably looks very similar to when it was deposited by catastrophic floods some 1.8-3.5 Ga allows quantitative constraints to be placed on the rate of change at the landing site since that time. When combined with interpretations of data recently returned by the Mars Pathfinder and Global Surveyor missions and perspectives drawn from 20 years of analysis and interpretation of Viking data, these observations and inferences suggest an early warmer and wetter environment with vastly different erosion rates and a major climatic change on Mars. Additional information is contained in the original extended abstract.

Author

Climate Change; Mars Surface; Erosion

20000110347 Hawaii Univ., Hawaii Inst. of Geophysics and Planetology, Honolulu, HI USA

Composition, Microphysical State, and Energy Balance of the Mars Seasonal Polar Caps from MGS

Hansen, G. B., Hawaii Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Continuing studies of the radiative properties of the seasonal polar caps of Mars will show how they impact the planetary energy balance and the seasonal cycle of CO2. These properties will be inferred by measurements from the Mars Global Surveyor (MGS), including primarily spectra and bolometric radiances from the thermal emission spectrometer (TES), but also reflectivity and cloud/surface detection from the Mars orbiter laser altimeter (MOLA) and images from the Mars orbiter camera (MOC). The shortwave measurements of the solar bolometer of TES and MOC images are available only for sunlit polar caps, while the 1-mm MOLA observations are available for polar night as well, albeit only for a limited range of spacecraft altitudes and geometries. The TES spectra and thermal bolometer are usable over a wide range of altitudes and all lighting conditions. A study has already been completed using MOLA brightness data and TES spectra from two of the first 36 orbits to estimate the composition and grain size of both seasonal polar caps. Additional information is contained in the original extended abstract.

Author

Balance; Bolometers; Energy Budgets; Grain Size; Mars Global Surveyor; Mars Surface; Polar Caps; Spectrometers; Thermal Emission

20000110352 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The MSP 2001 Mars Environmental Compatibility Assessment (MECA)

Hecht, M. H., Jet Propulsion Lab., California Inst. of Tech., USA; Meloy, T. P., West Virginia Univ., USA; Anderson, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Buehler, M. G., Jet Propulsion Lab., California Inst. of Tech., USA; Frant, M.

A., Orion Research, Inc., USA; Grannan, S. M., Jet Propulsion Lab., California Inst. of Tech., USA; Fuerstenau, S. D., Jet Propulsion Lab., California Inst. of Tech., USA; Keller, H. U., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W. J., Max-Planck-Inst. fuer Aeronomie, Germany; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A chemical analysis of soil-water mixtures and the first microscopic images of martian soil will be among the results to be returned by the Mars Environmental Compatibility Assessment (MECA) payload on the Mars Surveyor Program 2001 Lander. Sponsored by the Human Exploration and Development of Space (HEDS) enterprise, MECA's primary goal is to evaluate potential geochemical and environmental hazards that may confront future martian explorers, and to guide HEDS scientists in the development of high fidelity Mars soil simulants. As a survey of soil properties, the MECA data set will also be rich in information relevant to basic geology, paleoclimate, and exobiology. The integrated MECA payload contains a wet-chemistry laboratory, a microscopy station, an electrometer to characterize the electrostatics of the soil and its environment, and arrays of material patches to study the abrasive and adhesive properties of soil grains. MECA is allocated a mass of 10 kg and a peak power usage of 15 W within an enclosure of 35 x 25 x 15 cm. The Wet Chemistry Laboratory (WCL) consists of four identical cells that will accept samples from surface and subsurface regions accessible to the Lander's robotic arm, mix them with water, and perform extensive analysis of the solution. Ion-selective electrodes and related sensors will evaluate total dissolved solids, redox potential, pH, and the concentration of many soluble ions and gases. Cyclic voltammetry will address oxidants, and anodic stripping voltammetry will probe potentially hazardous trace metals. MECA's microscopy station combines optical and atomic-force microscopy (AFM) in a controlled illumination environment to image dust and soil particles from millimeters to nanometers in size. Careful selection of substrates and an abrasion tool allows experimental study of size distribution, adhesion, abrasion, hardness, color, shape, aggregation, magnetic and other properties. Mounted on the end of the robot arm, MECA's electrometer consists of four types of sensors: an electric field meter, several triboelectricity monitors, an ion gauge, and a thermometer. Tempered only by ultra-violet- light-induced ions and a low-voltage break-down threshold, the dry, cold, dusty martian environment presents an imposing electrostatic hazard to both robots and humans. In addition, the electrostatic environment is key to transport of dust and, consequently, martian meteorology. MECA will also observe natural dust accumulation on engineering materials. Viewed with the robot arm camera, the abrasion and adhesion plates are strategically placed to allow direct observation of the inter-action between materials and soils on a macroscopic scale. Materials of graded hardness are placed directly under the robot arm scoop to sense wear and soil hardness. A second array, placed on the lander deck, is deployed after the dust plume of landing has settled. It can be manipulated in a primitive fashion by the arm, first having dirt deposited on it from the scoop and subsequently shaken clean. Dust accumulation as a function of conductivity, magnetic field strength, and other parameters will be explored. The MECA instruments described above will assess potential hazards that the Martian soil might present to human explorers and their equipment. In addition, MECA will provide information on the composition of ancient surface water environments, observing microscopic evidence of geological (and biological?) processes, inferring soil and dust transport, comminution and weathering mechanisms, and characterizing soil horizons that might be encountered during excavation. Additional information is contained in the original extended abstract.

Author

Chemical Analysis; Soil Science; Soils; Water; Mars Surface; Microscopy; Image Analysis; Geochemistry; Geology

20000110449 California Inst. of Tech., Pasadena, CA USA

The Water Cycle: Dynamics of Reservoir Exchange, Transport, and Integrated Behaviour

Richardson, M. I., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Mars is replete with evidence suggesting variations in the nature of the water cycle over the planet's history. Indeed, a major goal of Mars exploration, and the Mars Surveyor program in particular, is understanding how the water cycle varied and why. Reconstructing the record of variations in the behaviour of water is within the domain of geology and geochemistry. However, physically-based models of Martian paleoclimate are required to understand these changes, and the development of a mechanistic understanding of the water cycle is one necessary prerequisite for the construction of such models. Additional information is contained in the original extended abstract.

Author

Geochemistry; Geology; Mars (Planet); Reservoirs; Water

20000110450 Academy of Sciences (USSR), Moscow, USSR

The Coupled Roles of Dust and Water Ice Clouds in the Mars Aphelion Season

Rodin, A. V., Academy of Sciences (USSR), USSR; Wilson, R. J., National Oceanic and Atmospheric Administration, USA; Clancy, R. T., SSI, USA; Richardson, M. I., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A new picture of the Mars aphelion season is increasingly becoming evident. A combination of data sources indicate a cooler atmosphere than had been inferred from Viking lander and IRTM observations. Revised IRTM T15 estimates now indicate temperatures consistent with microwave and MGS/TES observations and show little diurnal temperature variation in this season which is consistent with a cooler, and presumably, less dusty (at 0.5 mb) atmosphere. These cooler temperatures imply a relatively low water ice cloud condensation level. Extensive cloud coverage has been observed during NH spring and summer season, consistent with lifting associated with the Hadley circulation. Additional information is contained in the original extended abstract.

Author

Water; Ice Clouds; Mars Atmosphere; Mars Environment; Dust Storms

20000110459 Finnish Meteorological Inst., Geophysical Research Div., Helsinki, Finland

Numerical Simulations of Mesoscale Circulations and Resulting Water Vapour Transport in the Springtime Northern Polar Cap Edge Region

Siili, T., Finnish Meteorological Inst., Finland; Bass, D. S., Southwest Research Inst., USA; Savijari, H., Helsinki Univ., Finland; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Mariner 9 and Viking Orbiter observations of the polar cap and the atmosphere above it showed the residual/permanent Northern polar cap to be composed predominantly of water ice. Consequently, it is likely that during the spring and summer the exposing northern polar water ice is the major water vapour source. Indeed, the highest seasonal water vapour column abundances occur in the northern hemisphere. Our motivation for this work is to investigate the plausibility of the scenario by simulating the water transport due to regional/mesoscale circulations driven by the surface thermal contrasts generated by the regolith/water ice/CO2 ice edges. Terrestrial observational and modelling experience as well as Martian simulation work show that such thermal contrasts on level or negligibly sloped terrain drive circulation patterns characterized by formation of daytime circulation cells rotating in the thermally direct sense Schematic of a surface thermal contrast circulation and the plausible H2O sublimation (over water ice) and condensation (over CO2 ice) regions over the cap edge region. Additional information is contained in the original extended abstract.

Derived from text

Mesoscale Phenomena; Numerical Analysis; Water Vapor; Transport Properties; Simulation; Mars (Planet)

20000110473 Washington Univ., Dept. of Atmospheric Sciences, Seattle, WA USA

Martian Climate Variability: Multi-Year, In-Situ Observations of Pressure and Temperature

Tillman, J. E., Washington Univ., USA; Harri, Ari-Matti, Finnish Meteorological Inst., Finland; Larsen, S. E., Danish National Lab., Denmark; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Multi-Year meteorological observations at the same site on the surface of Mars are required to define the Martian Climate, interpret orbital observations, and understand atmosphere - surface interactions and their impact on spacecraft design, and operations. Prior to the Viking Lander Meteorology Experiments 3.3 Mars years observations at the Lander 1, 22 sec N site and 1.5 years at the 48 sec Lander 2 site, it was thought that Mars had ”great” dust storms each year at perihelion. How-ever, from atmospheric pressure measurements alone, Tillman demonstrated that the first 1.5 years strongly suggest that this is not the case, and confirmed it from third year, Lander 1 observations. The fourth year produced an intense dust storm, with an optical depth of the dense 1977 B dust storm but at the same season as the far less intense 1977 A storm. Additional information is contained in the original extended abstract.

Author

Mars Environment; Meteorological Parameters; Climate Change; Dust Storms; Data Processing; Storms

20000110475 California Inst. of Tech., Pasadena, CA USA

Seasonal Variation of Aerosols

Toigo, A. D., California Inst. of Tech., USA; Richardson, M. I., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dust has a profound impact on Martian atmospheric temperatures and circulation. Thus the repeatability of the seasonal dust cycle is of prime importance in understanding the current Martian climate. A number of different observation platforms have been used to measure the amount of aerosols suspended in the atmosphere over the course of the past 25 years. These instruments measure the optical depth of the atmosphere, which is a gauge of the amount of suspended aerosols. The most widely reported measurements are those derived from the Viking Lander camera. These are show in Figures 1a and 2a. The graphs show a relatively clear northern spring and summer (Ls 0 to 180) with visible optical depths of 0.4-0.7 (slightly smaller for Viking Lander 2). A more dusty southern spring and summer (northern fall and winter) included two great dust storms, during which optical depths reached values in excess of 3. Measurements of optical depth in the infrared (9 microns) were also made by the Viking Orbiters, using the Infrared Thermal Mapper (IRTM). The general cycle of opacity followed that of the landers, with a ratio of optical depths (visible to infrared) of 2.5 derived during the dusty southern summer period. Additional information is contained in the original extended abstract.

Derived from text

Aerosols; Annual Variations; Atmospheric Temperature; Dust Storms; Mars Atmosphere; Temperature Measurement; Thermal Emission

20000110485 Arizona Univ., Tucson, AZ USA

Analysis of Photometry of the Martian Sky and Ground to Determine the Coupling Between Derived Values of Optical Constants of the Aerosol Particles and the Surface Reflectivity

Wegryn, E., Arizona Univ., USA; Tomasko, M. G., Arizona Univ., USA; Doose, L. R., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Imager for Mars Pathfinder (IMP) measured the brightness of the sky of Mars during the morning and evening over a time period covering 52 Martian Sols. The evening observations for one sol have been analyzed and published in JGR 104, 1999. Recently, our analysis has been extended to cover the entire timespan of observations with the goal of understanding any variations in the optical properties of the aerosol particles during the roughly two months of operation on the Martian surface. This investigation to explore the variation in aerosol properties over the course of the Pathfinder mission revealed some interesting photometric effects.

Author

Photometry; Aerosols; Mars Atmosphere; Mars Surface; Optical Properties; Sky Brightness

20000110518 Middle Tennessee State Univ., Dept. of Chemistry, Murfreesboro, TN USA

Modeling Agricultural Soil Emissions of Nitric Oxide (NO) and Nitrous Oxide (N2O)

Devendorf, George S., Middle Tennessee State Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 56; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Nitric Oxide (NO) and nitrous oxide (N2O) are important trace gas component's in the earth's atmosphere, both being involved in ozone chemistry in the troposphere (NO) or stratosphere (N2O). Additionally, NO contributes to acid rain, and N2O is of concern as a greenhouse gas, exerting a much larger greenhouse effect than CO2 on a per molecule basis. Although both gases are natural products of microbial processes taking place in the soil, anthropogenic activities, particularly heavy fertilization of agricultural fields, greatly enhances the natural production of these gases. Much uncertainty exists however, over the total biogenic contributions of these gases, primarily because observed emissions are highly variable both across different land types as well as within given type. Simultaneous measurements of NO and N2O emissions, and soil temperature, moisture, and nitrogen (as NO3(-) and NH4(+)), were made in a North Carolina agricultural field in 1995 and 1996 as part of the NASA/EPA/North Carolina State University NOVA project. Analysis of the 1995 data reveals diurnal trends in both NO and N2O flux that suggests general rules for accurately estimating integrated 24 hr daily emissions. Diurnal measurements of NO flux are also applied to a temperature dependent exponential model, providing new insights into the details of the temperature dependent NO flux. Specifically, both the preexponential factor, A, and exponential factor, k, are observed to vary with the average NO flux. The variation of the factor, A, is correlated with the water content and available nitrogen in the soil and thus carries the observed dependence of NO flux on these soil variables. The detailed temperature dependent model.thus describes some of the local and temporal variability of NO flux, and provides fair estimates of NO flux based on soil water and nitrogen content. It also remains consistent with more

general observations in which the value of A is dependent upon the specific land type while k is approximately constant across all land types. Correlations of NO flux with N2O flux, particularly with respect to water saturated vs. non-saturated soil, provide a route for estimating N2O emissions based on NO emissions. This is especially important for water saturated soils, in which extremely high values of N2O flux are observed, and may comprise a substantial uncounted contribution to total atmospheric N2O.
Author
Agriculture; Nitric Oxide; Nitrous Oxides; Ozone; Soil Pollution

20000110544 Tuskegee Inst., AL USA
Modeling Resolved Subgrid Scale Noise in CAA
Zhou, Ye, Tuskegee Inst., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 84; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

With the rapid increase in air transportation, the federal government and other countries in the world face increased challenges in associated environmental problems. A chief issue one encounter is the increased landing noise particularly annoying to these residents living near the airport. As reviewed by my LaRC associate, Dr. Macaraeg, NASA LaRC has played a key role in the NASA's airframe noise reduction effort. Specifically at the request by industry partners, LaRC focused on determining fundamental noise source mechanisms by relating sound generation mechanisms to fundamental fluid mechanics. This effort is truly significant since past predictions on noise generations are essentially based on empirical data that no longer suits the newer classes of aircraft. It has been known for sometime that the primary sources emanate from the high lift system and undercarriage of subsonic aircraft with the dominant source vacillates between flap, slat, and gear. Recently, it appears that a compromising scheme, combining the method of large-eddy simulations (LES) for the flow field and the Lighthill analogy for sound generation, has been emerged as a promising approach. Since all the energy-containing scales, e.g., the coherent structure, are captured by LES, the location of the peak sound source is computed exactly. As a result, the LES can yield more accurate results than Reynolds Average Navier-Stokes (RANS) calculations. An important issue related to the noise generation, however, is the effect of the small scales on the source term in Lighthill's analogy. In this case, the acoustic calculation will evaluate the noise generated by the resolved scales along. We would anticipate that this would result in the suppression of high frequency noise. A priori studies suggest that this type of numerical sound could be quite significant. This motivates the subject of this proposal.
Derived from text
Aeroacoustics; Mathematical Models; Computational Grids; Air Transportation

20000110588 Desert Research Inst., Reno, NV USA
Cloud Condensation Nuclei in Fire-3 ***Final Report, 4 Jun. 1996 - 3 Jun. 2000***
[2000]; 2p; In English
Contract(s)/Grant(s): NAG1-1845; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The centerpiece of this research was the cloud condensation nuclei (CCN) measurements of the Desert Research Institute (DRI) CCN spectrometers on board the NCAR C-130 aircraft during the Arctic Cloud Experiment (ACE) in May, 1998. These instruments operated successfully throughout all eight 10-hour research flights based in Fairbanks and the two ferry flights between Colorado and Fairbanks. Within a few months of completion of ACE the CCN data was edited and put into the archives. A paper was completed and published on the CCN climatology during the previous two FIRE field projects-FIRE 1 based in San Diego in June and July, 1987 and ASTEX based in the Azores Islands in June, 1992. This showed distinct contrasts in concentrations and spectra between continental and maritime CCN concentrations, which depended on air mass trajectories. Pollution episodes from Europe had distinct influences on particle concentrations at low altitudes especially within the boundary layer. At higher altitudes concentrations were similar in the two air mass regimes. Cloudier atmospheres showed lower concentrations especially below the clouds, which were a result mostly of coalescence scavenging.
Derived from text
Condensation Nuclei; Clouds (Meteorology); Climatology; Arctic Regions

20000112946 Northwest Research Associates, Inc., Bellevue, WA USA
Decadal Variability and Temperature Trends in the Middle Atmosphere From Historical Rocketsonde Data ***Final Report, 5 Jun. 1997 - 4 Jun. 2000***
Dunkerton, Timothy J., Northwest Research Associates, Inc., USA; Nov. 01, 2000; 150p; In English; Original contains color illustrations
Contract(s)/Grant(s): NASW-97010
Report No.(s): NWRA-CR-00-R226; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Observational studies were performed using historical rocketsonde data to investigate long-term temperature trends, solar-cycle variations, and interactions between tropical and extratropical latitudes in the middle atmosphere. Evidence from tropical, subtropical, and midlatitude North American rocketsonde stations indicated a consistent downward trend over 25 years, with a solar cycle component superposed. The trend is about -1.4 to -2.0 K per decade and the amplitude of the decadal oscillation is about 1.1 K. Prior to trend derivation it was necessary for us to correct temperatures for aerodynamic heating in the early years. The empirically derived correction profile agrees well with a theoretical profile of Krumins and Lyons. A study was also performed of the correlation between equatorial winds and north polar temperatures in winter, showing that the entire stratospheric wind profile near the equator -- including the quasi-biennial oscillation (QBO) and stratopause semiannual oscillation (SAO) -- is important to the extratropical flow, not merely the QBO component as previously thought. A strong correlation was discovered between winter polar temperatures and equatorial winds in the upper stratosphere during the preceding September, suggesting a role for the second cycle of the SAO.
Author
Atmospheric Temperature; Middle Atmosphere; Stratosphere; Climate Change

20000112948 Washington Univ., Seattle, WA USA
Coupling Satellite and Ground-Based Instruments to Map Climate Forcing by Anthropogenic Aerosol ***Final Report, 16 Aug. 1999 - 15 Aug. 2000***
Charlson, Robert J., Washington Univ., USA; Anderson, Theodore L., Washington Univ., USA; Nov. 01, 2000; 12p; In English Contract(s)/Grant(s): NAG1-2200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Climate forcing by anthropogenic aerosols is a significant but highly uncertain factor in global climate change. Only satellites can offer the global coverage essential to reducing this uncertainty; however, satellite measurements must be coupled with correlative, in situ measurements both to constrain the aerosol optical properties required in satellite retrieval algorithms and to provide chemical identification of aerosol sources. This grant funded the third year of a three-year project which seeks to develop methodologies for combining spaceborne lidar with in-situ aerosol data sets to improve estimates of direct aerosol climate forcing. Progress under this one-year grant consisted in analysis and publication of field studies using a new in-situ capability for measuring aerosol 180 deg backscatter and the extinction-to-backscatter ratio. This new measurement capacity allows definitive lidar/in-situ comparisons and improves our ability to interpret lidar data in terms of climatically relevant quantities such as the extinction coefficient and optical depth. Analyzed data consisted of measurements made along the coast of Washington State, in Central Illinois, over the Indian Ocean, and in the Central Pacific. Thus, this research, combined with previous measurements by others, is rapidly building toward a global data set of extinction-to-backscatter ratio for key aerosol types. Such information will be critical to interpreting lidar data from the upcoming PICASSO-CENA, or P-C, satellite mission. Another aspect of this project is to investigate innovative ways to couple the lidar-satellite signal with target in-situ measurements toward a direct determination of aerosol forcing. This aspect is progressing in collaboration with NASA Langley's P-C lidar simulator.
Author
Satellite Instruments; Measuring Instruments; Optical Measurement; In Situ Measurement; Climate; Climate Change; Climatology; Aerosols

20000113068 DaimlerChrysler Corp., Auburn Hills, MI USA
USCAR Life Cycle Inventory Study Generic Vehicle LCA
Sullivan, J. L., Ford Motor Co., USA; Williams, R. W., General Motors Corp., USA; Yester, Susan G., DaimlerChrysler Corp., USA; Hentges, S., APC, USA; Pomper, S., AA, USA; Chubbs, S., AISI, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 573-596; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The USA Council for Automotive Research (USCAR) is the umbrella organization of Daimler-Chrysler, Ford and General Motors was formed to further strengthen the technology base of the American domestic auto industry through cooperative, precompetitive research. This presentation reviews the life cycle inventory (LCI) program which is hoped to assess the entire environmental performance of vehicles, to conduct an LCI for an entire generic vehicle, with the LCI quantifying energy and material flows over the vehicle's life cycle.
CASI
Automobiles; Life (Durability); Service Life; Life Cycle Costs

20000113073 Purdue Univ., Dept. of Mechanical Engineering Technology, West Lafayette, IN USA

Corking an Open-Ended Tank

Widener, Edward L., Purdue Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 647-653; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The objectives of this project are: (1)to promote creative problem-solving; (2)To see more than one path to a solution; (3) to cope with inadequate information; (4) to recognize an optimal solution, considering constraints of time, cost or accuracy; (5) to meet accreditation criteria for design skill.

Author

Experiment Design; Storage Tanks; Topology

20000113830 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

National Air Pollutant Emissions Trends, 1900-1998. US EPA and the States: Working Together for Cleaner Air

Nizich, S. V.; Pope, A. A.; Driver, L. M.; 2000; 244p; In English; Original contains color illustrations

Report No.(s): PB2000-108054; EPA/454/R-00/002; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The Emission Factor and Inventory Group (EFIG) annually produces a publication on the trends in emissions of criteria pollutants. The emission estimates developed and included in the Emission Trends database have been utilized to support development of the National Particulates Inventory, in support of recent evaluations of the particulate matter and ozone NAAQS, in support of the National Air Toxics Assessment, and to satisfy requirements under CAAA406(g) Included in this report are criteria, toxics, biogenics, greenhouse gases, and international criteria emission estimates.

NTIS

Air Pollution; Air Quality; Exhaust Emission; Trends; Contaminants; Pollution Monitoring

20000114369 Bundesministerium fuer Bildung, Forschung und Technoglogie, Bonn, Germany

Investigations of atmospheric input of polychlorinated dibenzo-p-dioxins and dibenzofurans into pasture. Pt. 1. Texts. Final report

McLachlan, M. S.; Welsch-Pausch, K.; Koemp, P.; Jul. 31, 1998; 314p; In German; In English

Report No.(s): DE99-706533; ETDE-DE-725; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Introduction of PCDD/Fs into the agricultural food chain 'atmosphere - fodder - cattle - cows' milk/beef - human' plays a major role in human exposure. The aim of this study was to establish a quantitative relationship between PCDD/Fs immissions and fodder concentrations. The identification of the most important atmospheric pathway of PCDD/F into greenland cultures was conducted under near natural conditions in a combined field/glasshouse experiment. It was found that for the Cl(4-6)DD/Fs dry gaseous and for the Cl(7/8)DD/Fs dry particle-bound deposition was the primary mechanism of uptake. A further greenhouse experiment showed that there is an isomere-unspecific photodegradation of PCDD/Fs on plant surfaces. Dry gaseous deposition, which is the major pathway of atmospheric deposition for the less chlorinated toxicological relevant PCDD/Fs, can be understood as a partitioning process between the gas phase of the atmosphere and the vegetation. Experiments investigating this topic were conducted in the laboratory using PCBs as model substances for the PCDD/Fs. Important knowledge was gained with regard to plant/air partitioning, their dependence on temperature and plant species, the kinetics and reversibility of the process. No partitioning equilibrium between the vegetation and the gas phase of the atmosphere was approached for the PCDD/Fs. The accumulation of PCDD/Fs in agricultural greenland was therefore controlled by a gaseous deposition velocity. In two typical German agricultural regions representative gaseous and particle-bound deposition velocities were different exposure conditions. All results from this study were incorporated into a mathematical model of the accumulation of PCDD/Fs and PCBs in greenland. Based on air concentration, plant species composition and growth, temperature and physical-chemical properties of the chemical the model is able to predict the concentration of a chemical in the plants as a function of time. A validation of this model for the less chlorinated PCBs showed, that the measured plant/air-partitioning and the corresponding components of the model can be extrapolated to environmental conditions. This model summarizes the results of this study and provides a valuable tool in understanding the enrichment of semivolatile lipophilic organic compounds in agricultural plants.

NTIS

Agriculture; Chlorination; Cattle; Farmlands; Vegetation; Plants (Botany)

20000114486 Forest Service, Pacific Southwest Research Station, Albany, CA USA

Carbon Dioxide Reduction through Urban Forestry: Guidelines for Professional and Volunteer Tree Planters ***Final Report***

McPherson, E. G.; Simpson, J. R.; Jan. 1999; 254p; In English

Report No.(s): PB2000-108502; PSW-GTR-171; No Copyright; Avail: CASI; A03, Microfiche; A12, Hardcopy

Carbon dioxide reduction through urban forestry-Guidelines for professional and volunteer tree planters has been developed by the Pacific Southwest Research Station's Western Center for Urban Forest Research and Education as a tool for utilities, urban foresters and arborists, municipalities, consultants, non-profit organizations and others to determine the effects of urban forests on atmospheric carbon dioxide (CO2) reduction. The calculation of CO2 reduction that can be made with the use of these Guidelines enables decision makers to incorporate urban forestry into their efforts to protect our global climate. With these Guidelines, the can: report current and future CO2 reductions through a standardized accounting process; evaluate the cost-effectiveness of urban forestry programs with CO2 reduction measures; compare benefits and costs of alternative urban forestry program designs; and produce educational materials that assess potential CO2 reduction benefits and provide information on tree selection, placement, planting, and stewardship.

NTIS

Carbon Dioxide Concentration; Forest Management; Urban Research

20000114487 Virginia Transportation Research Council, Charlottesville, VA USA

Digital Multispectral Videography for the Capture of Environmental Data Sets ***Final Report, Jul. 1998 - Jun. 2000***

Fitch, C. Michael; Anderson, John E.; Aug. 2000; 30p; In English; Original contains color illustrations

Contract(s)/Grant(s): 21425

Report No.(s): PB2000-108492; VTRC-01-R5; FHWA/VTRC-01/R5; Copyright; Avail: National Technical Information Service (NTIS)

The Virginia Department of Transportation's (VDOT) Environmental Division frequently uses spatial information to analyze and assess a variety of environmental resources. Environmental personnel are constantly looking for faster and more accurate means of collecting and managing these data. Digital multispectural videography (DMSV) is a data collection technology that has shown great potential in other areas where remote sensing data are used. DMSV provides digital frame coverage in four spectral bands for color infrared imaging, allowing for the detection of soils, vegetation, water bodies, chemically contaminated areas, and various other resources. This type of remote sensing differs from traditional methods in that sensor bandpass or wavelengths are typically equal to or less than 25 nm wide as opposed to the more typical 100+ nm wavelengths. The purpose of this research was to test the feasibility of using DMSV for some of VDOT's environmental data acquisition needs. This was accomplished by using the technology to capture imagery-based data sets and then developing a procedure for transforming the image data into geo-referenced vector data sets. The vector data were analyzed spatially, and the advantages and shortcomings of the technology were documented during this process. DMSV was very effective in identifying and classifying major plant communities in VDOT's wetland mitigation sites. Data were quickly collected, corrected, classified, and imported into an ArcView-based geographic information system. From there, the data sets could be analyzed and stored for further query and manipulation.

NTIS

Remote Sensing; Infrared Imagery; Video Data; Imaging Techniques; Data Acquisition

20000114823 NASA Goddard Space Flight Center, Greenbelt, MD USA

Atmospheric Sulfur Cycle Simulated in The Global Model GOCART: Model Description and Global Properties

Chin, Mian, NASA Goddard Space Flight Center, USA; Rood, Richard B., NASA Goddard Space Flight Center, USA; Lin, Shian-Jiann, NASA Goddard Space Flight Center, USA; Mueller, Jean-Francois, Institut d'Aeronomie Spatiale de Belgique, Belgium; Thompson, Anne M., NASA Goddard Space Flight Center, USA; [June 2000]; 30p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Georgia Tech/Goddard Global Ozone Chemistry Aerosol Radiation and Transport (GOCART) model is used to simulate the atmospheric sulfur cycle. The model uses the simulated meteorological data from the Goddard Earth Observing System Data Assimilation System (GEOS DAS). Global sulfur budgets from a 6-year simulation for SO2, sulfate, dimethylsulfide (DMS), and methanesulfonic acid (MSA) are presented in this paper. In a normal year without major volcanic perturbations, about 20% of the sulfate precursor emission is from natural sources (biogenic and volcanic) and 80% is anthropogenic: the same sources contribute 339% and 67% respectively to the total sulfate burden. A sulfate production efficiency of 0.41 - 0.42 is estimated in the model, an efficiency which is defined as a ratio of the amount oi sulfate produced to the total amount of SO2 emitted and produced in the atmosphere. This value indicates that less than half of the SO2 entering the atmosphere contributes to the sulfate production, the rest being removed by dry and wet depositions. In a simulation for 1990, we estimate a total sulfate production of 39 Tg S /yr

with 36% and 64% respectively from in-air and in-cloud oxidation of SO2. We also demonstrate that major volcanic eruptions, such as the Mt. Pinatubo eruption in 1991, can significantly change the sulfate formation pathways, distributions, abundance, and lifetime. Comparison with other models shows that the parameterizations for wet removal or wet production of sulfate are the most critical factors in determining the burdens of SO2 and sulfate. Therefore, a priority for future research should be to reduce the large uncertainties associated with the wet physical and chemical processes.
Author
Sulfur; Atmospheric Circulation; Sulfur Dioxides; Simulation; Ozone; Meteorological Parameters; Air Pollution

20000114831 NASA Goddard Space Flight Center, Greenbelt, MD USA
Tropical Tropospheric Ozone: A Multi-Satellite View From TOMS and Other Instruments
Thompson, Anne M., NASA Goddard Space Flight Center, USA; Hudson, Robert D., Maryland Univ., USA; Guo, Hua, Maryland Univ., USA; Witte, Jacquelyn C., NASA Goddard Space Flight Center, USA; Kucsera, Tom L., NASA Goddard Space Flight Center, USA; Seybold, Matthew G., North Carolina State Univ., USA; [2000]; 6p; In English; Ozone, 3-8 Jul. 2000, Hokkaido, Japan; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

New tropospheric ozone and aerosol products from the TOMS (Total Ozone Mapping Spectrometer) satellite instrument can resolve episodic pollution events in the tropics and interannual and seasonal variability. Modified-residual (MR) Nimbus 7 tropical tropospheric ozone (TTO), two maps/month (1979-1992, 1-deg latitude by 2-deg longitude) within the region in which total ozone displays a tropical wave-one pattern (maximum 20S to 20N), are available in digital form at http://metosrv2.umd.edu/~tropo. Also available are preliminary 1996-1999 MR-TTO maps based on real-time Earth-Probe (EP)/TOMS observations. Examples of applications are given.
Author
Ozone; Real Time Operation; Satellite Instruments; Tropical Regions; Troposphere

20000114838 NASA Goddard Space Flight Center, Greenbelt, MD USA
"Cloud Slicing" : A New Technique to Derive Tropospheric Ozone Profile Information from Satellite Measurements
Ziemke, J. R., NASA Goddard Space Flight Center, USA; Chandra, S., NASA Goddard Space Flight Center, USA; Bhartia, P. K., NASA Goddard Space Flight Center, USA; [2000]; 36p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new technique denoted cloud slicing has been developed for estimating tropospheric ozone profile information. All previous methods using satellite data were only capable of estimating the total column of ozone in the troposphere. Cloud slicing takes advantage of the opaque property of water vapor clouds to ultraviolet wavelength radiation. Measurements of above-cloud column ozone from the Nimbus 7 total ozone mapping spectrometer (TOMS) instrument are combined together with Nimbus 7 temperature humidity and infrared radiometer (THIR) cloud-top pressure data to derive ozone column amounts in the upper troposphere. In this study tropical TOMS and THIR data for the period 1979-1984 are analyzed. by combining total tropospheric column ozone (denoted TCO) measurements from the convective cloud differential (CCD) method with 100-400 hPa upper tropospheric column ozone amounts from cloud slicing, it is possible to estimate 400-1000 hPa lower tropospheric column ozone and evaluate its spatial and temporal variability. Results for both the upper and lower tropical troposphere show a year-round zonal wavenumber 1 pattern in column ozone with largest amounts in the Atlantic region (up to approx. 15 DU in the 100-400 hPa pressure band and approx. 25-30 DU in the 400-1000 hPa pressure band). Upper tropospheric ozone derived from cloud slicing shows maximum column amounts in the Atlantic region in the June-August and September-November seasons which is similar to the seasonal variability of CCD derived TCO in the region. For the lower troposphere, largest column amounts occur in the September-November season over Brazil in South America and also southern Africa. Localized increases in the tropics in lower tropospheric ozone are found over the northern region of South America around August and off the west coast of equatorial Africa in the March-May season. Time series analysis for several regions in South America and Africa show an anomalous increase in ozone in the lower troposphere around the month of March which is not observed in the upper troposphere. The eastern Pacific indicates weak seasonal variability of upper, lower, and total tropospheric ozone compared to the western Pacific which shows largest TCO amounts in both hemispheres around spring months. Ozone variability in the western Pacific is expected to have greater variability caused by strong convection, pollution and biomass burning, land/sea contrast and monsoon developments.
Author
Ozone; Annual Variations; Charge Coupled Devices; Convection; Satellite Observation; Slicing; Clouds (Meteorology); Troposphere; Water Vapor

20000114868 Stanford Univ., Dept. of Civil and Environmental Engineering, Stanford, CA USA

Enhanced in Situ Anaerobic Bioremediation of Fuel-Contaminated Ground Water ***Final Report, Oct. 1995 - Dec. 1999***

Reinhard, Martin, Stanford Univ., USA; Hopkins, Gary, Stanford Univ., USA; Cunningham, Jeff A., Stanford Univ., USA; Lebron, Carmen, Naval Facilities Engineering Command, USA; Sep. 2000; 171p; In English

Report No.(s): AD-A382558; NFESC-CR-00-005-ENV; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Enhanced anaerobic biodegradation of ground water contaminated by fuel hydrocarbons has been evaluated at a field demonstration conducted at the Naval Weapons Station, Seal Beach, California. This demonstration included establishing three different remediation zones in situ: one zone was augmented with sulfate, one was augmented with sulfate and nitrate, and the third was not augmented. This enables a comparison of hydrocarbon biodegradation under sulfate-reducing, sequential denitrifying/sulfate-reducing, and methanogenic conditions, respectively. In general, the results from the field demonstration are: (1) Certain fuel hydrocarbons were removed preferentially over others, but the order of preference depends on the geochemical conditions; and (2) in the zones that were augmented with sulfate and/or nitrate, the added electron acceptors were consumed quickly, indicating that enhancement via electron acceptor injection accelerates the biodegradation process. More specifically, in the sulfate-reducing zone, sulfate was utilized with an apparent first-order rate coefficient of approximately 0.1/day. In the combined denitrifying/sulfate- reducing zone, nitrate was utilized preferentially over sulfate, with an apparent first-order rate coefficient of 0.1-0.6/day. With regard to the aromatic BTEX hydrocarbons, toluene was preferentially removed under intrinsic conditions; biodegradation of benzene was slow if it occurred at all; augmentation with sulfate preferentially stimulated biodegradation of o-xylene; and ethylbenzene appeared recalcitrant under sulfate-reducing conditions but readily degradable under denitrifying conditions.

DTIC

Ground Water; Water Pollution; Augmentation; Biodegradation; Contamination; Hydrocarbons

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.

20000108793 NASA Marshall Space Flight Center, Huntsville, AL USA

The Response of the Ionospheric Cusp to the Solar Through Two Perspectives: Low Energy Changed Particle In-Situ Measurements and Low- Energy Neutral Atom Imaging

Coffey, V. N., NASA Marshall Space Flight Center, USA; Moore, T. E., NASA Goddard Space Flight Center, USA; Chandler, M. O., NASA Marshall Space Flight Center, USA; Craven, P. D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 19 Dec. 2000, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The IMAGE mission provides a new perspective on the study of the response of the magnetosphere/ionosphere system to changing solar wind conditions, particularly the variability of ion outflow. Learning to interpret this new type of data becomes an essential step in the process of melding these results with the wealth of in-situ charged particle observations obtained over the past 25 years. In order to understand how the in-situ data correspond to and contrast with IMAGE results we will perform a conjunctive study of event data from two instruments to shed light on the coupling of the solar wind and ionosphere from these different perspectives. We will use the Low Energy Neutral Atom instrument (LENA) which images energetic neutral atom emissions from upward flowing ionospheric ions and the Thermal Ion Dynamics Instrument (TIDE) on the Polar satellite which measures in-situ ion outflow from 0.3-300 eV. Our primary goal will be to understand how comparing the imaging and in-situ perspectives can aid in the analysis of both data sets.

Author

Neutral Atoms; In Situ Measurement; Cusps (Landforms); Solar Wind; Charged Particles; Imaging Techniques

20000109855 NASA Marshall Space Flight Center, Huntsville, AL USA

Case Study of Solar Wind and IMF Influence on Ionospheric Outflow

Elliott, H. A., NASA Marshall Space Flight Center, USA; Comfort, R. H., NASA Marshall Space Flight Center, USA; Craven, P. D., NASA Marshall Space Flight Center, USA; Chandler, M. O., NASA Marshall Space Flight Center, USA; Moore, T. E., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Huntsville 2000 Workshop, 30 Oct. 2000, Calloway Gardens, GA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We examine ionospheric outflows in the high attitude magnetospheric polar cap during the POLAR satellite's apogee on 04/19/96 using the TIDE instrument. The pass has a fairly constant flux of H+ which is similar to many other passes, but there

is a large amount of O+ present. The elevated levels of O+ may be due both to the geophysical conditions during the apogee pass (KP=5) and prior to the pass. When the outflows for many high altitude polar cap passes are analyzed the O+ density correlates well with the dynamic pressure. There are several aspects of this pass which are interesting besides the abundance of O+ relative to H+. In this pass both the H+ and O+ outflow velocity correlate with both the solar wind speed and Interplanetary Magnetic Field (IMF) Bx. The geophysical conditions are such that the solar wind speed and IMF Bx are highly correlated with each other. For this case the dynamic pressure of the solar wind is fairly constant and has an average value of about 2.5 nPa which is typical for the solar wind, but the average solar wind speed is about 695 km/s which is greater than 450 km/s which is typical for the solar wind at I AU. The ion outflow measurements themselves are interrelated. The H+ density and parallel speed are anticorrelated which results in the constant flux. The 0+ density does not have as large of a anticorrelation with its parallel speed as H+ does with its parallel speed.
Author
Interplanetary Magnetic Fields; Solar Wind; Earth Ionosphere; Earth Magnetosphere

20000109895 NASA Marshall Space Flight Center, Huntsville, AL USA
An Estimate of the Likelihood for a Climatically Significant Volcanic Eruption Within the Present Decade (2000-2009)
Wilson, Robert M., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Since 1750, the number of cataclysmic volcanic eruptions (i.e., those having a volcanic explosivity index, or VEI, equal to 4 or larger) per decade is found to span 2-11, with 96% located in the tropics and extra-tropical Northern Hemisphere, A two-point moving average of the time series has higher values since the 1860s than before, measuring 8.00 in the 1910s (the highest value) and measuring 6.50 in the 1980s, the highest since the 18 1 0s' peak. On the basis of the usual behavior of the first difference of the two-point moving averages, one infers that the two-point moving average for the 1990s will measure about 6.50 +/- 1.00, implying that about 7 +/- 4 cataclysmic volcanic eruptions should be expected during the present decade (2000-2009). Because cataclysmic volcanic eruptions (especially, those having VEI equal to 5 or larger) nearly always have been associated with episodes of short-term global cooling, the occurrence of even one could ameliorate the effects of global warming. Poisson probability distributions reveal that the probability of one or more VEI equal to 4 or larger events occurring within the next ten years is is greater than 99%, while it is about 49% for VEI equal to 5 or larger events and 18% for VEI equal to 6 or larger events. Hence, the likelihood that a, climatically significant volcanic eruption will occur within the next 10 years appears reasonably high.
Author
Probability Theory; Time Series Analysis; Volcanoes; Volcanology; Likelihood Ratio; Forecasting; Predictions

20000109903 Air Force Research Lab., Space Vehicles Directorate, Hanscom AFB, MA USA
Direct Experimental Evidence for an Atmospheric Gravity Wave Cascade
Dewan, Edmond M., Air Force Research Lab., USA; May 27, 1999; 24p; In English
Contract(s)/Grant(s): AFRL Proj. 2310
Report No.(s): AFRL-VS-TR-1520; 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.
Derived from text
Atmospheric Physics; Gravity Waves; Wave Interaction

20000109926 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Principle of universality of gravitational interactions
Pestov, A. B.; Dec. 31, 1997; 19p; In Russian; In English
Report No.(s): DE98-618208; JINR-R-2-97-156; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this work the experiment on the verification of the principle of universality of gravitational interactions and some related problems of gravity theory and physics of elementary particles is discussed. The meaning of this proposal lies in the fact the self-

consistency of General Relativity, as it turns out, presupposes the existence of the nongravitating form of energy. The theory predicts that electrons are particles that transfer the nongravitating form of energy.
NTIS
Gravitation; Gravitational Effects

20000109950 NASA Marshall Space Flight Center, Huntsville, AL USA
General Differences between Early and Late Stages of BATSE Gamma-Ray Bursts
Mitrofanov, I. G., NASA Marshall Space Flight Center, USA; Litvak, M. L., NASA Marshall Space Flight Center, USA; Anfimov, D. S., NASA Marshall Space Flight Center, USA; Sanin, A. B., NASA Marshall Space Flight Center, USA; Briggs, M. S., NASA Marshall Space Flight Center, USA; Paciesas, W. S., NASA Marshall Space Flight Center, USA; Pendleton, G. N., NASA Marshall Space Flight Center, USA; Preece, R. D., NASA Marshall Space Flight Center, USA; Meegan, C. A., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The early and late stages of gamma-ray bursts are studied in a statistical analysis of the large sample of long BATSE events. The primary peak is used as the boundary between the early and late stages of emission. Significant differences are found between the stages: the early stage is shorter, it has harder emission, and it becomes a smaller fraction of the total burst duration for burst groups of decreasing intensity.
Author
Gamma Ray Bursts; Gamma Ray Astronomy

20000110228 NASA Goddard Space Flight Center, Greenbelt, MD USA
Atlas of Seasonal Means Simulated by the NSIPP 1 Atmospheric GCM, Volume 17
Suarez, Max J., Editor, NASA Goddard Space Flight Center, USA; Bacmeister, Julio, Universities Space Research Association, USA; Pegion, Philip J., General Sciences Corp., USA; Schubert, Siegfried D., NASA Goddard Space Flight Center, USA; July 2000; 218p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 622-24-47-26
Report No.(s): NASA/TM-2000-104606/VOL17; Rept-2000-03740-0/VOL17; NAS 1.15:104606/VOL17; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This atlas documents the climate characteristics of version 1 of the NASA Seasonal-to-Interannual Prediction Project (NSIPP) Atmospheric General Circulation Model (AGCM). The AGCM includes an interactive land model (the Mosaic scheme), and is part of the NSIPP coupled atmosphere-land-ocean model. The results presented here are based on a 20-year (December 1979-November 1999) "ANIIP-style" integration of the AGCM in which the monthly-mean sea-surface temperature and sea ice are specified from observations. The climate characteristics of the AGCM are compared with the National Centers for Environmental Prediction (NCEP) and the European Center for Medium-Range Weather Forecasting (ECMWF) reanalyses. Other verification data include Special Sensor Microwave/Imager (SSNM) total precipitable water, the Xie-Arkin estimates of precipitation, and Earth Radiation Budget Experiment (ERBE) measurements of short and long wave radiation. The atlas is organized by season. The basic quantities include seasonal mean global maps and zonal and vertical averages of circulation, variance/covariance statistics, and selected physics quantities.
Author
Numerical Analysis; Atmospheric General Circulation Models; Climate; Mapping; Ocean Models

20000110274 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Implications of Flexural Flanks at the Valles Marineris, Mars
Anderson, F. S., Jet Propulsion Lab., California Inst. of Tech., USA; Banerdt, W. B., Jet Propulsion Lab., California Inst. of Tech., USA; Golombek, M. P., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The presence or absence of flexural flanks at the Valles Marineris (VM), Mars, have strong implications for the properties of the lithosphere, information which is critical for models of compensation state and formation of the troughs. Two hypotheses are favored for the formation of the VM, tectonic extension or subsurface withdrawal potentially related to dike emplacement; in either case, the formation of the large troughs at the VM requires a flexural response. After discussing preliminary models of flexure for VM from released Mars Global Surveyor (MGS) Mars Orbiting Laser Altimeter (MOLA) topography, this abstract considers the implications of flexure for gravity modeling and the lithosphere at VM. With future MGS topography and gravity

data, and constraints on T(sub e) from this study, significantly better gravity modeling can be done to understand the state of the lithosphere at VM. Additional information is contained in the original extended abstract.
Author
Gravitation; Lithosphere; Mars Surface; Topography; Mars (Planet); Mathematical Models; Canyons

20000110275 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Microscopy of Analogs for Martian Dust and Soil
Anderson, M. A., Jet Propulsion Lab., California Inst. of Tech., USA; Pike, W. T., Jet Propulsion Lab., California Inst. of Tech., USA; Weitz, C. M., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The upcoming Mars 2001 lander will carry an atomic force microscope (AFM) as part of the Mars Environmental Compatibility Assessment (MECA) payload. By operating in a tapping mode, the AFM is capable of sub-nanometer resolution in three dimensions and can distinguish between substances of different compositions by employing phase-contrast imaging. Phase imaging is an extension of tapping-mode AFM that provides nanometer-scale information about surface composition not revealed in the topography. Phase imaging maps the phase of the cantilever oscillation during the tapping mode scan, hence detecting variations in composition, adhesion, friction, and viscoelasticity. Because phase imaging highlights edges and is not affected by large-scale height differences, it provides for clearer observation of fine features, such as grain edges, which can be obscured by rough topography. to prepare for the Mars 01 mission, we are testing the AFM on a lunar soil and terrestrial basaltic glasses to determine the AFMOs ability to define particle shapes and sizes and grain-surface textures. The test materials include the Apollo 17 soil 79221, which is a mixture of agglutinates, impact and volcanic beads, and mare and highland rock and mineral fragments. The majority of the lunar soil particles are less than 100 microns in size, comparable to the sizes estimated for Martian dust. The terrestrial samples are millimeter size basaltic glasses collected on Black Pointe at Mono Lake, just north of the Long Valley caldera in California. The basaltic glass formed by a phreatomagmatic eruption 13,000 years ago beneath a glacier that covered the Mono Lake region. Because basaltic glass formed by reworking of pyroclastic deposits may represent a likely source for Martian dunes, these basaltic glass samples represent plausible analogs to the types of particles that may be studied in sand dunes by the 01 lander and rover. We have used the AFM to examine several different soil particles at various resolutions. The instrument has demonstrated the ability to identify parallel ridges characteristic of twinning on a 150-micron plagioclase feldspar particle. Extremely small (10-100 nanometer) adhering particles are visible on the surface of the feldspar grain, and appear elongate with smooth surfaces. Phase contrast imaging of the nanometer particles shows several compositions to be present. When the AFM was applied to a 100-micron glass spherule, it was possible to define an extremely smooth surface.E Also visible on the surface of the glass spherule were chains of 100-nanometer- and-smaller impact melt droplets. Additional information is contained in the original extended abstract.
Author
Mars (Planet); Mars Surface; Topography; Atomic Force Microscopy; Analogs

20000110278 Arizona State Univ., Dept. of Geology, Tempe, AZ USA
Martian Volcanic Compositions and Distributions: Results from the Thermal Emission Spectrometer
Bandfield, J. L., Arizona State Univ., USA; Christensen, P. R., Arizona State Univ., USA; Hamilton, V. E., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Martian low albedo regions exhibit distinctive absorptions in the 8-12 and 20-50 micron regions of the electromagnetic spectrum. These absorptions contain abundant information regarding the mineralogical composition of these regions. Because atmospheric dust, water ice, carbon dioxide, and water vapor contain numerous absorptions throughout the Martian spectrum, two surface-atmosphere separation algorithms have been developed to obtain these atmospherically corrected surface spectra. These models derive consistent spectral signatures under a variety of atmospheric conditions. With accurate surface spectra, mineralogical information about low albedo regions may be determined and any spatial variations in composition may be mapped globally. Additional information is contained in the original extended abstract.
Author
Mars Atmosphere; Mars Volcanoes; Planetary Geology; Models; Mars (Planet); Mars Surface

20000110284 Oregon State Univ., Coll. of Oceanic and Atmospheric Sciences, Corvallis, OR USA
GCM and SGCM Studies of Transient Baroclinic Eddies and Topography in the Martian Atmosphere
Barnes, J. R., Oregon State Univ., USA; Matheson, M., Oregon State Univ., USA; The Fifth International Conference on Mars;

July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It has been known since the Viking Lander observations that transient baroclinic eddies are a major component of the general circulation of the Martian atmosphere in winter midlatitudes. to date these remain the only solid detection of these atmospheric weather systems; the MGS TES experiment should be able to provide excellent observations of these eddies (as well as quasi-stationary eddies) above the surface, and the MCO PMIRR experiment should soon begin to further expand the observational database for this very important component of the circulation. Studies with atmospheric GCM's have shown that the amplitudes of the transient eddies in the southern hemisphere during winter are considerably smaller than in the northern hemisphere winter (the eddies are essentially not present during summer). Sensitivity experiments have indicated that differences in the topography between the two hemispheres are responsible in large part for the suppression of the southern hemisphere eddy activity. Until very recently this topography has been rather uncertain, though. The MGS MOLA experiment has now produced a global topographic dataset (at 1 degree resolution) which is much more accurate than the previous ones. It is thus very much of interest to use this topography dataset in atmospheric GCM's to examine the transient eddy amplitudes and properties in the two hemispheres of Mars. We have been using both state-of-the-art GCM's (the NASA-Ames Mars GCM) and so-called SGCM's (simplified GCM's) to study the transient eddies and the effects of the very large Martian topography upon them. The SGCM's have highly simplified physics by comparison with the full GCM's, and thus allow the essential dynamical processes related to the transient eddies to be isolated more readily. The model experiments to date with the new MOLA topography show that the transient eddies in the southern hemisphere in winter are still substan-tially weaker than those in the north, but not as much weaker as with the previous topographic datasets. Surface amplitudes are smaller by factors of about 3 in middle latitudes, with upper level amplitudes being reduced by somewhat smaller factors. The eddy amplitudes in the north are slightly smaller than with the previous topographic data, while those in the south are significantly larger. The biggest difference in the eddies between the two hemispheres is in their heat fluxes: meridional heat fluxes are roughly an order of magnitude smaller in the south than in the north. It appears from preliminary sensitivity experi-ments that it is the zonally asymmetric (eddy) component of the topography in the south that is responsible for a strong stabilization of the southern eddies. The southern eddy topography is dominated by a very large wavenumber 1 component in midlatitudes, which acts to force a very large-amplitude wavenumber 1 quasi-stationary disturbance during winter. The eddy topography in the northern hemisphere is not nearly as stabilizing to the baroclinic eddies as that in the south, and it is not clear at present why this is the case. The large zonally averaged topography in the south ap-pears to be fairly strongly destabilizing to the baroclinic eddies, but its effects are overwhelmed by those of the zonally asymmetric topography in this hemisphere. In addition to strongly affecting the amplitudes and fluxes of the transient eddies, the topography appears to have an important influence on the dominant zonal wavenumbers and periods of the eddies. In the absence of the (variable) topography, eddies of the largest zonal scales and longest periods-wavenumber 1 and periods of about 6-8 sols and longer, are strongly dominant, whereas with topography shorter-scale (higher wavenumber) and shorter period eddies become much more prominent. The latter is much more in accord with the available observational data. The baroclinic eddies remain to be detected in the southern hemisphere of Mars, but it should be possible to do this with TES data in the near future. Then the data can begin to be compared with the GCM results, providing a strong test of the ability of these models to simulate the effects of the very large topography on the atmospheric circulation and climate.

Author

Atmospheric Circulation; Baroclinity; Mars Atmosphere; Vortices; Atmospheric General Circulation Models

20000110287 Cornell Univ., Dept. of Astronomy, Ithaca, NY USA

Nature and Origin of Martian Surface Materials

Bell, J. F., III, Cornell Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The nature and origin of Martian surface materials can be assessed from a mineralogic and compositional standpoint using the available data from telescopic and orbiting spacecraft imaging and spectroscopy, as well as landed in situ imaging, spectroscopic, compositional, and magnetic studies. These studies are designed to answer important questions about Martian surface materials that constrain not only their present physical or compositional properties, but also the present and past environmental conditions that have lead to the formation of the presently-observed materials. Here I briefly describe some of the most recent observational data and interpretations that bear on the question of the nature and origin of Martian surface materials, focusing mostly on the composition and mineralogy of the ubiquitous soils and dust as derived from in situ (Viking and Pathfinder) studies, but also describing recent results on the chemistry and mineralogy of rocks. Many of the results and interpretations outlined here

are described in much more detail in recent papers based on Pathfinder results on Martian rocks and soils. Additional information is contained in the original extended abstract.
Author
Mars Surface; Planetary Geology; Surface Properties; Mars (Planet); Mars Environment; Soils; Mineralogy; Rocks; Planetary Composition

20000110289 Carnegie Institution of Washington, Geophysical Lab., Washington, DC USA
Geophysical and Geochemical Constraints on the Composition and Structure of the Martian Interior
Bertka, C. M., Carnegie Institution of Washington, USA; Fei, Y., Carnegie Institution of Washington, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Data constraining the structure and composition of the Martian interior are limited. Presently, the strongest geophysical constraints we have for Mars are knowledge of the mass and radius of the planet and the moment of inertia factor. Using the mass and radius of the planet and the moment of inertia factor as constraints, two of three variables, mantle density, core size, and core density, can be calculated as a function of one of the three variables. Folkner et al. recently reported a new value for the moment of inertia factor of Mars based on an improved estimate of the Martian spin pole precession rate determined from Doppler and range measurements to the Mars Pathfinder lander, 0.3662 +/- 0.0017. Most models for the composition of the Martian mantle and core are dependent on knowledge of the moment of inertia factor of Mars. Dreibus and Wanke, however, derived a model of Martian mantle and core composition independent of the moment of inertia factor of Mars. They used element correlations between measured ratios in the SNC meteorites and chondritic abundances to derive a mantle composition with all oxyphile refractory elements present in C1 chondrite abundance ratios, and a bulk planet composition with a C1 chondrite Fe/Si ratio. Bertka and Fei performed high-pressure multi-anvil experiments with an analog of the Dreibus and Wanke mantle composition to determine its modal mineralogy up to core-mantle boundary pressures along a model PT profile of the Martian interior. Using the results of these high-pressure experiments, they calculated a mantle density profile for the DW model, and then calculated the moment of inertia factor as a function core composition and crustal thickness. In this abstract we summarize the results of those calculations and evaluate the Dreibus and Wanke geochemical model for the Martian interior in light of the moment of inertia factor reported by the Pathfinder team. Despite the success of recent missions to Mars, there remains uncertainty about the internal structure of the planet, particularly the core. The weak Martian magnetic field is consistent with either an entirely solid or entirely liquid core. Earlier studies have presented core models based on meteoritic evidence. Fei et al. and Pike et. al. have explored the melting relations of core compositions in the S-rich Fe system proposed by these previous studies. In this abstract we also summarize the results of those studies and their implications for models of the state of the martian core. Additional information is contained in the original extended abstract.
Author
Composition (Property); Core-Mantle Boundary; Mars (Planet); Planetary Mantles; Planetary Structure

20000110291 NASA Ames Research Center, Moffett Field, CA USA
A Model for Generation of Martian Surface Dust, Soil and Rock Coatings: Physical vs. Chemical Interactions, and Palagonitic Plus Hydrothermal Alteration
Bishop, J. L., Search for Extraterrestrial Intelligence Inst., USA; Murchie, S., Johns Hopkins Univ., USA; Pieters, C., Brown Univ., USA; Zent, A., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This model is one of many possible scenarios to explain the generation of the current surface material on Mars using chemical, magnetic and spectroscopic data from Mars and geologic analogs from terrestrial sites. One basic premise is that there are physical and chemical interactions of the atmospheric dust particles and that these two processes create distinctly different results. Physical processes distribute dust particles on rocks, forming physical rock coatings, and on the surface between rocks forming soil units; these are reversible processes. Chemical reactions of the dust/soil particles create alteration rinds on rock surfaces or duricrust surface units, both of which are relatively permanent materials. According to this model the mineral components of the dust/soil particles are derived from a combination of ”typical” palagonitic weathering of volcanic ash and hydrothermally altered components, primarily from steam vents or fumeroles. Both of these altered materials are composed of tiny particles, about 1 micron or smaller, that are aggregates of silicates and iron oxide/oxyhydroxide/sulfate phases. Additional information is contained in the original extended abstract.
Author
Chemical Reactions; Dust; Mars Surface; Rocks; Mars (Planet); Chemical Composition; Planetary Composition; Mineralogy;

Geochemistry; Dynamic Models

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Comparative Geomorphology of Seasonally Active Crescentic Dunes: Nili Patera, Mars and Strzelecki Desert, Earth
Bishop, M. A., University of South Australia, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Images from Mars Global Surveyor (MGS) have shown evidence for recent-to-current aeolian activity and bedform change. Previous studies of dune morphology and activity were limited by the lower resolution of Viking Orbiter (VO) images, and could not conclusively discern landscape age. In comparison, the resolution of the Mars Orbiter Camera (MOC) shows details equivalent to terrestrial aerial photos. Such detail allows the identification of local wind flow directions as shown by changes in dune form, as well as, features and properties of the interdune. Early MGS MOC results have shown that sand dunes in the low latitudes have been recently active, while dunes in the North Polar Region are considered currently active. High-resolution MOC images of small dune concentrations such, as those within Nili Patera, also appear currently active. Additional information is contained in the original extended abstract.
Author
Dunes; Geomorphology; Wind (Meteorology); Mars (Planet); Mars Surface; Topography; Wind Effects

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Structure of the Mars Upper Atmosphere: MGS Aerobraking Data and Model Interpretation
Bougher, S. W., Arizona Univ., USA; Keating, G. M., George Washington Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Mars Global Surveyor (MGS) recently obtained coordinated lower-atmosphere (thermal and dust) measurements and simultaneous upper atmosphere accelerometer data (densities, scale heights and temperatures) yielding the first quantitative glimpse of the physical processes connecting the Mars lower and upper atmospheres during mildly dusty conditions and during a regional dust storm event. In particular, measurements from the MGS z-axis accelerometer (ACC) aboard MGS have provided to date more than about 1200 vertical structures of the Mars thermospheric density and derived temperature and pressure, as compared to only 3 previous in-situ profiles. These data have been obtained over two distinct Mars seasons: (Phase 1) 7-months approaching perihelion from southern Spring to early Summer (L(sub s) = 180 to 300), and (Phase 2) 4.5-months near aphelion from northern Spring to early Summer (L(sub s) = 30 to 95). Additional information is contained in the original extended abstract.
Author
Dust Storms; Mars Atmosphere; Atmospheric Temperature

20000110303 NASA Ames Research Center, Moffett Field, CA USA
Clues from the SWIR: Mineralogical Constraints from 1 to 4 microns
Calvin, W. M., Geological Survey, USA; Bishop, J. L., NASA Ames Research Center, USA; Erard, S., Paris Univ., France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Among the great Mars mineral problems are the predictions of both carbonates and clays as alteration products and the lack of observational evidence to support those predictions. In spite of geochemical evidence of sulfur and chlorine in the soils, assignment of specific sulfates and chlorides has remained elusive. The purpose of this contribution is to show several common alteration minerals that are consistent with the short-wave infrared surface spectra and geochemistry, briefly consider the silicate problem, propose an additional method of soil formation and review what surface measurements in the spectral range from approximately 1 to 4 microns can do to help resolve remaining ambiguities of surface mineralogy. Additional information is contained in the original extended abstract.
Author
Carbonates; Chlorides; Clays; Mars Surface; Minerals

20000110307 Paris VI Univ., Orsay, France

A Generic Package for Long Term Monitoring of the Martian Thermosphere on the Telecom Orbiters of the Mars Micromission Program

Chassefiere, E., Paris VI Univ., France; Forget, F.; Hourdin, F.; Vial, F.; Jegou, F.; Berthelier, J. J.; Duvet, L.; Touboul, P.; Bougher, S.; Keating, G.; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Future missions of Mars exploration will require an intensive use of aero-assistance techniques. Be-cause of their limited Delta-V capabilities, the micro-orbiters (Science/ Communication) of the Mars Micromission program will be inserted in highly elliptical orbits, with systematic use of aerobraking for subsequent circularization. The possibility of ”ballute” aerocapture, which would allow a substantial increase of payload capability, is presently being studied at JPL for post-05 missions. The Micromission program is not limited to Mars, and future exploration of other planets of the inner Solar System, like Venus, is anticipated. Independently, the CNES-provided orbiter of the 05 Mars Sample Return mission is expected to be inserted in Martian orbit by aerocapture. Besides, ESA is presently developing Martian climate data-bases, which will be extended to the Martian thermo-sphere, through combined observation/ modelling studies, in view of providing a realistic climatology of the whole Martian atmosphere, partially oriented toward designing future aero-assistance strategies. ESA is also interested in developing climate data-bases for Venus. Improving aeroassistance strategies needs a better understanding of dynamical processes controling the thermosphere. The solar cycle, seasonal, wave, and ”dust heating” responses of the Mars upper atmosphere (above 100 km) are very poorly constrained at present. Upcoming Mars missions (Planet-B and Mars Express) plan to sample the Martian upper atmosphere (above 150 km) for only a small portion of the solar cycle. Furthermore, their in-situ probing altitudes do not extend to the Mars lower thermo-sphere (100-150 km) where considerable variability has been observed recently by the Mars Global Surveyor (MGS) Accelerometer during aerobraking campaigns. A long-term program for Mars thermospheric monitoring (100-250 km), using the telecom orbiters of the Mars Micromission Program, would provide multiple opportunities (at each orbiter aero-braking window) to monitor these thermospheric variations. Ultimately, a climatology of the Mars lower thermospheric densities, temperatures, and winds can be constructed. The goals of such a monitoring program are twofold : (1) to fully characterize the Martian thermospheric structure and dynamics. This leads naturally to comparison to the terrestrial lower thermospheric (100-250 km) mean structure and its variations. Thermal and dynamical processes can then be studied in great detail for two planetary thermospheres (Earth and Mars). Wave effects (planetary, tidal, and gravity) are of great importance to study for these planets. (2) to provide a realistic Mars thermospheric climatology for the design of future aerobraking strategies. Additional information is contained in the original extended abstract.

Author

Accelerometers; Atmospheric Temperature; Climate; Gravitation; Mars Atmosphere; Mars Environment; Payloads; Solar Cycles

20000110309 Paris VI Univ., Orsay, France

Simulation of Thermal Tides in the Middle Atmosphere of Mars

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Measurements on the dynamics on Mars middle atmosphere (at 40-70 km) have been obtained from ground-based millimeter-wave observations. Specifically, inspection of Doppler shifts on strong rotational lines of CO mapped on the martian disk allows one to reconstruct the global wind field around 50 km. Such measurements have been already conducted with large single dish antennas, indicating for the first time the gross structure of the middle atmosphere circulation near Southern Solstice and Equinox. They are now being extended to interferometric observations, with a 5-fold improvement in spatial resolution. Information is also available on the temperature field up to 70 km altitude. Such measurements, which can be obtained on a regular basis, allow one to monitor the dynamical state of the middle atmosphere, providing insight in the coupling processes between the middle and upper atmosphere. Additional information is contained in the original extended abstract.

Author

Doppler Effect; Interferometry; Mars Atmosphere; Parabolic Reflectors; Simulation; Temperature Distribution; Tides; Velocity Distribution

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Observations of the Thermal Structure and Dynamics of the Martian Atmosphere

Conrath, B. J., Cornell Univ., USA; Pearl, J. C., NASA Goddard Space Flight Center, USA; Smith, M. D., Cornell Univ., USA; Banfield, D., Cornell Univ., USA; Christensen, P. R., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Information on the thermal structure of the Martian atmosphere has been obtained using several different techniques, including in situ sounding from decent probes, radio occultations and infrared thermal emission measurements from orbiters, and earth based full-disk microwave measurements. Knowledge of the 3- dimensional atmospheric temperature field and its temporal variation provides an important observational approach to the study of the dynamics of the atmosphere. Comparison of the observed thermal structure with results from a Mars General Circulation Model (MGCM) can be used to refine the model and provide greater insight into the physical processes controlling the dynamics of the atmosphere. Direct assimilation of the temperature observations into an MGCM can also be used to address similar goals. In addition, relatively simple diagnostic models can be applied to the data to directly obtain information on winds and other meteorological properties of the atmosphere. In this overview, we concentrate primarily on the structure retrieved from thermal emission measurements. Additional information is contained in the original extended abstract.

Author

Mars Atmosphere; Atmospheric General Circulation Models; Atmospheric Temperature; Dust Storms; Emission Spectra; Infrared Radiation; Wind Velocity

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Spectroscopic Detectibility of Sulfates in Dust and Duricrust on Mars

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Abundant sulfur was detected in the Martian surface material by the Viking Landers, with higher concentrations occurring in crusts and clouds. Cementation by sulfate salts has been proposed to explain the higher sulfate abundance in the more cohesive materials, with magnesium as the likely cation. In addition, there are a number of regions on Mars with a dark red color, intermediate albedo, and intermediate thermal inertia that appear to have a unique mineral composition and are thought to consist of regionally extensive cemented material analogous to the smaller clouds found at the landing sites. The high sulfur concentration and its apparent mobility have important implications for understanding surface compositions and pedogenic processes on Mars. A weak 4.5 microns band attributed to sulfate has been observed in some telescopic spectra. However, it did not appear to have the same pattern of absorptions seen in pure MgSO4, gypsum, or anhydrite. A fundamental question thus arises: what are the detection limits of sulfates on Mars? Furthermore, how does the physical form (e.g. powders vs. crusts) affect detection? In a previous work we showed that anhydrous MgSO4 in dry powder mixtures with palagonite was observable using laboratory reflectance spectroscopy from bands in the 4.5 micron and 9.8 microns regions, although absolute contrast on these bands was less than 1% reflectance. Cemented crusts formed from these mixtures had very different spectral properties and are more likely to be detectable with using TES. Our current work with these samples is aimed at distinguish-ing between textural and compositional sources for the changes in the spectral properties of powder and cemented mixtures of palagonite and sulfates. A suite of mixtures was prepared as analogs to Martian duricrust and dust and measured in the laboratory to investigate the spectral detectibility of sulfates on Mars. Additional information is contained in the original extended abstract.

Author

Spectroscopy; Sulfur; Dust; Crusts; Mars Surface; Observation; Magnesium Sulfates

20000110323 New Mexico Museum of Natural History, Albuquerque, NM USA

Volcanism on Mars: Volcanological and Global Significance of Its Calderas

Crumpler, L. S., New Mexico Museum of Natural History, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Advances in magma ascent and emplacement theory and quantitative analysis of martian volcanic landforms over the past decade enable new constraints on the magma budget associated with volcanism. These yield additional insights into the magmatic history of Mars. Calderas represent records of magmatic processes associated with magma ascent, emplacement, storage, and evolution in planetary lithospheres. Differences in their morphology and structure are functions of differing conditions of crustal density, structure, stress state, volume rates of magma emplacement, and changing conditions associated with magmatic evolu-

tion. These factors are recorded in the existing record of Martian calderas, but poorly resolved. Based on current understanding of magma rate regimes and detailed mapping of martian calderas, previous estimates of global magma budgets for Mars appear insufficient to sustain the observed calderas. Additional information is contained in the original extended abstract.
Author
Volcanology; Mars Volcanoes; Mars Surface; Magma; Morphology; Crusts

20000110326 Universidad Nacional Autonoma de Mexico, Dept. de Fisica Espacial, Mexico City, Mexico
Evolution of Mars Atmosphere in Post-Noachian Epochs
Durand-Manterola, Hector Javier, Universidad Nacional Autonoma de Mexico, Mexico; Perez-de-Tejada, Hector, Universidad Nacional Autonoma de Mexico, Mexico; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We developed a model to examine the evolution of the Mars atmosphere by including processes related to the lost of mass to space, the oxidation of the planetary surface and degassing. In our model we made the following assumptions: a) The amount of mass M in Martian atmosphere at time t is the sum of the degassed mass (Md) from planetary body and the lost mass (Ml), i.e. all the mass removed from the atmosphere in the same period. b) the degassing rate can be expressed as a descendent exponential. c) The mass lost is the sum of the mass of the ions dragged by the solar wind (Mi), the neutral particles lost by dissociative recombination (Mdr), and the mass of oxygen lost in oxidation of the surface rocks (Mo). d) Ionic mass loss rate is proportional to the solar ultraviolet irradiance and to the kinetic energy density of the solar wind. e) The dissociative recombination rate is proportional to the magnitude of the flux of incident solar radiation. f) The oxidation rate is constant in time and equal to 5 kg/s. g) The atmospheric composition was the same in all time. Solving all these conditions we obtained the total mass of atmosphere, the mean tropospheric temperature, and the mean superficial pressure. Additional information is contained in the original extended abstract.
Author
Atmospheric Composition; Incident Radiation; Mars Atmosphere; Mars Surface; Planetary Surfaces; Time Measurement; Degassing; Mass; Ions; Models

20000110339 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Recent Advances in Mars Tectonics
Golombek, M. P., Jet Propulsion Lab., California Inst. of Tech., USA; Banerdt, W. B., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since the publication of the ”Stress and Tectonics on Mars” chapter in the Mars book (the last comprehensive summary of our knowledge on the topic) considerable advances have been made in certain areas of Martian tectonics and significant advances are expected with the return of Mars Global Surveyor data. This abstract will summarize the advances in our knowledge of tectonic features and processes on Mars since the Mars book and point towards new areas of research that can be expected from the Mars Global Surveyor data. Two out of three areas of study that were discussed as future directions of work in the Mars chapter have had significant work directed towards them. One area is the field of structural mapping and understanding the timing of tectonic activity on Mars in the framework of the global stratigraphy. Although the general development and relative timing of the development of the Tharsis province on Mars had been understood for some time, actual placement of mapped tectonic features in a global stratigraphic framework has only recently been completed. The second area of study mentioned in the Mars chapter was the impact of improved topography and gravity on modeling loads and deriving stresses in the Martian lithosphere. Mars Global Surveyor is on the brink of returning vastly improved topographic and gravity fields and these newer data sets can be used to better define the size and shape of Tharsis and to quantify loads and derived stresses in the Martian lithosphere. Additional information is contained in the original extended abstract.
Author
Gravitational Fields; Landforms; Mars Global Surveyor; Mars Surface; Planetary Geology; Tectonics

20000110344 NASA Ames Research Center, Moffett Field, CA USA
Modeling the Atmospheric Structure and Dynamics of the Martian Atmosphere
Haberle, R. M., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Models of the general circulation and climate system of Mars have reached a high level of maturity, but observations to validate them have lacked the kind of global and temporal coverage required. However, we are now on the verge of a new era in Mars exploration as Mars Global Surveyor, and the now enroute Mars Climate Orbiter, will provide daily global coverage of the atmosphere for two Mars years. In the coming years, data from these missions will test the predictions of general circulation models (GCM's) whose results have perhaps become too accepted as truth. This talk will review what GCM's tell us about Mars, what their weaknesses are, and what the latest results imply for their future. Additional information is contained in the original extended abstract.
Author
Atmospheric General Circulation Models; Mars Atmosphere; Dynamics; Climate

20000110349 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Atmospheric Science Experiment for Mars: ATMIS for the Netlander 2005 Mission
Harri, A.-M., Finnish Meteorological Inst., Finland; Siili, T., Finnish Meteorological Inst., Finland; Angrilli, A., Padua Univ., Italy; Calcutt, S., Oxford Univ., UK; Crisp, D., Jet Propulsion Lab., California Inst. of Tech., USA; Larsen, S., Risoe National Lab., Denmark; Polkko, J., Finnish Meteorological Inst., Finland; Pommereau, J.-P., Centre National de la Recherche Scientifique, France; Malique, C., Centre National de la Recherche Scientifique, France; Tillman, J. E., Washington Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

ATMIS (Atmospheric and Meteorological Instrumentation System) is a versatile suite of atmospheric instrumentation to be accommodated onboard the Netlander Mission slated for launch in 2005. Four Netlanders are planned to form a geophysical measurement network on the surface of Mars. The atmospheric sciences are among the scientific disciplines benefiting most of the network concept. The goal of the ATMIS instrument is to provide new data on the atmospheric vertical structure, regional and global circulation phenomena, the Martian Planetary Boundary Layer (PBL) and atmosphere-surface interactions, dust storm triggering mechanisms, as well as the climatological cycles of H2O, dust and CO2. to reach the goal of characterization of a number of phenomena exhibiting both spatial and temporal variations, simultaneous observations of multiple variables at spatially displaced sites Deforming a network D are required. The in situ observations made by the ATMIS sensors will be supported by extensive modeling efforts. Additional information is contained in the original extended abstract.
Author
Air Land Interactions; Atmospheric Chemistry; Atmospheric Physics; Carbon Dioxide; Dust Storms; Mars Surface; Meteorological Instruments

20000110353 Ekra Geological Consulting, Reykjavik, Iceland
Tharsis Montes Subglacial Volcanism: Proposal for a New Classification of Tharsis Volcanoes Based on Volcano-Ice Interactions and an Estimate of the Tharsis Ice Budget
Helgason, J., Ekra Geological Consulting, Iceland; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An ice sheet has recently been discovered on Arsia Mons, Mars based on morphologic interpretation of Viking Orbiter images. On Arsia Mons a fissure swarm extends from the caldera on the northeast and southwest rim. There, numerous vent-like structures are interpreted as openings where volcanism has melted ice above an eruptive site. These vents are flat and without a collar of ash. Near each main vent are either several smaller openings down-dip or an open erosional pathway leading into a more increasingly eroded network of gullies that lack graben characteristics. It is postulated that during each eruption large quantities of meltwater were transported with jokulhlaups into the fan areas, extending up to 1000 km from the caldera rim. The shape of the vent areas and the erosional channels further down dip is an indicator of ice thickness that is assumed to be well over 1 km, reaching a maximum over the caldera lid center. The ice sheet is regarded a marker horizon within the Tharsis plateau that acted as a high "ice trap". Thus, it covered simultaneously the Tharsis Montes and Olympus Mons as well. Volcanic production in these four volcanoes has, however, varied from the time the marker formed. This has resulted in highly variable morphologic character of these stratovolcanoes where volcanism has gradually interacted with the overlying ice sheet. This is exemplified by various volcano/morphologic features such as: circular vents (melting above craters), canyon formation (jokulhlaup pathways), burial (outwash plain/lava fan), aureole formation (striated features on lower flanks), dead ice deposits (humocky moraines), rimless impact craters into the ice, large scale disintegration of the regolith. The different volcano/morphologic features lead to a volcano classification from least to most volcanic activity: Arsia left arrow Pavonis left arrow Ascreous left arrow Olympus. It is suggested that all Martian volcanoes can probably be classified on basis of interaction between volcanism and an associated ice sheet. The process of ice formation associated with the Arsia Mons ice sheet must have been of "Tharsis" extent and reflected a global hydro-

logic event. The estimated volume of ice associated with this ”glaciation” event is a minimum of 5 x 10 6 cu km, assuming a 0.5 km thick layer of ice that, at the time of formation, was equally distributed above an altitude of 2 km across Tharsis, including Olympus Mons. It is suggested that most of this ice is still buried within the Tharsis regolith and/or forms part of the near surface crustal layer.
Author
Amount; Calderas; Classifications; Deposits; Disintegration; Estimating; Glacial Drift; Ice Formation; Lava; Mars Photographs; Mars Surface; Melting

20000110356 WNS GeoScience, Eltham, Australia
Carbonatite Volcanism on Mars
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the White Mars paradigm, it is implicit that with CO2 as the dominant volatile in the crust, volcanism will be somewhat different than on Earth. Carbonatite magmas would be more common on a CO2-dominated Mars than on an H2O-dominated planet. Carbonatite magmas are unusual in being extremely fluid and having very low solidification temperatures (approx. 500 C). Minor element chemistry of Carbonatites is very different than ”normal” igneous rocks. High concentrations of rare-earths and alkali metals are typical Additional information is contained in the original extended abstract.
Author
Carbon Dioxide; Volcanology; Mars Surface; Mars Volcanoes; Crusts

20000110365 WNS GeoScience, Eltham, Australia
The White Rock on Mars Compared to Terrestrial Salt Diapirs and Glaciers
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The White rock on Mars is an enigmatic geological formation within a large Southern Hemisphere crater. Despite its high reflectivity it is not presently believed to represent surface ice, due to the prevailing equatorial temperature. Instead, evaporites or other unusual minerals are invoked. Here I demonstrate that uplift rates of an ice diapir are sufficient to balance sublimation into the atmosphere of a few metres/yr at most. The White Rock is reinterpreted as an icy diapir and glacier complex, akin to salt glaciers in arid zones on Earth such as the Great Kavir desert of Iran, or to submarine salt tongues in the Gulf of Mexico. It is widely known that ice in the equatorial regions of Mars is thermally unstable, therefore it is assumed unlikely that any significant deposits of ice exist to be found there. However, on Earth we can document a number of present and geologically recent examples where soluble rock salt has emerged at the surface in a large diapir and flowed downslope in glaciers or salt tongues. The trick is to balance solubility at the surface with upward flow rate, with the additional detail that a thin crust of less-soluble residue or a skin of sediment may protect the underlying salt from dissolution. Obviously, an arid climate assists this process so salt glaciers and piercement diapirs are associated with desert areas . Oil exploration in the Gulf of Mexico has documented a number of salt tongues that can be shown to have flowed out at the seabed and travelled downdip for several km without being dissolved in the overlying seawater, being protected by a thin film of mud and sands. In a similar manner, it is proposed that the White Rock on Mars may be the surface expression of an ice diapir that has emerged at the surface and is flowing downhill in a series of ice glaciers. Surface dust will help protect the ice from sublimation and the surface texture of the deposit shows signs of wind-sculpting just as do the polar caps and salt outcrops on Earth. The critical requirements for diapirism on Mars are the creep behaviour and volatility of the various ices believed to be present in the subsurface. Water ice is less volatile, but stronger. Clathrate is weaker and would feed the diapir stock well, but would transform at the surface to water ice plus CO2 gas, or would directly sublime. CO2 ice is a less known quantity but is also weak and is certainly the most volatile of the three. A cap rock of less volatile ices or other material concentrated from the body of the rising diapir is to be expected. Additional information is contained in the original extended abstract.
Author
Carbon Dioxide; Crusts; Deposits; Geology; Glaciers; Mars Surface; Mineral Deposits; Oil Exploration; Thin Films

20000110366 Manchester Univ., Dept. of Earth Sciences, UK
Evidence for an Unusual Generation of Carbonate in ALH84001
Holland, G., Manchester Univ., UK; Lyon, I. C., Manchester Univ., UK; Saxton, J. M., Manchester Univ., UK; Frankland, T., Manchester Univ., UK; Turner, G., Manchester Univ., UK; The Fifth International Conference on Mars; July 1999; In English; See

also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Chemical and isotopic zoning have been studied in several carbonate samples of the martian meteorite ALH84001. This ongoing line of research aims to determine the process responsible for the formation of secondary carbonates, quantify the conditions of formation and refine the timing of events in ALH84001. We have studied four small (2-8 mg) grains of ALH84001 from sample ALH84001,287. These contain carbonate rich areas up to 200 microns in diameter often intimately associated with feldspar, and fragments of rosettes up to 70 microns across similar to those we and others have studied previously. Additional information is contained in the original extended abstract.

Author

Chemical Composition; Carbonates; Isotopes; Research

20000110444 Centre National de la Recherche Scientifique, France

Measurements of Isotope Ratios and Abundances in the Atmosphere of Mars by a Mass Spectrometer: PALOMA

Quemerais, E., Centre National de la Recherche Scientifique, France; Chassefiere, E., Centre National de la Recherche Scientifique, France; Berthelier, J. J., Centre National de la Recherche Scientifique, France; Jambon, A., Centre National de la Recherche Scientifique, France; Agrinier, P., Centre National de la Recherche Scientifique, France; Javoy, M., Centre National de la Recherche Scientifique, France; Kunz, J., Centre National de la Recherche Scientifique, France; Sarda, P., Centre National de la Recherche Scientifique, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A mass spectrometer is proposed to be landed on the surface of Mars. It is aimed at measuring the isotope ratios and abundances of noble gases and of some of the major elements in the bulk atmosphere. Although previous measurements were obtained from the Viking landers or from telescopic observations from, the detailed composition of the Martian atmosphere, in particular the isotopic pattern of noble gases, is still poorly known and understood. While some measurements are available from SNC meteorites, assumed to have a Martian origin, there are many uncertainties connected with understanding their relationship to the Martian atmosphere. Additional information is contained in the original extended abstract.

Author

Isotope Ratios; Mass Spectrometers; Measure and Integration; Mars Atmosphere

20000110445 Oxford Univ., Atmospheric, Oceanic and Planetary Physics, Oxford, UK

POD/EOF Models of Mars' Atmospheric Circulation: Is Martian Meteorology Chaotic?

Read, P. L., Oxford Univ., UK; Lewis, S. R., Oxford Univ., UK; Whitehouse, S. G., Oxford Univ., UK; Moroz, I. M., Oxford Univ., UK; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since the early analyses of the Viking lander observations of pressure, wind and temperature variations on the surface of Mars, it has been apparent that certain components of Mars' meteorology exhibit a much stronger degree of periodicity and coherence than the corresponding phenomena on Earth. This was particularly clear for the baroclinic transients during Northern Hemisphere fall, winter and spring, during which signals from travelling wave disturbances could be detected which corresponded to relatively low planetary wavenumbers (m = 1-3) with periods of approx. 2-8 sols and which persisted for intervals of 10-50 sols. Together with the presence of strong, periodic diurnal tides, such observations suggest that Mars' climate and meteorology may operate in a dynamical regime which is more ordered and less chaotic than that of the Earth, and hence may be more predictable in the sense of meteorological weather forecasting. Additional information is contained in the original extended abstract.

Author

Wind (Meteorology); Temperature Measurement; Atmospheric Models; Baroclinity; Diurnal Variations; Mars Environment; Mars Surface

20000110469 Geological Survey, Flagstaff, AZ USA

What is the Significance of Layering Observed by MOC in Martian Heavily Cratered Terrain?

Tanaka, K. L., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The geology of the martian heavily cratered terrains has been studied and mapped extensively with Viking images . Impact, volcanic, fluvial, tectonic, periglacial, hydrothermal, and eolian processes have been suggested as contributing to the make up

and modification of these terrains. Malin and Edgett, viewing the ancient landscapes of Mars with Mars Orbiter Camera (MOC) images, observe that the heavily cratered terrains are made up of layers expressed by contrasts in albedo or resistance to erosion. They interpret that the layered material predates ”all of the landforms previously attributed to ’early Mars”” including valley networks and ”all of the major volcanic and tectonic features of the Tharsis/Syria rise.” Furthermore, they suggest that ”some of the layers must be of sedimentary origin, and might have a regional extent that implies that processes occurred on ancient Mars that are completely unlikely processes that occur there today.” They also claim that ”the presence of a layered crust suggests that planet Mars was once unlike anything that anyone has ever described.” Although MOC images provide a spectacular advance in our ability to observe the martian surface, just how oblivious were previous workers to layering and its consequences in ancient martian rocks? Do the layers necessarily predate Tharsis volcanic and tectonic activity and early valley network formation? Does the layering require the erosion of large mountain ranges and the formation of vast seas? Or are the layers consistent with the same ”old” Mars expressed by the extant landscape? Additional information is contained in the original extended abstract.
Author
Albedo; Craters; Crusts; Erosion; Landforms; Mars Surface; Tectonics; Terrain; Topography

20000110470 Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, Germany
The Martian Sky and Its Illumination of the Martian Surface
Thomas, N., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W. J., Max-Planck-Inst. fuer Aeronomie, Germany; Sablotny, R. M., Max-Planck-Inst. fuer Aeronomie, Germany; Keller, H. U., Max-Planck-Inst. fuer Aeronomie, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The dust in the atmosphere above the Mars Pathfinder landing site produced a bright, red sky that increases in redness toward the horizon at midday. There is also evidence for an absorption band in the scattered light from the sky at 860 nm. A model of the sky brightness has been developed and tested against Imager for Mars Pathfinder (IMP) observations of calibration targets on the lander. The resulting model has been used to quantify the total diffuse flux onto a surface parallel to the local level for several solar elevation angles and optical depths. The model shows that the diffuse illumination in shadowed areas is strongly reddened while areas illuminated directly by the Sun (and the blue forward scattering peak) see a more solar-type spectrum, in agreement with Viking and IMP observations. Quantitative corrections for the reddening in shadowed areas are demonstrated. It is shown quantitatively that the unusual appearance of the rock Yogi (the east face of which appeared relatively blue in images taken during the morning but relatively red during the afternoon) can be explained purely by the changing illumination geometry. We conclude that any spectrophotometric analysis of surfaces on Mars must take into account the diffuse flux. Specifically, the reflectances of surfaces viewed under different illumination geometries cannot be investigated for spectral diversity unless a correction has been applied which removes the influence of the reddened diffuse flux. Additional information is contained in the original extended abstract.
Author
Sky Brightness; Mars Surface; Landing Sites; Interstellar Extinction; Horizon; Forward Scattering; Elevation Angle; Dust; Absorption Spectra

20000110477 Indiana Univ., Dept. of Geological Sciences, Bloomington, IN USA
Zeolite Cement in Martian Volcaniclastic Rocks
Towell, D. G., Indiana Univ., USA; Basu, A., Indiana Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

There is a consensus that volcanic activity, action of water and wind, impact cratering, and cryogenic processes have shaped the surface of Mars. Older pyroclastic deposits and impact comminuted volcanic material would be buried under newer volcanic material. If water is stored as permafrost near the surface, any heating by volcanism or impact, would melt a part of the permafrost and set up a convection-cell-like flow. The flow will be most efficient in the volcaniclastic layers because of their higher porosity and permeability relative to volcanic rocks. Existence of liquid water and the flow, however, will be transient dependent upon the longevity of the heat source. If so, the temperature and the water-rock ratio in the circulation system will decrease with time from an initial high, favoring early dissolution of magmatic phases and subsequent precipitation of diagenetic phases. Such diagenesis will lithify buried volcaniclastic debris in Mars. On the basis of examples from Earth and on thermodynamic grounds, we argue

that zeolite is the likely cement in Martian volcaniclastic rocks. Additional information is contained in the original extended abstract.
Author
Zeolites; Cements; Cryogenics; Igneous Rocks; Mars Surface; Volcanology

20000110481 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Fe(VI) as a Possible Oxidant on the Martian Surface
Tsapin, A. I., Jet Propulsion Lab., California Inst. of Tech., USA; Goldfeld, M. G., California Inst. of Tech., USA; McDonald, G. D., Jet Propulsion Lab., California Inst. of Tech., USA; Nealson, K. H., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The essential findings of the three biological experiments (Gas Exchange, Labeled Released, and Pyrolitic Release) aboard the Viking Mars landers were the discovery of the presence of one or more strong oxidants on the Martian surface. The Gas Exchange experiments showed that wetting Martian soil leads to the evolution of oxygen, while in the Labeled Release experiment addition of a nutrient solution containing C-14-labeled formate, glycine, lactate, alanine, and glycolic acid induced CO2 evolution. A general consensus was reached that all data taken together pointed to the presence on Martian surface of a strong oxidant, or most probably several different types of oxidants. Several candidates have been proposed as oxidants, including superoxides, hydrogen peroxide, and iron oxides (possibly gamma-Fe2O3). Additional information is contained in the original extended abstract.
Author
Iron Isotopes; Oxidizers; Mars Surface; Lactates; Iron Oxides; Carbon Dioxide

20000110484 Max-Planck-Inst. fuer Chemie, Mainz, Germany
The Chemical Composition of the Martian Surface
Waenke, H., Max-Planck-Inst. fuer Chemie, Germany; Brueckner, J., Max-Planck-Inst. fuer Chemie, Germany; Dreibus, G., Max-Planck-Inst. fuer Chemie, Germany; Lugmair, G. W., Max-Planck-Inst. fuer Chemie, Germany; Rieder, R., Max-Planck-Inst. fuer Chemie, Germany; Economou, T., Chicago Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Pathfinder mission yielded the first in situ analysis of the chemical composition of Martian rocks with the APX-spectrometer on the rover Sojourner. The preliminary data indicated that the soil on Mars might be chemically homogeneous on a global scale as the Pathfinder soil is chemically almost identical to that at Viking 1 and 2 sites. The rocks embedded in the soil at the Pathfinder site turn out to be rather similar to each other but very different compared to the soil. In contrast to the mafic character of the SNC meteorites the Pathfinder rocks are felsic rocks, rich in SiO2 and K and low in Mg. Hence, the consensus generally reached after the Viking soil analyses of a rather primitive and mafic composition of the Martian surface has to be put into new perspective.
Derived from text
Chemical Composition; Crusts; Embedding; Igneous Rocks; Mineralogy; Planetary Geology; Planetary Mantles; Planetary Structure; Soil Sampling

20000110488 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Petrological Explanations for the Magnetic Anomalies Detected on Mars
Weitz, C. M., Jet Propulsion Lab., California Inst. of Tech., USA; Rutherford, M. J., Brown Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The discovery of crustal magnetization in some locations on Mars, particularly the southern highlands, has major implications for the early evolution of Mars. The east-west-trending linear features in the southern highlands with alternating polarity may be the result of an early seafloor spreading process similar to that seen on Earth today. The larger magnetization of the martian crust compared to the Earth can be attributed to its higher Fe content and the proposed minerals associated with this magnetization are multidomain hematite and pyrrhotite. In this study, we discuss the petrological evolution of basalts on Earth and Mars and suggest

processes that may enhance crystallization of magnetic minerals in the martian rocks, thereby accounting for their intense magnetic properties.
Author
Magnetization; Mars Surface; Planetary Geology; Petrology; Basalt; Magnetic Properties; Mars (Planet)

20000110489 Tel-Aviv Univ., Ramat-Aviv, Dept. of Geophysics and Planetary Sciences, Tel-Aviv, Israel
Models of the Thermal and Volcanic Evolution of Mars
Weizman, A., Tel-Aviv Univ., Ramat-Aviv, Israel; Prialnik, D., Tel-Aviv Univ., Ramat-Aviv, Israel; Podolak, M., Tel-Aviv Univ., Ramat-Aviv, Israel; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The surface of Mars shows many evidence of continued and diverse volcanic activity. The source for volcanism is partial melting in the mantle, as a result of two possible mechanisms: pressure release melting, when hot mantle rock ascends to fill gaps in the lithosphere, and plumes carrying hot material from the lower boundary layer to the upper boundary layer. Using numerical models, we calculate the rate of volcanism through time and compare the relative contributions of the two mechanisms. The results suggest that Mars could be still volcanically active, and the origin of any recent volcanism was probably from the plumes.
Derived from text
Mars Surface; Mars Volcanoes; Mathematical Models; Plumes; Mars (Planet); Volcanology; Planetary Mantles

20000110495 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Martian Surface Boundary Layer
Wilson, G. R., Jet Propulsion Lab., California Inst. of Tech., USA; Joshi, M., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The acquisition of meteorological data from the surface of Mars by the two Viking Landers and Mars Pathfinder make it possible to estimate atmospheric boundary layer parameters and surface properties at three different locations on the planet. Because the Martian atmosphere is so thin the majority of the solar radiance is converted to heat at the surface. The difference between surface and atmospheric temperature can also constraint surface albedo, thermal inertia, and infrared emissivity. The Mars Pathfinder Atmospheric Structure Instrument/Meteorological package (ASI/MET) was the most capable weather monitoring system ever sent to the surface of another planet to date. One of the prime objectives of the ASI/MET package is to characterize the surface boundary layer parameters, particularly the heat and momentum fluxes, scaling temperature and friction velocity, and estimate surface roughness. Other important boundary layer parameters, such as Richardson Number, Monin-Obukhov length, analysis of turbulence characteristics of wind and temperature, and atmospheric stability class can also be determined from these measurements.
Derived from text
Boundary Layers; Mars Atmosphere; Mars Surface; Surface Properties; Mars Environment; Mars (Planet); Planetary Meteorology

20000110498 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
The Martian Upper Atmosphere During Phase Two of Mars Global Surveyor Aerobraking: Comparison to Predictions
Withers, P. G., Arizona Univ., USA; Bougher, S. W., Arizona Univ., USA; Keating, G. M., George Washington Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Global Surveyor accelerometer provided density, density scale height, and temperature data for each orbit at periapsis and 130 km altitude (both inbound and outbound). It observed large and unexpected variations in upper atmospheric density with longitude. A stationary wave fit to these variations changed in both amplitudes and phases with latitude and did not correlate precisely with topography. Longitudinal variations were not predicted at all and the mean behaviour of the upper atmosphere was only partially predicted, with the south polar region being particularly poorly predicted.
Author
Mars Atmosphere; Upper Atmosphere; Atmospheric Density; Mars (Planet)

20000110506 Massachusetts Inst. of Tech., Dept. of Earth, Atmospheric and Planetary Sciences, Cambridge, MA USA
Structure of the Martian Polar Deposits
Zuber, M. T., Massachusetts Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The polar regions of Mars represent primary reservoirs of present-day volatiles on Mars and preserve the records of water, carbon dioxide, and dust over timescales that range from seasonal to geological. Major progress in understanding of the polar regions has been made since the initial telescopic detection of polar seasonal frost over two centuries ago, to moderate resolution imaging from the Mariner 9 and Viking 1 and 2 orbiters to systematic high resolution mapping by the current Mars Global Surveyor spacecraft. Detailed in situ sampling of the south polar layered terrains by the Mars '98 Polar Lander, due to land in December, 1999, will forge a link between local geology and global volatile cycles.
Author
Polar Regions; Mars Surface; Planetary Geology; Mars (Planet); Planetary Structure

20000110507 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Polar Layered Terrains: Links Between the Martian Volatile and Dust Cycles
Zurek, R. W., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The nature, origin and evolution of the polar layered terrains are a major mystery of Martian climate. Almost every aspect of these enigmatic terrains surrounding, and probably underlying, the polar residual ice caps is in contention. Are the polar laminae forming today? Are they inactive or even eroding, being mere relics of the past? Are the north and south polar layered terrains fundamentally different in composition, age or process? Are they a physical record of past, possibly cyclic, climate change and, if so, can we learn to read that record? We know from past Mariner 9 and Viking orbital observations that there are layered terrains at high latitudes, defined by alternating bands of visually lighter and darker material appearing in stacks hundreds of meters thick with individual bands as thin as could then be resolved (tens of meters). In this talk, aspects of the polar layered terrains will be reviewed with emphasis on issues likely to be addressed with data from ongoing and near-term flight missions to Mars. Particular attention will be given to what might be learned from observing the present seasonal cycles of dust, water and carbon dioxide on Mars, in conjunction with in situ data from one site on the south polar layered terrain.
Author
Mars Surface; Polar Caps; Mars (Planet); Dust; Planetary Meteorology; Mars Environment; Terrain; Planetary Geology

20000110579 NASA Marshall Space Flight Center, Huntsville, AL USA
Topside Ionosphere Parameters Observed by POLAR and DMSP at high latitudes
Zeng, Wen, Alabama Univ., USA; Horwitz, James L., Alabama Univ., USA; Stevenson, B. Adam, Alabama Univ., USA; Germany, Glynn A., Alabama Univ., USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Rich, Fred J., Air Force Research Lab., USA; Moore, Thomas E., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 5 Dec. 2000, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Several near-simultaneous Southern polar passes for both POLAR (at perigee) and DMSP spacecraft are examined. The core ion measurements from the Thermal Ion Dynamics Experiment (TIDE) on POLAR spacecraft near 5000 km altitude and the ionospheric ion and electron parameters measured by both DMSP 12 and DMSP 13 at 840 kin altitude during these near-simultaneous passes provide unique quasi-global snapshots of the ionospheric flows. We consider such parameters as the O (+) and H (+) densities, temperatures and parallel flows from POLAR/TIDE and the O (+) ion parameters and electron temperature from the DMSP observations. For some passes, auroral images from the POLAR Ultraviolet Imager (UVI) are used to complement the ion/electron parameter observations. We will also examine the interplanetary magnetic field context of these quasi-global topside ionospheric measurements.
Author
DMSP Satellites; Polar Regions; Earth Ionosphere

20000113400 Communications Research Lab., Japan
Wave Summit Course: Very Long Baseline Interferometer ***Wave Summit Kouza: VLBI Tekunorojii***
Takahashi, Fujinobu, Communications Research Lab., Japan; Kondo, Tetsuro, Communications Research Lab., Japan; Takahashi, Yukio, Communications Research Lab., Japan; Koyama, Yasuhiro, Communications Research Lab., Japan; 2000; 258p; In English

Report No.(s): LC-00-104535; ISBN 4-274-90378-8; Copyright; Avail: Issuing Activity

In October 1896, one year after the success of Marconi's wireless telegraphy experiments, Japan started research into wireless telegraphy at the Electrical Technical Laboratory of the Ministry of Communications. The following year, Mr. Matsunosuke Matsushiro found success in his wireless telegraphy experiments. The Radio Research Laboratories, Ministry of Posts and Telecommunications, was established in 1952 after some reorganization of the laboratories researching radio communication technology. The Radio Research Laboratories was renamed the Communications Research Laboratory in 1988 to reflect the change in the environment for research following the privatization of the Nippon Telegraph and Telephone Corporation in Japan. to celebrate 100 years of radio communications, we have spent several years at the Communications Research Laboratory planning and preparing to publish in book from the results of the research so far conducted. Entitled the "Wave Summit Course", it will contain a series of papers on various aspects of radio communications technology and is aimed at students of both the senior and graduate levels, that is, the generation of scientists who will lead the way in the 21st century. Now the time for publication has arrived. This series consists of seven volumes: 'Satellite Communications', 'Very Long Baseline Interferometer', 'Science of Space Environment', 'Modern Millimeter-Wave Technologies', 'Digital Broadcasting', 'Mobile Communications', and 'Global Environment Remote Sensing'. We hope that these volumes will be widely read as useful guides to the different fields in which radio waves are used.

Derived from text

Very Long Baseline Array (VLBA); Interferometers; Telegraph Systems; Telecommunication; Radio Communication

20000113823 Georgia Inst. of Tech., Atlanta, GA USA

Characterization of Nonlinearities in the Propagation of High Frequency Seismic Waves

Albert, Blace C.; Apr. 2000; 169p; In English

Report No.(s): AD-A376823; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

An austo-electromagnetic land mine detection technique is being investigated. A two-dimensional finite-difference model for elastic waves has also been developed, but it is a purely linear model. Strong nonlinearities are typical of the soils in which mines are buried. The purpose of this thesis is to characterize these nonlinearities for the propagation of high frequency seismic waves (30 - 2000 Hz) in moist, compacted sand so that the parameters used in acousto-electromagnetic land mine detection may be improved and the nonlinearities may be incorporated in the computer model. The frequency response of the soil model was recorded as a function of drive amplitude and propagation distance. The amplitude response of the soil model was recorded as a function of frequency and propagation distance. The fundamental and first five harmonics were saved for each. Three elastic wave transducers (shakers) were characterized so that source nonlinearities could be compared to propagation path nonlinearities. Characterization of the shakers included foot motion under unloaded and sand-loaded conditions. The source and propagation path produced nonlinearities as shown by harmonic generation in accelerometers mounted to the shaker foot and radar measurements of the soil surface displacement. Frequencies in the 100 - 600 Hz band propagated best while frequencies above 600 Hz attenuated rapidly. Once the shaker foot to sand coupling was changed results did not repeat with the same precision as when it was left alone.

DTIC

Elastic Waves; Finite Difference Theory; Harmonic Generations; Mine Detectors; Two Dimensional Models; Seismic Waves; Nonlinear Systems; Sound Detecting and Ranging

20000114423 Saint Louis Univ., Dept. of Earth and Atmospheric Sciences, MO USA

Regional Seismic Wavefield Calibration ***Final Report, 12 Jun. 1995 - 11 Jun. 1997***

Herrmann, R. B.; Raoof, M.; Malagnini, L.; Samiezade-Yazd, M.; Liu, W.; Dec. 15, 1998; 42p; In English

Contract(s)/Grant(s): F19628-95-K-0005; AF Proj. DENN

Report No.(s): AD-A382591; AFRL-VS-TR-1999-1514; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents an application of techniques developed to characterize Lg- and S-wave propagation as a function of distance and frequency. We have applied this technique to various regions in the USA and Europe.

DTIC

Seismic Waves; S Waves; Wave Propagation

20000114815 Saint Louis Univ., Dept. of Earth and Atmospheric Sciences, MO USA

Wave Propagation in the Arabian Plate ***Final Report, 11 Aug. 1995 - 31 Mar. 1998***

Herrmann, R. B.; Mokhtar, T. A.; Chang, T. M.; Ammon, C. J.; Ghalib, H. A.; Jun. 28, 1998; 63p; In English

Contract(s)/Grant(s): F19628-95-K-0019; AF Proj. DEEN

Report No.(s): AD-A382019; AFRL-VS-HA-TR-98-0081; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report presents a tomographic analysis of surface-wave group velocity dispersion through the Arabian Plate and studies on the usefulness of genetic algorithms for the inversion of surface-wave waveforms for earth structure. The raw group velocity dispersion measurements are available by anonymous ftp to ftp.eas.slu.edu in the directory pub/rbh/ARABIA.
DTIC
Wave Propagation; Surface Waves; Wave Dispersion; Rayleigh Waves; S Waves

20000114825 NASA Goddard Space Flight Center, Greenbelt, MD USA
Ozone and Water Vapor Measurements by Raman Lidar in the Planetary Boundary Layer: Error Sources and Field Measurements
Lazzarotto, Benoit, Ecole Polytechnique Federale de Lausanne, Switzerland; Frioud, Max, Cantonal Observatory, Switzerland; Larcheveque, Gilles, Ecole Polytechnique Federale de Lausanne, Switzerland; Mitev, Valentin, Cantonal Observatory, Switzerland; Quaglia, Philippe, Ecole Polytechnique Federale de Lausanne, Switzerland; Simeonov, Valentin, Ecole Polytechnique Federale de Lausanne, Switzerland; Thompson, Anne, NASA Goddard Space Flight Center, USA; VandenBergh, Hubert, Ecole Polytechnique Federale de Lausanne, Switzerland; Calpini, Bertrand, Ecole Polytechnique Federale de Lausanne, Switzerland; [2000]; 18p; In English
Contract(s)/Grant(s): SNSF-21-50861.97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Why do we need time series of ozone and water vapor profiles at low altitude? The degradation of air quality is a very serious environmental problem that affects urban and industrial areas worldwide. Air pollution injures human health and ecosystems, diminishes crop yield, and spoils patrimony and materials. The phenomena involved in air pollution are very complex. Once emitted into the atmosphere, (primary) pollutants are transported, dispersed, transformed by gas/solid phase change and chemical reaction, and finally removed by dry and wet deposition. Most challenging is the fact that the health and environmental impacts of secondary pollutants (formed in the atmosphere) are frequently more severe than those of their precursors (primary pollutants). This is the case of ozone and other photochemical pollutants, such as peroxyacetil nitrate (PAN) and secondary particles, produced in the atmosphere by the photo-oxidation volatile organic compounds (VOC) catalyzed by nitrogen oxides (NO(sub x)). Photochemical air pollution is a complex science because of the non-linearity of its response to changes in primary emission.
Author
Air Pollution; Air Quality; Atmospheric Chemistry; Atmospheric Moisture; Contaminants; Errors; Ozone; Photochemical Reactions; Water Vapor

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20000109803 Radex, Inc., Bedford, MA USA
Advanced Geophysical Environment Analysis and Simulation Techniques ***Final Report, May 1995-Jun 1998***
Ayer, S. M.; Bass, J. N.; Bonito, N. A.; Caton, R. G.; Cook, C. U.; Aug. 17, 1998; 152p; In English
Contract(s)/Grant(s): F19628-95-C-0106; AF Proj. 7659
Report No.(s): AD-A381225; RXR-980801; AFRL-VS-HA-TR-98-0083; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This contract supported investigations to analyze geophysical and atmosphere measurements and to develop software systems for the following: analysis of DMSP data for the SSM and SSIES experiments; the GEOSpace code for 3D visualization of the dynamic space environment; the IRTSS software, to support multiple users over the WWW; the CSSM, which renders clouds realistically in near real-time; SCINDA, to provide near real-time warning of communication outages; modeling of the atmospheric effects of meteors and the metals they leave behind; IONCAP, to modify for increased accuracy of area coverage analysis; the SPREE and CHAWS programs for data analysis; and DIDM software, for a web-based data analysis process that is fast and responsive to the user.
DTIC
Computerized Simulation; Data Processing; Geophysics; Real Time Operation; Software Engineering; Environment Simulation; Atmospheric Models; Applications Programs (Computers)

20000109862 National Environmental Satellite Service, Atmospheric Research and Applications Div., Washington, DC USA

The Use of Water Vapor for Detecting Environments that Lead to Convectively Produced Heavy Precipitation and Flash Floods

Scofield, Rod, National Environmental Satellite Service, USA; Vicente, Gilberto, NASA Goddard Space Flight Center, USA; Hodges, Mike, National Environmental Satellite Service, USA; September 2000; 72p; In English; Original contains color illustrations

Report No.(s): NOAA-TR-NESDIS-99; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Tech Report summarizes years of study and experiences on using GOES Water vapor (6.7 micron and precipitable water) and Special Sensor Microwave Imager (SSM/1) from the Defense Meteorological Satellite Program (DMSP) derived Precipitable Water (PNAI) for detecting environments favorable for convectively produced flash floods. An emphasis is on the moisture. upper air flow, and equivalent potential temperature (Theta(sub e)) patterns that lead to devastating flood events. The 15 minute 6.7 micron water vapor imagery is essential for tracking middle to upper tropospheric disturbances that produce upward vertical motion and initiate flash flood producing systems. Water vapor imagery at 6.7 micron is also used to detect surges of upper level moisture (called tropical water vapor plumes) that have been associated with extremely heavy rainfall. Since the water vapor readily depicts lifting mechanisms and upper level moisture, water vapor imagery is often an excellent source of data for recognizing patterns of heavy precipitation and flash floods. In order to analyze the depth of the moisture, the PW aspects of the troposphere must be measured. The collocation (or nearby location) of high values ofP\V and instability are antecedent conditions prior to the flash flood or heavy rainfall events. Knowledge of PW magnitudes have been used as thresholds for impending flash flood events, PW trends are essential in flash flood prediction. Conceptual models and water vapor products are used to study some of the characteristics of convective systems that occurred over the USA of America (USA) during the summer of 1997 and the 1997-1998 El Nino. P\V plumes were associated with most of the \vest coast heavy precipitation events examined during the winter season of 1997 - 1998, In another study, conducted during the summer season of 1997. results showed that the collocation of water vapor (6.7 micron) and P\N' plumes possessed higher correlations with predicted rainfall amounts than when PW plumes occurred by themselves (i.e.. without the presence of 6.7 micron water vapor plumes). Satellite Analysis Branch (SAB) meteorologists use the 6.7 micron water and P\V products for their QPE's (interactive Flash Flood Analyzer (IFFA) and Auto-Estimator precipitation estimates), Outlooks, and heavy precipitation briefings with the Hydrometeorological Prediction Center/National Center for Environmental Prediction.

Author

Atmospheric Models; Convection; Detection; Flood Predictions; Numerical Weather Forecasting; Statistical Analysis; Hydrometeorology

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Airborne Sunphotometer, Airborne in-situ, Space-borne, and Ground-Based Measurements of Troposoheric Aerosol in Ace-2

Schmid, Beat, NASA Ames Research Center, USA; Collins, D., NASA Ames Research Center, USA; Gasso, S., NASA Ames Research Center, USA; Ostrom, E., NASA Ames Research Center, USA; Powell, D., NASA Ames Research Center, USA; Welton, E., NASA Ames Research Center, USA; Durkee, P., NASA Ames Research Center, USA; Livingstron, J., NASA Ames Research Center, USA; Russell, P., NASA Ames Research Center, USA; Flagan, R., NASA Ames Research Center, USA; [2000]; 1p; In English; IGARSS 2000, 24-28 Jul. 2000, Honolulu, HI, USA

Contract(s)/Grant(s): RTOP 622-44-75-10; No Copyright; Avail: Issuing Activity; Abstract Only

We report on clear-sky column closure experiments performed in the Canary Islands during the second Aerosol Characterization Experiment (ACE-2) in June/July 1997. We present results obtained by combining airborne sunphotometer and in-situ aerosol measurements taken aboard the Pelican aircraft, space-borne NOAA/AVHRR data and ground-based lidars A wide range of aerosol types was encountered throughout the ACE-2 area, including background Atlantic marine, European pollution-derived, and African mineral dust. During !he two days discussed here, vertical profiles flown in cloud free air masses revealed three distinctly different layers: a marine boundary layer (MBL) with varying pollution levels, an elevated dust layer, and a very clean layer between the MBL and the dust layer. We found that the presence of the elevated dust layer removes the good agreement between satellite and sunphotometer AOD usually found in the absence of the dust layer. Using size-resolved composition information we have computed optical properties of the ambient aerosol from the in-situ measurements and subsequently compared those to the sunphotometer results. In the dust, the agreement in layer aerosol optical depth (380-1060 nm) is 3-8%. In the MBL there is tendency for the in-situ results to be slightly lower than the sunphotometer measurements (10-17% at 525 nm), but these differences are within the combined error bars of the measurements and computations.

Author

Photometers; Spaceborne Experiments; In Situ Measurement; Aerosols; Troposphere

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Comparison of Columnar Water Vapor Measurements During The Fall 1997 ARM Intensive Observation Period: Optical Methods

Schmid, Beat, NASA Ames Research Center, USA; Michalsky, J., NASA Ames Research Center, USA; Slater, D., NASA Ames Research Center, USA; Barnard, J., NASA Ames Research Center, USA; Halthore, R., NASA Ames Research Center, USA; Liljegren, J., NASA Ames Research Center, USA; Holben, B., NASA Ames Research Center, USA; Eck, T., NASA Ames Research Center, USA; Livingston, J., NASA Ames Research Center, USA; Russell, P., NASA Ames Research Center, USA; [2000]; 1p; In English; IGARSS 2000, 24-28 Jul. 2000, Honolulu, HI, San Antonio, TX, USA, USA

Contract(s)/Grant(s): RTOP 622-44-75-10; No Copyright; Avail: Issuing Activity; Abstract Only

In the fall of 1997 the Atmospheric Radiation Measurement (ARM program conducted an intensive Observation Period (IOP) to study water vapor at its Southern Great Plains (SGP) site. Among the large number of instruments, four sun-tracking radiometers were present to measure the columnar water vapor (CWV). All four solar radiometers retrieve CWV by measuring solar transmittance in the 0.94-micrometer water vapor absorption band. As one of the steps in the CWV retrievals the aerosol component is subtracted from the total transmittance, in the 0.94-micrometer band. The aerosol optical depth comparisons among the same four radiometers are presented elsewhere. We have used three different methods to retrieve CWV. Without attempting to standardize on the same radiative transfer model and its underlying water vapor spectroscopy we found the CWV to agree within 0.13 cm (rms) for CWV values ranging from 1 to 5 cm. Preliminary results obtained when using the same updated radiative transfer model with updated spectroscopy for all instruments will also be shown. Comparisons to the microwave radiometer results will be included in the comparisons.

Author

Atmospheric Radiation; Radiation Measurement; Water Vapor; Optical Properties; Microwave Radiometers

20000110129 NASA Wallops Flight Facility, Wallops Island, VA USA

Hurricane Directional Wave Spectrum Spatial Variation in the Open Ocean and at Landfall

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The sea surface directional wave spectrum was measured for the first time in all quadrants of a hurricane in open water using the NASA airborne scanning radar altimeter (SRA) carried aboard one of the NOAA WP-3D hurricane hunter aircraft at 1.5 km height. The SRA measures the energetic portion of the directional wave spectrum by generating a topographic map of the sea surface. At 8 Hz, the SRA sweeps a radar beam of 1 E half-power width (two-way) across the aircraft ground track over a swath equal to 0.8 of the aircraft height, simultaneously measuring the backscattered power at its 36 GHz (8.3 mm) operating frequency and the range to the sea surface at 64 positions. These slant ranges are multiplied by the cosine of the incidence angles to determine the vertical distances from the aircraft to the sea surface. Subtracting these distances from the aircraft height produces the sea surface elevation map. The sea surface topography is interpolated to a uniform grid, transformed by a two-dimensional FFT, and Doppler corrected. The open-ocean data were acquired on 24 August 1998 when hurricane Bonnie was east of the Bahamas and moving slowly to the north. Individual waves with heights up to 18 m were observed and the spatial variation of the wave field was dramatic. The dominant waves generally propagated at significant angles to the downwind direction. At some positions there were three different wave fields of comparable energy crossing each other. The NOAA aircraft spent over five hours within 180 km of the hurricane Bonnie eye, and made five eye penetrations. A 3-minute animation of the directional wave spectrum spatial variation over this period will be shown as well as summary plots of the wave field spatial variation. On 26 August 1998, the NOAA aircraft flew at 2.2 km height when hurricane Bonnie was making landfall near Wilmington, NC, documenting the directional wave spectrum in the region between Charleston, SC and Cape Hatteras, NC. The aircraft ground track included both segments along the shoreline and Pamlico Sound as well as far offshore. An animation of the directional wave spectrum spatial variation at landfall will be presented and contrasted with the spatial variation when Bonnie was in the open ocean on 24 August 1998.

Author

Hurricanes; Wind Direction; Surface Waves; Ocean Surface; Spectra; Spatial Distribution

20000110130 NASA Wallops Flight Facility, Wallops Island, VA USA

An Inexpensive Radiosonde Chilled Mirror Sensor: An Old Technology With New Impact

Schmidlin, F. J., NASA Wallops Flight Facility, USA; [1999]; 1p; In English, 12-15 Oct. 1999, Potomac, MD, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The availability of an inexpensive chilled mirror dewpoint sensor has made improved atmospheric relative humidity measurements accessible. Comparisons between the chilled mirror sensor and routine radiosonde sensors have provided new information on the limitation and reliability of the routine measurements. The chilled mirror has observed detailed moisture profiles at cirrus cloud levels when cirrus was not visible, a feature that routine sensors fail to observe. Comparison measurements between the chilled mirror, the carbon resistive (hygristor) and, the capacitive sensors will be discussed. Measurements from three locations (Wallops Island; Andros Island, Bahamas; and Camborne, UK) will be highlighted. It is conceivable that the chilled mirror sensor, when its capability is fully understood, may be sufficiently reliable to serve as a reference.

Author

Low Cost; Radiosondes; Mirrors

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Application of Statistical Methods of Rain Rate Estimation to Data From The TRMM Precipitation Radar

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The TRMM Precipitation Radar is well suited to statistical methods in that the measurements over any given region are sparsely sampled in time. Moreover, the instantaneous rain rate estimates are often of limited accuracy at high rain rates because of attenuation effects and at light rain rates because of receiver sensitivity. For the estimation of the time-averaged rain characteristics over an area both errors are relevant. by enlarging the space-time region over which the data are collected, the sampling error can be reduced. However. the bias and distortion of the estimated rain distribution generally will remain if estimates at the high and low rain rates are not corrected. In this paper we use the TRMM PR data to investigate the behavior of 2 statistical methods the purpose of which is to estimate the rain rate over large space-time domains. Examination of large-scale rain characteristics provides a useful starting point. The high correlation between the mean and standard deviation of rain rate implies that the conditional distribution of this quantity can be approximated by a one-parameter distribution. This property is used to explore the behavior of the area-time-integral (ATI) methods where fractional area above a threshold is related to the mean rain rate. In the usual application of the ATI method a correlation is established between these quantities. However, if a particular form of the rain rate distribution is assumed and if the ratio of the mean to standard deviation is known, then not only the mean but the full distribution can be extracted from a measurement of fractional area above a threshold. The second method is an extension of this idea where the distribution is estimated from data over a range of rain rates chosen in an intermediate range where the effects of attenuation and poor sensitivity can be neglected. The advantage of estimating the distribution itself rather than the mean value is that it yields the fraction of rain contributed by the light and heavy rain rates. This is useful in estimating the fraction of rainfall contributed by the rain rates that go undetected by the radar. The results at high rain rates provide a cross-check on the usual attenuation correction methods that are applied at the highest resolution of the instrument.

Author

Trmm Satellite; Rain; Meteorological Radar; Precipitation Particle Measurement

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Mapping the Martian Meteorology

Allison, M., NASA Goddard Inst. for Space Studies, USA; Ross, J. D., Pennsylvania State Univ., USA; Solomon, N., Science Systems and Applications, Inc., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars-adapted version of the NASA/GISS general circulation model (GCM) has been applied to the hourly/daily simulation of the planet's meteorology over several seasonal orbits. The current running version of the model includes a diurnal solar cycle, CO2 sublimation, and a mature parameterization of upper level wave drag with a vertical domain extending from the surface up to the 6microb level. The benchmark simulations provide a four-dimensional archive for the comparative evaluation of various

schemes for the retrieval of winds from anticipated polar orbiter measurements of temperatures by the Pressure Modulator Infrared Radiometer. Additional information is contained in the original extended abstract.
Author
Atmospheric General Circulation Models; Mars Atmosphere; Planetary Meteorology; Mars (Planet); Wind (Meteorology)

20000110282 Oregon State Univ., Coll. of Oceanic and Atmospheric Sciences, Corvallis, OR USA
Initiation and Spread of Martian Dust Storms
Barnes, J. R., Oregon State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Martian dust storms have been observed at least since the latter half of the 19th century. It was noted early on that the larger-scale obscurations by ”yellow clouds” tended to occur near the perihelion season, though these clouds were observed in other seasons as well. A large (”planet-encircling”) storm was observed extensively from Earth in 1956, but spacecraft observations have been associated with most of the best-known and largest Martian dust storms. In particular, the 1971 storm that essentially coincided with the arrival of Mariner 9 at Mars is the most extensive storm ever observed (and probably the only storm of truly global extent). Another very large storm was telescopically observed in 1973, the subsequent Mars year. Two large storms (the so-called 1977a and 1977b storms) were observed two Mars years later in 1977 by the Viking spacecraft - though these storms were not observed from Earth. Viking lander meteorological data indicate that another very large storm occured two Mars years later, in 1982. Earth-based microwave observations indicate that a large dust storm (with thermal effects approaching the magnitude of those observed by Mariner and Viking) occurred in 1994. Finally, again coincident with the presence of spacecraft at Mars, a large regional storm - close to planet-encircling size - was observed in late 1997 by MGS. Our knowledge of the frequency of major dust storms is limited because of the coverage biases inherent in the Earth-based observational record. Careful analyses of this record have led to an estimate that the probability of a ”planetary-encircling” storm occurring in any particular Mars year is roughly 1/3. The only confirmed such storms on record are the ones in 1956, 1971, 1973, 1977 (two), and 1982. It appears likely that a storm in 1924-25 was also planet-encircling, and the microwave data strongly suggest that the 1994 storm was of planet-encircling scale. It can be noted that all of the successful Mars spacecraft missions that have been at Mars during the perihelion season have observed large dust storms. It is somewhat difficult to attribute the apparent increased frequency of major dust storm activity starting in 1971 (essentially the beginning of the spacecraft era) to chance, but it is possible that the first half of the century was characterized by fewer large storms than the more recent era - something that would indicate substantial climate changes on Mars on decadal time scales. A categorization of dust storms can be made on the basis of horizontal scale, with a breakdown into local, regional, and planet-encircling storms. The demarcation between local and regional storms has been placed at a scale of 2000 km, or about 40 degrees of longitude (for the long axis of the storm). Local storms then include all dust activity at smaller scales, extending down to the dust devils ob-served by Viking and Pathfinder. In this categorization scheme, the planet-encircling storms can range from storms that remain largely restricted to one - northern or southern-hemisphere to storms that are completely global like the 1971 event. Obviously, a more quantitative categorization of storm size would also be based upon a measure of the total amount of dust put into the atmosphere and on the magnitude and extent of temperature changes induced. Some such estimates can already be made using the available spacecraft observations, and future data should permit much better estimates to be made for major storms that are observed. Additional information is contained in the original extended abstract.
Author
Dust Storms; Mars Environment; Perihelions; Mars (Planet); Planetary Meteorology; Mars Atmosphere

20000110304 Toledo Univ., Dept. of Physics and Astronomy, OH USA
Local Dust Storms in the Martian Northern Hemisphere: 1998 MGS/MOC Observations
Cantor, B. A., Toledo Univ., USA; James, P. B., Toledo Univ., USA; Wolff, M. J., Toledo Univ., USA; Malin, M. C., Malin Space Science Systems, USA; Jensen, E., Malin Space Science Systems, USA; Edgett, K. S., Malin Space Science Systems, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

MGS-Mars Observer Camera (MOC) wide-angle (WA) red (580-620 nm) and violet (400- 450 nm) filter observations obtained during the 1998 Martian dust storm season from Ls= 300 C - 318 C have resulted in the detection of five local dust storm events in the Martian northern hemisphere. The first three dust storms were observed in Amazonis Planitia, while the other two local events were observed in Chryse Planitia. It should be noted that a sixth local dust storm was observed in the Southern Hemisphere just south of the crater Schroeter (6.2 deg S, 296 deg W), in Syrtis Major Planum. The mapping orbit of MGS during SPO1

allowed MOC to monitor each of these regions on multiple occasions, in such a way that a single region could be viewed at different times of the day on three alternating orbits. Additional information is contained in the original extended abstract.
Derived from text
Dust Storms; Mars Surface; Southern Hemisphere; Radiative Transfer; Northern Hemisphere; Mars Volcanoes

20000110316 Colorado Univ., Lab. of Atmospheric and Space Physics, Boulder, CO USA
The Radiative Effects of Water Ice Clouds on the Martian Temperature Profile
Colaprete, A., Colorado Univ., USA; Toon, O. B., Colorado Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Deep temperature inversions have been observed in the near surface Martian atmosphere. It has been speculated that these inversions are the result of radiative cooling of air during the night. New observations from Mars Pathfinder and Mars Global Surveyor show deep temperature inversions not only occurring near the ground but also extending upward as high as 20 km. Some of these inversions extend over just a few kilometers in altitude and are disconnected from the ground entirely. The deepest inversions can be more than 15 K cooler than the average local temperature. These localized inversions may be the result of radiative cooling by water ice clouds. These ice clouds can occur anywhere between the ground and 50 km and can reach optical depths greater than tau = 0.5 at altitudes of around 20 km and greater than tau = 1 near the ground. Because of the low mass of the thin martian air even thin clouds can greatly alter the local temperature profile, both warming and cooling. We have developed a time dependent microphysical aero-sol model coupled to a radiative-convective thermal model to explore the effects of water ice clouds on the local Martian temperature profile. We compare our results to observations made during the Mars Pathfinder descent, and to temperature profiles retrieved by Mars Global Surveyor.
Author
Radiation Effects; Water; Ice Clouds; Mars Atmosphere; Temperature Profiles

20000110322 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Meteorological Experiment on the Mars Surveyor '98 Polar Lander
Crisp, D., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

When it lands on Mars on December 3, 1999, the Mars Surveyor '98 Mars Polar Lander (MPL) will provide the first opportunity to make in-situ measurements of the near-surface weather climate, and volatile inventory in the Martian south polar region. to make the most of this opportunity, the MPL's Mars Volatiles and Climate Surveyor (MVACS) payload includes the most comprehensive complement of meteorological instruments ever sent to Mars. Like the Viking and the Mars Pathfinder Lander, the MVACS Meteorological (Met) package includes sensors for measuring atmospheric pressures, temperatures, and wind velocities. This payload also includes a 2-channel tunable diode laser spectrometer for in-situ measurements of the atmospheric water vapor abundance near the ground, and improved instruments for measuring the relative abundances of oxygen isotopes (in water vapor and CO2) and a surface temperature probe for measuring the surface and sub-surface temperatures. This presentation will provide a brief overview of the environmental conditions anticipated at the surface in the Martian regions. We will then provide an overview of the MVACS Met instrument and describe the MET sensors in detail, including their principle of operation, range, resolution, accuracy, sampling strategy, heritage, accommodation on the Lander, and their control and data handling system. Finally, we will describe the operational sequences, resource requirements, and the anticipated data volumes for each of the Met instruments.
Author
Meteorological Instruments; Experimentation; Atmospheric Moisture; Atmospheric Pressure; Carbon Dioxide; Mars Surface; Pressure Measurement; Surface Temperature; Wind Velocity

20000110438 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Review of Spatial and Seasonal Changes in Condensation Clouds Observed During Aerobraking by MGS TES
Pearl, J. C., NASA Goddard Space Flight Center, USA; Smith, M. D., Catholic Univ. of America, USA; Conrath, B. J., Cornell Univ., USA; Bandfield, J. L., Arizona State Univ., USA; Christensen, P. R., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Successful operation of the Mars Global Surveyor spacecraft, beginning in September 1997, has permitted extensive infrared observations of condensation clouds during the martian southern summer and fall seasons (184 deg less than L(sub s) less than

28 deg). Initially, thin (normal optical depth less than 0.06 at 825/ cm) ice clouds and hazes were widespread, showing a latitudinal gradient. With the onset of a regional dust storm at L(sub s) = 224 deg, ice clouds essentially vanished in the southern hemisphere, to reappear gradually after the decay of the storm. The thickest clouds (optical depth approx. 0.6) were associated with major volcanic features. At L(exp s) = 318 deg, the cloud at Ascraeus Mons was observed to disappear between 21:30 and 09:30, consistent with historically recorded diurnal behavior for clouds of this type. Limb observations showed extended optically thin (depth less than 0.04) stratiform clouds at altitudes up to 55 km. A water ice haze was present in the north polar night at altitudes up to 40 km; this probably provided heterogeneous nucleation sites for the formation of CO2 clouds at altitudes below the 1 mbar pressure level, where atmospheric temperatures dropped to the condensation point of CO2.
Author
Aerobraking; Annual Variations; Atmospheric Temperature; Carbon Dioxide; Haze; Ice Clouds; Mars Volcanoes; Clouds (Meteorology); Condensates

20000110440 Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA
CO2 Ice Clouds in the Polar Hood as Seen by MOLA
Pettengill, G. H., Massachusetts Inst. of Tech., USA; Ford, P. G., Massachusetts Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Orbiting Laser Altimeter (MOLA) instrument, carried aboard the Mars Global Surveyor (MGS) spacecraft, has observed laser echoes from cloud tops on 57% of its orbital passes over the winter (L(sub s) = 300 deg - 350 deg) Martian north pole and on 90% of the passes over the winter (L(sub s) = 103 deg - 114 deg) south pole. The geographical locations of the cloud echoes are given for the north and south poles, respectively. Both show that clouds capable of producing echoes at the laser wavelength of 1.064 mm occur only poleward of approximately 65 deg latitude during local winter, when sunlight is largely absent from those regions. At the southern pole, where the coverage is more uniform and the statistics more meaningful, clouds may be seen to occur preferentially in two regions: at the edge of the polar hood between latitudes 65 deg S and 80 deg S, and again at extreme southern culmination near the pole. At both poles, the cloud occurrence appears correlated with the height of the underlying terrain, i.e. clouds occur more frequently over higher surface elevations. Clouds at the edge of the polar hood tend to show less coherent structure than those nearer the pole. Most clouds do not extend above about 10 km, although there are occasional examples up to 18 km above the geoid. As discussed, the sloping cloud tops characteristic of the structured clouds suggest wavefronts associated with gravity or buoyancy waves. The fact that they extend from the surface up to as much as 17 km above, at times when CO2 is known to be condensing in the polar regions, implies that the echoing particles consist primarily of dry ice, and that the vertical temperature profile follows that of a wet CO2 adiabat having a lapse rate of approximately 0.85K/km. Measurements of the apparent wavelengths of the buoyancy waves allow limits to be placed on the propagating phase velocities and, in some cases where the structure appears to be a lee wave associated with a surface height discontinuity, the velocity of the exciting wind. Additional information is contained in the original extended abstract.
Author
Cloud Height Indicators; Ice Clouds; Laser Altimeters; Polar Regions; Temperature Profiles; Wave Fronts; Echoes

20000110465 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
Correction for Scattering Opacity of Martian Atmospheric Water Vapor Abundances
Sprague, Ann, Arizona Univ., USA; Hunten, Donald, Arizona Univ., USA; Hill, Richard, Arizona Univ., USA; Doose, Lyn, Arizona Univ., USA; Rizk, Bashar, Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It has been known since the work of Davies that spectroscopic measurements of H2O abundance near the limb are affected by absorption and scattering by dust in the atmosphere. He suggested that this effect probably accounts for the apparent diurnal variations frequently seen in ground-based data of Barker. Modeling of the phenomenon suggests that only water-vapor in the lowest 1000 m is likely to deposit on the surface during the night and re-appear during the day, and this is only about 10% of the vapor in a typical atmospheric column. On the other hand, measurement from the Viking Landers do suggest depoisition.We have developed a method to correct near-limb measurement for the dust scattering. Instead of the Monte-Carlo treatment used by Davies, we use a doubling -adding code with a dust phase function determined by applying this code to data from Mars Pathfinder.
Derived from text
Abundance; Water Vapor; Scattering; Opacity; Mars Atmosphere; Dust; Diurnal Variations

20000110468 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Water Ice Cloud Opacities and Temperatures Derived from the Viking IRTM Data Set

TamppariL. K., Jet Propulsion Lab., California Inst. of Tech., USA; Zurek, R. W., Jet Propulsion Lab., California Inst. of Tech., USA; Paige, D. A., California Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The degree to which water ice clouds play a role in the Mars climate is unknown. Latent heating of water ice clouds is small and since most hazes appeared to be thin (tau less than or = 1) their radiative effects have been neglected. Condensation likely limits the vertical extent of water vapor in the water column and a lowering of the condensation altitude, as seen in the northern spring and summer, could increase the seasonal exchange of water between the atmosphere and the surface. It has been suggested that water ice cloud formation is more frequent and widespread in the aphelic hemisphere (currently the northern). This may limit water to the northern hemisphere through greater exchange with the regolith and through restricted southward transport of water vapor by the Mars Hadley circulation. In addition, it has been suggested that water ice cloud formation also controls the vertical distribution of atmospheric dust in some seasons. This scavenging of dust may Continuing from the IRTM cloud maps, derived cloud opacities and cloud temperatures for several locations and seasons will be presented. Sensitivities to cloud particle sizes, surface temperature, and dust opacity will be discussed.

Author

Water Vapor; Ice Clouds; Atmospheric Models; Atmospheric Temperature; Climate Models; Cloud Physics; Dust; Mars Environment

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Water Vapor in the Atmosphere of Mars: From Pathfinder to Mars Polar Lander

Titov, D. V., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W. J., Max-Planck-Inst. fuer Aeronomie, Germany; Thomas, N., Max-Planck-Inst. fuer Aeronomie, Germany; Keller, H. U., Max-Planck-Inst. fuer Aeronomie, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Imager for Mars Pathfinder (IMP) was the first instrument to study atmospheric water from the surface of Mars. The camera took images of the Sun at sun-rise and sunset in six filters in and around the 0.94 mm H2O band. The average value of 6 +/- 4 pr.microns of atmospheric water column density was derived from the measurements. The main result of IMP observations was the indication of that the atmospheric water is probably not uniformly distributed with altitude, but is rather confined to a 1-3 km layer at the surface. Figure 1 compares the results of water vapor determination by IMP to the predictions of uniform (solid lines) and non-uniform (dashes) models of H2O vertical distribution. Numbers at the curves denote H2O mixing ratio in the uniform model. The non-uniform model in which water vapor was confined to the lowest 1-3 km of the atmosphere reproduces the fast decrease of the measured transmittance with decreasing Sun elevation angle much better than the uniform model. Additional information is contained in the original extended abstract.

Author

Water Vapor; Mars Surface; Elevation Angle; Confinement; Cameras

20000110497 National Oceanic and Atmospheric Administration, Princeton, NJ USA

Comparison of Mars GCM Dust Storm Simulations with Viking Mission Observations

Wilson, R. J., National Oceanic and Atmospheric Administration, USA; Richardson, M. I., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

To date, comparisons of Mars General Circulation Model (MGCM) simulations with spacecraft infrared observations have generally focussed on the zonal mean temperature structure and derived wind fields. The recent identification of, and accounting for a surface radiance bias in the Viking IRTM 15 micrometer radiances has enabled atmospheric 0.5 mb (approx. 25 km) temperatures (T(sub 15)) to be recovered providing a fresh look at the data. In this presentation, we consider the evolution of the diurnal variation of T(sub 15) during the rise and subsequent decay of two major dust storms observed by the Viking spacecraft in 1977. Derived from text

Dust Storms; Mars Atmosphere; Mars Surface; Computerized Simulation; Mars (Planet); Atmospheric General Circulation Models

20000110499 NASA Goddard Space Flight Center, Greenbelt, MD USA

Some Characteristics of the Martian Aphelion Global Cloud Belt

Wolff, M. J., Space Science Inst., USA; Clancy, R. T., Space Science Inst., USA; Whitney, B. A., Space Science Inst., USA; Christensen, P. R., Arizona State Univ., USA; Pearl, J. C., NASA Goddard Space Flight Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The presence of discrete condensate clouds on Mars is certainly not a new discovery, having been observed through most of the documented history of telescopic monitoring. Furthermore, spacecraft data have been used to study discrete cloud features in the Martian atmosphere in greater detail, e.g., morphology, seasonal occurrence. Condensate clouds, specifically discrete water ice clouds, appeared to be regarded as fairly common but, with the possible exception of the polar regions, generally uninteresting from a climatological point of view. However, recent observations indicate that in addition to their large spatial scale, the water ice clouds may in fact play a more prominent role in the Martian climate. In this paper, we wish to examine the spatial and temporal variations of the cloud belt optical depth, as well as the microphysical characteristics of the water ice particles themselves.
Derived from text

Mars Atmosphere; Mars Environment; Ice Clouds; Mars (Planet); Ice; Planetary Meteorology

20000110535 Norfolk State Univ., Dept. of Computer Science, VA USA

Atmospheric Science Data and Its Usage in K-12 Education

Shah, Shantilal N., Norfolk State Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 75; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dr. Shah's project for the summer 1999 as an ASEE fellow, with the Learning Technologies Project under Mr. J. Seaton, involved the study of various satellite data launched by Atmospheric Sciences Division (ASD) at Langley Research Center (LaRC), and its use and application in K-12 science education. Dr. shah intended to study the data from Clouds and Earth's Radiant Energy System (CERES) satellite and how it could be used in school curriculum in the area of mathematics, physics, chemistry and computer science. The initial idea was to develop a program using this satellite data which would increase both teachers' and students' interest in science. Depending on the level of difficulty of the topic and content, the project could be divided into three parts, one for elementary level, one for middle level and one for high school level.
Derived from text

Atmospheric Chemistry; Education; Meteorology

20000111066 NASA Goddard Space Flight Center, Greenbelt, MD USA

High-Level Clouds and Relation to Sea Surface Temperature as Inferred from Japan's GMS Measurements

Chou, Ming-Dah, NASA Goddard Space Flight Center, USA; Lindzen, Richard S., Massachusetts Inst. of Tech., USA; Lee, Kyu-Tae, National Kangnung Univ., Korea, Democratic People's Republic of; [2000]; 1p; In English; International Radiation Symposium, 24-29 Jul. 2000, Saint Petersburg,, Russia; No Copyright; Avail: Issuing Activity; Abstract Only

High-level clouds have a significant impact on the radiation energy budgets and, hence, the climate of the Earth. Convective cloud systems, which are controlled by large-scale thermal and dynamical conditions, propagate rapidly within days. At this time scale, changes of sea surface temperature (SST) are small. Radiances measured by Japan's Geostationary Meteorological Satellite (GMS) are used to study the relation between high-level clouds and SST in the tropical western and central Pacific (30 S-30 N; 130 E-170 W), where the ocean is warm and deep convection is intensive. Twenty months (January 1998 - August, 1999) of GMS data are used, which cover the second half of the strong 1997-1998 El Nino. Brightness temperature at the 11-micron channel is used to identify high-level clouds. The core of convection is identified based on the difference in the brightness temperatures of the 11- and 12-micron channels. Because of the rapid movement of clouds, there is little correlation between clouds six hours apart. When most of deep convection moves to regions of high SST, the domain averaged high-level cloud amount decreases. A +2C change of SST in cloudy regions results in a relative change of -30% in high-level cloud amount. This large change in cloud amount is due to clouds moving from cool regions to warm regions but not the change in SST itself. A reduction in high-level cloud amount in the equatorial region implies an expanded dry upper troposphere in the off-equatorial region, and the greenhouse warming of high clouds and water vapor is reduced through enhanced longwave cooling to space. The results are important for understanding the physical processes relating SST, convection, and water vapor in the tropics. They are also important for validating climate simulations using global general circulation models.
Author

Geosynchronous Orbits; Sea Surface Temperature; Convection Clouds; Radiance; Oceanography; Meteorological Satellites

20000111068 NASA Goddard Space Flight Center, Greenbelt, MD USA

Soil Moisture and Mesoscale Convective Complex Development During the 1993 US Midwest Flood: Results from the MM5-PLACE Atmosphere/Land-Surface Model

Baker, R. David, Maryland Univ. Baltimore County, USA; Wang, Yansen, Maryland Univ. Baltimore County, USA; Tao, Wei-Kuo, NASA Goddard Space Flight Center, USA; Wetzel, Peter, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 2001 American Meteorological Society meeting, 14-19 Jan. 2001', Albuquerque, NM, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The 1993 US Midwest Flood produced record levels of flooding, in the Mississippi River Basin. This flooding resulted from repeated frontal passages and mesoscale convective complexes (MCCs) during the months of June and July. A better understanding of processes that influenced MCC development during the 1993 Flood may lead to improved forecasts of heavy precipitation and flooding. Here, we consider the impact of soil moisture on MCC development during a two-day period (June 23-24) of the 1993 US Midwest Flood. The purpose of this study is to assess the importance of soil moisture distribution on the timing, intensity, and location of heavy precipitation. In this study, the MM5-PLACE Atmosphere/Land-Surface Model is utilized. The atmospheric component consists of the Penn State/NCAR MM5 mesoscale model, and the land-surface component consists of the Goddard Parameterization for Land Atmosphere-Cloud Exchange (PLACE). Initial soil moisture is provided from two sources: 1) NCEP reanalysis, and 2) Antecedent Precipitation Index (API) using NOAA rain gauge measurements as a proxy for soil moisture. NCEP reanalysis provides coarse resolution initial soil moisture (2.5 degree), while API provides high resolution initial soil moisture (10-200 km depending on NOAA rain gauge spacing). Initial results indicate that the distribution of soil moisture has a significant impact on the timing and location of heavy precipitation during this two-day flood event. Precipitation in simulations with high resolution initial soil moisture agrees more closely with observed precipitation. These results suggest that high resolution soil moisture observations are necessary to accurately predict severe storm development, heavy precipitation, and subsequent flooding.

Author

Floods; Mesoscale Phenomena; Soil Moisture; Air Land Interactions; Atmospheric Models; Convection; Mississippi River (US); River Basins

20000112929 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: April 2000

April 2000; 1p; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity

The CD-ROM concerning the April 2000 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the polar orbital meteorological satellites operated by NOAA. The CD-ROM contains the following observation data. Full Disk Earth's Cloud Image, Cloud Image of Japan and its Vicinity, Cloud Amount, Sea Surface Temperature, Cloud Motion Wind, Water Vapor Motion Wind, Equivalent Blackbody Temperature, OLR (Out-going Longwave Radiation), Solar Irradiation, Snow and Ice Index, Orbit Data, Attitude Data, VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film), TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water, TOVS Total Ozone Amount. The CD-ROM is accompanied by a User's guide. Although this user's guide is revised yearly, it may happen that a change of contents of the Monthly Report is not reflected in the user's guide, if the change is carried out between revisions of the user's guide. The latest contents of the Monthly Report and the detailed information of the contents are described in document files contained in the CD-ROM. Please read the document files.

Author

Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20000112936 Science and Technology International Corp., Honolulu, HI USA

Dam Failure Inundation Map Project ***Annual Report, Sep. 1999 - Sep. 2000***

Johnson, Carl, Science and Technology International Corp., USA; Iokepa, Judy, Science and Technology International Corp., USA; Dahlman, Jill, Science and Technology International Corp., USA; Michaud, Jene, Hawaii Univ., USA; Oct. 15, 2000; 91p; In English

Contract(s)/Grant(s): NASW-99044

Report No.(s): Rept-957; Rept-10-02415; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

At the end of the first year, we remain on schedule. Property owners were identified and contacted for land access purposes. A prototype software package has been completed and was demonstrated to the Division of Land and Natural Resources (DLNR), National Weather Service (NWS) and Pacific Disaster Center (PDC). A field crew gathered data and surveyed the areas surrounding two dams in Waimea. (A field report is included in the annual report.) Data sensitivity analysis was initiated and completed.

A user's manual has been completed. Beta testing of the software was initiated, but not completed. The initial TNK and property owner data collection for the additional test sites on Oahu and Kauai have been initiated.
Author
Applications Programs (Computers); User Manuals (Computer Programs); Prototypes; Meteorological Services; Failure

20000112964 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: June 2000
June 2000; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity

The CD-ROM concerning the June 2000 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Author
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20000113131 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA
Juneau Terrain Induced Turbulence Project: Non-FAR Part 121 User Needs
Benner, William; Carty, Thopmas; McGettigan, Starr; May 2000; 98p; In English
Report No.(s): AD-A382688; DOT/FAA/CT-TN99/20; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Juneau International Airport (PAJN), Alaska, has a combination of extreme terrain features and adverse weather patterns that creates moderate to severe Terrain Induced Turbulence. As a result of this turbulence, the Federal Aviation Administration (FAA) has funded the National Center for Atmospheric Research (NCAR) to develop a Wind Hazard Information System (WHIS) for use by aviation users. This report describes the user needs assessment of the Juneau Terrain Induced Turbulence Project by ACT-320. Current practices were baselined and wind information needs were identified and defined for Non-FAR Part 121 Pilots, Automated Flight Service Station (AFSS) Specialists, Air Traffic Control Tower (ATCT) Specialists, and National Weather Service (NWS) Forecasters. Surveys and on-site interviews were used to gather information. In general, wind information used by the above mentioned users was not timely. The Gastineau Channel, Taku Inlet area, Outer Point, and PAJN were identified as being most impacted by winds. The importance of wind information varied across user groups.
DTIC
Information Systems; Weather; Meteorological Parameters; User Requirements; Specifications

20000113670 Hawaii Univ., Honolulu, HI USA
Construction of a Lightning Index Using Integrated Precipitable Water Derived From the Global Positioning System
Mazany, Robert A., Hawaii Univ., USA; Dec. 2000; 76p; In English
Report No.(s): AD-A381840; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A new approach is presented to forecasting the Kennedy Space Center's primary weather challenge, lightning. After examining the first years worth of integrated precipitable water data derived from Global Positioning System (GPS) and surface stations, two periods were chosen to develop a GPS lightning prediction model. Statistical regression methods were used to identify predictors that added skill in forecasting a lightning event. Four predictors proved important in forecasting lightning events; maximum electric field mill values, GPS Integrated Precipitable Water (IPW), nine hour change (V9 - hr) in IPW, and K index. Using the coefficients for these predictors along with a logistic regression equation, a running time series was plotted for the predictand. A common pattern emerged several hours prior to a lightning event. Whenever the predictand log value was 0.7 or below, lightning occurred within the next 12.5 hours. Lightning events were predicted using a logistic threshold value of 0.7 and forecasting time constraints based on the Kennedy Space Center (KSC) criteria. Forecast verification results obtained by using a contingency table revealed a 26.2% decrease from the Cape's previous season false alarm rates for a non-independent period, and a 13.2% decrease in false alarm rates for an independent test season using the GPS lightning model. Additionally, the model improved the KSC's desired lead-time by nearly 10%. Although a lightning strike window of 12 hours is quit lengthy, forecasters will now have an additional forecasting tool that can be implemented in their lightning forecast process. Once the value of the GPS lightning model

has been confirmed using data from the 2000 season, it is anticipated that the model will enhance mission readiness and save valuable time and dollars by helping forecasters anticipate and improve forecast lightning events at the KSC.
DTIC
Weather Forecasting; Lightning; Launching Sites; Global Positioning System; Statistical Analysis; Space Weather; Water Vapor; Time Series Analysis

20000113837 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: March 2000
March 2000; 1p; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity

The CD-ROM concerning the March 2000 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the polar orbital meteorological satellites operated by NOAA. The CD-ROM contains the following observation data. Full Disk Earth's Cloud Image, Cloud Image of Japan and its Vicinity, Cloud Amount, Sea Surface Temperature, Cloud Motion Wind, Water Vapor Motion Wind, Equivalent Blackbody Temperature, OLR (Out-going Longwave Radiation). Solar Irradiation, Snow and Ice Index, Orbit Data, Attitude Data, VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film), TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water, TOVS Total Ozone Amount. The CD-ROM is accompanied by a User's guide. Although this user's guide is revised yearly, it may happen that a change of contents of the Monthly Report is not reflected in the user's guide, if the change is carried out between revisions of the user's guide. The latest contents of the Monthly Report and the detailed information of the contents are described in document files contained in the CD-ROM. Please read the document files.
Author
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20000114827 NASA Goddard Space Flight Center, Greenbelt, MD USA
Tropical Convective Outflow and Near Surface Equivalent Potential Temperatures
Folkins, Ian, Dalhousie Univ., Canada; Oltmans, Samuel J., National Oceanic and Atmospheric Administration, USA; Thompson, Anne M., NASA Goddard Space Flight Center, USA; [2000]; 16p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We use clear sky heating rates to show that convective outflow in the tropics decreases rapidly with height between the 350 K and 360 K potential temperature surfaces (or between roughly 13 and 15 km). There is also a rapid fall-off in the pseudoequivalent potential temperature probability distribution of near surface air parcels between 350 K and 360 K. This suggests that the vertical variation of convective outflow in the upper tropical troposphere is to a large degree determined by the distribution of sub cloud layer entropy.
Author
Cloud Cover; Convection; Surface Temperature; Temperature Distribution; Tropical Regions

20000114833 NASA Goddard Space Flight Center, Greenbelt, MD USA
Goddard Cumulus Ensemble (GCE) Model: Application for Understanding Preciptation Processes
Tao, Wei-Kuo, NASA Goddard Space Flight Center, USA; [2000]; 71p; In English; Cloud Systems, Hurricanes and TRMM, 2000, Unknown; Sponsored by American Meteorological Society, USA; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The global hydrological cycle is central to climate system interactions and the key to understanding their behavior. Rainfall and its associated precipitation processes are a key link in the hydrologic cycle. Fresh water provided by tropical rainfall and its variability can exert a large impact upon the structure of the upper ocean layer. In addition, approximately two-thirds of the global rain falls in the Tropics, while the associated latent heat release accounts for about three-fourths of the total heat energy for the Earth's atmosphere. Precipitation from convective cloud systems comprises a large portion of tropical heating and rainfall. Furthermore, the vertical distribution of convective latent-heat releases modulates large-scale tropical circulations (e.g., the 30-60-day intraseasonal oscillation), which, in turn, impacts midlatitude weather through teleconnection patterns such as those associated with El Nino. Shifts in these global circulations can result in prolonged periods of droughts and floods, thereby exerting a tremendous impact upon the biosphere and human habitation. and yet, monthly rainfall over the tropical oceans is still not known within a factor of two over large (5 degrees latitude by 5 degrees longitude) areas. Hence, the Tropical Rainfall Measuring Mission (TRMM), a joint U.S./Japan space project, can provide a more accurate measurement of rainfall as well as estimate the four-dimensional structure of diabatic heating over the global tropics. The distributions of rainfall and inferred heating can be used to

advance our understanding of the global energy and water cycle. In addition, this information can be used for global circulation and climate models for testing and improving their parameterizations.
Author
Atmospheric Circulation; Atmospheric Models; Climate; Earth Atmosphere; Water; Hydrological Cycle; Rain; Tropical Regions; Weather; Clouds (Meteorology)

20000114836 NASA Goddard Space Flight Center, Greenbelt, MD USA
ER-2 Doppler Radar (EDOP) Investigations of the Eyewall of Hurricane Bonnie CAMEX-3
Heymsfield, G. M., NASA Goddard Space Flight Center, USA; Halverson, J., Maryland Univ. Baltimore County, USA; Simpson, J., NASA Goddard Space Flight Center, USA; Tian, L., Universities Space Research Association, USA; Bui, P., NASA Ames Research Center, USA; [2000]; 43p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A persistent, mesoscale region of intense eyewall convection contained within Hurricane Bonnie on 23 August 1998 is examined from multiple observations synthesized from the NASA ER-2 and DC-8 aircraft. The intense convection occurred late in the day as Bonnie was attaining its minimum central pressure and during a stage when the inner core featured a markedly asymmetric structure. The main purpose of this paper is to describe the internal structure of a convective burst and its relationship to the warm core using a synthesis of high-resolution satellite, aircraft radar, and in situ data. An exceptionally vigorous eyewall tower penetrating to nearly 18 km is described. A second intense eyewall tower, adjacent to the eye, is shown to be associated with a mesoscale subsiding current of air that extends horizontally nearly 20 km into the eye interior. The subsidence occupies a substantial depth within the eye and appears to be a much larger scale feature than the convectively-induced, symmetric overturning which commonly occurs on the upper-level flanks of convective towers in other tropical environments.
Author
Convection; Doppler Radar; Hurricanes; Mesoscale Phenomena; Towers

20000114837 NASA Goddard Space Flight Center, Greenbelt, MD USA
Double-Edge Molecular Measurement of Lidar Wind Profiles at 355 nm
Flesia, Cristina, Geneva Univ., Switzerland; Korb, C. Laurence, NASA Goddard Space Flight Center, USA; Hirt, Christian, Geneva Univ., Switzerland; [2000]; 13p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We built a direct detection Doppler lidar based on the double-edge molecular technique and made the first molecular based wind measurements using the eyesafe 355 nm wavelength. Three etalon bandpasses are obtained with Step etalons on a single pair of etalon plates. Long-term frequency drift of the laser and the capacitively stabilized etalon is removed by locking the etalon to the laser frequency. We use a low angle design to avoid polarization effects. Wind measurements of 1 to 2 m/s accuracy are obtained to 10 km altitude with 5 mJ of laser energy, a 750s integration, and a 25 cm telescope. Good agreement is obtained between the lidar and rawinsonde measurements.
Author
Doppler Radar; Etalons; Lasers; Radar Measurement; Wind Measurement; Wind Profiles

20000114843 Maryland Univ. Baltimore County, Joint Center for Earth Systems Technology, Catonsville, MD USA
A Texture-Polarization Method for Estimating Convective/Stratiform Precipitation Area Coverage from Passive Microwave Radiometer Data
Olson, William S., Maryland Univ. Baltimore County, USA; Hong, Ye, Aerospace Corp., USA; Kummerow, Christian D., Colorado State Univ., USA; Turk, Joseph, Naval Research Lab., USA; [2000]; 39p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Observational and modeling studies have described the relationships between convective/stratiform rain proportion and the vertical distributions of vertical motion, latent heating, and moistening in mesoscale convective systems. Therefore, remote sensing techniques which can quantify the relative areal proportion of convective and stratiform, rainfall can provide useful information regarding the dynamic and thermodynamic processes in these systems. In the present study, two methods for deducing the convective/stratiform areal extent of precipitation from satellite passive microwave radiometer measurements are combined to yield an improved method. If sufficient microwave scattering by ice-phase precipitating hydrometeors is detected, the method relies mainly on the degree of polarization in oblique-view, 85.5 GHz radiances to estimate the area fraction of convective rain within the radiometer footprint. In situations where ice scattering is minimal, the method draws mostly on texture information in radiometer imagery at lower microwave frequencies to estimate the convective area fraction. Based upon observations of ten convective systems over ocean and nine systems over land, instantaneous 0.5 degree resolution estimates of convective area fraction from the Tropical Rainfall Measuring Mission Microwave Imager (TRMM TMI) are compared to nearly coincident estimates

from the TRMM Precipitation Radar (TRMM PR). The TMI convective area fraction estimates are slightly low-biased with respect to the PR, with TMI-PR correlations of 0.78 and 0.84 over ocean and land backgrounds, respectively. TMI monthly-average convective area percentages in the tropics and subtropics from February 1998 exhibit the greatest values along the ITCZ and in continental regions of the summer (southern) hemisphere. Although convective area percentages. from the TMI are systematically lower than those from the PR, monthly rain patterns derived from the TMI and PR rain algorithms are very similar. TMI rain depths are significantly higher than corresponding rain depths from the PR in the ITCZ, but are similar in magnitude elsewhere.
Author
Convection; Microwave Radiometers; Rain; Precipitation (Meteorology); Estimates

20000114867 Army Research Lab., Computational and Information Science Directorate, White Sands Missile Range, NM USA
An Evaluation of Three-Dimensional Weather Hazards Using Sounding Data and Model Output Data ***Final Report***
Passner, Jeffrey E.; Aug. 2000; 52p; In English
Report No.(s): AD-A382550; ARL-TR-1046; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Atmospheric Sounding Program (ASP) is initialized by upper-air observations, either from standard rawinsonde observations (RAOB)s or output from a numerical model, the Battlescale Forecast Model (BFM). These data are decoded and processed before calculations are performed, giving the forecaster an overview of the atmospheric conditions at or near the ROAB launch site or the BFM grid point. The ASP uses these data to produce a series of weather-hazard products that can be used for analysis or forecasting to 24 h from the initial time of the BFM run. Included in these weather hazards are turbulence, icing, and clouds - three parameters, which have major influence in military operations.
DTIC
Atmospheric Sounding; Proving; Three Dimensional Models; Mathematical Models; Weather Forecasting; Meteorological Services; Hazards

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OCEANOGRAPHY

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

20000109809 Naval Research Lab., Bay Saint Louis, MS USA
Operational Oceanography and Prediction - A GODAE Perspective
Le Traon, P. Y.; Rienecker, M.; Smith, N.; Bahurel, P.; Bell, M.; Oct. 1999; 23p; In English; Presented at the International Conference on Ocean Observing System for Climate, 18-22 Oct 1999, Saint Raphael, France.
Report No.(s): AD-A381161; NRL/PP/7323--99-0050; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper gives an overview of GODAE focusing on aspects relevant to the development of a global ocean observing system and to the demonstration of its scientific and practical societal benefits. A general overview of GODAE is first given. The main operational applications which are expected to benefit from the global and integrated approach of GODAE are then presented. User requirements are identified and we try to appraise the benefits of the integrated and global GODAE approach for meeting these requirements. We then proceed to the relationship between GODAE and the design/development of an ocean observing system: what are the GODAE data requirements and how GODAE should help to assess improve and sustain the observing system? The main scientific and technical issues related to the successful development of GODAE are discussed.
DTIC
Climate; Ocean Currents; Oceanographic Parameters

20000110131 NASA Wallops Flight Facility, Wallops Island, VA USA
Sea Surface Slope Statistics for Intermediate and Shore Scale Ocean Waves Measured Using a Low-Altitude Aircraft
Vandemack, Douglas, NASA Wallops Flight Facility, USA; Crawford, Tim, National Oceanic and Atmospheric Administration, USA; Dobosy, Ron, National Oceanic and Atmospheric Administration, USA; Elfouhaily, Tanos, Johns Hopkins Univ., USA; [19099]; 1p; In English; IGARSS'99, 29 Jun. - 2 Jul. 1999, Hamburg, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

Ocean surface remote sensing techniques often rely on scattering or emission linked to shorter- scale gravity-capillary ocean wavelets. However, it is increasingly apparent that slightly longer wavelengths of O(10 to 500 cm) are vital components in the robust sea surface description needed to link varied global remote sensing data sets. This paper describes a sensor suite developed

to examine sea surface slope variations in the field using an aircraft flying at very low altitude (below 30 m) and will also provide preliminary measurements detailing changes in slope characteristics versus sea state and friction velocity. Two-dimensional surface slope is measured using simultaneous range measurements from three compact short-range laser altimeters mounted in an equilateral triangle arrangement with spacing of about 1 m. In addition, all three lasers provide independent wave elevation profiles after GPS-aided correction for aircraft altitude. Laser range precision is 1 cm rms while vertical motion correction is 15 cm rms. The measurements are made along-track at approximately 1 m intervals setting the spatial scale of the measurement to cover waves of intermediate to long scale. Products available for this array then include surface elevation, two-dimensional slope distribution, and the cross- and along-track 1-D slope distributions. to complement the laser, a down-looking mm-wave radar scatterometer is centered within the laser array to measure radar backscatter simultaneously with the laser slope. The radar's footprint is nominally 1 m in diameter. Near-vertical radar backscatter is inversely proportional to the small-scale surface slope variance and to the tilt of the underlying (laser-measured) surface facet. Together the laser and radar data provide information on wave roughness from the longest scales down to about 1 cm. These measurements are complemented by aircraft turbulence probe data that provides robust surface flux information.
Author
Slopes; Statistical Analysis; Ocean Surface; Sea Roughness; Surface Waves; Water Waves

20000110574 Woods Hole Oceanographic Inst., MA USA
Tidal Observations at Ria Formosa, Algarve, Portugal
Salles, Paulo; O'Malley, Stephen P.; Voulgaris, George; Aubrey, David G.; May 2000; 100p; In English
Report No.(s): AD-A379975; WHOI-2000-04; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The apparent persistence and stability of multiple tidal inlets in coastal lagoons are important for a variety of reasons, such as water quality, navigability and beach, barrier stability. to identify and study the processes controlling the persistence of multiple tidal inlets, the hydrodynamics of the system have to be better understood. This project is part of a larger study (INDIA) examining general tidal inlet processes. The present components consist of a numerical simulation study of processes controlling multiple inlet stability, combined with exhaustive field measurements. This report addresses only the second component. The analysis uses as study site and main source of data the Ria Formosa lagoon in Portugal, which has multiple and historically persistent inlets. For the numerical simulation model, field measurements are needed to provide (i) updated bathymetry of the inlets, in situ measurements of (ii) water level fluctuations within the estuary and (iii) flow velocities through the inlets. This report gives first a brief description of the instrumentation used in the field (section 2), then describes the methods used to deploy the instruments, perform the surveys and gather the data (section 3), explains the procedures for data reduction and shows some results (section 4 and Annex).
DTIC
Estuaries; Hydrodynamics; Tides; Lagoons; Mathematical Models; Bathymeters

20000110627 Washington Univ., Applied Physics Lab., Seattle, WA USA
International Arctic Buoy Programme Data Report 1 January 1999 - 31 December 1999
Rigor, Ignatius; Ortmeyer, Mark; Jun. 2000; 176p; In English
Contract(s)/Grant(s): N00014-98-1-0698
Report No.(s): AD-A378688; APL-UW-TM-6-00; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report presents data collected by the International Arctic Buoy Programme (IABP) between 1 January 1999 and 31 December 1999. The network of automatic data buoys deployed by the IABP monitors synoptic-scale fields of pressure, temperature, and ice motion throughout the Arctic Basin.
DTIC
Buoys; Structural Basins; Marine Meteorology; Sea Ice; Arctic Regions

20000112962 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Coupled Ocean General Circulation, Biogeochemical, and Radiative Model of the Global Oceans: Seasonal Distributions of Ocean Chlorophyll and Nutrients
Gregg, Watson W., NASA Goddard Space Flight Center, USA; September 2000; 44p; In English
Report No.(s): NASA/TM-2000-209965; Rept-2000-03905-0; NAS 1.15:209965; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A coupled ocean general circulation, biogeochemical, and radiative model was constructed to evaluate and understand the nature of seasonal variability of chlorophyll and nutrients in the global oceans. Biogeochemical processes in the model are determined from the influences of circulation and turbulence dynamics, irradiance availability. and the interactions among three func-

tional phytoplankton groups (diatoms. chlorophytes, and picoplankton) and three nutrients (nitrate, ammonium, and silicate). Basin scale (greater than 1000 km) model chlorophyll results are in overall agreement with CZCS pigments in many global regions. Seasonal variability observed in the CZCS is also represented in the model. Synoptic scale (100-1000 km) comparisons of imagery are generally in conformance although occasional departures are apparent. Model nitrate distributions agree with in situ data, including seasonal dynamics, except for the equatorial Atlantic. The overall agreement of the model with satellite and in situ data sources indicates that the model dynamics offer a reasonably realistic simulation of phytoplankton and nutrient dynamics on synoptic scales. This is especially true given that initial conditions are homogenous chlorophyll fields. The success of the model in producing a reasonable representation of chlorophyll and nutrient distributions and seasonal variability in the global oceans is attributed to the application of a generalized, processes-driven approach as opposed to regional parameterization and the existence of multiple phytoplankton groups with different physiological and physical properties. These factors enable the model to simultaneously represent many aspects of the great diversity of physical, biological, chemical, and radiative environments encountered in the global oceans.
Author
Biogeochemistry; Chlorophylls; Oceans; Annual Variations; Irradiance; Atmospheric General Circulation Models; Nutrition

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.

20000109818 Colorado State Univ., Dept. of Radiological Health Sciences, Fort Collins, CO USA
The 'Pro-Drug' RibCys Decreases The Mutagenicity of High LET Radiation in Cultured Mammalian Cells
Lenarczyk, M., Colorado State Univ., USA; Ueno, A., Colorado State Univ., USA; Vannais, D. B., Colorado State Univ., USA; Kraemer, S., Colorado State Univ., USA; Kronenberg, A., California Univ., Lawrence Berkeley Lab., USA; Roberts, J. C., Utah Univ., USA; Tatsumi, K., National Inst. of Radiological Sciences, Japan; Hei, T. K., Columbia Univ., USA; Waldren, C. A., Colorado State Univ., USA; [2000]; 7p; In English, 2000, Unknown; Sponsored by Committee on Space Research, Unknown; Sponsored in part by Utah Regional Cancer Center
Contract(s)/Grant(s): NASA Order W-19133; DOE-522507; NAGW5-3768; NIH-NCI-36447; NIH-NCI-75384; NIH-5-R29-GM-44785; CA42401
Report No.(s): COSPAR Paper F2.1-0012; Copyright; Avail: Issuing Activity

We have initiated studies aimed at reducing the mutational effects of high LET radiation such as Fe-56 ions and C-12 ions with certain drugs. The mutagenicity of high LET (143 keV/micrometer) Fe-56 or C-12 ions (LET = 100 keV/micrometer) was quantified at the CD59 locus of human-hamster hybrid AL cells. RibCys [2,S)-D-ribo-(1',2',3',4'- Tetrahydroxybutyl)-thiazolidine-4(R)-ca riboxylic acid], formed by condensation of L-cysteine with D-ribose, is designed so that the sulfhydryl amino acid L-cysteine is released intracellularly via nonenzymatic ring opening and hydrolysis leading to increased levels of glutathione (GSH). RibCys (4 or 10 mM), present during irradiation and a few hours post-irradiation, significantly decreased the yield of CD59(-) mutants induced by radiation. RibCys did not affect the clonogenic survival of irradiated cells, nor was it mutagenic itself. These results, together with the minimal side effects reported in mice and pigs, indicate that RibCys may be useful, perhaps even when used prophylactically, in reducing the load of mutations created by high LET radiation in astronauts or other exposed individuals. RibCys is an attractive drug that may reduce the risk of carcinogenesis in people exposed to high LET radiation.
Author
Irradiation; Mutations; Radiation Effects; Mutagens; Cysteamine

20000109823 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Studies on the purification, characterization and structure of antibiotics from centipede using RI labelled compound
Cho, K. S.; Lee, S. M.; Choi, J. S.; Hong, S. W.; Jul. 31, 1997; 35p; In Korean
Report No.(s): DE99-727842; KAERI-CM-152/96; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The substance which has antibiotic properties was extracted by diethyl ether and purified from a centipede S. subspinipes by the silicic acid and high S column chromatography. This antibiotics named (sup C)entipedin(sup h)as exhibited a significant antibiotic activity against a variety of microorganism, such as Gram(sup +), Gram(sup -), fungi etc. In connection with the antibiotic property, it was confirmed that its inhibitory effect on the growth of Staphylococcus aureus was related with the transcriptional level of DNA and RNA polymerase. The centipedin was measured quantitatively by GC methods and molecular weight

was confirmed as 162 Da by mass-spec. Also, molecular formula was identified to C(sub 9)O(sub 3)H(sub 6) by the method of UV, IR and NMR. Antibiotics from centipede did not exhibit any significant cytotoxicity against cancer cell lines, such as HL-60 cell and myeloma cell. It was confirmed that centipedin antibiotics was biosynthesized from (sup 14)C-acetate in vivo experiment. Author(NTIS)

Purification; Characterization; Molecular Structure; Antibiotics; Microorganisms; Fungi

20000109848 NASA Marshall Space Flight Center, Huntsville, AL USA

Morphology and Viability of Pleistocene Microbiota from the CRREL Permafrost Tunnel Near Fox, Alaska

Hoover, Richard B., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 30 Jul - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The U. S. Army Cold Regions Research and Engineering Laboratory maintains the CRREL Permafrost Tunnel at Fox, Alaska (-10 miles north of Fairbanks.) The active microbial ecosystems and the cryopreserved anabiotic viable microorganisms and dead microbial remains and biomarkers frozen within the permafrost and ice of the CRREL Permafrost Tunnel are of direct relevance to Astrobiology. Microbial extremophiles from permafrost and ice provide information concerning where and how should we search for evidence of life elsewhere in the Cosmos. The permafrost and ice wedges of the Fox tunnel preserves a magnificent of record of Pliocene, Pleistocene and Holocene life on Earth spanning more than 2.5 million years. This record includes frozen fossil bacteria, archaea, algae, mosses, higher plants, insects and mammals. In this paper we present the preliminary results of studies of the morphology, ultramicrostructure and elemental distributions of Fox tunnel microbiota as determined in-situ by the Environmental Scanning Electron Microscope (ESEM) and the Field Emission Scanning Electron Microscope (FESEM) investigations. The long-term viability of cryopreserved microbiota and potential implications to Astrobiology will be discussed. Author

Fossils; Life Sciences; Low Temperature Environments; Microorganisms; Viability; Paleontology; Archaebacteria; Protobiology; Paleobiology; Cryogenics

20000109875 Enterprise Advisory Services, Inc., Houston, TX USA

Functional Assessment of NK and LAK Cells Following Space Flight

Kaur, Indreshpal, Enterprise Advisory Services, Inc., USA; Pierson, Duane L., NASA Johnson Space Center, USA; [1999]; 1p; In English; Experimental Biology ’99, 17-21 Apr. 1999, Washington, DC, USA; Sponsored by Federation of American Societies for Experimental Biology, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Space flight associated stress alters some aspects of the human immune response. In this study, we determined the effects of 10 days aboard the Space Shuttle on the cytotoxic activity of NK and LAK cells. PBMCs were collected from 10-ml blood specimens from 5 astronauts 10 days before launch, immediately after landing, and again at 3 days after landing and stored at -80 C. All PBMCs were thawed simultaneously, and the cytotoxic activities of NK and LAK cells were measured by a 4 hour Cr-51 release assay. K562 cells were used to assess NK cell cytotoxicity. Following 4 days of IL-2 activation, the LAK cell cytotoxic activity was determined using K562 cells and Daudi cells as the target cells. NK cell cytotoxicity decreased at landing ($p<.05$) in 3/5 astronauts, and recovered to preflight levels by 3 days following landing; NK cell cytotoxicity was increased ($p=0.1$) in the remaining 2 astronauts at landing. In 4/5 astronauts, LAK cytotoxic activity was decreased at landing against K562 cells ($p = 0.13$) and Daudi cells ($p = 0.08$). Phenotyping of PBMC’s and LAK cells showed alterations in some surface markers and adhesion molecules (CD11b, CD11c, CD11a, CD16, L-selectin, and CD3).
Author

Cobalt 60; Mars Surface Samples; Sterilization; Mars (Planet); Radiation Dosage; Irradiation; Decontamination

20000110294 Complex Systems Research, Inc., Boulder, CO USA

Terrestrial Cave Microbiota: Models of Martian Subsurface Biology

Boston, P. J., Complex Systems Research, Inc., USA; Northup, D. E., New Mexico Univ., USA; Spilde, M. N., New Mexico Univ., USA; Hose, L. D., Westminster Coll., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Our studies of microbial life in chemically diverse and unusual caves on Earth and the in situ biomineralization that we are observing form a unique basis for constructing a catalog of potential metabolic types, chemical processes, and physical biomarkers of use to future Martian subsurface exploration and study. We will discuss the diverse microbial ecosystems of Earth’s subsurface as revealed in the sulfide, carbon dioxide, and relict caves of our studies. We will touch on the salient features of the bizarre means by which they make their livings, including dissolving rock, scavenging from the air, living in sulfuric acid, and using inorganic chemical reactions to provide energy. We will then consider the possibility of such communities in the deep subsurface of Mars

and potential exploration methods for studying them based on our field-tested protocols in physically rigorous and hazardous conditions. Additional information is contained in the original extended abstract.
Author
Caves; Microorganisms; Extraterrestrial Life; Exobiology; Aerospace Environments; Mars (Planet); Environment Models

20000110299 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Aminostratigraphy of Organisms in Antarctic and Siberian Permafrost Cores
Brinton, K. L. F., Jet Propulsion Lab., California Inst. of Tech., USA; Tsapin, A. I., Jet Propulsion Lab., California Inst. of Tech., USA; McDonald, G. D., Jet Propulsion Lab., California Inst. of Tech., USA; Gilichinsky, D., Academy of Sciences (USSR), USSR; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Amino acid racemization dating (or aminostratigraphy) in Antarctic and Siberian permafrost core samples can be used to evaluate the age of organisms in frozen environments. The potential for subsurface permafrost on Mars makes terrestrial permafrost an important source of information regarding the preservation of both living organisms and their remains. Additional information is contained in the original extended abstract.
Author
Preserving; Permafrost; Organisms; Core Sampling; Amino Acids

20000110314 Lockheed Martin Aerospace, Denver, CO USA
Superbug: Make a Living on Current-Day Mars
Clark, Benton C., Lockheed Martin Aerospace, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The martian surface environment is currently so inhospitable that survival and growth is deemed to be impossible. Certainly, no known terrestrial organism could succeed under the myriad constraints and ". . . the probability of growth of a terrestrial organism on present-day Mars is essentially zero." Yet, if life ever did exist on that planet prior to a pervasive but gradual evolution of the climate toward its current hostile form, that life may have evolved likewise sufficiently to find a mode of precarious, albeit not abundant, survival. This report considers some hypothetical possibilities by which it might be feasible for a highly adapted microbe to cope with the adversities presented it. Such a life form, super-adapted to Mars, would be called an extremophile by terrestrial standards, but would find most Earth habitats to be "extreme", and most likely fatal. Additional information is contained in the original extended abstract.
Author
Habitats; Mars Surface; Microorganisms

20000110416 Puerto Rico Univ., Dept. of Physics and Chemistry, Arecibo, Puerto Rico
Biophysical Comparison of the Habitable Zones on Earth and Mars
Mendez, A., Puerto Rico Univ., Puerto Rico; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A planet's habitable zone (HZ) is the spatial and temporal region capable of supporting life. The biosphere (Earth's habitable zone) extends to the near-surface environment (about +/- 10 km with respect to sea level) including part of the atmosphere, hydrosphere and lithosphere. Its extension is also controlled by temporal variations due to daily and seasonal cycles. Bacteria spores have been collected from the air at several kilometers over sea level and barophilic bacteria have been isolated from a deep of 11 km under sea level. These examples show the broad vertical extension of the biosphere. Life is limited in this region at least by the temporal availability of liquid water, and this is controlled by the environment temperature and pressure as described in a water phase diagram. The planet Mars' near-surface environment oscillates between 140 to 300 K with an average atmospheric pressure of 6.1 mbar. There are no Earth examples of microorganisms adapted to similar low temperature and pressure environments because natural examples of such environments are rare or difficult to study. The purpose of this research is to give a global comparison of Earth's and Mars' habitable zones from a biophysical point of view. This biophysical approach includes the construction of a single pressure-temperature (PT-space) diagram combining Earth's and Mars' near-surface environment, a water phase diagram and known microbial habitats. This approach gives a general panorama of the limits of life with respect to temperature and

pressure. These two basic environmental variables control the reaction rates, diffusion rates, viscosity, dielectric constant, stresses respond and heat capacities of the cell biochemicals and structures.
Derived from text
Biophysics; Mars Environment; Earth Atmosphere; Ambient Temperature; Atmospheric Pressure; Controlled Atmospheres

20000110464 New Mexico Univ., Dept. of Earth and Planetary Sciences, Albuquerque, NM USA
Was It Alive? Distinguishing Biological from Non-Biological Mineralization and Geological Structures
Spilde, M. N., New Mexico Univ., USA; Boston, P. J., Complex Systems Research, Inc., USA; Northup, D. E., New Mexico Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Biologists studying unusual micro-organisms in exotic environments often ask the question ”Is it alive?” Geomicrobiologists and mineralogists face an even harder question...”Was it ever alive?” Organisms can leave extensive traces of their presence long after death. of course, the obvious, clear structural fossils are usually the most straightforward to identify. However, other traces of the byproducts of life, e.g. biomineralization, are much more difficult to interpret. In our work in caves, we have discovered many structures and mineral types that appear to be biological or the indirect result of biological activity. Are they? How can we tie these apparent remains to the organisms that may have created them? Even with investigators on site, bringing in equipment, taking samples back to well-equipped, sophisticated scientific laboratories, the status of a natural object as once alive or not alive can be equivocal. How much more difficult, then, will it be to conduct such studies in environments that are unimaginably remote and inaccessible like Mars? We will present examples of materials from our own work that have made us face these questions and detail the methods that we are employing in our ongoing attempts to answer them.
Author
Biology; Activity (Biology); Microorganisms; Minerals

20000110479 Lunar and Planetary Inst., Houston, TX USA
Biomarkers in ALH84001???
Treiman, Allen H., Lunar and Planetary Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format
Contract(s)/Grant(s): NAGW-5098; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

D. McKay and colleagues suggested that four sets of features in ALH84001 were biomarkers, signs of an ancient martian biota that once inhabited the meteorite. Subsequent work has not validated their hypothesis; each suggested biomarker has been found to be ambiguous or immaterial. Nor has their hypothesis been disproved. Rather, it is now one of many hypotheses about the alteration of ALH84001. Additional information is contained in the original extended abstract.
Author
Mars (Planet); Meteorites

20000110482 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Microorganisms from Permafrost Viable and Detectable by 16SRNA Analysis: A Model for Mars
Tsapin, A. I., Jet Propulsion Lab., California Inst. of Tech., USA; McDonald, G. D., Jet Propulsion Lab., California Inst. of Tech., USA; Andrews, M., Jet Propulsion Lab., California Inst. of Tech., USA; Bhartia, R., Jet Propulsion Lab., California Inst. of Tech., USA; Douglas, S., Jet Propulsion Lab., California Inst. of Tech., USA; Gilichinsky, D., Academy of Sciences (USSR), USSR; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Preliminary studies of Arctic and Antarctic permafrost have shown that this environment harbors microorganisms which can be isolated in pure culture, and that these organisms can survive for a long period of time (up to 20 Ma) in permafrost. It is believed that the permanent subzero temperatures in permafrost and ice environments are the main parameters ensuring the longevity of microbes. In this project we studied permafrost cores from different areas of the Siberian Arctic and Antarctic, with ages from several thousand years up to several millions years (Ma). In general, Antarctic permafrost has a higher sand content, while Siberian permafrost has a texture more characteristic of clay or normal soil. Additional information is contained in the original extended abstract.
Author
Clays; Ice Environments; Microorganisms; Permafrost; Subzero Temperature; Models; Mars (Planet)

20000110487 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Atmospheric Energy Limits on Subsurface Life on Mars

Weiss, B. P., California Inst. of Tech., USA; Yung, Y. L., Jet Propulsion Lab., California Inst. of Tech., USA; Nealson, K. H., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It has been suggested that the terrestrial biomass of subterranean organisms may equal or exceed that at the surface. Taken as a group, these organisms can live in heavily saline conditions at temperatures from 115 C to as low as -20 C. Such conditions might exist on Mars beneath the surface oxidant in an aquifer or hydrothermal system, where the surrounding rock would also protect against the solar ultraviolet radiation. The way that such systems could obtain energy and carbon is not completely clear, although it is believed that on Earth, energy flows from the interaction of highly reduced basalt with groundwater produce H2, while carbon is derived from CO2 dissolved in the groundwater. Another potential source is the Martian atmosphere, acting as a photochemical conduit of solar insolation.

Derived from text

Biomass; Extraterrestrial Life; Mars (Planet); Mars Environment; Mars Surface; Organisms; Exobiology

20000110491 NASA Johnson Space Center, Houston, TX USA

Identifying Fossil Bacteria in Martian Materials

Westall, F., NASA Johnson Space Center, USA; McKay, D. S., NASA Johnson Space Center, USA; Gibson, E. K., Jr., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Within the next decade, robotic missions are going to Mars with the search for evidence for extant and extinct life as at least one of the mission objectives. Moreover, the first Martian samples will be returned to Earth in 2008. It is therefore imperative that we can be certain that we can identify life in Martian rocks. In this paper we will not be discussing extant life but will concentrate on fossil life.

Derived from text

Fossils; Identifying; Mars (Planet); Bacteria; Extraterrestrial Life; Exobiology

20000110503 NASA Ames Research Center, Moffett Field, CA USA

Life and Death on Mars and Earth

Zahnle, K. J., NASA Ames Research Center, USA; Sleep, N. H., Stanford Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Failure to discover life on Mars has led a great many experts to conclude that it must be hiding. Where? The likeliest hiding places are deep beneath the surface, where geothermal heat could permit liquid water. In this the search for life on Mars parallels the search for water on Mars. Liquid water has been, at least on occasion, a geologically significant presence on the surface. Channels were cut and plains dissected. This water is now hidden, in all likelihood having drained to the base of the porous regolith, where it fills possibly frozen aquifers. Presumably any surviving biota has followed the water from the surface to its hiding places in the deep. Accordingly, we have extended our environmental impact assessment of the environmental hazards posed by large asteroid and comet impacts to Mars, and compare its case to Earth's. In particular, we address the continuous habitability of surface and subsurface environments.

Derived from text

Extraterrestrial Life; Water; Mars Surface; Exobiology; Mars (Planet); Mars Atmosphere

20000110582 NASA Marshall Space Flight Center, Huntsville, AL USA

The Effect of Solution Thermal History on Chicken Egg White Lysozyme Nucleation

Burke, Michael W., Alabama Univ., USA; Judge, Russell A., Alabama Univ., USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; 13th; Crystallization of Biological Macromolecules, May 2000, Sandestin, FL, USA

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

Proteins are highly flexible molecules and often exhibit defined conformational changes in response to changes in the ambient temperature. Chicken egg white lysozyme has been previously shown to undergo an apparent structural change when warmed above the tetragonal/orthorhombic phase transition temperature. This is reflected by a change in the habit of the tetragonal and orthorhombic crystals so formed. In this study we show that possible conformational changes induced by heating are stable and

apparently non- reversible by simple cooling. Exposure of protein solutions to temperatures above the phase change transition temperature, before combining with precipitant solution to begin crystallization, reduces final crystal numbers. Protein that is briefly warmed to 37 C, then cooled shows no sign of reversal to the unheated nucleation behavior even after storage for 4 weeks at 4 C. The change in nucleation behavior of tetragonal lysozyme crystals, attributed to a structural shift, occurs faster the greater the exposure to temperature above the equi-solubility point for the two phases. Heating for 2 h at 48 C reduces crystal numbers by 20 fold in comparison to the same solution heated for the same time at 30 C. Thermal treatment of solutions is therefore a possible tool to reduce crystal numbers and increase crystal size. The effects of a protein's previous thermal history are now shown to be a potentially critical factor in subsequent macromolecule crystal nucleation and growth studies.
Author
Chickens; Eggs; Lysozyme; Nucleation; Temperature Effects; Solutions

20000112937 Waterloo Univ., Guelph-Waterloo Program for Graduate Studies in Physics, Ontario Canada
Radioprotective Thiolamines WR-1065 and WR-33278 Selectively Denature Nonhistone Nuclear Proteins
Booth, Valerie K., Waterloo Univ., Canada; Roberts, Jeanette C., Utah Univ., USA; Warters, Raymond L., University of Utah Health Sciences Center, USA; Wilmore, Britta H., Utah Univ., USA; Lepock, James R., Waterloo Univ., Canada; Radiation Research; 2000; ISSN 0033-7587; Volume 153, pp. 813-822; In English
Contract(s)/Grant(s): NAG5-4452; NIH-5P30CA42014; NIH-5R29GM22785; Copyright; Avail: Issuing Activity

Differential scanning calorimetry was used to study the interactions of nuclei isolated from Chinese hamster V79 cells with the radioprotector WR-1065, other thiol compounds, and polyamines. Differential scanning calorimetry monitors denaturation of macromolecules and resolves the major nuclear components (e.g. constrained and relaxed DNA, nucleosome core, and nuclear matrix) of intact nuclei on the basis of thermal stability. WR-1065 treatment (0.5-10 mM) of isolated nuclei led to the irreversible denaturation of nuclear proteins, a fraction of which are nuclear matrix proteins. Denaturation of 50% of the total nonhistone nuclear protein content of isolated nuclei occurred after exposure to 4.7 mM WR-1065 for 20 min at 23 C. In addition, a 22% increase in the insoluble protein content of nuclei isolated from V79 cells that had been treated with 4 mM WR-1065 for 30 min at 37 C was observed, indicating that WR-1065-induced protein denaturation occurs not only in isolated nuclei but also in the nuclei of intact cells. From the extent of the increase in insoluble protein in the nucleus, protein denaturation by WR-1065 is expected to contribute to drug toxicity at concentrations greater than approximately 4 mM. WR-33278, the disulfide form of WR1065, was approximately twice as effective as the free thiol at denaturing nuclear proteins. The proposed mechanism for nucleoprotein denaturation is through direct interactions with protein cysteine groups with the formation of destabilizing protein-WR-1065 disulfides. In comparison to its effect on nuclear proteins in isolated nuclei, WR-1065 had only a very small effect on non-nuclear proteins of whole cells, isolated nuclear matrix, or the thiol-rich Ca (2+) ATPase of sarcoplasmic reticulum, indicating that WR-1065 can effectively denature protein only inside an intact nucleus, probably due to the increased concentration of the positively charged drug in the vicinity of DNA.
Author
Amines; Thiols; Antiradiation Drugs; Biopolymer Denaturation; Nuclei (Nuclear Physics)

20000112938 Utah Univ., Dept. of Radiation Oncology, Salt Lake City, UT USA
Modulation of Radiation-Induced Apoptosis by Thiolamines
Warters, R. L., Utah Univ., USA; Roberts, J. C., Utah Univ., USA; Wilmore, B. H., Utah Univ., USA; Kelley, L. L., Utah Univ., USA; International Journal of Radiation Biology; 1997; ISSN 0955-3002; Volume 72, No. 4, pp. 439-448; In English
Contract(s)/Grant(s): NAGW-4914; NIH-5R29GM44785; 5P30-CA42401; Copyright; Avail: Issuing Activity

Exposure to the thiolamine radioprotector N-(2-mercaptoethyl)-1,3-propanediamine (WR-1065) induced apoptosis in the mouse TB8-3 hybridoma after 60-minute (LD(sub50) = 4.5mM) or during a 20-hour (LD(sub50) = 0.15 mM) exposure. In contrast, a 20-hour exposure to 17 mM L-cysteine or 10 mM cysteamine was required to induce 50 percent apoptosis within 20 hours. Apoptosis was not induced by either a 60-minute or 20-hour exposure to 10 mM of the thiazolidime prodrugs ribose-cysteine (RibCys) or ribose-cysteamine (RibCyst). Thiolamine-induced apoptosis appeared to be a p53-independent process since it was induced by WR-1065 exposure in human HL60 cells. Exposure to WR-1065 (4mM for 15 minutes) or cysteine (10mM for 60 minutes) before and during irradiation protected cells against the induction of both DNA double-strand breaks and apoptosis, while exposure to RibCys (10 mM for 3 hours) did not. Treatment with either WR-1065, cysteine, RibCys or RibCyst for 60 minutes beginning 60 minutes after irradiation did not affect the level of radiation-induced apoptosis. In contrast, treatment with either cysteine, cysteamine or RibCys for 20 hours beginning 60 minutes after irradiation enhanced radiation-induced apoptosis. Similar

experiments could not be conducted with WR-1065 because of its extreme toxicity. Our results indicate that thiolamine enhancement of radiation-induced apoptosis is not involved in their previously reported capacity to reduce radiation-induced mutations. Author

Radiation Effects; Irradiation; Modulation; Apoptosis; Radiation Protection

20000114277 Institute of Space Medico-Engineering, Beijing, China

Effects of Tail Suspension on Learning and Memory Function of Mice

Wu, Da-Wei, Institute of Space Medico-Engineering, China; Shen, Xian-Yun, Institute of Space Medico-Engineering, China; Dong, Qi, Institute of Space Medico-Engineering, China; Wang, Sheng-Ping, Institute of Space Medico-Engineering, China; Cheng, Zhang-Hong, Institute of Space Medico-Engineering, China; Zhang, Shu-Jing, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 244-248; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of simulated weightlessness on learning and memory capability of the brain. Accuracy fraction, error frequency and pass rate were observed among control, restrained control, tail suspended (TS) control, restrained, and tail suspended mice in square water maze tests. and latent period and error time were observed in control and 30 deg. tail suspension mice in step down test. The indices did not change significantly during learning period. Accuracy fraction of tail suspended group was reduced significantly in the tests accompared with pretest values. In step down test, latent period and error time showed no difference between TS 5 h and 2 d in untrained mice, but shortened evidently after TS 2 d and prolonged after TS 7 d in trained mice,which suggested the degradation of learning and memory ability after TS 5 h and 2 d respectively. Acute tail suspension depressed brain' s learning ability and quality, while tail suspension of 7 d and 12 d impaired the spatial memory in mice. Author

Weightlessness Simulation; Mice; Memory; Disorders; Brain

20000114281 Air Force General Hospital, Dept. of Molecular Biology, Beijing, China

A Study of Apoptosis and Related Gene bcl-2 and p53 Expression in Hippocampus of Rats Exposed to Repeated + Gz

Cai, Qing, Air Force General Hospital, China; Zhan, Zhi, Air Force General Hospital, China; Zhu, Mei-Cai, Air Force General Hospital, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 263-266; In Chinese; Copyright; Avail: Issuing Activity

To investigate the role of apoptosis in mechanisms of brain damage induced by repeated + Gz exposures. Twenty concious SD rats were randomly divided into 5 groups. Rats in the control group (n = 4) were exposed to + 1 Gz and rats in the 4 experimental groups (n = 16) were exposed to + 14 Gz for three times, each for 45 seconds with 30 min interval in between. All the + Gz exposured were on an animal centrifuge. The rat brains were taken 30 min, 6 h, 24 h and 48 h after the last centrifuge run and fixed and embeded. The apoptosis and expression changes of related gene bcl-2 and p53 were detected by terminal deoxynuleotide transferase-mediated dUTP nick end labeling (TUNEL) technique and immunohistochernical method, respectively. Apoptotic cells and expression changes of bcl-2 and p53 were observed in CAI subregion of rat hippocampus taken 6 h after repeated + Gz exposures, but returned to normal after 24 - 48 h. It suggests that apoptosis and expression changes of bcl-2 and p53 in rats hippocampus can be induced by repeated + Gz exposures and the apoptosis is one of the molecular mechanisms of brain damage induced by repeated + Gz exposures. Keywords: positive acceleration; apoptosis; brain damage; bcl-2; p53; immunication; rats Author

Brain Damage; Centrifuges; Enzymes; Hippocampus

20000114286 Academy of Military Medical Sciences, Inst. of Hygiene and Environmental Medicine, Tianjin, China

Effects of Hypoxia on the Growth of Pulmonary Artery Endothelial Cell

Hong, Xin, Academy of Military Medical Sciences, China; Yin, Zhao-Yun, Academy of Military Medical Sciences, China; Sun, Xing-Bin, Academy of Military Medical Sciences, China; Jiu, Jun-Ping, Academy of Military Medical Sciences, China; Xie, Yin-Zhi, Academy of Military Medical Sciences, China; Lu, Yong-Da, Academy of Military Medical Sciences, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 290-293; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of hypoxia on the growth of pulmonary artery endothelial cell (PAEC). Growth number, growth cycle phase, and the characteristics of endothelial cells(factor VIII related antigen) of PAEC were investigated during hypoxia using the PAEC cultured in vitro as a model. No difference was found between growth numbers of PAEC under hypoxia and that under normoxia conditions during the culture of 48 h(P greater than 0.05). The numbers of positive immunofluoescence PAEC of factor VIII related antigen in hypoxic groups were lower than those in normoxic groups - The cell cycle phase figures showed that the DNA synthetic phase (S phase) in hypoxia 2 hour group was increased significantly, while the pre-synthetic phase(G(sub 0)/G(sub

1)) was decreased as compared with that of normoxic group. However, the S,G(sub 2)M(gap2 and mitotic phase) or G(sub 1)/G(sub 0) stage of hypoxia for 12, 24 or 48 hours group all had no change as compared with those of normoxic group. Growth of the PAEC changed significantly during hypoxia. Although the quantity and the growth cycle of PAEC showed little change, the quality was degraded seriously that its function as a permeability barrier would be affected.
Author
Hypoxia; Arteries; Deoxyribonucleic Acid

20000114287 Air Force Medical Coll., Jilin, China
Changes of POMC Peptides Levels During Hypothermia and Hypoxia in Rats
Mei, Dan, Air Force Medical Coll., China; Xu, Bin, Air Force Medical Coll., China; Lu, Shi-Jie, Air Force Medical Coll., China; Sun, Xin-Qi, Air Force Medical Coll., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 294-297; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of hypothermia and hypoxia on plasma POW peptides levels in rats. Acute hypobaric hypoxia experiment in 10 C or 20 C environment were carried out in 56 healthy Wistar rats to observe changes of brain beta-EP, plasma beta-EP and ACTH contents determined by radioimmunoassay. Plasma beta-EP and ACTH levels increased more significantly under cold condition than under room temperature (P less than 0.01). Plasma ACTH concentrations after 5 km acute hypoxia exposure under 10 C decreased more significantly than in ground control groups (P less than 0.01). Plasma ACTH and beta-EP levels after 5 km acute hypoxia exposure under 20 C increased more significantly than ground control groups (P less than 0.01). Plasma ACTH levels in all groups at 20 C and plasma beta-EP levels in 5 km group increased more significantly than in the groups under same attitude at 10 C. After acute hypoxia in cold environment, plasma ACTH and beta-EP contents increased and it may have serious effects on body temperature regulation.
Author
Adrenocorticotropin (ACTH); Brain; Exposure; Hypothermia; Radioimmunoassay; Rats

20000114288 Institute of Space Medico-Engineering, Beijing, China
Changes of Femur Minerals and Serum BGP in Hindlimb Unloaded Rats During Convalescence
Wan, Yu-Min, Institute of Space Medico-Engineering, China; Zhang, Man-Fu, Institute of Space Medico-Engineering, China; Cui, Wei, Institute of Space Medico-Engineering, China; Song, Jin-Ping, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 298-300; In Chinese; Copyright; Avail: Issuing Activity

To observe bone mass changes during convalescence after simulated weightlessness. 7-week-old rats were tail-suspended for 21 d then reloaded for 7 d arid 21 d to recover, and measured serum BGP. Tail suspension of rats for 21 d caused significant decrease of serum BGP and phosphorus as well as femur minerals. Serum BGP and femur minerals were still lower than control levels, but serum contents of calcium, phosphorus and magnesium increased significantly after reloading for 7 d. Femur minerals and serum BGP, calcium, phosphorus and magnesium returned to control levels after reloading for 21 d. The deficit in femur mineral induled by hindlimb unloading in rats can be restored by return to normal weight bearing,BGP can be used to monitor the case of its recovery.
Author
Bone Mineral Content; Calcium; Femur; Rats; Weightlessness Simulation

20000114292 Institute of Space Medico-Engineering, Beijing, China
Effects of CO2 Concentration on Growth and Development of Lettuce in Controlled Environment
Guo, Shuang-Sheng, Institute of Space Medico-Engineering, China; Ai, Wei-Dang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 267-271; In Chinese; Copyright; Avail: Issuing Activity

To study the tolerance of lettuce to elevated CO2 concentration in Controlled Ecological Life Support System(CELSS). Lettuce was cultivated in the Ground-based Experimental Facility for Higher Plant Cultivation in Space (GEFHPCS), in which many parameters were kept unchanged, while concentration of CO2 was controlled at 5 different levels (2000 approx. 10000 micro mol/mol). During the growing periods, the morphologies of lettuce were observed every day, the replenished amounts of CO2 to GEFHPCS and water to the nutrient fluid box as well as the amounts of condensed water collected from GEFHPCS were all recorded every day. After harvest, the output and photosynthetic rate were calculated and lots of constituents of lettuce were analyzed. The growth of lettuce were relatively ideal when CO2 concentration was at 6000 micro mol/mol, but an obviously withering appearance was found when CO2 concentration increased 10000 micro mol/ mol this time the output and quality of lettuce were

unsatisfactory. It would be optimal when CO2 concentration is controlled at about 6000 micro mol/mol in a lettuce-cultivating chamber.
Author
Carbon Dioxide Concentration; Vegetables; Growth; Closed Ecological Systems

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.

20000109798 Brigham and Women's Hospital, Boston, MA USA
FACTS (Find the Appropriate Clinical Trials) for You: A Computer-Based Decision Support System for Breast Cancer Patients ***Annual Report, 20 Apr. 1998-19 Apr. 1999***
Ohno-Machado, Lucila; May 1999; 82p; In English
Contract(s)/Grant(s): DAMD17-98-1-8039
Report No.(s): AD-A381179; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

We have developed a system for clinical trial eligibility determination where patients or primary care providers can enter clinical information about a patient and obtain a ranked list of clinical trials for which the patient is likely to be eligible. We used clinical trial eligibility information from the National Cancer Institute's Physician Data Query (PDQ) database. We translated each free-text eligibility criterion into a machine executable statement using a derivation of the Arden Syntax. Clinical trial protocols were then structured as collections of these eligibility criteria using XML. The application compares the entered patient information against each of the eligibility criteria and returns a numerical score. Results are displayed in order of likelihood of match. We have tested our system using all phase II and III clinical trials for treatment of metastatic breast cancer found in the PDQ database. Preliminary results are encouraging. We have completed the tasks in the approved statement of work that were planned for Year I of this project. A working prototype of the system we envision as our final product is available at http://telmato.bwh.harvard.edu: 8OOO/FACTS/FormIn.htm.
DTIC
Computer Techniques; Decision Support Systems; Patients; Cancer; Clinical Medicine

20000109799 Louisiana State Univ., Baton Rouge, LA USA
Determination of Total Daily Energy Requirements and Activity Patterns of Service Women ***Annual Report, 26 Sep. 1998-25 Sep. 1999***
Delaney, James P.; Oct. 1999; 27p; In English
Contract(s)/Grant(s): DAMD17-96-2-6025
Report No.(s): AD-A381203; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the current study is to define a range of energy requirements of servicewomen, defining the variation as it relates to jobs, military settings, and activity patterns. This is crucial information needed not only for determination of nutritional requirements for energy balance, but specific nutrient density standards for servicewomen. Total daily energy expenditure is measured using the doubly labeled water (DLW) method. Activity patterns from actigraphs will be analyzed for hours of sleep, description of job/work patterns by examining bursts of concerted activity versus steady activity. Energy requirements for men have been better established and will serve to anchor the results obtained in women to previously established norms in men. The first field study was conducted at Fort Bragg/Camp Mckall during a Combat Support Hospital training exercise. Energy expenditures were moderate, and higher in men than women. However, when adjusting for differences in body size, energy expenditures were similar. Very high energy expenditures were observed during the Crucible studies in Marine Recruits. Further data analyses for this study are being carried out. Planning for the next studies are underway. The Shipboard study is planned to occur in November or December of 1999. The Marine Basic Training Study planning is underway and should occur early in 2000.
DTIC
Energy Consumption; Physical Exercise; Nutritional Requirements; Energy Requirements; Females; Nutrients

20000109857 NASA Marshall Space Flight Center, Huntsville, AL USA

Overexpression of Human Bone Alkaline Phosphatase in Pichia Pastoris

Karr, Laurel, NASA Marshall Space Flight Center, USA; Malone, Christine, C., Universities Space Research Association, USA; [2000]; 1p; In English; 2000 Current Topics in Gene Expression Systems Conference, 25 Sep. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Pichiapastoris expression system was utilized to produce functionally active human bone alkaline phosphatase in gram quantities. Bone alkaline phosphatase is a key enzyme in bone formation and biomineralization, yet important questions about its structural chemistry and interactions with other cellular enzymes in mineralizing tissues remain unanswered. A soluble form of human bone alkaline phosphatase was constructed by deletion of the 25 amino acid hydrophobic C-terminal region of the encoding cDNA and inserted into the X-33 Pichiapastoris strain. An overexpression system was developed in shake flasks and converted to large-scale fermentation. Alkaline phosphatase was secreted into the medium to a level of 32mgAL when cultured in shake flasks. Enzyme activity was 12U/mg measured by a spectrophotometric assay. Fermentation yielded 880mgAL with enzymatic activity of 968U/mg. Gel electrophoresis analysis indicates that greater than 50% of the total protein in the fermentation is alkaline phosphatase. A purification scheme has been developed using ammonium sulfate precipitation followed by hydrophobic interaction chromatography. We are currently screening crystallization conditions of the purified recombinant protein for subsequent X-ray diffraction analyses. Structural data should provide additional information on the role of alkaline phosphatase in normal bone mineralization and in certain bone mineralization anomalies.

Author

Bones; Calcification; Bone Demineralization; Physiological Effects; Human Body

20000109863 Utah Univ., Dept. of Radiation Oncology, Salt Lake City, UT USA

Radioprotection of Human Cell Nuclear DNA by Polyamines: Radiosensitivity of Chromatin is Influenced by Tightly Bound Spermine

Warters, Raymond L., Utah Univ., USA; Newton, Gerald L., California Univ., San Diego, USA; Olive, Peggy L., British Columbia Univ., Canada; Fahey, Robert C., California Univ., San Diego, USA; Radiation Research; 1999; ISSN 0033-7587; Volume 151, pp. 354-362; In English

Contract(s)/Grant(s): NAGW-4914; NIH-NCI-CA-35982; NIH-5P30-CA-42014; Copyright; Avail: Issuing Activity

The polyamines putrescine (PUT) and spermine (SPM) were examined for their ability to protect human cell Deoxyribonucleic Acid (DNA) against the formation of radiation-induced double-strand breaks (DSBs). As observed previously, under conditions where polyamines were shown to be almost completely absent, association with nuclear matrix protein into a nucleoid, and organization into chromatin structure, protected DNA from induction of DSBs by factors of 4.5 and 95, respectively. At concentrations below 1 mM, PUT or SPM provided equivalent levels of protection to deproteinized nuclear DNA, consistent with their capacity to scavenge radiation-induced radicals. At constant ionic strength, 5 mM SPM protected deproteinized DNA and nucleoid DNA and DNA in nuclear chromatin by factors of 100 and 26, respectively. At 5 mM, SPM provided 15 times greater protection of deproteinized DNA than did PUT. Under physiologically relevant conditions, 5 mM SPM protected DNA in the intact nucleus from the induction of DSBs by a factor of 2 relative to DNA in the absence of SPM. Studies of SPM binding during cellular fractionation revealed that a significant fraction of the cellular SPM is tightly bound in the nucleus but can be removed by extended washing. Thus the association of SPM with nuclear chromatin appears to be a significant contributor to the resistance of the cell's DNA to the induction of DSBs.

Author

Radiation Protection; Cells (Biology); Human Beings; Deoxyribonucleic Acid

20000109879 NASA Johnson Space Center, Houston, TX USA

Cell-Mediated Immune Function and Cytokine Regulation During Space Flight

Sams, Clarence F., NASA Johnson Space Center, USA; Pierson, Duane L., NASA Johnson Space Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The changes in immune function which occur during space flight potentially expose the crews to an increased risk for development of illness. Decreased cellular immune function has been repeatedly documented after space flight and confirmed during flight by in vivo delayed-type hypersensitivity testing. However, correlation of immune changes with a clinically significant risk factor has not yet been performed. Our hypothesis is that space flight induces a decrease in cell-mediated immune function accompanied by a shift from a type 1 cytokine pattern (favoring cell-mediated immunity) to a type 2 cytokine pattern (favoring humoral immunity). We further hypothesize that reactivation of latent viruses will occur during space flight in association with the decreased cellular immunity. to test these hypotheses, we will determine the effects of space flight on cell-mediated immunity and viral reactivation. We will utilize delayed-type hypersensitivity testing as an in vivo measure of integrated cell-mediated

immune function. The production of cytokines and immunoregulatory factors by lymphocytes and monocytes will be measured to determine whether changes in cytokine patterns are associated with the space flight-induced immune dysregulation. Correlation of antigen-specific immune changes with reactivation of latent herpes viruses will be determined by measuring peripheral levels of viral (CMV, VZV, EBV) antigen-specific T cells and comparing to the levels of EBV-infected B-cells by fluorescence in situ hybridization and flow cytometry. A comparison of cell-mediated immune function, cytokine regulation and viral reactivation will provide new insights into crew member health risks during flight.
Author
Immune Systems; Antigens; Lymphocytes; Space Flight

20000109899 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Entrainment of Brain Wave as a Complex System
Mori, Toshio, Kyushu Univ., Japan; Kimura, Takeshi, Kyushu Univ., Japan; Yamazaki, Hideki, Kyushu Univ., Japan; Technology Reports of Kyushu University; September 2000; ISSN 0023-2718; Volume 73, No. 5, pp. 577-584; In Japanese; Copyright; Avail: Issuing Activity

The alpha rhythm is a very stable brain wave compared with the other rhythms (beta,theta,delta), and its spatio-temporal aspect is rich in variety. The alpha rhythm for example usually shows very chaotic behavior. From viewpoints of the complex system, in the present study, we focus our subjects on the entrainment of the a rhythm by photic stimulation to investigate its nonlinear dynamics. The entrainment is obtained only at neighboring frequencies to one of the alpha rhythm. We propose a new idea for the mechanism of the alpha rhythm based on the experimental results and discuss about the analogy with the nonlinear dynamics observed in the Belousov-Zhabotinsky reaction.
Author
Brain Circulation; Rhythm (Biology); Stability; Electroencephalography

20000109956 NASA Ames Research Center, Moffett Field, CA USA
Development of Wireless Subsurface Microsensors for Health Monitoring of Thermal Protection Systems
Pallix, Joan, NASA Ames Research Center, USA; Milos, Frank, NASA Ames Research Center, USA; [2000]; 1p; In English; Research Symposium of the Spring Conference, 27 Mar. 2000, Birmingham, AL, USA; Sponsored by American Society for Nondestructive Testing, Inc., USA
Contract(s)/Grant(s): RTOP 242-82-85; No Copyright; Avail: Issuing Activity; Abstract Only

Low cost access to space is a primary goal for both NASA and the U.S. aerospace industry. Integrated subsystem health diagnostics is an area where major improvements have been identified for potential implementation into the design of new reusable launch vehicles (RLVS) in order to reduce life cycle costs, increase safety margins and improve mission reliability. A number of efforts are underway to use existing and emerging technologies to establish new methods for vehicle health monitoring on operational vehicles as well as X-vehicles. This paper summarizes a joint effort between several NASA centers and industry partners to develop rapid wireless diagnostic tools for failure management and long-term TPS performance monitoring of thermal protection systems (TPS) on future RLVS. An embedded wireless microsensor suite is being designed to allow rapid subsurface TPS health monitoring and damage assessment. This sensor suite will consist of both passive overlimit sensors and sensors for continuous parameter monitoring in flight. The on-board diagnostic system can be used to radio in maintenance requirements before landing and the data could also be used to assist in design validation for X-vehicles. For a 3rd generation vehicle, wireless diagnostics should be at a stage of technical development that will allow use for intelligent feedback systems for guidance and navigation control applications and can also serve as feedback for TPS that can intelligently adapt to its environment.
Author
Microelectronics; Thermal Protection; Aerospace Industry; Systems Integration; Wireless Communication

20000109958 NASA Ames Research Center, Moffett Field, CA USA
Low LBNP Tolerance in Men is Associated With Attenuated Activation of Renin-Angiotensin System
Greenleaf, John E., NASA Ames Research Center, USA; Petersen, T. W., Danish Aerospace Medical Center of Research, Denmark; Gabrielsen, A., Danish Aerospace Medical Center of Research, Denmark; Pump, B., Danish Aerospace Medical Center of Research, Denmark; Bie, P., Danish Aerospace Medical Center of Research, Denmark; Christensen, N.-J., Danish Aerospace Medical Center of Research, Denmark; Warberg, J., Danish Aerospace Medical Center of Research, Denmark; Videbaeck, R., Danish Aerospace Medical Center of Research, Denmark; Simonson, S. R., Danish Aerospace Medical Center of Research, Denmark; Norsk, P., Danish Aerospace Medical Center of Research, Denmark; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Vasoactive hormone concentrations (epinephrine (pE), norepinephrine (pNE), angiotensin II (pATII), vasopressin (pVP), endothelin 1 (pET1)] and plasma renin activity (pRA) were measured during lower body negative pressure (LBNP) to test the hypothesis that responsiveness of the reninangiotensin system is related to LBNP tolerance. Healthy men (2,822 cal per day, 2 mmol per kilogram per day Na (+)) were exposed to 30 min of progressive LBNP to -50mmHg. LBNP was uneventful for 7 men (2512 yr, HiTol group), but 8 men (26 plus or minus 3 yr) reached pre-syncope after 11 plus or minus 1 min (P less than 0.001, LoTol group). Mean arterial pressure was unchanged. Central venous pressure and left atrial diameter decreased in both groups (5-6 mmHg by 30%, P less than 0.05). Control [hormone] were similar but, pRA differed between groups (LoTol 0.6 plus or minus 0.1, HiTol 1.2 plus or minus 0.1 ng Ang1 per milliliter per hour, per hour, P less than 0.05). LBNP increased (P less than 0.05) pRA and pATII more in HiTol (9.9 plus or minus 2.2 ng Ang1 per milliliter per hour and 58 plus or minus 12 pg per milliliter) than LoTol (4.3 plus or minus 0.9 ng Angl per milliliter per hour and 28 plus or minus 6 pg per milliliter). In contrast, pVP was higher (P less than 0.05) in LoTol than in HiTol. The response of the renin-angiotensin system seems linked to the occurrence of pre-syncope, and measurement of resting pRA may be predictive.
Author
Hormones; Lower Body Negative Pressure; Males; Vasoconstrictor Drugs; Antidiuretics; Immunoassay

20000109963 NASA Ames Research Center, Moffett Field, CA USA
Differences in Acceleration Training and Exercise Training on Resting Cardiovascular Variables
Evans, J. M., NASA Ames Research Center, USA; Simonson, S. R.; Knapp, C. F.; Stocks, J. M.; Biagini, H. W.; Cowell, S. A.; Bailey, Kn. N.; Vener, J. M.; Evetts, S. N.; [2000]; 1p; In English
Contract(s)/Grant(s): RTOP UPN-111-10-20; No Copyright; Avail: Issuing Activity; Abstract Only

The relative effects of alternating exercise vs. acclamation training an mean blood pressure (BP, Finapres), cardiac output (CO, BoMed) and peripheral resistance (PR, calculated) were evaluated. Six healthy men (33$\pm$(SD)6 yr. 178$\pm$4 cm, 86$\pm$6 kg) underwent exercise training (ET, n=3): supine on a cycle ergometer (40 to 90\% Vo$_{2}$ max) during exposure to constant+1G$_{z}$ for $\sim$30 min/day for 14 days on NASA's 1.9m Human Powered Centrifuge (HPC). They also underwent oscillatory (between +1 G$ {z}and\sim$2.5G$_{z}$) acceleration training (AT, n=3) for $\sim$30 min/day for 14 days on the HPC. After four weeks of ambulatory deconditioning, training protocols were switched. AT increased resting CO by 9.MpmS(SE)3.2\% (p$less than$0.05) with no effect on BF, and ET decreased BP by 9.2$\pm$4.6\% (p$less than$0.08) as well as spectral power of PR by 41$\pm$9\% (p$less than$0.05). The major effect of acceleration training was to increase resting cardiac output while that of exercise mining was to decrease resting blood pressure.
Author
Cardiovascular System; Physical Exercise; Aerospace Medicine; Acceleration Stresses (Physiology)

20000110018 NASA Johnson Space Center, Houston, TX USA
Marked Exacerbation of Orthostatic Intolerance After Long vs. Short-Duration Spaceflight in Veteran Astronauts
Fritsch-Yelle, Janice M., NASA Johnson Space Center, USA; Reyes, Carlos, Wyle Labs., Inc., USA; Perez, Sondra A., Wyle Labs., Inc., USA; Goldberger, Ary L., Beth Israel Deaconess Medical Center, USA; Ziegler, Michael G., California Univ., USA; December 1999; 2p; In English
Contract(s)/Grant(s): NAS9-97005; NAG5-6350; No Copyright; Avail: Issuing Activity; Abstract Only

The incidence of postflight orthostatic intolerance following short-duration spaceflight is about 20%. However, the incidence following long-duration spaceflight is unknown. We performed tilt tests on six astronauts before and after their long-duration (129 - 190 days) spaceflights and compared these data to those obtained during stand tests before and after their previous short-duration missions and also to tilt test data from 20 different short-duration (8 - 16 days) flight astronauts. Five of these six became presyncopal during tilt testing after long-duration flights: only one had become presyncopal during stand testing after short-duration flights. Five of the twenty astronauts who flew on other short-duration flights, became presyncopal during upright tilt on landing day. Long-duration presyncopal subjects had lower stroke volumes, lower cardiac outputs and higher peripheral vascular resistance than short-duration presyncopal subjects, but their heart rate responses were not different. One subject had subnormal norepinephrine release with upright posture after a long but not short flight. Plasma volume losses were not greater after long flights. Long-duration spaceflight markedly increases orthostatic intolerance, probably related to altered autonomic function.
Author
Long Duration Space Flight; Autonomic Nervous System; Astronauts; Cardiovascular System; Aerospace Medicine; Head Up Tilt

20000110067 NASA Johnson Space Center, Houston, TX USA

Space Flight Decompression Sickness Contingency Plan

Dervay, Joseph, NASA Johnson Space Center, USA; Gernhardt, Michael L., NASA Johnson Space Center, USA; Ross, Charles E., NASA Johnson Space Center, USA; Hamilton, Douglas, Wyle Labs., Inc., USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The purpose was to develop an enhanced plan to diagnose, treat, and manage decompression sickness (DCS) during extravehicular activity (EVA). This plan is merited by the high frequency of upcoming EVAs necessary to construct and maintain the International Space Station (ISS). The upcoming ISS era will demand a significant increase in EVA. The DCS Risk and Contingency Plan provided a new and improved approach to DCS reporting, treatment, management, and training.

Derived from text

Space Flight; Decompression Sickness

20000110070 NASA Johnson Space Center, Houston, TX USA

Human Trials of a 2-Hour Prebreathe Protocol

Butler, Bruce D., Texas Univ. Medical School, USA; Vann, R. D., Duke Univ., USA; Nishi, Ronald Y., Defence and Civil Inst. of Environmental Medicine, Canada; Gerth, W. A., Duke Univ., USA; Beltran, E., Texas Univ. Medical School, USA; Conkin, J., Baylor Coll. of Medicine, USA; Schneider, Suzanne, NASA Johnson Space Center, USA; Loftin, K. C., Wyle Labs., Inc., USA; Sullivan, Pat A., Canadian Space Agency, Canada; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We evaluate 2-hour prebreathe protocols combining simulated microgravity and exercise during prebreathe with the objective of validating a protocol for use on International Space Station (ISS). The protocol was tested with four different exercise doses during prebreathe in a multi-center trial involving three laboratories. Subject selection, Doppler monitoring techniques for venous gas emboli (VGE), test termination criteria, and definitions of decompression sickness (DCS) were standardized in all laboratories. The Phase II protocol met the accept criteria for a prebreathe procedure for use by astronauts during assembly and maintenance of the ISS Dual-cycle ergometry or light exercise individually was not sufficient to protect against DCS at acceptable levels. The combination of both was successful.

Derived from text

High Altitude Breathing; Microgravity; Physical Exercise

20000110138 NASA Johnson Space Center, Houston, TX USA

Assessment of Countermeasure Efficacy for Long-Term Space Missions

Feiveson, Alan H., NASA Johnson Space Center, USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

One of the main functions of the upcoming International Space Station (ISS) will be to provide a venue for testing proposed countermeasures for their ability to protect humans from the debilitating effects of longterm space flight. However, several limiting factors preclude an evaluation process similar to that used in clinical trials which traditionally are implemented with large sample sizes of subjects, including control groups, and with blind or double-blind application of treatments according to factorial or other balanced experimental designs. In particular, only very limited numbers of human subjects will be available for actual field testing in the ISS With no more than 125 subjects planned to fly on all ISS missions over 10 years, it is not possible to test extensive combinations of some 15-20 proposed countermeasures. Furthermore because of safety concerns and operational considerations, it is unlikely that anything other than the current best guess at the most effective countermeasure package will ever be used on ISS. In particular, control or placebos will not be allowed. In view of these limitations, historical data and groundbased or animal studies will have to be used to compensate for small sample sizes and lack of controls in the field. As a result, statistical analysis methodology will have to be developed which allows for the integration of these disparate data types into a meaningful evaluation process. The process must be sequential, providing objective rules for deciding through time whether to reject or modify an ineffective countermeasure, or whether to certify one as effective. Additional output should include performance characteristics for all relevant physiological systems, including uncertainty analyses and estimates of accept/reject decision error rates.

Author

Assessments; Countermeasures; Long Duration Space Flight; Flight Stress (Biology); Biological Effects; Human Beings

20000110943 Arizona Univ., Dept. of Radiation Oncology, Tucson, AZ USA

Free Radicals Generated by Ionizing Radiation Signal Nuclear Translocation of p53

Martinez, J. D., Arizona Univ., USA; Pennington, M. E., Arizona Univ., USA; Craven, M. T., Arizona Univ., USA; Warters, R. L., Utah Univ., USA; September 1997; Volume 8, pp. 941-949; In English

Contract(s)/Grant(s): DOE-307190; NAGW-4914; NIH-R29-CA-64842; NIH-R29-CA-23074; HHMI-71109-52130; Copyright; Avail: Issuing Activity

The p53 tumor suppressor is a transcription factor that regulates several pathways, which function collectively to maintain the integrity of the genome. Nuclear localization is critical for wild-type function. However, the signals that regulate subcellular localization of p53 have not been identified. Here, we examine the effect of ionizing radiation on the subcellular localization of p53 in two cell lines in which p63 is normally sequestered in the cytoplasm and found that ionizing radiation caused a biphasic translocation response. p53 entered the nucleus 1-2 hours postirradiation (early response), subsequently emerged from the nucleus, and then again entered the nucleus 12-24 hours after the cells had been irradiated (delayed response). These changes in subcellular localization could be completely blocked by the free radical scavenger, WR1065. By comparison, two DNA-damaging agents that do not generate free radicals, mitomycin C and doxorubicin, caused translocation only after 12-24 h of exposure to the drugs, and this effect could not be inhibited by WR1065. Hence, although all three DNA-damaging agents induced relocalization of p53 to the nucleus, only the translocation caused by radiation was sensitive to free radical scavenging. We suggest that the free radicals generated by ionizing radiation can signal p53 translocation to the nucleus.

Author

Ionizing Radiation; Tumors; Irradiation; Radiation Effects

20000111088 Wyle Labs., Inc., Medical Operations Branch, Houston, TX USA

Medical Training Issues and Skill Mix for Exploration Missions

Janney, R. P., Wyle Labs., Inc., USA; Armstrong, C. W., Wyle Labs., Inc., USA; Stepaniak, P. C., Wyle Labs., Inc., USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The approach for treating in-flight medical events during exploration-class missions must reflect the need for an autonomous crew, and cannot be compared to current space flight therapeutic protocols. An exploration mission exposes the crew to periods of galactic cosmic radiation, isolation, confinement, and microgravity deconditioning far exceeding the low-Earth orbital missions performed to date. In addition, exploration crews will not be able to return to Earth at the onset of a medical event and will need to control the situation in-flight. Medical consultations with Earth-based physicians will be delayed as much as 40 minutes, dictating the need for a highly-trained medical team on board. This presentation will address the mix of crew medical skills and the training required for crew health care providers for missions beyond low-Earth orbit. Both low- and high-risk options for medical skill mix and preflight training will be compared.

Author

Medical Personnel; Aerospace Medicine; Telemedicine; Space Exploration

20000112959 NASA Ames Research Center, Moffett Field, CA USA

EEG Analysis of the Effects of Therapeutic Cooling on the Cognitive Performance of Multiple Sclerosis Patients

Montgomery, Leslie D., Lockheed Martin Engineering and Sciences Co., USA; Montgomery, Richard W., Lockheed Martin Engineering and Sciences Co., USA; Ku, Yu-Tsuan E., Lockheed Martin Engineering and Sciences Co., USA; Luna, Bernadette, NASA Ames Research Center, USA; Lee, Hank C., Lockheed Martin Engineering and Sciences Co., USA; Kliss, Mark, NASA Ames Research Center, USA; Webbon, Bruce, NASA Ames Research Center, USA; [1999]; 30p; In English

Contract(s)/Grant(s): RTOP 251-10-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this project was to determine whether a controlled period of head and torso cooling would enhance the cognitive performance of multiple sclerosis patients. Nineteen MS patients (11 men and 8 women) participated in the study. Control data were taken from nineteen healthy volunteers (12 men and 7 women). All but six of nineteen MS patients tested improved their cognitive performance, as measured by their scores on the Rao test battery. A second objective was to gain insight into the neurological effects of cooling. Visual evoked potentials (VEPs) stimulated by a reversing checkerboard pattern were recorded before and after cooling. We found that cooling selectively benefited the cognitive performance of those MS patients whose precooling VEPs were abnormally shaped (which is an indication of visual pathway impairment due to demyelinization). Moreover, for female MS patients, the degree of cognitive performance improvement following cooling was correlated with a change in the shape of their VEPs toward a more normal shape following cooling.

Author

Bioelectric Potential; Cooling; Mental Performance; Neurology; Therapy; Clinical Medicine; Cognitive Psychology; Electroencephalography

20000113831 University of Southern California, Los Angeles, CA USA

An Innovative Assessment of Endogenous Estrogen Activity in Persons with Different Habits of Exercise ***Annual Report, 1 Sep. 1998-30 Aug. 1999***

Hamilton, Ann S.; Sep. 1999; 19p; In English

Contract(s)/Grant(s): DAMD17-97-1-7081

Report No.(s): AD-A380910; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Evidence exists that women exercising have lower estrogen levels than sedentary women. These lower estrogen levels may be the mechanism behind their reduced breast cancer risk. Previous studies included athletes with high exercise levels, and estrogen measurements were based on a few serum samples from different times during a menstrual cycle. This study includes identical female twins who are discordant for moderate exercise. Estradiol is measured on a daily basis from saliva samples collected during a complete menstrual cycle. Procedures and questionnaires have been developed; enrollment of eligible pairs is ongoing. Screening interviews have been conducted with 197 pairs. of these, 36 were initially eligible; however 7 declined to participate and 2 later became ineligible due to menopausal related reasons. Thus, sample collection is currently completed or underway for 27 pairs. Estradiol and progesterone assays have been completed for 16 pairs. Although fewer eligible pairs were identified than expected, more twins will be available from additional phases of the California Twin Program. In Year 3, we will continue to screen and enroll twins, complete data entry of questionnaires, conduct hormonal assays, integrate laboratory and questionnaire data sets, and complete preliminary analyses. It is anticipated that a 1 year no cost extension will be requested.

DTIC

Physical Exercise; Estrogens; Mammary Glands; Cancer

20000113922 Ohio State Univ., Research Foundation, Columbus, OH USA

X-Photon-to-Information Conversion Efficiency in Digital Telemammography ***Annual Report, 1 Jun 1998-31 May 1999***

Williams, Celeste B.; Clymer, Bradley D.; Jun. 1999; 31p; In English

Contract(s)/Grant(s): DAMD17-96-1-6139

Report No.(s): AD-A374996; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Imaging techniques for diagnosis and detection of breast cancer deform the breast from its original shape by applying external forces. However, these methods do not take into account the mechanical nature of breast tissue. It is known that pathology has different elastic properties than healthy tissue and the characterization of the mechanical nature of tissue may act as a diagnostic tool, which may improve the prognosis for breast cancer patients. This research is based on these factors of breast cancer research. The purpose of this study is to non-invasively estimate the in vivo force-deformation behavior of normal breast tissue undergoing mild compression.

DTIC

Mammary Glands; Cancer; Diagnosis; Tissues (Biology); Imaging Techniques; Digital Techniques; Deformation; Prognosis

20000114275 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Effects of Acute Exposure to Mild or Moderate Hypoxia on Human Psychomotor and Visual-Reaction Time

Li, Xue-Yi, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Fu, Chuan, China Southwest Airlines, China; Shen, Xiao-Feng, China Southwest Airlines, China; Yang, Chang-Bin, Fourth Military Medical Univ., China; Wu, Yan-Hong, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 235-239; In English; Copyright; Avail: Issuing Activity

The aim of this study was to determine whether psychomotor performance and visual reaction time were affected by acute exposure to mild or moderate hypoxia.

Author

Exposure; Hypoxia; Psychomotor Performance

20000114276 Fourth Military Medical Univ., Dept. of Aerospace Physiology, Xi'an, China

Effects of Sleep Deprivation on Human Performance

Fu, Zhao-Jun, Fourth Military Medical Univ., China; Ma, Rui-Shan, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 240-243; In Chinese; Copyright; Avail: Issuing Activity

To investigate the effects of sleep deprivation(SD) on human performance. 8 healthy male college students participated the test. During 26 h of continuous awakeness (from 6:00 to 8: 00 the next day), the volunteers were demanded to perform a battery of tests at 9 different time (7:00, 12:00, 16:00, 20:00, 0:00, 2:00, 4:00,6:00, 8:00). The tests include: (1) single task: aural Oddball response,the response time (RT1) and correct rate (CR(sub 1)) were recorded; (2) dual tasks: manual tracking and aural Oddball response, the response time(RT(sub 2)), tracking error (ER) and correct rate (CR2) were recorded; (3) the Stanford sleepiness scale

and subjective ratings of task difficulty access. SD had significant effects on CT(sub 1),CT(sub 2) and ER(P = 0.0001, P = 0.00001, P = 0.0004 respectively); SD increased RT(sub 1) , RT(sub 2), ER at night time. SD had significant effects on SD increased SR, SSS score at night time. Since the subjects changed their response strategy, CR1 and CR2 were not influenced by SD at night time. SD has significant effects on response time, tracking error subjective difficulty of cognitive tasks and subjective sleepiness. Author

Circadian Rhythms; Human Performance; Mental Performance; Sleep Deprivation; Time Measurement

20000114278 Xian Jiaotong Univ., Dept. of Biomedical Engineering, China

Effects of Mild and Moderate Hypoxia on Complexity-Measure of the EEG Signals

Huang, Li-Yu, Xian Jiaotong Univ., China; Cheng, Jing-Zhi, Xian Jiaotong Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 255-258; In Chinese; Copyright; Avail: Issuing Activity

Non-linear analysis of EEG signals is important in EEG studies. In this paper, the effects of mild or moderate hypoxia on the complexity of EEG were studied. A model for acute altitude hypoxia experiment was presented. EEG before and 30 minutes during four different levels of hypoxia were recorded. The complexities of these EEG signals were analyzed. With increase of altitude and time, to a certain extent, the complexity became lower than that under normal condition. The complexity of EEG is sensitive to hypoxia, and can be regarded as one of the features classifying the hypoxic EEG and normal EEG. Author

Hypoxia; Electroencephalography

20000114279 Institute of Space Medico-Engineering, Beijing, China

Physiological Evaluation of Vestibular Training Load

Wang, Lin-Jie, Institute of Space Medico-Engineering, China; Pei, Jing-Chen, Institute of Space Medico-Engineering, China; Tong, Bo-Lun, Institute of Space Medico-Engineering, China; Liu, Zhi-Qiang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 249-254; In Chinese; Copyright; Avail: Issuing Activity

To evaluate the effects of vestibular training by observing the variations of the physiological indices. It is helpful in grasping the training load, setting down and implementing the training plan. 10 healthy subjects received linear acceleration, continuous Coriolis acceleration and discontinuous Coriolis acceleration stimuli on different dates. The stimulus was stopped when there were slight autonomic nervous symptoms, ECG, EGG and BP were recorded before during and after the stimuli. Computerized Dynamic Postrograph (CDP) was tested before and after experiment. One subject finished the training of the three stimuli with only slight autonomic nervous symptoms. The CDP tests pre-and post-experiment indicated that for most subjects the contribution of vestibular function in maintaining dynamic posture equilibrium increased after the linear acceleration stimuli, but decreased after continuous Coriolis acceleration stimuli, and there was great individual difference after discontinuous Coriolis acceleration stimuli because the stimulation was relatively heavy. The equilibrium score in SOT2 decreased significantly after linear acceleration stimuli, and increased significantly after discontinuous Coriolis acceleration stimuli. The training methods we designed and used in this experiment are feasible, and the required training load can be reached. EGG, BP and the percentage of LF (low frequency) in ECG R-R power spectrum can reflect the subject's condition when the period stimuli stopped. It provided important reference in the determination of training stimulation load. Key words vestibular stimulus; vestibular function tests; acceleration; dynamic posture equilibrium tests; motion sickness; physiological parameters Author

Coriolis Effect; Dynamic Tests; Loads (Forces); Motion Sickness; Signs and Symptoms; Training Evaluation; Vestibular Tests

20000114280 Tsinghua Univ., Lab. of Biomedical Engineering, Bejing, China

A Simulated Study of Effects of Simulated Hypovolemia on Cardiovascular Response to Orthostatic Stress

Hao, Wei-Ya, Tsinghua Univ., China; Zhang, Li-Fan, Tsinghua Univ., China; Wu, Xing-Yu, Tsinghua Univ., China; Zhang, Wei-Ying, Tsinghua Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 259-262; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of hypovolemia on cardiovascular response to orthostatic stress, and to investigate the role of hypovolemia in the mechanism of cardiovascular deconditioning and orthostatic intolerance induced by space weightlessness. The effects of loss of blood volume had been incorporated in the sub-model of blood redistribution in the model developed for simulating the cardiovascular response to lower body negative pressure (LBNP) - With the help of the model, we simulated the changes of heart rate (HR) and blood pressure (BP) during LBNP after 0 approx. 25 % loss of blood volume. When the amount of decrease of blood volume was less than 5 % of the total blood volume, HR and BP could be maintained in normal range during LBNP through baroreflex regulation. When the amount of the decrease of blood volume was more than 15 % of the total blood volume,

HR and BP could be kept in normal range when the subject was supine and at rest. But BP fell sharply and the cardiovascular system almost collapsed during orthostatic exposure. Decrease of blood volume causes significant degradations of cardiovascular response to orthostatic stress.
Author
Hypovolemia; Cardiovascular System; Orthostatic Tolerance; Physiological Responses; Lower Body Negative Pressure; Weightlessness

20000114290 Institute of Space Medico-Engineering, Beijing, China
Change of Pulmonary Circulation in Microgravity and Simulated Microgravity
Sun, Lei, Institute of Space Medico-Engineering, China; Xiang, Qiu-Lu, Institute of Space Medico-Engineering, China; Wang, De-Sheng, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 305-309; In Chinese; Copyright; Avail: Issuing Activity

Fluid is transferred cephalad in microgravity and simulated microgravity, and the pulmonary circulation is the first to be affected. Blood and fluid contents in the lungs increase, but unevenly distributed among various zones of the lungs. Blood vessels in the lungs are filled and distend. Capillary changes have been observed in the animal model of simulated microgravity. Studies about the changes of regulative function of pulmonary circulation are relatively rare. Observations of the reactivity of pulmonary vessels may help to understand the mechanisms of the changes in pulmonary circulation during microgravity.
Author
Blood Vessels; Microgravity; Pulmonary Circulation; Weightlessness Simulation

20000114291 Institute of Space Medico-Engineering, Beijing, China
Ultraviolet Radiation and Long Term Space Flight
Wu, Hui-Bin, Institute of Space Medico-Engineering, China; Su, Shuang-Ning, Institute of Space Medico-Engineering, China; Ba, Fu-Sen, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 310-312; In Chinese; Copyright; Avail: Issuing Activity

With the prolongation of space flight, influences of various aerospace environmental factors on the astronauts become more and more severe, while ultraviolet radiation is lacking. Some studies indicated that low doses of ultraviolet rays are useful and essential for human body. In space flight, ultraviolet rays can improve the hygienic condition in the space cabin, enhance astronaut's working ability and resistance to unfavorable factors, prevent Mineral metabolic disorders, cure purulent skin diseases and deallergize the allergens. So in long-term space flight, moderate amount of ultraviolet rays in the space cabin would be beneficial.
Author
Ultraviolet Radiation; Human Body; Long Duration Space Flight; Metabolism

20000114820 Arkansas Univ., Little Rock, AR USA
Magnetic Resonance-Guided Interstitial Laser Photocoagulation for the Treatment of Breast Cancer ***Annual Report, 1 Aug. 1998 - 31 Jul. 1999***
Harms, Steven E.; Aug. 1999; 16p; In English
Contract(s)/Grant(s): DAMD17-97-1-7087
Report No.(s): AD-A382429; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study assesses magnetic resonance (MR)-guided interstitial laser photocoagulation (ILP) for the treatment of breast cancer. ILP has been successfully used for the treatment of a variety of solid tumors, and recent studies have indicated the capability of ILP, which employs low level heat (50 centigrade) for about 10 minutes, to kill breast cancer tissue. Because breast cancer cells are often interspersed with surrounding normal tissue, making boundaries difficult to define by most diagnostic imaging methods, MR imaging is used to define tumor margins and extent. Our research group has developed a high%contrast, high-resolution method for MR imaging of the breast, called RODEO (Rotating Delivery of Excitation Off-resonance), proven to have twice the sensitivity and specificity of mammography. Cellular death induced by ILP produces a phase change that can be visualized on MR images. This MRI hypointense zone can then be used to determine the adequacy of ILP treatment. The combination of RODEO imaging and a system for MRI-directed stereotaxic biopsy allows the accurate localization and placement of the laser fibers for ILP. This study tests the feasibility and outcome of MR-directed ILP in 30 patients with breast cancer who are scheduled for surgical removal of the lesion (mastectomy or lumpectomy). Our major findings to date are (1) RODEO MRI can accurately identify cancers for laser ablation; (2) Stereotaxic MRI needle positioning can be performed; (3) Fast RODEO MR can accurately depict zones of ablation for interactive ILP; (4) ILP is an effective method for the minimally invasive ablation of breast cancer;

(5) MRI-guided ILP is safe and is a potential alternative to surgical lumpectomy; and (6) MRI-guided ILP may have lower costs and provide better cosmesis than surgical lumpectomy.
DTIC
Laser Beams; Magnetic Resonance; Mammary Glands; Cancer; Imaging Techniques

53
BEHAVIORAL SCIENCES

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

20000109865 Army Aviation Research and Development Command, Moffett Field, CA USA
Sensitivity Analysis of Situational Awareness Measures
Shively, R. J., Army Aviation Research and Development Command, USA; Davison, H. J., San Jose State Univ., USA; Burdick, M. D., San Jose State Univ., USA; [2000]; 1p; In English; 14th; 14th Triennial HFES/IEA Conference, 30 Jul. - 4 aug. 2000, San Diego, CA, USA
Contract(s)/Grant(s): 21-1614-2360; RTOP 581-31-22; No Copyright; Avail: Issuing Activity; Abstract Only

A great deal of effort has been invested in attempts to define situational awareness, and subsequently to measure this construct. However, relatively less work has focused on the sensitivity of these measures to manipulations that affect the SA of the pilot. This investigation was designed to manipulate SA and examine the sensitivity of commonly used measures of SA. In this experiment, we tested the most commonly accepted measures of SA: SAGAT, objective performance measures, and SART, against different levels of SA manipulation to determine the sensitivity of such measures in the rotorcraft flight environment. SAGAT is a measure in which the simulation blanks in the middle of a trial and the pilot is asked specific, situation-relevant questions about the state of the aircraft or the objective of a particular maneuver. In this experiment, after the pilot responded verbally to several questions, the trial continued from the point frozen. SART is a post-trial questionnaire that asked for subjective SA ratings from the pilot at certain points in the previous flight. The objective performance measures included: contacts with hazards (power lines and towers) that impeded the flight path, lateral and vertical anticipation of these hazards, response time to detection of other air traffic, and response time until an aberrant fuel gauge was detected. An SA manipulation of the flight environment was chosen that undisputedly affects a pilot's SA-- visibility. Four variations of weather conditions (clear, light rain, haze, and fog) resulted in a different level of visibility for each trial. Pilot SA was measured by either SAGAT or the objective performance measures within each level of visibility. This enabled us to not only determine the sensitivity within a measure, but also between the measures. The SART questionnaire and the NASA-TLX, a measure of workload, were distributed after every trial. Using the newly developed rotorcraft part-task laboratory (RPTL) at NASA Ames Research Center, each pilot flew eight trials, four using SAGAT and four using performance measures. Each set of four trials differed by level of visibility as well. The flight paths were very similar in appearance and hazard number, allowing comparison between flight paths. The pilots were tasked with flying along a road at an assigned altitude and speed while avoiding any hazards that they happened upon. The attempt here was not to find a single best measure of SA, but rather to begin an investigation of the sensitivity of common measures of SA. Upon completion of this study, its results, in combination with future studies, should allow us to develop an empirically based taxonomy of SA measures and the contexts for their appropriate use.
Author
Sensitivity; Pilot Performance; Human Factors Engineering

20000109961 NASA Ames Research Center, Moffett Field, CA USA
NASA's Design and Development of a Field Goniometer Instrument Using Solid Works
Turner, Mark, NASA Ames Research Center, USA; Sasaki, Glen, NASA Ames Research Center, USA; [2000]; 1p; In English; 14th; SolidWorks World 2000 Conference, 12-15 Jan. 2000, USA
Contract(s)/Grant(s): 21-1614-2360; RTOP 581-31-22; No Copyright; Avail: Issuing Activity; Abstract Only

With NASA suffering severe funding cutbacks, engineers at NASA are required to produce state-of-the-art hardware with limited personnel and financial resources. In light of these constraints, the new NASA mandate is to build better, faster and cheaper. In April of 1998, Stennis Space Center's Commercial Remote Sensing Program contracted to the Systems Engineering Division at NASA Ames Research Center to develop a device known as a Field Goniometer. A Field Goniometer is a device that measures bi-directional reflectance of a target, such as vegetation, relative to the sun and an imaging system in an aircraft or spacecraft. The device is able to provide a spectral fingerprint of the surface it is measuring in wavelengths from 350nm-2500nm using a hyperspectral imager. to accomplish this project, several obstacles had to be overcome. First, the design had to be completed in less than four months. Second, due to the complexity of the design, the use of solid modeling was highly desirable but most

of the group's solid modelers were assigned to other jobs. Third, the amount of funding available from the customer was one half to one third the funding typically expended for a job of this nature. Our choices for this project were to design with standard 2-D CAD systems currently used in-house or train additional engineers on our existing solids package or purchase a new solid model package. The use of a 2D CAD system was very undesirable due to the complexity of the design. Using our existing solids modeler would have required a learning curve for our engineers that would be incompatible with our schedule. Prior to this project, a member of our design group researched the solid modeling industry and decided to purchase SolidWorks. After examining the product for ease of use, modeling capability, training time required and cost, we decided our highest probability of success would be to design with Solidworks. During the design phase, our fabrication group was able to provide input at the very early stages, which added significant benefit to the final product. Fabrication cost and schedule savings have been realized by having complex part geometries translated directly from the SolidWorks design models to Surfcam and other computer-aided manufacturing (CAM) software. This direct model translation capability optimized the fabrication processes. The end result was that we were able to successfully complete the project on time and on budget. Other advantages of using SolidWorks, as cited by the design team, include a rapid negotiation of the initial learning curve, the ability to develop solid model hardware prototypes (used to communicate the design intent to both the customer and the fabricator), and the ability to work as a team collaborating on a large, complex model. These types of tools and efforts represent our response to NASA's challenge to produce higher quality products within shorter design and fabrication times.

Author

Fabrication; Goniometers; Design Analysis; Measuring Instruments; Systems Engineering; Remote Sensing

20000110868 Civil Aeromedical Inst., Oklahoma City, OK USA

The Relationship Between Aviators' Home-Based Stress to Work Stress and Self-Perceived Performance ***Final Report***

Fiedler, Edna R., Civil Aeromedical Inst., USA; Della Rocco, Pam S., Civil Aeromedical Inst., USA; Schroeder, David J., Civil Aeromedical Inst., USA; Nguyen, Kiet T., Civil Aeromedical Inst., USA; October 2000; 12p; In English

Contract(s)/Grant(s): AM-B-99-HRR-518

Report No.(s): DOT/FAA/AM-00/32; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper investigates the relationship between domestic-based stress and pilots' perceptions of their effectiveness in the cockpit and in the office. Despite the importance placed on the family as a source of social support, there have been few systematic studies of the relationships between pilot family life, workplace stress, and performance. As part of a larger study, 19 USA Coast Guard (USCG) helicopter pilots at two air stations completed a stress questionnaire (adapted from Cooper and Sloan, 1986), rated the importance of various coping strategies, and evaluated their own flying performance The results of this study indicate that the effects of domestic stress carry over to the pilots' work world, directly influencing work stress and indirectly affecting pilots' perceptions of their flying performance. The positive influence of home life in mediating stress was noted when pilots were asked to rate the importance of various coping strategies. Pilots rated three aspects of home life as the most "important" factors in helping them cope with problems or stress. Thus, domestic-related issues were very important to this group of USCG pilots, suggesting the need for management to maintain awareness of how the quality of home life may affect the work environment and overall performance.

Derived from text

Aircraft Pilots; Aviation Psychology; Psychological Effects; Psychological Factors; Stress (Psychology); Pilot Performance

20000111086 NASA Johnson Space Center, Houston, TX USA

Training Select-in Interviewers for Astronaut Selection: A Program Evaluation

Hysong, S., Wyle Labs., Inc., USA; Galarza, L., Wyle Labs., Inc., USA; Holland, A., NASA Johnson Space Center, USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Psychological factors critical to the success of short and long-duration missions have been identified in previous research; however, evaluation for such critical factors in astronaut applicants leaves much room for human interpretation. Thus, an evaluator training session was designed to standardize the interpretation of critical factors, as well as the structure of the select-in interview across evaluators. The purpose of this evaluative study was to determine the effectiveness of the evaluator training sessions and their potential impact on evaluator ratings.

Derived from text

Astronaut Training; Space Psychology; Training Analysis; Personnel Development

20000112923 NASA Ames Research Center, Moffett Field, CA USA

Physiologic and Functional Responses of MS Patients to Body Cooling Using Commercially Available Cooling Garments

Ku, Yu-Tsuan E., Lockheed Martin Engineering and Sciences Co., USA; Montgomery, Leslie D., Lockheed Martin Engineering and Sciences Co., USA; Lee, Hank C., Lockheed Martin Engineering and Sciences Co., USA; Luna, Bernadette, NASA Ames Research Center, USA; Webbon, Bruce W., NASA Ames Research Center, USA; [1999]; 24p; In English

Contract(s)/Grant(s): RTOP 251-10-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Personal cooling systems are widely used in industrial and aerospace environments to alleviate thermal stress. Increasingly they are also used by heat sensitive multiple sclerosis (HSMS) patients to relieve symptoms and improve quality of life. There are a variety of cooling systems commercially available to the MS community. However, little information is available regarding the comparative physiological changes produced by routine operation of these various systems. The objective of this study was to document and compare the patient response to two passive cooling vests and one active cooling garment. The Life Enhancement Technology, Inc. (LET) lightweight active cooling vest with cap, the MicroClimate Systems (MCS) Change of Phase garment, and the Steele Vest were each used to cool 13 male and 13 female MS subjects (31 to 67 yr.) in this study. The subjects, seated in an upright position at normal room temperature (approximately 22 C), were tested with one of the cooling garments. Oral, fight and left ear temperatures were logged manually every 5 min. An-n, leg, chest and rectal temperatures; heart rate; and respiration were recorded continuously on a U.F.I., Inc. Biolog ambulatory monitor. Each subject was given a series of subjective and objective evaluation tests before and after cooling. The LET and Steele vests test groups had similar, significant (P less than 0.01) cooling effects on oral and ear canal temperature, which decreased approximately 0.4 C, and 0.3 C, respectively. Core temperature increased (N.S.) with all three vests during cooling. The LET vest produced the coldest (P less than 0.01) skin temperature. Overall, the LET vest provided the most improvement on subjective and objective performance measures. These results show that the garment configurations tested do not elicit a similar thermal response in all MS patients. Cooling with the LET active garment configuration resulted in the lowest body temperatures for the MS subjects; cooling with the MCS vest was least effective. For functional responses, the LET test group performed better than the other two vests.

Author

Physiological Responses; Body Temperature; Cooling Systems; Garments; Diseases; Nervous System

20000113409 Eastern Virginia Medical School, Behavioral Medicine Clinic, . Norfolk, VA USA

Stress Counter-Response Training Via Physiological Self-Regulation During Flight Simulation, *29 Jul. 1998 - 30 Jun. 2000*

Palsson, Olafur S., Eastern Virginia Medical School, USA; [2000]; 10p; In English

Contract(s)/Grant(s): NCC1-310; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This study provided the first evaluation of a new training concept and technology aimed at training pilots to maintain physiological equilibrium during circumstances in an airplane cockpit. Thirty healthy subjects (16 males and 14 females) between the ages of 18 and 35 were randomized into two study groups, A and B. Subjects participated individually in a sequence of four study sessions. In the first visit, subjects were taught to operate a desktop fighter jet flight simulation program. In the three sessions that followed, subjects in group A were trained to minimize their autonomic deviation from baseline values while operating the desktop flight simulation. This was done by making their skin conductance and hand temperature deviations from baseline impair the functionality of the aircraft controls. Subjects also received auditory and visual cues about their autonomic deviation, and were instructed to keep these within pre-set limits to retain full control of the aircraft. Subjects in group B were subjected to periods of impaired aircraft functionality independent of their physiologic activity, and thus served as a control group. No statistically significant group differences were found in the flight performance scores from the three training sessions, and post-training flight performance scores of the two groups were not different. We conclude that this study did not provide clear support for this training methodology in optimizing pilot performance. However, a number of shortcomings in the current status of this training methodology may account for the lack of demonstrable training benefit to the experimental group. Suggested future modifications for research on this training methodology include: Limiting the amount of instrument impairment resulting from physiological deviations; conducting a greater number of physiological training sessions per subject; using pre-post training performance tests which invoke a greater amount of stress in subjects; and developing a more detailed performance scoring system.

Author

Flight Simulation; Flight Stress (Biology); Psychophysiology; Pilot Performance; Autonomic Nervous System

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

20000109870 Norwegian Defence Research Establishment, Kjeller, Norway
Test of Adsorption Capacity of Protecting Materials ***Adsorpsjonstesting av Vernematerialer***
Haldorsen, Tone Merete, Norwegian Defence Research Establishment, Norway; Roen, Bent Tore, Norwegian Defence Research Establishment, Norway; Busmundrud, Odd, Norwegian Defence Research Establishment, Norway; Skas, Bjornar Lowe, Norwegian Defence Research Establishment, Norway; Sep. 01, 2000; 26p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): FFIBM Proj. 757/138
Report No.(s): FFI/RAPPORT-2000-04404; ISBN-82-464-0437-7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NM143 NBC protective suit used by the Norwegian armed forces and the NBC protective underliner in use for pilots has been examined regarding their adsorption capacities. Penetration analyses were performed with mustard gas at a contamination level of 10 Mg/sq cm. The underliner together with the pilot survival suit gives an accumulated penetrated amount over 24 hours of less than 0.5 microg/sq cm. Penetration analyses on NM143 materials give significant higher penetrated amount on a ready-made suit from March 1990 than for yard goods from the same period. However, both materials satisfy the requirement of less than 4 microg/sq cm total penetrated amount over 24 hours. Adsorption isotherms are measured on the materials at 90 C with methyl salicylate. The underliner shows better adsorption capacity than the NM143 inner materials at vapor concentrations below 2 * 10(exp -4) P/P(sub 0) but lower adsorption capacity at higher concentrations. No significant difference was measured in adsorption capacity between NM143 materials from suit and materials from yard goods. A laundering test on the NM143 suit shows lower adsorption capacity of the inner material after one laundering.
Author
Protective Clothing; Flight Clothing; Adsorption

20000109874 NASA Johnson Space Center, Houston, TX USA
Two-Phase Technology at NASA/Johnson Space Center
Ungar, Eugene K., NASA Johnson Space Center, USA; [1999]; 1p; In English; Two-Phase Technology 1999, 17-19 May 1999, College Park, MD, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Since the baseline International Space Station (ISS) External Active Thermal Control System (EATCS) was changed from a two-phase mechanically pumped system to a single phase cascade system in the fall of 1993, two-phase EATCS research has continued at a low level at JSC. One of-the lessons of the ISS EATCS selection was that two-phase thermal control systems must have significantly lower power than comparable single phase systems to overcome their larger radiator area, larger line and fluid mass, and perceived higher technical risk. Therefore, research at JSC has concentrated on low power mechanically pumped two-phase EATCSs. In the presentation, the results of a study investigating the trade of single and two-phase mechanically pumped EATCSs for space vehicles will be summarized. The low power two-phase mechanically pumped EATCS system under development at JSC will be described in detail and the current design status of the subscale test unit will be reviewed. Also, performance predictions for a full size EATCS will be presented. In addition to the discussion of two-phase mechanically pumped EATCS development at JSC, two-phase technologies under development for biological water processing will be discussed. These biological water processor technologies are being prepared for a 2001 flight experiment and subsequent usage on the TransHab module on the International Space Station.
Author
International Space Station; Active Control; Temperature Control; Systems Engineering

20000109876 Lockheed Martin Space Operations, Houston, TX USA
Development of the ECLSS Sizing Analysis Tool and ARS Mass Balance Model Using Microsoft Excel
McGlothlin, E. P., Lockheed Martin Space Operations, USA; Yeh, H. Y., Lockheed Martin Space Operations, USA; Lin, C. H., NASA Johnson Space Center, USA; [1999]; 1p; In English; 29th; 29th ICES, 12-15 Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA
Contract(s)/Grant(s): PWC-260981; No Copyright; Avail: Issuing Activity; Abstract Only

The development of a Microsoft Excel-compatible Environmental Control and Life Support System (ECLSS) sizing analysis ”tool” for conceptual design of Mars human exploration missions makes it possible for a user to choose a certain technology in the corresponding subsystem. This tool estimates the mass, volume, and power requirements of every technology in a subsystem

and the system as a whole. Furthermore, to verify that a design sized by the ECLSS Sizing Tool meets the mission requirements and integrates properly, mass balance models that solve for component throughputs of such ECLSS systems as the Water Recovery System (WRS) and Air Revitalization System (ARS) must be developed. The ARS Mass Balance Model will be discussed in this paper.
Author
Environmental Control; Life Support Systems; Air Purification; Water Reclamation

20000110015 NASA Johnson Space Center, Houston, TX USA
Hybrid Modeling for Testing Intelligent Software for Lunar-Mars Closed Life Support
Malin, Jane T., NASA Johnson Space Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Intelligent software is being developed for closed life support systems with biological components, for human exploration of the Moon and Mars. The intelligent software functions include planning/scheduling, reactive discrete control and sequencing, management of continuous control, and fault detection, diagnosis, and management of failures and errors. Four types of modeling information have been essential to system modeling and simulation to develop and test the software and to provide operational model-based what-if analyses: discrete component operational and failure modes; continuous dynamic performance within component modes, modeled qualitatively or quantitatively; configuration of flows and power among components in the system; and operations activities and scenarios. CONFIG, a multi-purpose discrete event simulation tool that integrates all four types of models for use throughout the engineering and operations life cycle, has been used to model components and systems involved in the production and transfer of oxygen and carbon dioxide in a plant-growth chamber and between that chamber and a habitation chamber with physicochemical systems for gas processing.
Author
Life Support Systems; Artificial Intelligence; Moon; Mars (Planet); Software Development Tools; Hybrid Computers; Mathematical Models; Performance Tests

20000110017 NASA Johnson Space Center, Houston, TX USA
Modulation of Head Movement Control During Walking
Mulavara, Ajitkumar P., Wyle Labs., Inc., USA; Verstraete, Mary C., Akron Univ., USA; Bloomberg, Jacob J., NASA Johnson Space Center, USA; [1999]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The purpose of this study was to investigate the coordination of the head relative to the trunk within a gait cycle during gaze fixation. Nine normal subjects walked on a motorized treadmill driven at 1.79 m/sec (20 s trials) while fixing their gaze on a centrally located earth-fixed target positioned at a distance of 2m from their eyes. The relative motion of the head and the net torque acting on it relative to the trunk during the gait cycle were used as measures of coordination. It was found that the net torque applied to the head counteracts the destabilizing forces acting on the upper body during locomotion. The average net torque impulse was significantly different (p less than 0.05) between the heel strike and swing phases and were found to be symmetrical between the right and left leg events of the gait cycle. However, the average net displacement of the head relative to the trunk was maintained uniform (p greater than 0.05) throughout the gait cycle. Thus, the coordination of the motion of the head relative to the trunk during walking is dynamically modulated depending on the behavioral events occurring in the gait cycle. This modulation may serve to aid stabilization of the head by counteracting the force variations acting on the upper body that may aid in the visual fixing of targets during walking.
Author
Head Movement; Modulation; Walking; Aerospace Medicine; Control Theory

20000110097 NASA Johnson Space Center, Houston, TX USA
Design and Testing of a 2-Hour Oxygen Prebreathe Protocol for Space Walks from the International Space Station
Gernhardt, Michael L., NASA Johnson Space Center, USA; Conkin, J., Baylor Coll. of Medicine, USA; Foster, P. P., Baylor Coll. of Medicine, USA; Pilmanis, A. A., Armstrong Lab., USA; Butler, B. D., University of Texas Medical School, USA; Beltran, E., University of Texas Medical School, USA; Fife, C. E., University of Texas Medical School, USA; Vann, R. D., Duke Univ., USA; Gerth, W. A., Duke Univ., USA; Loftin, K. C., Wyle Labs., Inc., USA; [2000]; 1p; In English; Undersea and Hyperbaric Medical Society, 18-22 Jun. 2000, Stockholm, Sweden; No Copyright; Avail: Issuing Activity; Abstract Only

To develop and test a 2-hour prebreathe protocol for performing extravehicular activities (EVAs) from the International Space Station (ISS). Combinations of adynamia (non-walking), prebreathe exercise, and space suit donning options (10.2 vs. 14.7 psi) were evaluated, against timeline and consumable contraints to develop an operational 2- hour prebreathe protocol. Prospective accept/reject criteria were defined for decompression sickness (DCS) and venous gas emboli (VGE) from analysis of historical DCS data, combined with risk management of DCS under ISS mission circumstances. Maximum operational DCS levels were

defined based on protecting for EVA capability with two crew-members at 95% confidence, throughout ISS lifetime (within the constraints of NASA DCS disposition policy JPG 1800.3). The accept/reject limits were adjusted for greater safety based on analysis of related medical factors. Monte-Carlo simulation was performed to design a closed sequential, multi-center human trial. Protocols were tested with 4 different prebreathe exercises (Phases I-IV), prior to exposure to 4.3 psi for 4 hrs. Subject selection, Doppler monitoring for VGE, test termination criteria, and DCS definitions were standardized. Phase I: upper and lower body exercises using dual-cycle ergometry (75% VO2 max for 10 min). Phase II: ergometry plus 24 min of light exercise (simulating space-suit preparations). Phase III: same 24 min of light exercise but no ergometry, and Phase IV: 56 min of light exercise without ergometry. A prebreathe procedure was accepted if, at 95% confidence, the incidence of DCS was less than 15% (with no Type II DCS), and Grade IV VGE was less than 20%.
Derived from text
International Space Station; Walking; Oxygen Breathing; Aerospace Medicine; Breathing Apparatus; Design Analysis; Performance Tests; Protocol (Computers)

20000113037 Biosphere 2 Center, Oracle, AZ USA
Biosphere 2 Center: Past, Present and Future
Harris, William C., Biosphere 2 Center, USA; Fine, Leonard W., Columbia Univ., USA; Friedman, Morton B., Columbia Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 145-150; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Columbia University assumed responsibility for the Biosphere 2 Center January 1, 1996 with the goal of building a new campus that focused on earth systems science, policy and management. Academic programs are now offered year round and we benefit by working with 25 university and college partners. Our research effort is now receiving external funding, following a major investment in re-configuring the Biosphere 2 apparatus and converting into a laboratory for controlled studies to determine the impact of high CO2 on oceans (coral reefs), agroforestry systems (carbon sequestration) and a rain forest model. How did Columbia University get involved in this new activity is a fascinating story - which will be outlined during the presentation.
Derived from text
Biosphere; Test Facilities; Research Facilities; Laboratories; Experimentation

20000114282 Institute of Space Medico-Engineering, Beijing, China
Design of Reaction Canister in a Solid Amine Carbon Dioxide Removal System
Zhou, Kang-Han, Institute of Space Medico-Engineering, China; Lu, Xi-Yu, Institute of Space Medico-Engineering, China; Liu, Xiang-Yang, Institute of Space Medico-Engineering, China; Ai, Shang-Kun, Institute of Space Medico-Engineering, China; Liu, Cheng-Liang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 272-276; In Chinese; Copyright; Avail: Issuing Activity

To design a reaction canister using in solid amine carbon dioxide removal system for long-duration spaceflight. On consideration of system demand and properties of solid amine, key problems must be solved were found out: 1) the rated resistance limit tends to shorten the length of the canister while absorption and concentration require to increase the length of the canister: 2) limited quantity of heat for keeping the temperature of the canister; 3) inflation or contraction of the solid amine under micro-gravity. After appropriate measures were taken, effective adsorption and desorption, as well as concentration of CO2 were achieved, the concentration of CO2 in the space cabin could be controlled below 0 - 5 %; and the concentration of the concentrated CO2 was as high as 98 % so that it could be directly send to the CO2 reduction system; and that the resistance of the canister was below 160 mm H2O; moreover , the energy consumption was decreased to below 650 W. The designed reaction canister could meet the requirements of the solid amine carbon bioxide removal system under microgravity.
Author
Design Analysis; Cans; Carbon Dioxide Removal; Desorption; Solidified Gases

20000114283 Institute of Space Medico-Engineering, Beijing, China
A Study of Low Temperature Catalyst for Sabatier Reaction
Ai, Shang-Kun, Institute of Space Medico-Engineering, China; Zhou, Ding, Institute of Space Medico-Engineering, China; Sun, Jin-Biao, Institute of Space Medico-Engineering, China; Hou, Wen-Hua, Institute of Space Medico-Engineering, China; Zhou, Kang-Han, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 277-280; In Chinese; Copyright; Avail: Issuing Activity

To develop a low temperature catalyst for the Sabatier CO2 reduction of the atmospheric regeneration system and lower the start-up temperature of the Sabatier reaction. A low temperature catalyst was designed from the considerations of the active composition, the choice of the carrier, the production method and condition of the catalyst. Then the performance of the newly devel-

oped low temperature catalyst was tested. A new low temperature catalyst for the Sabatier reaction using Ru as the active composition and using r-A12O3 as the carrier was developed. The start-up temperature was lower than 110 C and the start-up time was 8 min. The conversion efficiency of the lean component (H2 or CO2) was over 95 percent when the temperature of the reactor was from 200 C to 300C. The reaction product water was nearly colorless, transparent and neutral. The test results showed that the goals of the design are achieved and it is worthwhile to make further studies on the low temperature catalyst.
Author
Low Temperature; Catalysts; Carbon Dioxide; Sabatier Reaction; Energy Conversion Efficiency

20000114289 Institute of Space Medico-Engineering, Beijing, China
Manual Operation in Manned Spacecraft
Ma, Zhi-Jia, Institute of Space Medico-Engineering, China; Zhou, Qian-Xiang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 301-304; In Chinese; Copyright; Avail: Issuing Activity

The main character of manned spacecraft is that there are astronauts in it. In order to ensure security, reliability and high efficiency of the whole system, it is necessary to make full use of human operation in space environment at the stage of system overall design, especially for long manned flight. On the basis of related data, this paper summarized the principles of manual operation, its main objects and some requirement on man-machine interface. At last, some views have been put forward for discussion. Key words: manned spacecraft; systems engineering; systems design; control systems; ergonomics; man-machine interfaces
Author
Aerospace Environments; Human Factors Engineering; Man Machine Systems; Reliability

20000114848 Massachusetts Inst. of Tech., International Center for Air Transportation, Cambridge, MA USA
Analysis of Complexity Evolution Management and Human Performance Issues in Commercial Aircraft Automation Systems ***Final Report, 1 Jul. 1996 - 30 Jun. 2000***
Vakil, Sanjay S., Massachusetts Inst. of Tech., USA; Hansman, R. John, Massachusetts Inst. of Tech., USA; May 2000; 265p; In English
Contract(s)/Grant(s): NAG1-1857
Report No.(s): ICAT-2000-3; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Autoflight systems in the current generation of aircraft have been implicated in several recent incidents and accidents. A contributory aspect to these incidents may be the manner in which aircraft transition between differing behaviours or 'modes.' The current state of aircraft automation was investigated and the incremental development of the autoflight system was tracked through a set of aircraft to gain insight into how these systems developed. This process appears to have resulted in a system without a consistent global representation. In order to evaluate and examine autoflight systems, a 'Hybrid Automation Representation' (HAR) was developed. This representation was used to examine several specific problems known to exist in aircraft systems. Cyclomatic complexity is an analysis tool from computer science which counts the number of linearly independent paths through a program graph. This approach was extended to examine autoflight mode transitions modelled with the HAR. A survey was conducted of pilots to identify those autoflight mode transitions which airline pilots find difficult. The transitions identified in this survey were analyzed using cyclomatic complexity to gain insight into the apparent complexity of the autoflight system from the perspective of the pilot. Mode transitions which had been identified as complex by pilots were found to have a high cyclomatic complexity. Further examination was made into a set of specific problems identified in aircraft: the lack of a consistent representation of automation, concern regarding appropriate feedback from the automation, and the implications of physical limitations on the autoflight systems. Mode transitions involved in changing to and leveling at a new altitude were identified across multiple aircraft by numerous pilots. Where possible, evaluation and verification of the behaviour of these autoflight mode transitions was investigated via aircraft-specific high fidelity simulators. Three solution approaches to concerns regarding autoflight systems, and mode transitions in particular, are presented in this thesis. The first is to use training to modify pilot behaviours, or procedures to work around known problems. The second approach is to mitigate problems by enhancing feedback. The third approach is to modify the process by which automation is designed. The Operator Directed Process forces the consideration and creation of an automation model early in the design process for use as the basis of the software specification and training.
Author
Aircraft Pilots; Airline Operations; Automatic Control; Behavior; Commercial Aircraft; Feedback; Human Performance

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EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.

20000110068 NASA Johnson Space Center, Houston, TX USA
Martian Life: Evidence from Martian Meteorites
Gibson, Everett K., Jr., NASA Johnson Space Center, USA; [1999]; 1p; In English; Think Mars, 30 Sep. - 3 Oct. 1999, Cambridge, MA, USA; Sponsored by Massachusetts Inst. of Tech., USA
Contract(s)/Grant(s): RTOP 344-38-11-01; No Copyright; Avail: Issuing Activity; Abstract Only

In August 1996 our research team presented a chain of evidence within the ALH84001 meteorite which could be interpreted as signatures of relic Martian life. Additional research has shown that two additional Martian meteorites contain similar evidence. Three SNC meteorites ranging in age from 4.5 Ga. to 1.3 Ga. to 165 m.y. contain features suggestive of past biogenic activity on Mars. Because we do not know what Martian life looks like or its physical or chemical properties, the only tools or criteria which the scientific community have to evaluate the evidence of past life on Mars is to use those used to evaluate the evidence for early life on Earth. The eight criteria established for evaluating evidence of early life on the Earth include: geologic context of the sample: sample's age and stratigraphic location; cellular morphology; colonies or biofilms biominerals or evidence of chemical disequilibria; stable isotope patterns unique to biology; presence of organic biomarkers: and proof that the features are indigenous to the sample. For acceptance of past life within terrestrial samples essentially most or all of these criteria must be met. The features within ALH84001's carbonate globules and the preterrestrial aqueous alteration phases in Nakhla and Shergotty have been interpreted as containing evidence of possible past life on Mars. Studies have shown conclusively that the reduced carbon components in ALH84001 and Nakhla are indigenous to the meteorites and are not terrestrial contaminants. Based on carbon isotopic compositions and mineralogical morphologies, there is no question or disagreement that the carbonate globules in Nakhla and Shergotty were formed on Mars. Possible microfossil structures and some reduced carbon components in the carbonates and preterrestrial aqueous alteration products, are therefore, almost certainly indigenous, but other possible evidence of life (e.g. amino acids) may be a result of terrestrial contamination. Our hypothesis of possible early life on Mars was presented three years ago and today we believe that it stands stronger than when originally presented. to date, no fatal strikes have been made on any of the original four lines of evidence. While details of the hypothesis are evolving as new data is generated, we believe that our basic premise remains intact: these meteorites contain evidence suggestive for early life on Mars.
Author
Mars (Planet); Extraterrestrial Life; SNC Meteorites; Amino Acids; Contaminants; Contamination

20000110336 NASA Johnson Space Center, Houston, TX USA
Evidence for Ancient Martian Life
Gibson, E. K., Jr., NASA Johnson Space Center, USA; Westall, F., NASA Johnson Space Center, USA; McKay, D. S., NASA Johnson Space Center, USA; Thomas-Keprta, K., NASA Johnson Space Center, USA; Wentworth, S., NASA Johnson Space Center, USA; Romanek, C. S., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Three SNC meteorites ranging in age from 4.5 Ga. to 1.3 Ga. to 165 m.y. contain features suggestive of past biogenic activity on Mars. Because we do not know what past martian life looks like or its physical or chemical properties, the only tools or criteria which the scientific community have to evaluate evidence of past life is to use evidence for early life on earth. There are features within ALH84001's carbonate globules and the preterrestrial aqueous alteration phases of Nakhla and Shergotty which have been interpreted as possible evidence for past life on early Mars. Additional information is contained in the original extended abstract.
Author
Extraterrestrial Life; Life Sciences; Mars (Planet); Meteoritic Composition; SNC Meteorites

20000110409 NASA Ames Research Center, Moffett Field, CA USA
Bringing Life to Mars
McKay, C. P., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A suitable long-term goal for human exploration of Mars is the determination of whether or not a self-sustainable bio-sphere could be constructed on Mars, a process called Terraforming. Preliminary considerations of the conditions on a habitable Mars suggest that there are two potentially habitable states: one -characterized by an atmosphere of 1-3 bars of CO2 - would be habitable for plants and microorganisms and another which would be habitable by humans. It may be possible to warm the planet by selective introduction of trace gases to enhance the greenhouse effect. Energy balance considerations suggest that warming Mars would take on the order of 100 years with a much longer time required to produce a breathable atmosphere.
Author
Atmospheric Composition; Energy Budgets; Mars Environment; Terraforming; Trace Elements

20000110410 NASA Johnson Space Center, Houston, TX USA
Possible Evidence for Life in ALH84001
McKay, David, NASA Johnson Space Center, USA; Gibson, Everett, NASA Johnson Space Center, USA; Thomas-Keprta, Kathie, Lockheed Martin Corp., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since our original paper in Science in August 1996, considerable new data has appeared from laboratories throughout the world, and our own team has had a chance to examine the sample in greater detail. The following summary touches on our original data and interpretation, and points out new data from us and from other groups, and the resulting changes and refinements in interpretations which we have made during the past three years. Additional information is contained in the original extended abstract.
Author
Data Acquisition; Planetary Environments; Extraterrestrial Life

20000110490 NASA Johnson Space Center, Houston, TX USA
An ESA Robotic Package to Search for Life on Mars
Westall, F., NASA Johnson Space Center, USA; Brack, A., NASA Johnson Space Center, USA; Clancy, P., NASA Johnson Space Center, USA; Hofmann, B., NASA Johnson Space Center, USA; Horneck, G., NASA Johnson Space Center, USA; Kurat, G., NASA Johnson Space Center, USA; Maxwell, J., NASA Johnson Space Center, USA; Ori, G. G., NASA Johnson Space Center, USA; Pillinger, C., NASA Johnson Space Center, USA; Raulin, F., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Similarities in the early histories of Mars and Earth suggest that life may have arisen on Mars as it did on Earth. The early life forms on Mars were probably simple organisms, similar to terrestrial prokaryotes. In fact, given the early deterioration of the Martian climate, it is unlikely that life on Mars could ever have reached more sophisticated evolution. Based on the present knowledge of Mars, the possibility of extant life at the surface is small. However, given the adaptability of terrestrial prokaryotes under adverse conditions, it is not excluded. Any extant life is hypothesized to reside in the permafrost in a dormant state until ”reanimated” by impact-caused hydrothermal activity. Using this rationale, a group of European scientists worked together to conceive a hypothetical strategy to search for life on Mars. A possible configuration for a lander/rover is outlined.
Derived from text
Extraterrestrial Life; Mars (Planet); Mars Environment; Organisms; Exobiology; Roving Vehicles

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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.

20000109802 Naval Postgraduate School, Monterey, CA USA
An Architectural Framework for Integrating COTS/GOTS/Legacy Systems
Gee, Karen M.; Jun. 2000; 226p; In English
Report No.(s): AD-A381221; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Building distributed systems more effectively and efficiently is an essential goal of the Department of Defense (DoD). We are driven by the push toward greater use of COTS, the need to improve access to legacy data and services, and the new business opportunities offered by web- based technologies and electronic commerce. to fully realize the DoD’s goal, a new architectural framework is needed. This thesis proposes an architectural framework suitable for integrating COTS/GOTS/legacy systems in

a distributed, heterogeneous environment. The proposed architectural framework uses The Open Group Architectural Framework (TOGAF) as a basis and includes new tools to support the COTS/GOTS/legacy system development and integration. A case study for the Naval Integrated Tactical Environmental Systems (NITES) program where a prototype is built, demonstrates the effective use of the proposed architectural framework.
DTIC
Software Engineering; Electronic Commerce; Architecture (Computers); Distributed Processing

20000109859 NASA Glenn Research Center, Cleveland, OH USA
Developing CORBA-Based Distributed Scientific Applications From Legacy FORTRAN Programs
Sang, Janche, Cleveland State Univ., USA; Kim, Chan, NASA Glenn Research Center, USA; Lopez, Isaac, Army Research Lab., USA; July 2000; 14p; In English; Computational Aerosciences, 15-17 Feb. 2000, Moffett Field, CA, USA; Sponsored by High Performance Computing and Communications Program
Contract(s)/Grant(s): RTOP 509-10-24
Report No.(s): NASA/TM-2000-209950; NAS 1.15:209950; ARL-MR-488; E-12204; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An efficient methodology is presented for integrating legacy applications written in FORTRAN into a distributed object framework. Issues and strategies regarding the conversion and decomposition of FORTRAN codes into Common Object Request Broker Architecture (CORBA) objects are discussed. FORTRAN codes are modified as little as possible as they are decomposed into modules and wrapped as objects. A new conversion tool takes the FORTRAN application as input and generates the C/C++ header file and Interface Definition Language (IDL) file. In addition, the performance of the client server computing is evaluated.
Author
Applications Programs (Computers); FORTRAN; Architecture (Computers); Object-Oriented Programming; Distributed Processing

20000109868 Norwegian Defence Research Establishment, Kjeller, Norway
An Internet (IETF) Rfc Draft Standard for the Use of S/MIME V.3 to Secure X.400 Objects
EGGEN, Anders, Norwegian Defence Research Establishment, Norway; Aug. 03, 2000; 24p; In English
Contract(s)/Grant(s): FFIE Proj. 784/110
Report No.(s): FFI/RAPPORT-2000/04221; ISBN-82-464-0437-7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document describes a protocol for adding cryptographic signature and encryption services to X.400 content (i.e., CMS-X.400). The techniques described in S/MD4E Cryptographic Message Syntax [CMS] specification are general enough to support many different content types. The [CMS] specification thus provides many options for providing different security mechanisms. In order to ensure interoperability of systems within the X.400 community, it is necessary to specify the use of CMS features to protect X.400 content. This IETF RFC Draft is sent to the IETF for approval. The intention with making this an international standard, is to try to influence the vendors to implement the solutions into their products, and thereby making them COTS (Commercial of The Shelf) solutions.
Author
Cryptography; Computer Information Security; Decoding

20000109893 Tokyo Denki Univ., Faculty of Engineering, Japan
The Multi-Affine Key Cipher and the Safety
Shuzuki, Shuichi, Tokyo Denki Univ., Japan; Research Reports of The Faculty of Engineering, Tokyo Denki University; Dec. 1999; ISSN 0389-617X, No. 47, pp. 39-47; In English; Copyright; Avail: Issuing Activity

The multi-affine key cipher is extremely safe. Moreover, using this algorithm, with only software we can encode 100 mega bits per second on a personal computer. With this speed of our cipher, we are able to encrypt all the information that is sent to a network. Therefore we can use our cipher in the entirely new field. Key words cipher, symmetric cryptosystem, stream cipher, Lehmer's method, random number, multi-affine key system.
Author
Affinity; Transmitters; Random Numbers; Safety

20000109904 Sterling Software, Inc., Moffett Field, CA USA

Heterogeneous Clustering: Operational and User Impacts

Salm, Saita Wood, Sterling Software, Inc., USA; [1999]; 7p; In English; Cray User Group, 26 May 1999, Minneapolis, MN, USA

Contract(s)/Grant(s): NAS2-13619; RTOP 519-40-62; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Heterogeneous clustering can improve overall utilization of multiple hosts and can provide better turnaround to users by balancing workloads across hosts. Building a cluster requires both operational changes and revisions in user scripts.

Author

Computer Design; Supercomputers; Distributed Processing

20000109909 Instituto Mexicano de Petroleo, Mexico City, Mexico

Use of genetic algorithms for the calculus of the efficiency in an X-ray detector

Aspiazu, J.; Edo.deBelmont, E.; Dec. 31, 1996; 9p; In Spanish; Technological Specialties, Unknown

Report No.(s): DE98-618156; INIS-MX-042; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

PIXE Analysis as an analytical technique means the realization of very difficult calculations, moreover requires a necessary knowledge about several parameters. Immediately we report the preliminary works that have been realized over the efficiency or more parameters. For the improvement, the reproducibility of this methodology it will be necessary to simulate all parameters which intervene in the concentration calculations.

Author(NTIS)

Calculus; Genetic Algorithms; X Ray Detectors; Algorithms; Artificial Intelligence; Collimators; Computation

20000109916 Joint Inst. for Nuclear Research, Dubna, USSR

Effective pulse resolution algorithms for detectors with Gaussian-like signal shape

Agakishiev, G.; Kolganova, E.; Ososkov, G.; Panebrattsev, Y.; Ceretto, F.; Dec. 31, 1997; 20p; In English

Report No.(s): DE98-618166; JINR-E-10-97-105; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Due to an extremely high multiplicity of central ultrarelativistic nucleus- nucleus collisions the crucial point of vertex tracking systems is the demand for the highest accuracy and speed of any algorithm intended to determine the position of each charge particle detected by these systems. We propose effective pulse resolution algorithms for the detectors with Gaussian-like signal shape, for example, a vertex tracking system based on silicon drift detectors (SiDD). We present some new algorithms of overlapping peak resolution, which finally enables us to cope with the high charged multiplicity environment in nucleus collisions taking into account both such factors as SiDD signal asymmetry and the noise correlation.

NTIS

Algorithms; Gauss Equation; Iterative Networks; Nuclear Interactions; Collisions

20000109965 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Enhancing Jini for Use Across Non-multicastable Networks ***Final Report***

Al-Theneyan, Ahmed, Old Dominion Univ., USA; Mehrotra, Piyush, Institute for Computer Applications in Science and Engineering, USA; Zubair, Mohammad, Old Dominion Univ., USA; September 2000; 13p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-2000-210329; NAS 1.26:210329; ICASE-2000-34; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Distributed heterogeneous systems are being increasingly used to execute a variety of large size simulation and computational problems. Resource management is one of the most important issues in building such systems. Recently, Sun introduced the Jini connection technology for building plug-and-play networks of resources. Jini relies on multicasting across the network for its internal protocols. However, in a distributed environment, such as the one under consideration here, multicasting may not be supported across the subnets for various reasons. In this paper we describe enhancements to Jini required to use it for building a middleware resource management system in a distributed environment that does not support multicasting. In particular, we introduce a lightweight service, called the Tunneling Service, which tunnels multicast messages across the subnets. We have implemented our mechanism and used it to successfully tunnel messages between subnets in a single domain and also between different domains. In this paper we describe our design choices and our implementation of the system.

Author

Distributed Processing; Computer Systems Design; Computer Networks; Heterogeneity; Resources Management

20000110380 Geological Survey, Flagstaff, AZ USA

Revision of the Mars Control Net and Global Digital Image Mosaic

Kirk, R., Geological Survey, USA; Becker, K., Geological Survey, USA; Cook, D., Geological Survey, USA; Hare, T., Geological Survey, USA; Howington-Kraus, E., Geological Survey, USA; Isbell, C., Geological Survey, USA; Lee, E., Geological Survey, USA; Rosanova, T., Geological Survey, USA; Soderblom, L., Geological Survey, USA; Sucharski, T., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the late 1980s, the USGS, Flagstaff, produced the first in what would become a series of very large, global digital image mosaics of solar system bodies. This Mars mosaicked digital image model (MDIM) incorporated roughly 4600 Viking Orbiter images. The global mosaic, at a scale of 1/256 degree or about 231 m/pixel, was widely distributed on 6 CD-ROMs produced in 1991. As the highest resolution global map of Mars, the MDIM is vital for both scientific studies and planning of current and future missions. Unfortunately, it has significant shortcomings, particularly in the accuracy of geodetic control (i.e., the accuracy of feature positions). Geodetic accuracy is a particular concern for mission planning, which involves targeting of observations and navigation of landers to specific ground points. The process by which the existing MDIM was controlled is too complex to explain in detail, but two key problem areas can be summarized. First, the MDIM inherited from an early version of the RAND 2D control net a definition of the prime meridian that has been superseded, resulting in a systematic longitudinal offset of 10-15 km between the mosaic and newer control nets. This longitude error propagated into a USGS 3D geodetic calculation in which low-resolution but oblique Viking Orbiter images were used in an attempt to derive three-dimensional control (i.e., heights as well as horizontal coordinates of points). This net, and hence the MDIM, has significant errors both because of the low resolution of the images and because of unreliability of supplementary information used. Since the MDIM was produced, considerable progress has been made in refining the 2D RAND control net, in refining elevations, and in reanalyzing the 3D net. Further useful inputs can be expected from the Mars Global Surveyor mission. We are therefore undertaking the production of revised and improved global mosaics of Mars. Revision of the MDIM by the USGS is part of a significant team effort by members of the Mars Surveyor Program Geodesy and Cartography Working Group (MSGCWG) with expertise in geodesy, cartography, photogrammetry, spacecraft ephemerides and navigation, and analysis of datasets for Mars gravity, altimetry, and image data. Principal products of this joint effort will include a new unified control net for Mars, revised SPICE data for existing and new datasets, global digital image models (DIMs), digital topographic models (DTMs), and derived maps, and higher resolution special mosaics and maps of MED program landing sites. Our current and planned activities in this project are described. Additional information is contained in the original extended abstract.

Author

Errors; Geodesy; Geodetic Accuracy; Geological Surveys; Mapping; Mars Surface; Topography; Mars (Planet); Three Dimensional Models

20000110576 NASA Glenn Research Center, Cleveland, OH USA

Contribution of the Recent AUSM Schemes to the Overflow Code: Implementation and Validation

Liou, Meng-Sing, NASA Glenn Research Center, USA; Buning, Pieter G., NASA Langley Research Center, USA; [2000]; 18p; In English; 18th; Applied Aerodynamics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4404; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We shall present results of a recent collaborative effort between the authors attempting to implement the numerical flux scheme, AUSM+ and its new developments, into a widely used NASA code, OVERFLOW. This paper is intended to give a thorough and systematic documentation about the solutions of default test cases using the AUSNI+ scheme. Hence we will address various aspects of numerical solutions, such as accuracy, convergence rate, and effects of turbulence models, over a variety of geometries, speed regimes. We will briefly describe the numerical schemes employed in the calculations, including the capability of solving for low-speed flows and multiphase flows by employing the concept of numerical speed of sound. As a bonus, this low Mach number formulations also enhances convergence to steady solutions for flows even at transonic speed. Calculations for complex 3D turbulent flows were performed with several turbulence models and the results display excellent agreements with measured data.

Author

Numerical Analysis; Applications Programs (Computers); Computational Fluid Dynamics; Coding

20000112942 Research Inst. for Advanced Computer Science, Moffett Field, CA USA

Bayesian Super-Resolved Surface Reconstruction From Multiple Images

Smelyanskiy, V. N., Research Inst. for Advanced Computer Science, USA; Cheesman, P., Research Inst. for Advanced Computer Science, USA; Maluf, D. A., Research Inst. for Advanced Computer Science, USA; Morris, R. D., Research Inst. for Advanced Computer Science, USA; [1999]; 9p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Bayesian inference has been wed successfully for many problems where the aim is to infer the parameters of a model of interest. In this paper we formulate the three dimensional reconstruction problem as the problem of inferring the parameters of a surface model from image data, and show how Bayesian methods can be used to estimate the parameters of this model given the image data. Thus we recover the three dimensional description of the scene. This approach also gives great flexibility. We can specify the geometrical properties of the model to suit our purpose, and can also use different models for how the surface reflects the light incident upon it. In common with other Bayesian inference problems, the estimation methodology requires that we can simulate the data that would have been recoded for any values of the model parameters. In this application this means that if we have image data we must be able to render the surface model. However it also means that we can infer the parameters of a model whose resolution can be chosen irrespective of the resolution of the images, and may be super-resolved. We present results of the inference of surface models from simulated aerial photographs for the case of super-resolution, where many surface elements project into a single pixel in the low-resolution images.

Author

Bayes Theorem; Image Reconstruction; Image Processing; Image Analysis; Imaging Techniques; Image Enhancement

20000112943 MRJ Technology Solutions, Moffett Field, CA USA

Interactive Computer Graphics

Kenwright, David, MRJ Technology Solutions, USA; [2000]; 5p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Aerospace data analysis tools that significantly reduce the time and effort needed to analyze large-scale computational fluid dynamics simulations have emerged this year. The current approach for most postprocessing and visualization work is to explore the 3D flow simulations with one of a dozen or so interactive tools. While effective for analyzing small data sets, this approach becomes extremely time consuming when working with data sets larger than one gigabyte. An active area of research this year has been the development of data mining tools that automatically search through gigabyte data sets and extract the salient features with little or no human intervention. With these so-called feature extraction tools, engineers are spared the tedious task of manually exploring huge amounts of data to find the important flow phenomena. The software tools identify features such as vortex cores, shocks, separation and attachment lines, recirculation bubbles, and boundary layers. Some of these features can be extracted in a few seconds; others take minutes to hours on extremely large data sets. The analysis can be performed off-line in a batch process, either during or following the supercomputer simulations. These computations have to be performed only once, because the feature extraction programs search the entire data set and find every occurrence of the phenomena being sought. Because the important questions about the data are being answered automatically, interactivity is less critical than it is with traditional approaches. Derived from text

Computer Graphics; Computer Programs; Searching; Data Retrieval

20000112944 NASA Ames Research Center, Moffett Field, CA USA

Information Power Grid: Distributed High-Performance Computing and Large-Scale Data Management for Science and Engineering

Johnston, William E., NASA Ames Research Center, USA; Gannon, Dennis, California Univ., USA; Nitzberg, Bill, MRJ Technology Solutions, USA; [2000]; 10p; In English; CAS, 2000, Unknown

Contract(s)/Grant(s): NAS2-14303; RTOP 704-40-00; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The term ”Grid” refers to distributed, high performance computing and data handling infrastructure that incorporates geographically and organizationally dispersed, heterogeneous resources that are persistent and supported. The vision for NASN’s Information Power Grid - a computing and data Grid - is that it will provide significant new capabilities to scientists and engineers by facilitating routine construction of information based problem solving environments / frameworks that will knit together widely distributed computing, data, instrument, and human resources into just-in-time systems that can address complex and large-scale computing and data analysis problems. IPG development and deployment is addressing requirements obtained by analyzing a number of different application areas, in particular from the NASA Aero-Space Technology Enterprise. This analysis has focussed primarily on two types of users: The scientist / design engineer whose primary interest is problem solving (e.g., determining wing aerodynamic characteristics in many different operating environments), and whose primary interface to IPG will be through various sorts of problem solving frameworks. The second type of user if the tool designer: The computational scientists

who convert physics and mathematics into code that can simulate the physical world. These are the two primary users of IPG, and they have rather different requirements. This paper describes the current state of IPG (the operational testbed), the set of capabilities being put into place for the operational prototype IPG, as well as some of the longer term R&D tasks.
Author
Data Management; Networks; Data Processing; Distributed Processing; Information Management; Information Systems

20000113041 California Univ., Dept. of Chemical Engineering and Materials Science, Davis, CA USA
Four Windows Programs for the Materials Science Laboratory
Meier, Mike L., California Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 197-204; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

This article does not describe an experiment, but rather several computer programs that may be useful in laboratory experiments many of us already perform. The functions and features of each program are summarized along with comments on how we use these programs in the classroom. As microcomputers become more powerful, less expensive and easier to use they are finding their way into almost every aspect of education. In the laboratory they have long been used for data collection and analysis. Currently there are also many large and often expensive programs on the market that will do what would have been extremely impractical, if not impossible to do by hand. In our small department, for instance, we use major software packages that perform finite element modeling, molecular dynamics modeling, crystallographic calculations, image processing and analysis, thermodynamic calculations and data retrieval from large databases. Still, we are in constant need of simpler and smaller software tools that do tedious work that we somehow still find ourselves doing manually. Many of us can think of operations that we wish the computer could do for us, or which would help ensure success in our teaching experiments, or something that has been sitting in our heads for years, or staring back at us from a text book, whose time has come to be "animated" as computer code. Fortunately programming tools such as Microsoft's VisualBASIC and Borland's Delphi make it relatively easy for intermittent programmers such as engineering students and instructors to write useful programs that can run in the rich but very complicated Windows environment. With the availability of such tools the desire to code finally got the best of me and I ended up writing several modest but useful computer programs that we regularly use in our laboratory courses.
Author
Applications Programs (Computers); Computer Programs; Microcomputers; Education

20000113046 TGB Partnership, Hillsborough, NC USA
Structural Design of Aluminum Components with ADS Software
Kissell, J. Randolph, TGB Partnership, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 249-253; In English; See also 20000113027; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

The Aluminum Association recently released software called the Aluminum Design System (ADS) based on Specifications for Aluminum Structures, a structural design code for aluminum components. Specifications for Aluminum Structures includes equations for the strength of aluminum members, but is complicated to understand and apply, often involving many calculations. The ADS software performs these calculations automatically to check the structural adequacy of aluminum parts subjected to various loads. The software also includes several data bases - one for various aluminum cross sections and one for aluminum alloys, both of which may be customized by the user. This paper describes the main features of the software for potential users.
Author
Aluminum; Structural Design; Applications Programs (Computers); Engine Parts; Structural Members

20000113058 Norfolk State Univ., VA USA
MST Onlione: The Design of an Internet Gateway for Educational Resources in Materials Science and Technology
Chaudhury, S. Raj, Norfolk State Univ., USA; Sanders, Matthew, Norfolk State Univ., USA; Wall, Curtiss, Norfolk State Univ., USA; Jacobs, James A., Norfolk State Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 461-473; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

MST-Online is a web site that is being designed with an eye to the future of internet technologies and the future needs of materials science educators and students. With the support of NASA Langley Research Center, this project is combining the traditional collection of useful links with actual content adapted especially for this purpose from a variety of sources. Textbook resources are being provided (Jacobs and Kilduff) as an overview to different types of materials. Valuable, out-of-print references such as Elizabeth Wood's manual on single crystals and Laue diffraction are being digitized for easy access. In addition, Java applets are

being collected and showcased for applications of visualization to the study of materials science. In this talk we shall present our overall design philosophy and methodology and discuss features of the growing website.
Author
Applications Programs (Computers); Internet Resources; Education; Materials Science

20000113402 NASA Langley Research Center, Hampton, VA USA
The NASA Tetrahedral Unstructured Software System (TETRUSS)
Frink, Neal T., NASA Langley Research Center, USA; Pirzadeh, Shahyar Z., NASA Langley Research Center, USA; Parikh, Paresh C., NASA Langley Research Center, USA; Pandya, Mohagna J., Paragon Research, Inc., USA; Bhat, M. K., Paragon Research, Inc., USA; [2000]; 14p; In English; 22nd; Congress, 27 Aug. - 1 Sep. 2000, Harrogate, UK; Sponsored by International Council of the Aeronautical Sciences, Unknown; Copyright; Avail: Issuing Activity

The NASA Tetrahedral Unstructured Software System (TetrUSS) was developed during the 1990's to provide a rapid aerodynamic analysis and design capability to applied aerodynamicists. The system is comprised of loosely integrated, user-friendly software that enables the application of advanced Euler and Navier-Stokes tetrahedral finite volume technology to complex aerodynamic problems. TetrUSS has matured well because of the generous feedback from many willing users representing a broad cross-section of background and skill levels. This paper presents an overview of the current capabilities of the TetrUSS system along with some representative results from selected applications.
Author
Navier-Stokes Equation; Unstructured Grids (Mathematics); Computational Fluid Dynamics; Euler Equations of Motion; Applications Programs (Computers)

20000113404 NASA Ames Research Center, Moffett Field, CA USA
Automatic Data Distribution for CFD Applications on Structured Grids
Frumkin, Michael, MRJ Technology Solutions, USA; Yan, Jerry, NASA Ames Research Center, USA; [2000]; 18p; In English; 14th; Supercomputing, 8-11 May 2000, Santa Fe, NM, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Data distribution is an important step in implementation of any parallel algorithm. The data distribution determines data traffic, utilization of the interconnection network and affects the overall code efficiency. In recent years a number data distribution methods have been developed and used in real programs for improving data traffic. We use some of the methods for translating data dependence and affinity relations into data distribution directives. We describe an automatic data alignment and placement tool (ADAFT) which implements these methods and show it results for some CFD codes (NPB and ARC3D). Algorithms for program analysis and derivation of data distribution implemented in ADAFT are efficient three pass algorithms. Most algorithms have linear complexity with the exception of some graph algorithms having complexity O(n(sup 4)) in the worst case.
Author
Computational Fluid Dynamics; Structured Grids (Mathematics); Data Processing; Applications Programs (Computers)

20000113834 California Univ., Dept. of Earth and Space Sciences, Los Angeles, CA USA
Phosphates and Carbon in Martian Meteorites
Mojzsis, Stephen J., California Univ., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

This paper proposes tests for exobiological examination of samples prior to obtaining martian rocks of known provenance via future sample-return missions. If we assume that all of the secondary minerals in martian meteorite ET79001 were indeed cogenetic and originate from Mars, we list conclusions that can be drawn that are of exobiological interest. This work serves as a preamble for the subsequent work listed below.
Author
Phosphates; Carbon; SNC Meteorites; Mars Surface

20000113835 Army War Coll., Carlisle Barracks, PA USA
Using Commercial Games to Enhance Agility and Flexibility in Training
Johnson, Malcolm D., Jr., Army War Coll., USA; Fair, Matthew J., Army War Coll., USA; Apr. 04, 2000; 49p; In English
Report No.(s): AD-A380104; No Copyright; Avail: Defense Technical Information Center (DTIC)

The transformation of the Army into a more versatile and agile land force must also be reflected in a training strategy that shares these traits. Training for both warfighting and Operations Other Than War (OOTW) is, however, leading to a tendency to let the unit Mission Essential Task List (METL) to grow out of proportion - with reduced standards of performance and readiness resulting. Live training remains the cornerstone of the Army's training strategy and although the growth of simulations reflects

the emergence of a 2nd training revolution, most current simulations focus on combat operations with a limited ability to simulate OOTW or urban terrain. In particular, our virtual simulation tools are predominantly combat system focused, very specialized expensive, have a long development cycles, and are economically hard to modify. The trend in industry and education is toward Personal Computer and Internet based applications that are more flexible cost effective and able to reach a broad audience. Commercial computer games already allow hundreds of players to compete as individuals or on teams in a virtual world. The ability to incorporate voice commands, improved graphics, mission-planning editors, and automated or semi-automated opposing forces are examples of recent innovations that significantly enhance realism.
DTIC
Computerized Simulation; Education; Mission Planning; War Games; Military Operations

20000114426 Coyote Systems, San Francisco, CA USA
Portable Coupled Field CAD ***Final Report, Nov. 1996 - Sep. 1999***
Liung, Per; Aug. 2000; 82p; In English
Contract(s)/Grant(s): F30602-96-2-0305; DARPA Order E117; AF Proj. E117
Report No.(s): AD-A382657; AFRL-IF-RS-TR-2000-122; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Coyote Systems has developed a coupled CAD tool for Microelectromechanical Systems (MEMS), called AutoMEMS, which accurately simulates the coupled fields in large, realistic MEMS devices with minimal user input. AutoMEMS generates a three dimensional (3D) solid model from a user-supplied two dimensional device layout. A device mesh is then created from the 3D solid model which can be automatically and adaptively refined for accurate results. Simulations are the conducted utilizing a fast Boundary Element Method (BEM). The resulting cross-capacitances and electrostatic forces can be automatically extracted. The final version of AutoMEMS was developed in a C++ environment using gnu-style tools and high-speed portable OpenGL graphics which allows it to run on Linux and UNIX platforms. Two particular examples used to demonstrate the functionality of AutoMEMS were of a micromirror and Analog Devices ADXL76 accelerometer. Thus, an effective and easy-to-use MEMS simulation tool was developed and demonstrated.
DTIC
Computer Aided Design; Computerized Simulation; Three Dimensional Models; Microelectromechanical Systems; Electric Fields

20000114809 Paul Scherrer Inst., Villigen, Switzerland
Improved version of the MICROX-2 code
Mathews, D.; Nov. 30, 1997; 100p; In English
Report No.(s): DE98-616931; PSI-97-11; No Copyright; Avail: Department of Energy Information Bridge

The MICROX-2 code prepares broad group neutron cross sections for use in diffusion- and/or transport-theory codes from an input library of fine group and pointwise cross sections. The neutron weighting spectrum is obtained by solving the B(sub 1) neutron balance equations at about 10000 energies in a one-dimensional (planar, spherical or cylindrical), two-region unit cell. The regions are coupled by collision probabilities based upon spatially flat neutron emission. Energy dependent Dancoff factors and bucklings correct the one-dimensional calculations for multi-dimensional lattice effects. A critical buckling search option is also included. The inner region may include two different types of fuel particles (grains). This report describes the present PSI FORTRAN 90 version of the MICROX-2 code which operates on CRAY computers and IBM PC's. The equations which are solved in the various energy ranges are given along with descriptions of various changes that have been made in the present PSI version of the code. A completely re-written description of the user input is also included.
NTIS
Neutron Cross Sections; FORTRAN; Personal Computers

20000114839 NASA Ames Research Center, Moffett Field, CA USA
Managing Distributed Systems with Smart Subscriptions
Filman, Robert E., NASA Ames Research Center, USA; Lee, Diana D., Caelum Research Corp., USA; [2000]; 6p; In English; 1st; Distributed Objects in Computational Science, Unknown; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We describe an event-based, publish-and-subscribe mechanism based on using 'smart subscriptions' to recognize weakly-structured events. We present a hierarchy of subscription languages (propositional, predicate, temporal and agent) and algorithms for efficiently recognizing event matches. This mechanism has been applied to the management of distributed applications.
Author
Algorithms; Hierarchies; Languages; Information Flow

20000114840 MRJ Technology Solutions, Moffett Field, CA USA

Parallel Conjugate Gradient: Effects of Ordering Strategies, Programming Paradigms, and Architectural Platforms

Oliker, Leonid, National Energy Research Supercomputer Center, USA; Heber, Gerd, Cornell Univ., USA; Biswas, Rupak, MRJ Technology Solutions, USA; [2000]; 16p; In English; 13th; Parallel and Distributed Computing Systems, 8-10 Aug. 2000, Las Vegas, NV, USA

Contract(s)/Grant(s): NAS2-14303; DE-AC03-76SF-00098; NSF CISE-97-26388; NSF MIPS-97-07125; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Conjugate Gradient (CG) algorithm is perhaps the best-known iterative technique to solve sparse linear systems that are symmetric and positive definite. A sparse matrix-vector multiply (SPMV) usually accounts for most of the floating-point operations within a CG iteration. In this paper, we investigate the effects of various ordering and partitioning strategies on the performance of parallel CG and SPMV using different programming paradigms and architectures. Results show that for this class of applications, ordering significantly improves overall performance, that cache reuse may be more important than reducing communication, and that it is possible to achieve message passing performance using shared memory constructs through careful data ordering and distribution. However, a multi-threaded implementation of CG on the Tera MTA does not require special ordering or partitioning to obtain high efficiency and scalability.

Author

Algorithms; Matrices (Mathematics); Conjugate Gradient Method; Iteration; Vectors (Mathematics); Mathematical Models

20000114847 NASA Goddard Space Flight Center, Greenbelt, MD USA

Pre-Launch Algorithm and Data Format for the Level 1 Calibration Products for the EOS AM-1 Moderate Resolution Imaging Spectroradiometer (MODIS)

Guenther, Bruce W., NASA Goddard Space Flight Center, USA; Godden, Gerald D., Physics Applications, Inc., USA; Xiong, Xiao-Xiong, Science Systems and Applications, Inc., USA; Knight, Edward J., Research and Data Systems, Inc., USA; Qiu, Shi-Yue, Computation Physics Applications, Inc., USA; Montgomery, Harry, NASA Goddard Space Flight Center, USA; Hopkins, M. M., General Sciences Corp., USA; Khayat, Mohammad G., Research and Data Systems, Inc., USA; Hao, Zhi-Dong, General Sciences Corp., USA; [2000]; 23p; In English; Geoscience and Remote Sensing, 24-30 Jul. 2000, Honolulu, HI, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Moderate Resolution Imaging Spectroradiometer (MODIS) radiometric calibration product is described for the thermal emissive and the reflective solar bands. Specific sensor design characteristics are identified to assist in understanding how the calibration algorithm software product is designed. The reflected solar band software products of radiance and reflectance factor both are described. The product file format is summarized and the MODIS Characterization Support Team (MCST) Homepage location for the current file format is provided.

Author

Algorithms; Calibrating; Imaging Spectrometers; Imaging Techniques; Radiometers; Spectroradiometers; Terra Spacecraft

20000114870 Cornell Univ., School of Electrical Engineering, Ithaca, NY USA

Space-Time Adaptive Processing on Commercial High-Performance Computers ***Final Report, Apr. 1995 - Jun. 1999***

Bojanozyk, Adam W.; Jul. 2000; 86p; In English

Contract(s)/Grant(s): F30602-95-1-0016; DARPA Order C253; AF Proj. C253

Report No.(s): AD-A382569; AFRL-IF-RS-TR-2000-105; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

This project consisted of building a portable parallel library for the space-time adaptive processing (STAP) problem. Portability was achieved by using standard like BLAS, LAPACK, SCALAPACK and MPI. The library simplifies implementation of STAP applications on different high-performance parallel computers, allowing rapid prototyping of parallel STAP systems. The library includes common to STAP communication and computation procedure. All library routines take as input 3D data cubes, and produce as outputs also 3D cubes. Two user manuals, one describing the data distributions library, and the other describing the STAP algorithms construction were developed for this project.

DTIC

Data Processing; Parallel Computers; Computation; Libraries

62
COMPUTER SYSTEMS

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

20000109812 Naval Postgraduate School, Dept. of Computer Science, Monterey, CA USA
Management System for Heterogeneous Networks, Volume 1, Summary and Papers ***Final Report***
Irvine, Cynthia E.; Siegel, H. J.; Prasanna, Viktor; Hensgen, Debra; Levin, Timothy; Apr. 14, 2000; 403p; In English
Report No.(s): AD-A381237; NPS-CS-00-006-VOL-1-PT-B; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

Enforcement of a high-level statement of security policy may be difficult to discern when mapped through functional requirements to a myriad of possible security services and mechanisms in a highly complex, networked environment. A method for articulating network security functional requirements, and their fulfillment, is presented. Using this method, security in a quality of service frame. work is discussed in terms of ”variant” security mechanisms and dynamic security policies. For illustration, it is shown how this method can be used to represent Quality of Security Service (QoSS) in a network scheduler benefit function.
DTIC
Computer Information Security; Computer Networks; Management Planning

20000109813 Naval Postgraduate School, Dept. of Computer Science, Monterey, CA USA
Management System for Heterogeneous Networks, Volume 1, Summary and Papers ***Final Report***
Irvine, Cynthia E.; Siegel, H. J.; Prasanna, Viktor; Hensgen, Debra; Levin, Timothy; Apr. 14, 2000; 383p; In English
Report No.(s): AD-A381238; NPS-CS-00-006-VOL-1-PT-A; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche

The goal of the MSHN Project was to explore the application of adaptive and heuristic matching and scheduling techniques, and modem distributed security methods, to a distributed heterogeneous resource management system (RMS) which allows system resources to be accessed by both MSHN-controlled and external applications. This document provides both a high-level overview of the MSHN technical program and a reference guide to the MSHN research papers constituting Appendix A.
DTIC
Computer Information Security; Heterogeneity; Scheduling; Management Systems

20000109853 NASA Marshall Space Flight Center, Huntsville, AL USA
The Science@NASA Websites
Koczor, Ronald J., NASA Marshall Space Flight Center, USA; Phillips. Tony, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 15-19 Dec. 2000, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Science@NASA websites represent a significant stride forward in communicating NASA science to the general public via the Internet. Using a family of websites aimed at science-attentive adults, high school students, middle school students and educators, the Science@NASA activity presents selected stories of on-going NASA science, giving context to otherwise dry press releases and scientific reports.
Author
World Wide Web; NASA Programs; Education; Information Transfer

20000110029 Defence Science and Technology Organisation, Communications Div., Salisbury, Australia
Combinatorics of Crossing Networks
Latham, Geoff A., Defence Science and Technology Organisation, Australia; June 2000; 64p; In English
Report No.(s): DSTO-RR-0176; DODA-AR-011-477; Copyright; Avail: Issuing Activity

In scenarios such as software agents sharing time slots or blocks in different physical cpus or memories, communications agents accessing channels or bandwidth on shared links or bearers and economic agents trading in commodities in financial markets, the agents in question can exchange resources among themselves for mutual benefit. This report develops a combinatorial probability model to describe the like-for-like exchange of resources between multiple unbiased agents. The expected exchange rates are computed for individual agents, syndicates of agents and the collection of all agents. These performance benchmarks provide intuition and understanding for the performance of real crossing networks. A number of combinatorial identities are also produced as a consequence of the modelling and analysis.
Author
Channels (Data Transmission); Combinatorial Analysis; Economics; Market Research

20000110523 James Madison Univ., School of Media Arts and Design, Harrisonburg, VA USA

Creative Development of 'NASA'S Kids Science News Network' A Children's Educational Television Series

Greene, Rustin, James Madison Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 61; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

NASA Langley Research Center's Office of Education and WVEC-TV (ABC in Norfolk, VA) agreed to develop and produce a new basic science and math television series for elementary-age children, called "NASA'S KIDS SCIENCE NEWS NETWORK". This new educational outreach program was conceived to provide children with basic concepts in math and science presented in short "newsbreaks" broadcast during Saturday morning children's programming. I was given the responsibility of developing the creative concept for this new series, selecting the content and writing the five "pilot" episodes, and assisting with their production.

Derived from text

Children; Educational Television; Science; News; Mathematics

20000110541 Inter-American Univ. of Puerto Rico, School of Engineering, Bayamon, Puerto Rico

User-Interface and Educational Improvements to a Web-Based Aircraft Design Module

Withington, Jim, Inter-American Univ. of Puerto Rico, Puerto Rico; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 81; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

BadWeb, or Basic Aircraft Design Web Page, is an existing Internet site developed by members of NASA Langley and Ames Research Centers. The purpose of the web page is to enhance interest and awareness in aeronautics by bringing powerful design and analysis tools in the area of aircraft design to the general public. Using the BadWeb site, users are asked to design a commercial transport aircraft that will result in the lowest ticket price for a flight between San Francisco and New York. The BadWeb site allows 13 design parameters to be modified to improve the design. The underlying computer program behind BadWeb uses many advanced and professional grade routines that have been adapted for purposes of running from a web server. Very realistic results are obtained as indicated by its current popularity among professional aircraft designers. In order that the educational mission of the project be more successfully addressed, particularly in the K-12 environment, a number of elements of the web site have been modified. Improvements include links to an expanded discussion of how the choice of parameters affects issues such as aircraft weight, range, fuel/passenger capacity, lift and drag. by reading these links, a user can determine which of the design parameters are most important, the extent to which each could be used to improve aircraft performance, and the positive and negative design implications of each. In addition to the technical information, references to historical and modem examples of the design parameter are included. Over thirty links to photographs, videos, charts and graphs are available for users to follow and be able to visualize how the different design approaches look and behave. It is envisioned that in an educational setting such as a high school math or physics class, the information provided in this web page could serve as a strong basis for teachers' lectures or for students to follow up on and do more detailed projects or reports. Examples such as breaking the speed of sound, the history of swept wing aircraft, the jet engine or the future of aircraft design are just a few examples of the types of topics that the BadWeb page could lead students to. In addition to the information directly obtainable through the BadWeb site, links are also given to other NASA sites including the photo galleries, on-line versions of printed material and the site for ordering helpful NASA publications.

Derived from text

Aircraft Design; World Wide Web; Education; Commercial Aircraft; Human-Computer Interface

20000113028 LightSpeed Technologies, Inc., Saint Louis, MO USA

Continuous Learning Network (CLN)

Kleinhans, Robert, LightSpeed Technologies, Inc., USA; Arizpe, Marina, LightSpeed Technologies, Inc., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 1-25; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This document is a presentation in viewgraphs form, which discusses the design of a intranet based system for continuous learning for the use of engineers. The system requirements, and the benefits are reviewed. Several examples of the modules are included.

CASI

Computer Networks; Education; Programmed Instruction; Computer Assisted Instruction; Retraining; Training Devices

20000113405 MRJ Technology Solutions, Moffett Field, CA USA

Automatic Generation of Directive-Based Parallel Programs for Shared Memory Parallel Systems

Jin, Hao-Qiang, MRJ Technology Solutions, USA; Yan, Jerry, MRJ Technology Solutions, USA; Frumkin, Michael, MRJ Technology Solutions, USA; [2000]; 21p; In English; ICS, May 2000, Unknown

Contract(s)/Grant(s): NAS2-14303; RTOP 509-10-31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The shared-memory programming model is a very effective way to achieve parallelism on shared memory parallel computers. As great progress was made in hardware and software technologies, performance of parallel programs with compiler directives has demonstrated large improvement. The introduction of OpenMP directives, the industrial standard for shared-memory programming, has minimized the issue of portability. Due to its ease of programming and its good performance, the technique has become very popular. In this study, we have extended CAPTools, a computer-aided parallelization toolkit, to automatically generate directive-based, OpenMP, parallel programs. We outline techniques used in the implementation of the tool and present test results on the NAS parallel benchmarks and ARC3D, a CFD application. This work demonstrates the great potential of using computer-aided tools to quickly port parallel programs and also achieve good performance.

Author

Computer Programming; Computer Techniques; Memory (Computers); Software Development Tools; Software Engineering; Distributed Processing; Parallel Processing (Computers)

20000113411 Naval Research Lab., Target Characteristics Branch, Washington, DC USA

Radio-Frequency Propagation Measurements in Confined Ship Spaces Aboard the ex-USS Shadwell *Final Report*

Mokole, Eric L., Naval Research Lab., USA; Parent, Mark, Naval Research Lab., USA; Samaddar, Surendra N., Naval Research Lab., USA; Tomas, Edmond, Naval Research Lab., USA; Gold, Brian T., Naval Research Lab., USA; Street, Tom T., Naval Research Lab., USA; Valenzi, John, Naval Research Lab., USA; Aug. 18, 2000; 72p; In English

Report No.(s): AD-A381789; NRL/FR/5340-00-9951; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Understanding the propagation of RF energy in confined naval shipboard environments is extremely important to the operability and effectiveness of communication systems used by the Navy. Single-frequency communication systems are known to suffer from multipath interference that can render them ineffective in confined spaces. Spread-spectrum and frequency-hopping systems, currently used in wireless local area networks (LANs), have been shown to operate effectively in confined shipboard environments in the absence of other RF signals. However, the transfer characteristics of these signals relative to bulkheads, watertight doors, ducts, mast cable transits, compartment penetrations and obstructions, and steel deck plates are not well characterized. Also, the complex interactions of communication signals with competing RF signals are not well understood for confined ship spaces. to address these issues for systems between 800 MHz and 3 GHz, a broadband bistatic measurement system was designed, and initial measurements were taken on the ex-USS Shadwell (23-25 February 1998) in Mobile, Alabama. More than 100 sets of data were collected for various open/closed door configurations on three levels of the ex-USS Shadwell. The measurement system and the measurements are discussed. Initial observations indicate that received power levels over reasonably long propagation distances were sufficient to ensure communication, even when all closures were set.

DTIC

Local Area Networks; Jamming; Radiotelephones; Frequency Hopping; Metal Plates; Multipath Transmission; Radio Frequencies

20000114845 NASA Goddard Space Flight Center, Greenbelt, MD USA

Parallel Implementation of a High Order Implicit Collocation Method for the Heat Equation

Kouatchou, Jules, NASA Goddard Space Flight Center, USA; [2000]; 10p; In English; 1st; Computational Science and Engineering, 21-24 Sep. 2000, Washington, DC, USA; Sponsored by Society for Industrial and Applied Mathematics, USA

Contract(s)/Grant(s): NAG5-3508; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We combine a high order compact finite difference approximation and collocation techniques to numerically solve the two dimensional heat equation. The resulting method is implicit arid can be parallelized with a strategy that allows parallelization across both time and space. We compare the parallel implementation of the new method with a classical implicit method, namely the Crank-Nicolson method, where the parallelization is done across space only. Numerical experiments are carried out on the SGI Origin 2000.

Author

Two Dimensional Models; Thermodynamics; Iterative Solution; Sorting Algorithms; Parallel Computers

20000114871 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA

A Quality of Service Approach to Survivability ***Final Report, Aug. 1996 - Aug. 1999***

Karr, David A.; Zinky, John A.; Schantz, Richard; Berman, Mark; Bakken, David E.; Jul. 2000; 31p; In English

Contract(s)/Grant(s): F30602-96-C-0315; DARPA Order E318; AF Proj. D985

Report No.(s): AD-A382571; AFRL-IF-RS-TR-2000-107; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The scope of the project includes creating an interface definition language for Quality of Service (QoS) in support of end-to-end composibility and metrics/models and instrumentation for QoS. A design for providing varying degrees of redundancy in an object-oriented distributed system has been completed. Application programmer can specify both a degree of redundancy and the degree of consistency/synchronization among the redundant copies of a resource. The Adaptive Quality of Service Availability (AQuA) project had the objective of controlling the availability of application services in the common Object Request Broker Architecture (CORBA). The project focused primarily on the problem of crash failures, an secondary on other failures that would cause untimely or incorrect replies to be received by clients. Under these circumstances, AQuA controls the availability of CORBA services by replicating servers, that is, by providing multiple, essentially identical copies of the server operating on different hosts. In this way, the failure of any one copy of the server or of it host tends to be masked by the correct operation of other copies of the server. The AQuA project demonstrated how a distributed system could provide dependability of service. The AQuA release provides dependability of objects (clients as well as servers) by means of replication of the objects. The provision of dependability is highly controllable and adaptable at run time.

DTIC

Data Processing; Fault Tolerance; Services; Object-Oriented Programming; Q Factors

20000114873 SRI International Corp., Menlo Park, CA USA

Secure Distributed Transaction Precessing ***Final Report, Jul. 1995 - Jul. 1998***

Riemenschneider, R. A.; Jul. 2000; 136p; In English

Contract(s)/Grant(s): F30602-95-C-0277; DARPA Order D337; AF Proj. C929

Report No.(s): AD-A382584; AFRL-IF-RS-TR-2000-103; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This technical report describes the work of the Dependable System Architecture Group on the Secure Distributed Transaction Processing (SDTP) project. Chapter 1 provides an overview of secure software architectures. Chapter 2 describes the goals and methodology of the SDTP project. Chapter 3 of this report provides a proof of the model-theoretic approach used in the project to prove that refinement steps are faithful and preserve both security and faithful properties. Chapter 4 introduces an alternative method of proving refinement. Chapter 5 describes the method for showing patterns are faithful and hence security-preserving. Chapter 6 shows refinement patterns that do not always preserve a property of interest, such as security, can be used without losing the correctness guarantee that a restriction to validated refinement patterns automatically provides. Chapter 7 discusses a case study in architecture verification. Finally, Chapter 8 provides more detail on the reference implementation and describes two applications of the reference implementation (law enforcement and intrusion detection).

DTIC

Data Processing; Warning Systems; Security; Distributed Processing; Architecture (Computers)

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

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

20000109910 Instituto Mexicano de Petroleo, Mexico City, Mexico

Neural network for the Bragg synthetic curves recognition

Reynoso, M. R.; Vega, J. J.; Fernandez, J.; Belmont, E.; Policroniades, R.; Dec. 31, 1996; 9p; In Spanish; Technological Specialties, Unknown

Report No.(s): DE98-618157; INIS-MX-043; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A ionization chamber was employed named Bragg curve spectroscopy. The Bragg peak amplitude is a monotone growing function of Z, which permits to identify elements through their measurement. A better technique for this measurement is to improve the use of neural networks with the purpose of the identification of the Bragg curve.

Author

Bragg Curve; Monotone Functions; Spectroscopy; Diagrams; Ions; Pair Production; Computer Programs

20000110037 Japan Atomic Energy Research Inst., Tokyo, Japan

Obstacle avoidance test using a redundant manipulator

Fujii, Y.; Suzuki, K.; Jan. 31, 1998; 49p; In Japanese; In English

Report No.(s): DE98-744701; JAERI-TECH-97-071; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

From a viewpoint of reducing personnel radiation exposure of plant staffs working in a high radiation area in nuclear facilities, it is often said to be necessary to develop remote robotics technologies which have great potential of performing various types of work in nuclear facilities. In order to develop advanced remote robotic handling systems, hence, we manufactured a redundant manipulator and an environment-sensing system. This report describes the results of the obstacle avoidance test in which some operational functions of the manipulator, on a programming control mode, are observed. The test of manipulating valves at the rear side of wall, through a narrow window of the wall, was carried out by using the redundant manipulator mounted on an x-axis driving mechanism. From this test, it is confirmed that the redundant manipulator can achieve handling tasks that are difficult to be done by a nonredundant manipulator.

NTIS

Obstacle Avoidance; Manipulators; Robots; Remote Control; Robot Arms; Robotics

20000110094 California Inst. of Tech., Control and Dynamical Systems, Pasadena, CA USA

Robust Nonlinear Control Theory with Applications to Aerospace Vehicles ***Final Report, 1 Jun. 1996 - 30 Sep. 1999***

Murray, Richard M.; Sep. 1999; 3p; In English

Contract(s)/Grant(s): F49620-96-1-0207

Report No.(s): AD-A381744; AFRL-SR-BL-TR-00-0420; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant was a subcontract to the University of Minnesota, under the supervision of Prof. Gary Balas. This ASSERT subcontract augmented the parent subcontract of UMN and is focused on the application of Linear Parameter Varying (LPV) Control to Aerospace Systems. The focus of our PRET program is fundamental research in general methods of analysis and design of complex uncertain nonlinear systems. We are working to create new mathematical theory as well as doing the necessary work to make that theory help engineers solve a variety of real industrial problems. Caltech's Control and Dynamical Systems department (CITCDS) was created with precisely this goal, and our industrial collaborators, led by Honeywell, give us a proven team. The University of Minnesota contributes valuable application and experimental expertise, and an academic team member geographically co-located with Honeywell, facilitating personnel exchange.

DTIC

Control Theory; Dynamical Systems; Complex Systems; Aerospace Systems; Systems Analysis

20000110377 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

MABVAP: One Step Closer to an Aerobot Mission to Mars

Kerzhanovich, V. V., Jet Propulsion Lab., California Inst. of Tech., USA; Cutts, J. A., Jet Propulsion Lab., California Inst. of Tech., USA; Bachelder, A. D., Jet Propulsion Lab., California Inst. of Tech., USA; Cameron, J. M., Jet Propulsion Lab., California Inst. of Tech., USA; Hall, J. L., Jet Propulsion Lab., California Inst. of Tech., USA; Patzold, J. D., Jet Propulsion Lab., California Inst. of Tech., USA; Quadrelli, M. B., Jet Propulsion Lab., California Inst. of Tech., USA; Yavrouian, A. H., Jet Propulsion Lab., California Inst. of Tech., USA; Cantrell, J. A., Utah State Univ., USA; Lachenmeier, T. T., GSSL, Inc., USA; Smith, M. G., Raven Industries, Inc., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Lighter-than-air planetary missions continued attract growing interest in Mars exploration due to unique combination of proximity to the surface and mobility that far surpasses capability of surface vehicles. Following the experience with the Sojourner rover and subsequent development of powerful rovers for Mars 2003 and 2005 missions it became clear that on Mars surface rover mobility is quite restricted. Realistic travel distances may be limited to tens of kilometers per year on relatively obstacle-free plains and a few kilometers or less on the more rugged terrains. Many areas on Mars will be inaccessible to rovers. Several concepts for a Mars aerobot (robotic balloon) mission have been pursued in the last decade. Additional information is contained in the original extended abstract.

Author

Flying Platforms; Imaging Techniques; Mars Atmosphere; Mars Exploration; Mars Surface; Microminiaturization; Robotics

20000110944 Draper (Charles Stark) Lab., Inc., Houston, TX USA

Reducing Conservatism of Analytic Transient Response Bounds via Shaping Filters

Kwan, Aiyueh, Draper (Charles Stark) Lab., Inc., USA; Bedrossian, Nazareth, Draper (Charles Stark) Lab., Inc., USA; Jan, Jiann-Woei, Draper (Charles Stark) Lab., Inc., USA; Grigoriadis, Karolos, Houston Univ., USA; [1999]; 11p; In English; Astrodynamics Conference, 16-19 Aug. 1999, Girdwood, AK, USA; Sponsored by American Astronomical Society, USA

Contract(s)/Grant(s): NAS9-19556

Report No.(s): AAS Paper 99-341; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent results show that the peak transient response of a linear system to bounded energy inputs can be computed using the energy-to-peak gain of the system. However, analytically computed peak response bound can be conservative for a class of class bounded energy signals, specifically pulse trains generated from jet firings encountered in space vehicles. In this paper, shaping filters are proposed as a Methodology to reduce the conservatism of peak response analytic bounds. This Methodology was applied to a realistic Space Station assembly operation subject to jet firings. The results indicate that shaping filters indeed reduce the predicted peak response bounds.

Author

Transient Response; Linear Systems

20000112922 NASA Ames Research Center, Moffett Field, CA USA

On-Board Real-Time State and Fault Identification for Rovers

Washington, Richard, NASA Ames Research Center, USA; [2000]; 6p; In English; Robotics and Automation, 2000, Unknown; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For extended autonomous operation, rovers must identify potential faults to determine whether its execution needs to be halted or not. At the same time, rovers present particular challenges for state estimation techniques: they are subject to environmental influences that affect senior readings during normal and anomalous operation, and the sensors fluctuate rapidly both because of noise and because of the dynamics of the rover's interaction with its environment. This paper presents MAKSI, an on-board method for state estimation and fault diagnosis that is particularly appropriate for rovers. The method is based on a combination of continuous state estimation, wing Kalman filters, and discrete state estimation, wing a Markov-model representation.

Author

Error Analysis; Fault Detection; Real Time Operation; Roving Vehicles; State Estimation; Autonomy

20000113410 Hungarian Academy of Sciences, Computer and Automation Research Inst., Budapest, Hungary

Super-fast Intelligent Target Evaluation (SITE) ***Final Report***

Roska, Tamas, Hungarian Academy of Sciences, Hungary; Apr. 24, 2000; 24p; In English

Contract(s)/Grant(s): F61775-99-W-E083

Report No.(s): AD-A381788; EOARD-SPC-99-4083; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking SzTAKI as follows: Contractor will conduct a feasibility study on the system idea for the SITE unit to detect targets with predetermined morphology under extremely difficult visibility conditions. Study will involve the development of an algorithm and an optical lensing system to test the concept.

DTIC

Neural Nets; Target Acquisition; Infrared Detectors; Target Recognition

64
NUMERICAL ANALYSIS

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

20000109821 NASA Ames Research Center, Moffett Field, CA USA

Combining Automated Theorem Provers with Symbolic Algebraic Systems: Position Paper

Schumann, Johann, NASA Ames Research Center, USA; [1999]; 4p; In English; Federated Logic, 1999, Unknown; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In contrast to pure mathematical applications where automated theorem provers (ATPs) are quite capable, proof tasks arising form real-world applications from the area of Software Engineering show quite different characteristics: they usually do not only contain much arithmetic (albeit often quite simple one), but they also often contain reasoning about specific structures (e.g. graphics, sets). Thus, an ATP must be capable of performing reasoning together with a fair amount of simplification, calculation and

solving. Therefore, powerful simplifiers and other (symbolic and semi-symbolic) algorithms seem to be ideally suited to augment ATPs. In the following we shortly describe two major points of interest in combining SASs (symbolic algebraic systems) with top-down automated theorem provers (here: SETHEO [Let92, GLMS94]).
Derived from text
Theorem Proving; Software Engineering

20000109927 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
About infinitesimal analysis on the basis of finite groups
Kosmachev, O. S.; Dec. 31, 1997; 16p; In Russian; In English
Report No.(s): DE98-618209; JINR-R-2-97-175; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

On the basis of finite group irreducible representations such as Dirac (gamma)-matrix representations, its maximal subgroup and quaternion group the coincidence of commutative relations between the algebra elements, which are constructed on above-cited groups and commutative relations between infinitesimal operators of Dirac equation group, Lorentz group and 3-dimensional rotation group respectively is shown.
NTIS
Finite Element Method; Group Theory

20000109962 NASA Ames Research Center, Moffett Field, CA USA
Extension of Efficient Low Dissipative High Order Schemes for 3-D Curvilinear Moving Grids
Vinokur, Marcel, NASA Ames Research Center, USA; Yee H. C., NASA Ames Research Center, USA; [2000]; 1p; In English; Computing the Future III: Frontiers of CFD 2000 Symposium, 26-28 Jun. 2000, Half Moon Bay, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The efficient low dissipative high order schemes proposed by Yee et al. is formulated for 3-D curvilinear moving grids. These schemes consists of a high order base schemes combined with nonlinear characteristic filters. The amount of numerical dissipation is minimized by applying the schemes to the entropy splitting form of the inviscid flux derivatives. The analysis is given for a thermally perfect gas. The main difficulty in the extension of higher order schemes that were formulated in Cartesian coordinates to curvilinear moving grids is the higher order transformed metric evaluations. The higher order numerical evaluation of the transformed metric terms to insure freestream preservation is done in a coordinate invariant manner. The formulation is an improvement over existing formulation of high order scheme in curvilinear moving grids.
Author
Computational Grids; Spherical Coordinates; Three Dimensional Models; Numerical Analysis; Entropy

20000109966 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
On the Local Convergence of Pattern Search *Final Report*
Dolan, Elizabeth D., Argonne National Lab., USA; Lewis, Robert Michael, Institute for Computer Applications in Science and Engineering, USA; Torczon, Virginia, College of William and Mary, USA; September 2000; 20p; In English
Contract(s)/Grant(s): NAS1-97046; NSF CCR-97-34044; RTOP 505-90-52-01
Report No.(s): NASA/CR-2000-21035; NAS 1.26:210535; ICASE-2000-36; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We examine the local convergence properties of pattern search methods, complementing the previously established global convergence properties for this class of algorithms. We show that the step-length control parameter which appears in the definition of pattern search algorithms provides a reliable asymptotic measure of first-order stationarity. This gives an analytical justification for a traditional stopping criterion for pattern search methods. Using this measure of first-order stationarity, we analyze the behavior of pattern search in the neighborhood of an isolated local minimizer. We show that a recognizable subsequence converges r-linearly to the minimizer.
Author
Convergence; Problem Solving; Numerical Analysis; Optimization; Searching

20000110531 Mount Olive Coll., Dept. of Science and Mathematics, Mount Olive, NC USA
Rapid Robust Modeling Based on Parametric Interface Representation
Rose, Ollie J., Mount Olive Coll., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 71; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Over the past few years the development of interface technology has provided an analysis framework for embedding detailed finite element models within finite element models that are less refined. This development has enabled the use of substructure domains without the restriction of coincident nodes along the substructure boundaries. The approach used for the interface element is based on an alternate variational principle often used in deriving hybrid finite elements. The resulting system of equations exhibits a high degree of sparsity but gives rise to a non-positive definite system which causes difficulties with many of the equation solvers in general-purpose finite element codes. Hence the global system of equations is generally solved using a decomposition procedure with pivoting. The research reported to-date includes one- and two-dimensional interface elements. Several simulations, including geometrically non-linear problems, have been reported. In the applications reported, the geometric definition of the interface is based on fitting splines to a subset of nodes which form the interface portion of adjacent subdomains in a given finite element model. The research reported to-date allows for a limited magnitude of inaccuracy in the node locations making up the interface definition. The present research is focussed on a rapid modeling procedure based on a parametric representation of independently defined subdomains that are also independently descretized. The methodology allows for inaccuracies in the node locations that may be of nearly arbitrary magnitude. In many cases, this approach can expedite the modeling task as well as essentially eliminate any inaccuracies in the interface-node locations. Specific applications addressed in this application, which demonstrate the features of the approach, include: (i) baseline bar in tension using K-arrays computed with and without COMET-AR, (ii) plate with central hole in tension, (iii) plate with square notch showing effect of mis-matched nodes at the boundary of interface, (iv) configuration having large random inaccuracies in the interface-node locations.
Author
Mathematical Models; Interfaces; Independent Variables; Robustness (Mathematics)

20000113920 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Asymptotics and Zero Distribution of Pade Polynomials Associated with the Exponential Function: Modeling, Analysis and Simulation
Driver, K. A., Center for Mathematics and Computer Science, Netherlands; Temme, N. M., Center for Mathematics and Computer Science, Netherlands; Oct. 1997; 26p; In English
Report No.(s): PB2000-103722; MAS-R9726; Copyright; Avail: Issuing Activity

The polynomials P(sub n) and Q(sub m) having degrees n and m respectively, with P(sub n) monic, that solve the approximation problem P(sub n)(z)e(exp -z) + Q(sub m)(z) = O[z(exp n+m+1)] will be investigated for the asymptotic behavior, in particular in connection with the distribution of their zeros. The symbol O means that the left-hand side should vanish at the origin at least to the order of n+m+1. This problem is discussed in great detail in a series of papers by Saff and Varga. In the present paper we show how their results can be obtained by using uniform expansions of integrals in which Airy functions are the main approximants. We give approximations of the zeros of P(sub n) and Q(sub m) in terms of zeros of certain Airy functions, as well of those of the remainder defined by E(sub n,m)(z) = P(sub n)(z)e(exp -z) + Q(sub m)(z).
Author
Approximation; Asymptotic Properties; Polynomials; Simulation; Asymptotic Methods; Exponential Functions

65
STATISTICS AND PROBABILITY

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

20000109775 Academy of Sciences of the Ukraine, Inst. Yadernykh Issledovanij, Kiev, Ukraine
Internally consistent polynomial approximation of the two dimensional experimental data with account of probability distribution
Kashuba, Y.; Golubova, A. A.; Razdol'kij, Y.; Dec. 31, 1997; 15p; In Ukranian; In English
Report No.(s): DE98-625483; KIYI-97-7; No Copyright; Avail: Department of Energy Information Bridge

The method of a determination of the degree of approximative polynom for a description of a point array (x,y) at the use of least squares fitting is proposed. The additional information on low of distributions of a physical random quantity Y(sub mi) at fixed argument X(sub i) is made use.
NTIS
Polynomials; Approximation

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

20000110027 Defence Science and Technology Organisation, Joint Systems Branch, Salisbury, Australia
Thinking Together: New Forms of Thought System for a Revolution in Military Affairs
Burke, Martin, Defence Science and Technology Organisation, Australia; July 2000; 118p; In English; Original contains color illustrations
Report No.(s): DSTO-RR-0173; DODA-AR-011-473; Copyright; Avail: Issuing Activity

The notion of Thought Warfare and Anti-Warfare (TWAW) is introduced as a way of thinking about military conflict and its avoidance; it is foreseen as an increasingly important Defence issue in the twenty-first century. TWAW involves the dynamic interaction of allies' and adversaries' Thought Systems. Current Thought Systems involve entities capable of cognition, emotion and volition - typically (groups of) people - interacting via networks of information and data systems. New forms of Thought System are proposed that go beyond this; if realised they could provide significant comparative advantage in TWAW and may contribute to a Revolution in Military Affairs. I
Author
Warfare; Emotions; Military Technology

20000110626 Naval War Coll., Joint Military Operations Dept., Newport, RI USA
Space Forces Support for the Joint Forces Commander: Who's In Charge? ***Final Report***
Rice, Carlos F.; Feb. 08, 2000; 28p; In English
Report No.(s): AD-A378593; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 1990s were a decade where space power came of age, both economically and militarily. Commercial space revenues exceeded U.S. government spending for the first time, making space power a vital contributor to U.S. economic power. As for the military space, Desert Storm demonstrated the true value of space assets for enhancing combat capabilities of terrestrial forces.
DTIC
Armed Forces (USA); Economics; Revenue; Warfare; Command and Control

67
THEORETICAL MATHEMATICS

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

20000109924 Joint Inst. for Nuclear Research, Laboratory of Computing Techniques and Automation, Dubna, USSR
Semiclassical quantization of elliptic equations of motion
Yamaleev, R. M.; Dec. 31, 1997; 24p; In Russian; In English
Report No.(s): DE98-618206; JINR-R-2-97-110; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The semiclassical method of quantization for elliptic equations of motion is developed. We generalized Bohr-Sommerfeld's rule of quantization (which can be realized for the potentials with double walls only) to the case of motion with four turning points. This motion is described by double periodic (elliptic) functions, and the phase integral O(integral) pdx becomes a complex value. It gives instead one two conditions of quantization for two constants of motion corresponding to two Hamilton-Nambu functions. As a result the spectrum of energy is splitted forming the strip of infinite number of levels thickened around the principal energy level. It is shown that the relativistic equations of motion can be formulated by using the procedure of elliptic deformation. Relativistic motion in the potential with monotonic increasing walls is described by doubly periodic functions. It means that within the relativistic mechanics such kind of periodic motion is characterized with the period consisting of real and imaginary parts. The imaginary part of the period is related to the periodic motion under the potential barrier. Thus we conclude, it is impossible to construct a confinement by using the potential with monotonic increasing walls as far as within the relativistic dynamics this potential is effectively discovered. As a result the value of penetrating probability through the barrier becomes finite.
NTIS
Classical Mechanics; Elliptic Differential Equations; Equations of Motion

20000109925 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Reduction of the Dirac-Fock-Ivanenko equation to a special form in the Lobachevsky space-time
Paramonov, D. V.; Chernikova, N. N.; Shavokhina, N. S.; Dec. 31, 1997; 11p; In Russian; In English
Report No.(s): DE98-618207; JINR-R-2-97-134; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Lobachevsky space is considered as a hyperboloid's sheet in the four-dimensional pseudo-Euclidean space. The Dirac - Fock - Ivanenko equation is reduced to a special form by passing from Lame basis in the Lobachevsky space to the Cartesian basis of the enveloping pseudo-Euclidean space.

NTIS
Dirac Equation; S Matrix Theory

20000110089 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Exact solutions of nonstationary Schroedinger equations
Suz'ko, A. A.; Velicheva, E. P.; Dec. 31, 1997; 12p; In Russian; In English
Report No.(s): DE98-627243; JINR-R-4-97-311; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The procedure of solving nonstationary Schroedinger equations in exact form is elaborated on the basis of exactly solvable stationary models. The exact solutions are employed to study the nonadiabatic geometric phase at cyclic evolution of quantum system.

NTIS
Calibrating; Canonical Forms; Transformations (Mathematics); Schroedinger Equation

20000110237 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
L(sub n)-bar, g-spaces. Ordinary and tensor differentials
Manoff, S.; Dimitrov, B.; Dec. 31, 1998; 32p; In English
Report No.(s): DE99-614519; JINR-E-5-98-183; No Copyright; Avail: Department of Energy Information Bridge

Different types of differentials as special cases of differential operators acting on tensor fields over (L(sub n) bar, g)-spaces are considered. The ordinary differential, the covariant differential as a special case of the covariant differential operator, and the Lie differential as a special case of the Lie differential operator are investigated. The tensor differential and its special types (Covariant tensor differential, and Lie tensor differential) are determined and their properties are discussed. Covariant symmetric and antisymmetric (external) tensor differentials, Lie symmetric, and Lie antisymmetric (external) tensor differentials are determined and considered over (L(sub n) bar, g)-spaces.

NTIS
Tensors; Differential Equations; Operators (Mathematics); Lie Groups

20000110268 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
L(sub n)-bar, g-spaces. Special tensor fields
Manoff, S.; Dimitrov, B.; Dec. 31, 1998; 24p; In English
Report No.(s): DE99-614518; JINR-E-5-98-182; No Copyright; Avail: Department of Energy Information Bridge

The Kronecker tensor field, the contraction tensor field, as well as the multi-Kronecker and multi-contraction tensor fields are determined and the action of the covariant differential operator, the Lie differential operator, the curvature operator, and the deviation operator on these tensor fields is established. The commutation relations between the operators Sym and Asym and the covariant and Lie differential operators are considered acting on symmetric and antisymmetric tensor fields over (L(sub n) bar, g)-spaces.

NTIS
Tensors; Operators (Mathematics)

70
PHYSICS (GENERAL)

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

20000109814 Materials Research Society, Warrendale, PA USA
Materials Research Society Symposium Proceedings Volume 603. Materials Issues for Tunable RF and Microwave Devices Held November 30-December 2, 1999, Boston, Massachusetts, USA
Jia, Quanxi; Miranda, Felix A.; Oates, Daniel E.; Xi, Xiaoxing; Dec. 02, 1999; 298p; In English
Contract(s)/Grant(s): N00014-99-1-1047
Report No.(s): AD-A381260; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This proceedings contains papers presented at Symposium KK, "Materials Issues for Tunable RF and Microwave Devices," held November 30-December 2 at the 1999 MRS Fall Meeting in Boston, Massachusetts. Electric or magnetic tunability of RF and microwave devices is desirable for a variety of civilian and military applications. In recent years, there have been tremendous advances in thin-film processing, in particular the metal-oxide thin films. Consequently, it has been recognized that the integration of nonlinear-dielectric, ferrite, colossal magnetoresistive (CMR), and superconductor materials could revolutionize tunable devices by providing new capabilities while significantly reducing size and cost. Some of the crucial issues facing the tunable RF and microwave device technology concern the material properties, in particular the loss in thin films of the tunable materials. Extensive efforts are being devoted to understand the tuning and loss mechanisms, improve thin-film processing and characterization, develop new materials, and design novel device concepts. The papers contained in this volume are a reflection of the work currently in progress in this exciting area. They range from electric-field to magnetic-field tuning, from devices to materials, and from fundamental understanding to materials characterization. The authors come from different materials communities: nonlinear dielectric, ferrite, colossal magnetoresistive (CMR), semiconductors, superconductivity, and device engineering, etc. We hope that this volume will serve as an up-to-date reference for the researchers inside and outside the field of tunable RF and microwave devices, and thus contribute to new breakthroughs in the basic and applied research in this rapidly expanding field.
DTIC
Microwave Equipment; Ferroelectric Materials; Superconductors (Materials); Semiconductors (Materials); Radio Frequencies; Conferences; Tuning

20000110100 Allied-Signal Technical Services Corp., Las Cruces, NM USA
Adiabatic Compression of Oxygen: Real Fluid Temperatures
Barragan, Michelle, Allied-Signal Technical Services Corp., USA; Wilson, D. Bruce, L and M Technologies, Inc., USA; Stoltzfus, Joel M., NASA Johnson Space Center, USA; [2000]; 1p; In English; 9th; 9th International Symposium on Flammability and Sensors of Materials in O2-Envirched Atmosphere, 28-29 Sep. 2000, Paris, France; Sponsored by American Society for Testing and Materials, USA
Contract(s)/Grant(s): NAS9-99100; No Copyright; Avail: Issuing Activity; Abstract Only

The adiabatic compression of oxygen has been identified as an ignition source for systems operating in enriched oxygen atmospheres. Current practice is to evaluate the temperature rise on compression by treating oxygen as an ideal gas with constant heat capacity. This paper establishes the appropriate thermodynamic analysis for the common occurrence of adiabatic compression of oxygen and in the process defines a satisfactory equation of state (EOS) for oxygen. It uses that EOS to model adiabatic compression as isentropic compression and calculates final temperatures for this system using current approaches for comparison.
Author
Adiabatic Conditions; Oxygen; Thermodynamics; Liquids; Temperature Dependence

20000111078 NASA Marshall Space Flight Center, Huntsville, AL USA
Inducing Lift on Spherical Particles by Traveling Magnetic Fields
Mazuruk, Konstantin, NASA Marshall Space Flight Center, USA; Grugel, Richard N., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Aerospace Science Meeting, 8-12 Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Gravity induced sedimentation of suspensions is a serious drawback to many materials and biotechnology processes, a factor that can, in principle, be overcome by utilizing an opposing Lorentz body force. In this work we demonstrate the utility of employing a traveling magnetic field (TMF) to induce a lifting force on particles dispersed in the fluid. Theoretically, a model has been developed to ascertain the net force, induced by TMF, acting on a spherical body as a function of the fluid medium's electrical

conductivity and other parameters. Experimentally, the model is compared to optical observations of particle motion in the presence of TMF.
Author
Gravitation; Magnetic Fields; Particle Motion

20000111081 NASA Marshall Space Flight Center, Huntsville, AL USA
Mixing Dynamics Induced by Traveling Magnetic Fields
Grugel, Richard N., NASA Marshall Space Flight Center, USA; Mazuruk, Konstantin, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Aerospace Science Meeting, 8-12 Jan. 2100, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Microstructural and compositional homogeneity in metals and alloys can only be achieved if the initial melt is homogeneous prior to the onset of solidification processing. Naturally induced convection may initially facilitate this requirement but upon the onset of solidification significant compositional variations generally arise leading to undesired segregation. Application of alternating magnetic fields to promote a uniform bulk liquid concentration during solidification processing has been suggested. to investigate such possibilities an initial study of using traveling magnetic fields (TMF) to promote melt homogenization is reported in this work. Theoretically, the effect of TMF-induced convection on mixing phenomena is studied in the laminar regime of flow. Experimentally, with and without applied fields, both: mixing dynamics by optically monitoring the spreading of an initially localized dye in transparent fluids and, compositional variations in metal alloys have been investigated.
Author
Magnetic Fields; Homogeneity; Microstructure; Solidification

20000113042 Youngstown State Univ., Mechanical Engineering Dept., OH USA
Egg Bungee Cord Drop
McCoy, Robert A., Youngstown State Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 205-212; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The objectives of this competitive exercise are: 1. The students gain practical experience of working together on a group design project that is both educational and fun; 2. The students learn how a real bungee cord behaves as compared with an ideal linear spring; 3. The students discover the large difference between the cord behavior when statically loaded as compared with the same cord dynamically loaded; 4. The students learn how to use the computer program Excel to record, mathematically manipulate, and plot experimental data; 5. The students learn how to apply experimental data from a small test piece of cord to their full-scale egg-drop apparatus.
Derived from text
Stretching; Elongation; Drop Tests; Springs (Elastic); Potential Energy

20000113072 Universidad Nacional Autonoma de Mexico, Inst. for Materials Research, Mexico City, Mexico
A Method For The Measurement of Magnetostriction in Ferromagnetic Alloys
Garcia-Hernendez, O., Universidad Nacional Autonoma de Mexico, Mexico; Galindo, R., Universidad Nacional Autonoma de Mexico, Mexico; Garcia, K. L., Universidad Nacional Autonoma de Mexico, Mexico; Valenzuela, Raul, Universidad Nacional Autonoma de Mexico, Mexico; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 633-646; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The objective of this demonstration is to obtain ferromagnetic hysteresis loops, observe the effects of mechanical stresses on them, and thereby understand the interaction between magnetic and elastic energies; finally, to evaluate the magnetostriction constant. The magnetization process, i.e. the change of magnetization state of a ferromagnetic material from the demagnetized state (M = 0) to the maximum magnetization value (saturation magnetization, M(sub s)) under a magnetic field, H, involves a change in the dimensions of the sample. These changes are very small (usually a few parts per million), but they can be important in many aspects. For instance, the most common manifestation of this phenomenon is the "humming" from transformers, where the core is submitted to an ac current that magnetizes and demagnetizes it (at a rate twice the current frequency).
Derived from text
Ferromagnetic Materials; Magnetization; Magnetostriction; Magnetic Properties; Magnetoelastic Waves; Experiment Design

20000114808 Joint Publications Research Service, Arlington, VA USA

Shock Waves in Solids: USSR

Orlenko, L. P.; Stanyukovich, K. P.; Jul. 14, 1960; 18p; Transl. into ENGLISH of Izvestiya Vysshikh uchebnykh Zavedeniy, Fizika (News of the Higher Institutions of Learning, Physics) (USSR), n6 p14-24 1958; In English

Report No.(s): AD-A379436; JPRS-5022; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The propagation of shock waves in solids under high pressure considering the compressibility of the material is examined in this article. The motion of the material is studied in the zone of an incident shock wave and the reflected wave zone, where the body has finite dimensions. The solution is obtained in the form of finite formulas.

DTIC

Shock Waves; Shock Wave Propagation; Solids

71
ACOUSTICS

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

20000109789 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Acoustic Scattering into Shadow Zones from Atmospheric Turbulence

Auvermann, Harry J.; Goedecke, George H.; Aug. 1993; 11p; In English; Prepared in collaboration with New Mexico State Univ., Las Cruces, NM. Presented at Fourth Annual Ground Target Modeling and Validation Conference, Aug 93.

Report No.(s): AD-A381269; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When acoustic scattering estimates are desired from atmospheric regions containing fully developed isotropic homogeneous turbulence, scattering formulas based upon statistical representations of the turbulence well represent the experimental results. However, there is a class of battlefield scenarios where these provisos of fully developed, isotropic and homogeneous sometimes do not apply. The example of this class that is most familiar is that of source and detector near the ground. At ground level, the wind velocity is zero, while at altitude it is not. Thus a gradient of wind velocity exists. There exists often a temperature gradient caused by heating or cooling of the air by contact with the ground. These gradients are recognized in propagation codes by modeling the atmosphere as stratified with each stratum bounded by planes parallel to the assumed flat ground. The anisotropy of the atmosphere near the ground recognized in propagation codes carries over into the generation of turbulence. The above discussion leads to the conclusion that anisotropy in turbulence is to be expected in scenarios played out near the ground, scenarios common to Army operations. The understanding that high sound levels in shadow zones (those regions in an acoustical field in which no sound can reach if the field is determined by ray theory) is caused by scattering from turbulence is very important. This importance arises from the possibility that shadow zone sensors may be used to achieve passive non-line-of-sight detection of enemy assets. This paper unites the above considerations by calculating the shadow zone signal level for a representative battlefield scenario using a structural model of turbulence.

DTIC

Acoustic Scattering; Sound Transmission; Acoustic Propagation; Atmospheric Turbulence; Isotropic Turbulence

20000109847 NASA Marshall Space Flight Center, Huntsville, AL USA

An Experimental and Mathematical Study to Evaluate the Role of Ultrasonic Energy in Promoting Microstructural Uniformity During Controlled Directional Solidification Processing

Grugel, R. N., NASA Marshall Space Flight Center, USA; Fedoseyev, A. I., Alabama Univ., USA; [2000]; 1p; In English; 3rd; 3rd International Aerospace Congress, 24 Aug. 2000, Moscow, Russia; No Copyright; Avail: Issuing Activity; Abstract Only

There are many commercially relevant metal and non-metal ”alloy” systems that separate into two different liquids upon cooling from a higher temperature. Consequently during solidification processing the inherent density differences between the two liquid phases leads to rapid, gravity driven, separation and severe segregation, a factor that significantly compromises the desired material properties. Processing in a microgravity environment minimizes settling but segregation still occurs due to gravity independent wetting and coalescence phenomena. This presentation reports on experiments that utilized succinonitrile-glycerol mixtures, a transparent system that 1) separates into two liquids upon cooling and 2) is also well established as an analogue to solidification phenomena observed in metals. Segregation was significantly reduced when the mixtures were subjected to ultrasonic energy during directional solidification processing. The processing parameters introduced by this application have been evaluated in view of optimizing dispersion uniformity. The improvement is in good agreement with a novel model that 1) predicts

the achievable size of the droplets as a function of applied ultrasonic energy and then 2) calculates their relative sinking velocity through the bulk liquid.
Author
Directional Solidification (Crystals); Microstructure; Ultrasonics; Ultrasonic Processing; Experimentation

20000112947 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Development and Demonstration of Active Noise Control Concepts ***Final Report***
Kraft, R., General Electric Co., USA; Hu, Z., General Electric Co., USA; Sommerfeldt, S., Brigham Young Univ., USA; Walker, B., Hersh Acoustical Engineering, Inc., USA; Hersh, A., Hersh Acoustical Engineering, Inc., USA; Luo, H., General Electric Co., USA; Spencer, M., Signal Processing Solutions, USA; Hallman, D., General Electric Co., USA; Mitchell, C., Colorado State Univ., USA; Sutliff, D., AYT Corp., USA; September 2000; 152p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-27720; RTOP 522-81-11
Report No.(s): NASA/CR-2000-210037; E-12235; NAS 1.26:210037; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report details design methods for and feasibility of an Active Noise Control (ANC) system using flush-wall-mounted sensors and actuators to reduce turbofan engine rotor-stator interaction noise. ANC concepts capable of suppressing discrete-tone spinning modes containing several cut-on radial mode were identified, developed analytically, and evaluated. Separate ANC systems that suppressed at least three radial modes in a cylindrical inlet duct and three radial modes in an exhaust annulus were developed. These designs resulted in inlet duct and exhaust duct tests that were performed at NASA on the 4-ft ANC Fan in the NASA Glenn AAPL facility. Effective suppression of 2-BPF spinning mode m = 2 tone noise was achieved over a range of fan speeds 1800 to 2450 rpm, where up to 4 radials were present. In the inlet duct, up to 12 dB reduction was obtained for 3 radial modes, and up to 4 dB was obtained with 4 radial modes. In the exhaust duct, up to 15 dB PWL reduction was obtained with either two or three radial modes present. Thus, the ability to suppress multiple radial modes for tones in both the inlet and exhaust ducts has been successfully demonstrated. Implications of ANC system design requirements on installation and system integration issues for ANC systems capable of suppressing higher order radial mode content when applied to a 767 using twin CF6 engines were evaluated analytically. The analytical results indicated an ANC system must be part of an integrated design to be effective.
Derived from text
Control Theory; Noise Reduction; Turbofan Engines; Ducted Fan Engines; Aircraft Engines; Active Control; Self Adaptive Control Systems; Acoustic Ducts; Aircraft Noise; Aerodynamic Noise

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.

20000109774 Tri-Univ. Meson Facility, Vancouver, British Columbia Canada
HERMES experiment ***Progress Report***
Miller, C. A.; Apr. 30, 1996; 5p; In English; 7th; Structure of Baryons
Report No.(s): DE98-625505; TRI-PP-96-12; No Copyright; Avail: Department of Energy Information Bridge

The HERMES experiment at HERA is introducing a new technique and new kinds of experimental information to the study of spin structure of the nucleon. To measure spin independent deep inelastic scattering from the proton and neutron, HERMES utilizes polarized internal gas targets of hydrogen, deuterium and He-3 in the longitudinally polarized electron beam of the HERA storage ring. Key features are zero dilution of the target by unpolarized nuclei, and rapid reversal of the target spin. The (chi) dependencies of the proton and neutron spin-dependent structure functions are being measured with high precision. But most importantly, the large acceptance HERMES spectrometer detects and identifies leading hadrons in coincidence with the scattered electron. This will provide crucial additional information on the individual contributions of the valence and sea quarks to the nucleon spin, The 1995 running period is being dedicated to the He-3 target.
NTIS
Nucleons; Particle Spin

20000109776 Lund Univ., Dept. of Theoretical Physics, Sweden

Structure functions and final-state properties in deeply inelastic electron-proton scattering

Kharraziha, H.; Dec. 31, 1997; 17p; In English

Report No.(s): DE98-621569; LUNFD6-NFTF-1036; ISBN 91-628-2826-6; No Copyright; Avail: Department of Energy Information Bridge

In this thesis, we give a description of the detailed structure of the proton and a description of the final-state properties in electron-proton scattering. Qualitative results, in a purely gluonic scenario with the leading log approximation, and quantitative results, where quarks are included and some sub-leading corrections have been made, are presented. The quantitative results are in fair agreement with available experimental data and a Monte Carlo event generator for electron-proton scattering is presented. Further, a computer program for calculating QCD colour factors is presented.

NTIS

Protons; Inelastic Scattering; Electron Scattering

20000109777 Lund Univ., Dept. of Physics, Sweden

Search for a standard model Higgs at the LHC and electron identification using transition radiation in the ATLAS tracker

Egede, U.; Jan. 31, 1998; 197p; In English

Report No.(s): DE98-621568; LUNFD6-NFFL-7150; ISBN 91-628-2804-5; No Copyright; Avail: Department of Energy Information Bridge

The large Hadron Collider (LHC) will be ready for proton-proton collisions in the year 2005 and the ATLAS detector will be one of the two experiments at the LHC which will explore a new and higher energy range for particle physics. In this thesis, an analysis of the power of the ATLAS detector to detect a Standard Model Higgs boson has been performed. It is shown that it will be possible to discover a Higgs particle across the complete mass range from the lower limit defined by the reach of the LEP2 collider experiments to the upper theoretical limit around 1 TeV. The role of the inner tracking detector of ATLAS for the detection of conversions and the identification of the primary vertex in the detection of a Higgs particle in the Higgs to two photon decay channel is demonstrated with a detailed detector simulation. The identification of a 1 TeV Higgs particle requires a good understanding of both the signal and the backgrounds. The related uncertainties are covered in detail and it is shown that the Higgs can be identified in the H(yields)WW(yields)lvjj, H(yields) ZZ(yields)llvv and H(yields)ZZ(yields)lljj decay channels. The Transition Radiation Tracker (TRT) is a combined tracking and electron identification device which will be a part of the inner tracking detector of ATLAS. For a prototype of the TRT the electron identification performance is analysed and it is shown that the full scale TRT together with the calorimeters will provide the electron identification power required for a clean electron and photon signal at the LHC. For the prototype a rejection factor of 100 against pions was achieved with an electron efficiency of 90%. the importance of the TRT for a clear detection of a Higgs particle is demonstrated.

NTIS

Standard Model (Particle Physics); Higgs Bosons

20000109908 Centre National de la Recherche Scientifique, Lab. de Physique Subatomique et des Technologies Associees, Nantes, France

Test of a MICROMEGAS detector for the muon tracking chambers of ALICE

Cussonneau, J. P.; Lautridou, P.; Luquin, L.; Metivier, V.; Rahmani, A.; Dec. 31, 1997; 13p; In English

Report No.(s): DE98-617554; SUBATECH-97-24; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An alternative solution for the muon tracking chambers of ALICE, based on the detector MICROMEGAS, is investigated at SUBATECH. Three prototypes have been constructed and tested in the 3 GeV/c pion beam of the CERN PS. The characteristics of these detectors, and the set-up used for the tracking test are described. Results concerning efficiencies and spatial resolutions as a function of gas mixtures, high voltages and the angular incidences of the particles are presented and discussed.

NTIS

Efficiency; Gas Mixtures; Muons; Synchrotrons; Gases; Analyzers

20000109911 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR

Necessity to study thin samples at the radiation damage of plastic scintillators

Shafranov, M. D.; Dec. 31, 1997; 11p; In Russian

Report No.(s): DE98-618161; JINR-D-13-97-120; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

To clarify the radiation damage processes in plastic scintillators, it is .necessary to study not only their transmission but emission spectra. That is why thin samples are to be studied. A method to increase the spectral sensitivity has been motivated and proposed for the film samples several microns thick.
NTIS
Emission Spectra; Radiation Damage; Scintillation Counters; Radiation Effects; Plastics

20000109917 Joint Inst. for Nuclear Research, Lab. of Computing Techniques and Automation, Dubna, USSR
Program BETA for simulation of particle decays and reactions
Takhtamyshev, G. G.; Merkulova, T. A.; Dec. 31, 1997; 10p; In English
Report No.(s): DE98-618167; JINR-E-11-97-182; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Program BETA is designed for simulation of particle decays and reactions. The program also produces integration over the phase space and decay rate or the reaction cross section are calculated as a result of such integration. At the simulation process the adaptive random number generator SMART may be used, what is found to be useful for some difficult cases.
NTIS
Computerized Simulation; Particle Decay; Scattering Cross Sections; Measure and Integration; Computer Programs

20000109928 Oslo Univ., Norway
Yukawa-dissociation and the deuteron binding energy
Jacobsen, T., Oslo Univ., Norway; May 31, 1997; 6p; In English
Report No.(s): DE98-626464; OUP-97-05; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
It is shown that energy must be conserved by the dissociation of an elementary particle. The energy deficit by a dissociation behaves as a basic concept. The binding energy of the deuteron is reproduced.
NTIS
Binding Energy; Deuterons; Dissociation; Yukawa Potential

20000110021 Russian Research Centre Kurchatov Inst., Moscow, Russian Federation
Radiation damage calculation in aluminium oxide under neutron irradiation
Vladimirov, P. V.; Lizunov, Y.; Ryazanov, A.; Dec. 31, 1994; 20p; In English
Report No.(s): DE98-628549; IAE-5729/12; No Copyright; Avail: Department of Energy Information Bridge
A method for displacement damage rate calculations in component materials under neutron irradiation is applied to Al2O3. Partial contributions of each sort of atoms to displacement damage and spectral- averaged damage cross-sections for several fusion and fission facilities were calculated.
NTIS
Radiation Damage; Neutron Irradiation

20000110022 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Shaping of positron beams from extended (beta)(sup +/-) radioactive sources in static magnetic and electric fields
Gorev, V. V.; Kachalov, K. O.; Serebrennikov, K. S.; Stolbetsov, S.; Dec. 31, 1994; 24p; In Russian; In English
Report No.(s): DE98-628548; IAE-5721/14; No Copyright; Avail: Department of Energy Information Bridge
In the paper the formation of positron beam is considered. Positrons are injected from the extensive (beta)(sup +/-) radioactive source placed in the focusing magnetic field and strong longitudinal electric field conducting positrons through the neck of magnetic bottles. Numerical results were found to be in good agreement with theoretical predictions. Optimal parameters were established when current density is increasing by more than two orderers of magnitude, with current dropping by 50%.
NTIS
Positrons; Beam Currents

20000110101 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Possibility of electron-neutrino angular correlation a coefficient measuring on the base of installation for neutron life time measurement
Balashov, C. N.; Mostovoj, Y.; Dec. 31, 1994; 20p; In Russian; In English
Report No.(s): DE98-628547; IAE-5718/2; No Copyright; Avail: Department of Energy Information Bridge
The angular correlation measurements give information about Ga/Gv ratio of fundamental constants of the weak interaction. The measurement precision of the a-coefficient of the electron-neutrino correlation is not so high as electron-spin one due to diffi-

culties of the absolute measuring of an energy. The estimation of the measurement precision of the a-coefficient is about 2%. This is 2.5 times better than recent experimental result.
NTIS
Angular Correlation; Neutrinos; Time Measurement; Correlation Coefficients

20000110172 Oak Ridge National Lab., TN USA
Proton Radioactivity Measurements at HRIBF: Ho, Lu, and Tm Isotopes
Akovali, Y.; Batchelder, J. C.; Bingham, C. R.; Davinson, T.; Ginter, T. N.; Nov. 13, 1998; 11p; In English; International Symposium on Perspectives in Nuclear Physics, Paradise Island, Bahamas, November 13-17, 1998, 13-17 Nov. 1998, Paradise Island, Bahamas, USA
Report No.(s): DE00-004542; ORNL/CP-102163; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Two new isotopes, Tm-145 and Ho-140 and three isomers in previously known isotopes, 141mHo, 150mLu and 151mLu have been discovered and studied via their decay by proton emission. These proton emitters were produced at the Holifield Radioactive Ion Beam Facility (HRIBF) by heavy-ion fusion-evaporation reactions, separated in A/Q with a recoil mass spectrometer (RMS), and detected in a double-sided silicon strip detector (DSSD). The decay energy and half-life was measured for each new emitter. An analysis in terms of a spherical shell model is applied to the Tm and Lu nuclei, but Ho is considerably deformed and requires a collective model interpretation.
NTIS
Radioactive Isotopes; Radioactivity; Holmium Isotopes; Protons; Lutetium Isotopes; Thulium Isotopes

20000110205 Bergen Univ., Norway
Strange and non-strange baryon and antibaryon production in sulphur-tungsten and sulphur-sulphur interactions at 200 A Gev/c
Holme, A. K.; Nov. 30, 1995; 133p; In English
Report No.(s): DE98-626457; NEI-NO-895; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The author has studied production of strange and multistrange baryons and antibaryons in central sulphur-tungsten, sulphur-sulphur, and lead-lead interactions at relativistic energies. The spectra of strange baryons and antibaryons provide information about the dynamics of hadronic matter under the extreme conditions realised in these collisions. The particle ratios allow the degree and the nature of the flavour equilibrium to be studied, while the transverse mass distributions provide independent information of the temperatures achieved.
NTIS
Baryons; Hadrons; Sulfur; Tungsten; Particle Collisions; Particle Production; Quarks; Strangeness

20000110208 Oslo Univ., Norway
Non-leptonic decays of K-mesons within the chiral quark model
Bergan, A. E.; Dec. 31, 1996; 110p; In English
Report No.(s): DE98-626451; NEI-NO-889; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This theses is based upon four previously printed paper. The main result of the first paper was that a very small contribution to K(0)-anti K(0) was found for the siamese penguin diagram with a momentum dependent penguin coefficient. The calculation was done with different regularizations. The same momentum dependent penguin interaction was used in the second paper. Dimensional regularization made it possible to calculate analytical results for K yields phi, and a relatively small g(sub 8)(sup 1/2) factor was found due to large subleading terms. In the third paper nonperturbative effects on the B(sub K) parameter were obtained. to order (G(sup 3)) a vanishing result appeared due to a complete cancellation among the 20 contributing diagrams. In the fourth paper a calculation was made of K yields phi which included non- diagonal self-energy effects due to the s yields d transition. This calculation made it possible to include a heavy top quark. The calculation was done in two ways. First the unphysical K yields phi transition was calculated. The result was then related to the physical K yields 2(phi) decay due to chiral symmetry. Then the same result was obtained by a direct calculation of K yields 2(phi). In the CP-conserving case the contribution was small while the CP-violating part was sizable. Due to a large cancellation between the operator Q(sub 6) and Q(sub 8) the contribution was of the same size as epsilon/epsilon itself.
NTIS
Quark Models; Mesons; Invariance; Particle Decay; Kaons; Quantum Chromodynamics

20000110209 Bergen Univ., Norway
Determination of the CP of the Higgs boson
Skjold, A.; Dec. 31, 1995; 90p; In English
Report No.(s): DE98-626450; NEI-NO-888; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

While the Higgs particle of the Standard Models is a Cp-even scalar particle, extended models may contain Higgs particles that are odd under CP, and also models invoking Higgs-like particles which are not eigenstates of CP may be considered. In the context of Higgs production via the Bjorken process and Higgs decay to tour fermions distributions that are sensitive to the CP parity are discussed. The author also discuss observables which may demonstrate presence of CP violation and identify a phase shift (delta) which is a measure of the strength of CP violation in the Higgs-vector-vector coupling, and which can be measured directly in the relevant distribution. In the case of Higgs production via the Bjorken process at a future e(+)e(-)collider, Monte Carlo data on the expected efficiency is presented, and it is concluded that it is relatively easy to determine whether the produced particle is even or odd under CP. However, observation of any CP violation would require a very large amount of data. It is argued that the analogous prospects at LEP2 or at a future hadron collider like the LHC seem to be less promising.
NTIS
Higgs Bosons; Invariance; Particle Production; Standard Model (Particle Physics); Fermions; Monte Carlo Method

20000110210 Oslo Univ., Norway
Studies of short-lived nuclei in the proximity of closed shells
Omtvedt, J. P.; Dec. 31, 1995; 100p; In English
Report No.(s): DE98-626445; NEI-NO-858; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this work the structure of Se-84 & Se-85, at the closed N = 50 neutron shell, and the Sb-132, Sn-132, and Te-134 nuclei, at the doubly closed N=82,Z=50 shells, was studied. The experiments were performed at the OSIRIS fission product mass separator at Studsvik, Sweden. The excited levels of the studied nuclei were populated in (beta) decay. The sources were produced in fission of (sup 235)U in the OSIRIS combined target and ion source. The nuclei were studied by standard nuclear spectroscopy measuring techniques: Singles gamma spectra and gamma gamma-coincidence data were obtained. In addition gamma gamma(theta) angular correlation and beta gamma gamma(t) triple coincidence ”fast-timing”, measurements were performed on the nuclei in the Sn-132 (N=82,Z=50) region. Detailed level schemes for the Se-84 & Se-85, Sb-132, Sn-132, Te-132 nuclei were built, greatly improve our knowledge of the structure of these nuclei. The experimentally deduced transition rates and multipole mixing ratios of the studied Sn-132 region nuclei were compared to theoretical calculations within the random phase approximation framework and related models. Particular attention was paid to the collective properties of nuclei in the Sn-132 region, parametrized by the electrical octupole effective charge. A range of general software spectroscopic tools were developed for the purpose of analysing the experimental data. This included a program, Yggdrasil, which for the first time allowed a complete two-dimensional gamma gamma-coincidence matrix to be analysed on ordinary ”small” personal computers (PCs).
NTIS
Nuclear Structure; Antimony Isotopes; Beta Particles; Fission; Neutrons; Radioactive Isotopes; Tellurium Isotopes; Tin Isotopes; Spectroscopy; Computer Programs

20000110229 Defence Science and Technology Organisation, Weapons Systems Div., Melbourne, Australia
Intermolecular Potentials of Mixed Systems: Testing the Lorentz-Berthelot Mixing Rules with Ab Initio Calculations
White, A., Defence Science and Technology Organisation, Australia; August 2000; 36p; In English
Report No.(s): DSTO-TN-0302; DODA-AR-011-549; Copyright; Avail: Issuing Activity

The Lorentz-Berthelot mixing rules are extensively used for estimating intermolecular potential parameters between pairs of non-identical molecules (ij) from those between pairs of identical molecules (ii and jj). Ab initio molecular calculations allow direct estimation of intermolecular potentials in all three systems and hence afford a method of testing the Lorentz-Berthelot mixing rules.
Author
Intermolecular Forces; Potential Energy

20000110232 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Radiation of a charge uniformly moving in medium
Afanas’ev, G. N.; Kartavenko, V.; Dec. 31, 1998; 27p; In Russian; In English
Report No.(s): DE99-614525; JINR-R-2-98-157; No Copyright; Avail: Department of Energy Information Bridge

It is analyzed how the frequency dependence of the electric permittivity (epsilon) affects the electromagnetic field radiated by a point charge uniformly moving in medium. It turns out that a moving charge radiates at every velocity when the standard

parametrization of (epsilon) is chosen. This consideration is applied to the interpretation of experiments recently discussed in physical literature.
NTIS
Electromagnetic Fields; Radiation

20000110248 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Determination of hydrogen atom concentration in large gadolinium-loaded liquid scintillator detectors
Mikaelyan, L.; Sinev, V.; Dec. 31, 1994; 16p; In English
Report No.(s): DE98-628553; IAE-5763/2; No Copyright; Avail: Department of Energy Information Bridge
An accurate knowledge of the hydrogen atom concentration in large volume liquid scintillator detectors loaded with high neutron capture rate isotopes such as Gd or Cd is of great importance for neutrino experiments using the inverse beat-decay reaction. The method is based on measuring the neutron capture time distributions on hydrogen and on high neutron capture rate isotope Gd or Cd.
NTIS
Hydrogen Atoms; Atom Concentration

20000110257 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Gluon and photon radiation by quark-gluon plasma
Peresun'ko, D.; Pokrovskij, Y.; Dec. 31, 1994; 12p; In English
Report No.(s): DE98-628564; IAE-5824/1; No Copyright; Avail: Department of Energy Information Bridge
Differential rate of gluon emission from the quark gluon plasma is calculated within a framework of perturbative QCD. The rate is found to be four order of magnetic greater then the corresponding rate for direct thermal photons at any frequencies and temperature. Using a simplest model of gluon-to-photon conversion it is shown that the gluonic photons radiated earlier than the final hadronization stage strongly contribute to photon background at (omega) is less than T at least.
NTIS
Gluons; Photons; Radiation

20000110267 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Inquiry for the conversion of the ((pi)(sup +) - (pi)(sup -)) bound state into two (pi)(sup 0)
Bunatyan, G.; Dec. 31, 1998; 19p; In English
Report No.(s): DE99-614516; JINR-E-4-98-177; No Copyright; Avail: Department of Energy Information Bridge
In the work presented, the decay of the pionium, that is the ((pi)(sup +) (pi)(sup -)) bound state, into two (pi)(sup 0) is studied, the (pi)(pi)- interaction causing this transition being described by the underlying Weinberg Lagrangian. The calculation with such a (pi)(pi)-Lagrangian being carried out, the (pi)-meson size r(sub 0) emerges to be allowed for, and this quantity occurs in the final result. The bound ((pi)(sup +)(pi)(sup -))-system itself is presumed to be due to the instantaneous Coulomb interaction and is treated consistently nonrelativistically, the Bethe-Salpeter equation being utilized. When calculating, the terms to the lowest order in the fine structure constant (alpha) and the terms (approx) ln (r(sub 0)) are retained. The obtained pionium lifetime (tau) is thought to be compatible with the conceivable future experimental data. The dependence of the results on the effective Lagrangian parameters is visualized. The investigation carried out persuades us that it is just the complete form of the genuine (pi)(pi)-interaction that determines the pionium lifetime , but not much simply the (pi)(pi) scattering lengths. The inquiry into pionium decaying promotes to specify the validity of the various (pi)(pi)-interaction descriptions.
NTIS
Atomic Physics; Pions; Particle Decay

20000112920 MRJ Technology Solutions, Moffett Field, CA USA
Precise Nanoelectronics with Adatom Chains
Yamada, Toshishige, MRJ Technology Solutions, USA; [1999]; 10p; In English; 196th, 17-22 Oct. 1999, Honolulu, HI, USA; Sponsored by Electrochemical Society, Inc., USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Adatom chains on an atomically regulated substrate will be building components in future precise nanoelectronics. Adatoms need to be secured with chemical bonding, but then electronic isolation between the adatom and substrate systems is not guaranteed. A one-dimensional model shows that good isolation with existence of surface states is expected on an s-p crossing substrate such as Si, Ge, or GaAs, reflecting the bulk nature of the substrate. Isolation is better if adatoms are electronically similar to the substrate atoms, and can be manipulated by hydrogenation. Chain structures with group IV adatoms with two chemical bonds,

or group III adatoms with one chemical bond, are semiconducting, reflecting the surface nature of the substrate. These structures are unintentionally doped due to the charge transfer across the chemical bonds. Physical properties of adatom chains have to be determined for the unified adatom-substrate system.
Author
Molecular Chains; Chemical Bonds; Nanotechnology; Semiconductors (Materials); Substrates

20000114812 Clermont-Ferrand Univ., Lab. de Physique Corpusculaire, France
Quantitative predictions for B semileptonic decays into D,D(sup *) and the orbitally excited D(sup **) in quark models a la Bakamjian-Thomas
Morenas, V.; Le Yaouanc, A.; Oliver, L.; Pene, O.; Raynal, J. C.; Dec. 31, 1997; 19p; In English
Report No.(s): DE98-617547; PCCF-RI-9707; No Copyright; Avail: Department of Energy Information Bridge

Once chosen the dynamics in one frame, the rest frame in this paper, the Bakamjian and Thomas method allows to define relativistic quark models in any frame. These models have been shown to provide, in the infinite quark mass limit, fully covariant current form factors as matrix elements of the quark current operator. In this paper the rest frame dynamics is used. B semileptonic branching ratios to the ground state and orbitally excited charmed mesons D, D(sup *) and D(sup **) are predicted. Bjorken's sum rule is checked.
NTIS
Predictions; Particle Decay; Quark Models

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.

20000109913 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR
Picture of the nuclei disintegration mechanism: From hadron-nucleus and nucleus-nucleus collisions experimental investigations at high energies
Strugalska-Gola, E.; Strugalski, Z.; Chmielowski, W.; Dec. 31, 1997; 16p; In English
Report No.(s): DE98-618163; JINR-E-1-97-129; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The mechanism of the nuclei disintegration process in collisions of high- energy hadrons with nuclei is revealed experimentally. The disintegration appears as a complicated nuclear process developing in time and space in intranuclear matter, consisting at least of three stages which last together about 10(exp -24) - 10(exp -17)/ s after the impact. At the first stage, which lasts about 10(exp -24) - 10(exp -22)/ s, fast nucleons are densely emitted and the target-nucleus is locally damaged. At the second stage, lasting about 10(exp -22) - 10(exp -1)/ s, the damaged and unstable residual target nucleus uses to evaporate light fragments - mainly nucleons, deuterons, tritons, (alpha) -particles. At the final stage, the residual target-nucleus uses to split sometimes into two or more nuclear fragments.
NTIS
Alpha Particles; Deuterons; Nuclear Interactions; Hadrons; Evaporation; Disintegration

20000109914 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR
Energy changes in massive target-nuclei, induced by high-energy hadronic projectiles
Strugalski, Z.; Strugalska-Gola, E.; Dec. 31, 1997; 16p; In English
Report No.(s): DE98-618164; JINR-E-1-97-130; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Now it turned out that it is real to estimate by experiments the energy changes in massive target-nuclei, induced by high-energy hadronic projectiles. The subject matter in this work is to present results of the quantitative estimations of the energy changes in intranuclear matter at various stages of hadron-nucleus collision reactions. Appropriate formulas are proposed for the energy balances - as following from the experimentally based mechanism of the hadron-nucleus collision reactions.
NTIS
Energy Budgets; Energy Consumption; Evaporation Rate; Models; Hadrons; Nuclear Emulsions

20000109915 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR

Possibility of experimental investigation of extreme states of nuclear matter. The invariant inclusive spectra of secondary particles production in pi(-), p, d, He-4, C-12 + C interactions

Abdinov, O. B.; Bagirov, A. M.; Mekhdiev, R. R.; Sulejmanov, M. K.; Rzaev, G. D.; Dec. 31, 1997; 24p; In English

Report No.(s): DE98-618165; JINR-E-1-97-178; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The experimental data on (pi)(sup -)C-interactions at P(sub (pi)-)=40 GeV/c, also pC, dC, (sup 4)HeC and (sup 12)CC-interactions at a momentum of 4.2 A GeV/c are used in this paper. The statistical material was separated into the following groups with the number of protons Q:Q(>=)1;2;3;...Q;.... The invariant inclusive spectra of (pi)(sup -)-mesons and protons f=(E/(sigma)) d(sup 3)(sigma)/dp(sup 3) versus their kinetic energy T in the laboratory system of coordinates were obtained for each group of events. These spectra are of the exponential form, and they were approximated by the expressions consisting of one exponent, the sum of two exponents and the sum of three exponents. The best approximations were selected, and the behaviours of the parameters from these approximations were studied depending on Q. As a result, the boundary values of Q(sup *), under the excess of which qualitative changes in the properties of the considered interactions take place, are verified. It is shown that the events with Q(>=)Q(sup *) correspond to the events with the total disintegration of the nuclear target. In this region a sharp increase of the kinetic energy of (pi)(sup -)-mesons and a sharp decrease of the kinetic energy of protons are observed for nucleus-nucleus interactions with increasing Q. The suppression of the 'leading' effect is observed in the events with Q(>=) Q(sup *) We have discovered a connection between the number of collisions and the number of protons, i.e. increasing the number of protons at a constant number of protons at a constant number of collisions. This contradiction is explained by that there is fast widening of some metastable state, the extreme state of nuclear matter, in the region Q greater or = Q(sup *).

NTIS

Experimentation; Data Acquisition; Nuclear Interactions; Kinetic Energy; Alpha Particles; Boundaries; Carbon 12; Deuterons; Disintegration; Collisions

20000110137 NASA Johnson Space Center, Houston, TX USA

A Nuclear Interaction Model for Understanding Results of Single Event Testing with High Energy Protons

Culpepper, William X., NASA Johnson Space Center, USA; ONeill, Pat, NASA Johnson Space Center, USA; Nicholson, Leonard L., NASA Johnson Space Center, USA; [2000]; 1p; In English; Commercialization of Military and Space Electronics, Feb. 2000, Los Angeles, CA, USA; Sponsored by Components Technology Inst., Inc., USA

Contract(s)/Grant(s): NAS9-5374; No Copyright; Avail: Issuing Activity; Abstract Only

An internuclear cascade and evaporation model has been adapted to estimate the LET spectrum generated during testing with 200 MeV protons. The model-generated heavy ion LET spectrum is compared to the heavy ion LET spectrum seen on orbit. This comparison is the basis for predicting single event failure rates from heavy ions using results from a single proton test. of equal importance, this spectra comparison also establishes an estimate of the risk of encountering a failure mode on orbit that was not detected during proton testing. Verification of the general results of the model is presented based on experiments, individual part test results, and flight data. Acceptance of this model and its estimate of remaining risk opens the hardware verification philosophy to the consideration of radiation testing with high energy protons at the board and box level instead of the more standard method of individual part testing with low energy heavy ions.

Author

Nuclear Interactions; High Energy Interactions; Proton Energy; Models

20000110171 Oak Ridge National Lab., TN USA

PHENIX Experiment

Read, K. F.; Jan. 09, 1999; 13p; In English; Winter Workshop on Nuclear Dynamics, 9-16 Jan. 1999, Park City, UT, USA

Report No.(s): DE00-004592; ORNL/CP-102125; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The PHENIX experiment at RHIC is currently under construction with data collection planned to start in 1999. The heavy ion and spin physics goals of PHENIX are described. We discuss the experiment's capabilities to address these physics goals. Highlights of the present status of construction and installation are presented.

NTIS

Heavy Ions; Radiation Counters; Particle Spin; Nuclear Physics

20000110173 Oak Ridge National Lab., TN USA

Status of U.S. Plans for an Advanced ISOL Facility: A Brief Report

Bertrand, F. E.; Nov. 13, 1998; 6p; In English; International Symposium on Perspectives in Nuclear Physics, Paradise Island, Bahamas, 13-17 Nov. 1998, Paradise, Island, Bahamas, USA

Report No.(s): DE00-004528; ORNL/CP-102129; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A brief discussion is provided of the current status of plans to build an advanced ISOL radioactive ion beam facility in the USA. Designs for this new facility, which was recommended as the next major construction project of the DOE Nuclear Physics Program Office, have been proposed by two U.S. national laboratories, Argonne National Laboratory and Oak Ridge National Laboratory. The new facility will provide orders-of-magnitude higher radioactive beam currents than existing facilities of this type and will cost in the range of $250 million.

NTIS

Ion Sources; Isotope Separation; Nuclear Physics; Laboratories

20000110185 Joint Inst. for Nuclear Research, Lab. of High Energies, Dubna, USSR

KNO scaling

Golokhvastov, A.; Dec. 31, 1998; 35p; In Russian; In English

Report No.(s): DE99-614526; JINR-R-2-98-181; No Copyright; Avail: Department of Energy Information Bridge

The questions related to the correct version of the KNO scaling of the multiplicity distributions are discussed. Comparison with experiment is presented for the negative particle multiplicities in e(sup +)e(sup -) annihilation at (radical) s = 3 - 161 GeV, in inelastic pp interactions at (radical) s = 2.7 - 62 GeV (and p bar p 546 GeV), and in inelastic nucleus-nucleus interactions at p(sub lab) = 4.5 - 520 GeV/c per nucleon. An evidence for the scaling violation which was obtained in the experiment at (radical) s = 546 GeV is discussed.

NTIS

Nuclear Interactions; Scaling Laws; Nuclear Physics

20000110234 Joint Inst. for Nuclear Research, Lab. of High Energies, Dubna, USSR

Total destruction of target nuclei and modified cascade-evaporation model of nucleus-nucleus interactions

Bondarenko, A. I.; Bondarenko, R. A.; Kladnitskaya, E. N.; Musul'manbekov, Z.; Toneeva, G.; Dec. 31, 1998; 32p; In Russian; In English

Report No.(s): DE99-614522; JINR-R-1-98-155; No Copyright; Avail: Department of Energy Information Bridge

The multiplicities, momentum and angular characteristics of secondaries from inelastic interactions of protons, deuterons, (alpha)-particles and carbon nuclei with a momentum of 4.2 A GeV/c and from interactions with the total destruction of a carbon target obtained in the propane bubble chamber are compared with the modified cascade-evaporation model. The model describes the experimental data with 20-30% accuracy. Including the projectile nucleus braking inside the target nucleus in the model improves an agreement of the calculations with the experiment for total destruction events and has a weak influence on the characteristics of inelastic interactions.

NTIS

Nuclear Physics; Destruction; Evaporation; Nuclear Interactions

20000110235 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR

Search for spontaneous fission of Ra-226 and systematics of the spontaneous fission, (alpha)-decay and cluster decay probabilities

Mikheev, V. L.; Tret'yakova, S. P.; Golovchenko, A. N.; Timofeeva, O. V.; Hussonnois, M.; Dec. 31, 1998; 16p; In English

Report No.(s): DE99-614521; JINR-E-7-98-178; No Copyright; Avail: Department of Energy Information Bridge

The low limit of the Ra-226 spontaneous fission half-life corresponding to T(sub 1/2) 4 (center-dot) 10(sup 18) years is measured. The Ra-226 spontaneous fission probability proved to be about 50 times less than the value expected from the known systematics, connecting the ratios of the(alpha)-decay and spontaneous fission probabilities with the fissility parameter Z(sup 2)/A. It is shown that the probabilities of spontaneous fission, (alpha)-decay and cluster decay can be systematized in the same way according to the difference between the decay products Coulomb energy near the scission point and decay energy Q.

NTIS

Nuclear Physics; Fission; Radium 226; Alpha Decay; Atomic Clusters

20000110252 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR

Possible asymmetry of particle distribution around axes of hard jets in ultrarelativistic heavy ion collisions

Kopysov, M.; Pokrovskij, Y.; Dec. 31, 1994; 13p; In English

Report No.(s): DE98-628558; IAE-5799/2; No Copyright; Avail: Department of Energy Information Bridge

Possible manifestation of a formation of an nonequilibrium flux table stage for the quark-gluon transition in high energy heavy ion collisions is described. It is shown that the typical flux table like fluctuations of gluon color-electric fields which are oriented along to the reaction axis leads to a strong asymmetry in particle distributions around the axes the hard-transverse jets.

NTIS

Nuclear Physics; Asymmetry; Quarks; Gluons

20000110255 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR

Does the excited state of the He-3 nucleus exist

Barabanov, A.; Dec. 31, 1994; 14p; In English

Report No.(s): DE98-628561; IAE-5811/2; No Copyright; Avail: Department of Energy Information Bridge

The suggestion is made that the excited state of the He-3 nucleus found out recently in the reaction has spin and parity 1/2(sup +) and the same configuration that the ground open of He-6. It is shown that in an elastic nd-scattering a resonance associated with the excited state may be absent due to destructive interference of potential and resonant scattering phases.

NTIS

Excitation; Helium Isotopes; Nuclear Physics

20000110620 Oak Ridge National Lab., TN USA

Nanostructured Arrays Formed by Finely Focused Ion Beams

Budai, J. D.; Datsos, P. G.; Feldman, L. C.; Heinig, K. H.; Meldrum, A.; Nov. 30, 1998; 9p; In English, 30 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): DE00-003657; ORNL/CP-101219; No Copyright; Avail: Department of Energy Information Bridge

Amorphous, polycrystalline, and single crystal nanometer dimension particles can be formed in a variety of substrates by ion implantation and subsequent annealing. Such composite colloidal materials exhibit unique optical properties that could be useful in optical devices, switches, and waveguides. However colloids formed by blanket implantation are not uniform in size due to the nonuniform density of the implant, resulting in diminution of the size dependent optical properties. The objective of the present work is to form more uniform size particles arranged in a 2-dimensional lattice by using a finely focused ion beam to implant identical ion doses only into nanometer size regions located at each point of a rectangular lattice. Initial work is being done with a 30 keV Ga beam implanted into Si. Results of particle formation as a function of implant conditions as analyzed by Rutherford backscattering, x-ray analysis, atomic force microscopy, and both scanning and transmission electron microscopy will be presented and discussed.

NTIS

Nanostructures (Devices); Arrays; Ion Beams; Amorphous Materials; Polycrystals; Single Crystals

20000113129 Missouri Univ., Kansas City, MO USA

Slow Positron Beam for Material and Surface Characterization ***Final Report, 1 Mar. 1998 - 28 Feb. 2000***

Jean, Yanching C.; Sandreczki, Thomas C.; Aug. 26, 2000; 4p; In English

Contract(s)/Grant(s): F49620-98-1-0309

Report No.(s): AD-A382678; AFRL-SR-BL-TR-00-0438; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A variable, mono-energetic slow positron beam (0-30 keV) coupled with Doppler broadening of annihilation radiation and positron lifetime measurements has been constructed at the University of Missouri-Kansas City. The beam is ideal for surface and materials characterization of defects of polymeric and coating materials in the range of sub-nanometer on the surface to a few microns in the bulk. This instrument becomes one of five slow positron beams currently available in the US for research on sub-nanometer defects and for training students and scientists in defense-related research. The performance of the beam, the counting rate and the resolution, is one of the best in the world.

DTIC

Coatings; Positrons

20000113842 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR

Dynamic approach to fusion of massive nuclei

Dzholos, R. V.; Nasirov, A. K.; Muminov, A. I.; Dec. 31, 1997; 15p; In English

Report No.(s): DE98-627229; JINR-E-4-97-302; No Copyright; Avail: Department of Energy Information Bridge

The role of the entrance channel in the fusion-fission reactions leading to nearly the same superheavy compound nucleus is studied in the framework of dynamic model. The calculations are done for Ca-48 + Pu-244 and Ge-74, 76 + Pb-208 reactions which could lead to formation of superheavy element Z = 114. It is shown that for these reactions there is an energy window for the values of the bombarding energy at which a capture probability is sufficiently large. Together with the restriction coming from the intrinsic barrier for fusion, it helps to find an optimal value of the bombarding energy for a given projectile - target combination.

NTIS

Nuclear Physics; Fusion-Fission Hybrid Reactors; Dynamic Models; Nuclei (Nuclear Physics)

20000113844 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR

Energy dependence of the Coulomb-nuclear interference at small momentum transfers

Selyugin, O. V.; Dec. 31, 1997; 19p; In English

Report No.(s): DE98-627224; JINR-E-2-97-298; No Copyright; Avail: Department of Energy Information Bridge

The analyzing power of the elastic proton-proton scattering at small momentum transfers and the effect of the Coulomb-nuclear interference are examined on the basis of the available experimental data at p(sub L) from 6 up to 200 GeV/c taking account of a phenomenological analysis at p(sub L)=6 GeV/c and of the dynamic high energy spin model. The structure of the spin-dependent elastic scattering amplitude at small momentum transfers is obtained. The predictions for the analyzing power at RHIC energies are made.

NTIS

Nuclear Physics; Coulomb Potential

20000114811 Lyon-1 Univ., Inst. de Physique Nucleaire, Villeurbanne, France

Local nuclear slope and curvature in high energy pp and pp-bar elastic scattering

Desgrolard, P.; Kontros, J.; Lengyel, A. I.; Martynov, E. S.; May 31, 1997; 25p; In English

Report No.(s): DE98-617537; LYCEN-9721; No Copyright; Avail: Department of Energy Information Bridge

The local nuclear slope is reconstructed from the experimental angular distributions with a procedure that uses overlapping t-bins, for an energy that ranges from the ISR to the Sp-bar pS and the Tevatron. Predictions of several models of (p-bar,p) elastic scattering at high energy are tested. Only a model with two-components Pomeron and Odderon gives a satisfactory agreement with the (non fitted) slope data. The extreme sensitivity of the local nuclear curvature with the choice for a Pomeron model is emphasized.

NTIS

Slopes; Curvature; Nuclear Physics

20000114813 Centre National de la Recherche Scientifique, Lab. de Physique Subatomique et des Technologies Associees, Nantes, France

Search for dynamical effects in the multifragmentation process at intermediate energy

Germain, M.; Eudes, P.; Gourio, D.; Laville, J. L.; Lebrun, C.; Dec. 31, 1997; 13p; In English

Report No.(s): DE98-617548; SUBATECH-97-09; No Copyright; Avail: Department of Energy Information Bridge

Inclusive energy spectra of fast protons arising from Ar+Ta collisions at 94 MeV/u have been measured at large angles. These data are analysed in the framework of a one-body transport theory simulated by the BNV code emphasizing the primordial origin of these protons. A possible extension of such an analysis is derived using correlation functions in relative angle between two protons emitted in the mid rapidity region of the Xe+Sn reaction at 50 MeV/u.

NTIS

Nuclear Physics; Fragmentation

20000114875 Centre National de la Recherche Scientifique, Lab. de Physique Subatomique et des Technologies Associees, Nantes, France

Temperature measurements from relative populations of excited states with INDRA

Assenard, M.; Lebrun, C.; Lautridou, P.; Eudes, P.; Germain, M.; Dec. 31, 1997; 15p; In English

Report No.(s): DE98-617550; SUBATECH-97-15; No Copyright; Avail: Department of Energy Information Bridge

For the first time, INDRA has been used to analyse resonances observed in correlation functions, giving thus the possibility to probe the caloric curve (correlation between the excitation energy and the temperature). First results obtained for the reaction Ar-18, 36 + Ni-28, 58 at 95 MeV/nucleon are presented where the projectile-like apparent temperature has been evaluated. Moreover, the measured populations of excited states are compared with the predictions of a statistical model which includes an original hypothesis of excluded volume for species at the freeze-out.
NTIS
Temperature Measurement; Nuclear Physics; Correlation

20000114876 Centre National de la Recherche Scientifique, Lab. de Physique Subatomique et des Technologies Associees, Nantes, France
Beyond mean field confrontation of different models with high transverse momentum proton spectra
Germain, M.; Hartnack, C.; Laville, J. L.; Aichelin, J.; Belkacem, M.; Dec. 31, 1997; 5p; In English
Report No.(s): DE98-617551; SUBATECH-97-17; No Copyright; Avail: Department of Energy Information Bridge
Several models have been proposed to simulate heavy ion reactions beyond the mean field level. The lack of data in phase space regions which may be sensitive to different treatments of fluctuations made it difficult to judge these approaches. The recently published high energy proton spectra, measured in the reaction 94 A MeV Ar+Ta, allow for the first time for a comparison of the models with data. It was found that these spectra are reproduced by Quantum Molecular Dynamics (QMD) calculations. Models in which effective collective effects are introduced lead to too large proton yields. High energy proton production hence does not seem to require collective effects such as the ones needed to understand well below threshold kaon production.
NTIS
Transverse Momentum; Energy Spectra

20000114877 Centre National de la Recherche Scientifique, Lab. de Physique Subatomique et des Technologies Associees, Nantes, France
Importance of initial-final state correlations for the formation of fragments in heavy ion collisions
Gossiaux, P. B.; Aichelin, J.; Dec. 31, 1997; 67p; In English
Report No.(s): DE98-617552; SUBATECH-97-20; No Copyright; Avail: Department of Energy Information Bridge
Using quantum molecular dynamics simulations, the formation of fragments in symmetric reactions is investigated between beam energies of E = 30 A MeV and 600 A MeV. After a comparison with existing data some observables relevant to tackle equilibration are investigated. None of our simulations gives evidence that the system passes through a state of equilibrium. The production mechanisms are also investigated.
NTIS
Correlation; Fragments; Nuclear Physics

20000114878 Centre National de la Recherche Scientifique, Lab. de Physique Subatomique et des Technologies Associees, Nantes, France
Coulomb corrections for interferometry analysis of expanding hadron systems
Sinyukov, Y.; Lednicky, R.; Pluta, J.; Erazmus, B.; Akkelin, S. V.; Sep. 30, 1997; 20p; In English
Report No.(s): DE98-617553; SUBATECH-97-22; No Copyright; Avail: Department of Energy Information Bridge
The problem of the Coulomb corrections to the two-boson correlation functions for the systems formed in ultra-relativistic heavy ion collisions is considered for large effective system volumes. The modification of the standard zero-distance correction (so called Gamow or Coulomb factor) has been proposed for such a kind of systems. For the (pi)(sup +)(pi)(sup +) and K(sup +)K(sup +) correlation functions the analytical calculations of the Coulomb correction are compared with the exact numerical results.
NTIS
Correlation; Interferometry; Hadrons

74
OPTICS

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

20000108796 NASA Marshall Space Flight Center, Huntsville, AL USA
Stellar Calibration of the WIC and SI Imagers and the GEO Photometers on IMAGE/FUV
Gladstone, R., Southwest Research Inst., USA; Mende, S. B., California Univ., USA; Frey, H. U., California Univ., USA; Geller, S. P., California Univ., USA; Immel, T. J., California Univ., USA; Lampton, M., California Univ., USA; Gerard, J.-C., Liege Univ., Belgium; Spann, J., NASA Marshall Space Flight Center, USA; Habraken, S., Centre Spatial de Liege, Belgium; Renotte, E., Centre Spatial de Liege, Belgium; Jamar, C., Centre Spatial de Liege, Belgium; Rochus, P., Centre Spatial de Liege, Belgium; [2000]; 1p; In English, 15-19 Dec. 2000, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The FUV instrument on the IMAGE spacecraft comprises three wide-field imagers, the Wide-Band Imaging Camera (WIC) of observing N2 Lyman-Birge-Hopfield (LBH) (140-190 nm) emissions and the Spectrographic Imager (SI), which has a 121.8 nm channel for observing red-shifted HI Lya photons and a 135.6 run channel for observing 01 135.6 nm emissions. In addition, three HI Lya photometers (GEO) are used to monitor the geocorona. The fields of view are 17 degrees x 17 degrees for the WIC imagers, 15 degrees x 15 degrees for the two SI imagers, and 10 diameter for the three GEO photometers. As the IMAGE spacecraft spins every 120 seconds, the GEO photometers sweep out circles on the sky (at 0 degrees and plus or minus 30 degrees with respect to the spacecraft spin plane), and the WIC and SI imagers use the Time Delay Integration (TDI) method to construct images centered on the Earth. Many FUV-bright stars are seen in the WIC, SI and even the GEO data. WE have used archived International Ultraviolet Explorer (IUE) far-ultraviolet flux spectra for 22 of the brightest of these stars to help refine the FUV instrumental sensitivities. The stars chosen range in spectral type form B0V to A11V, with magnitudes ranging from V- 1.3 (a Cru) to V=4.7 (G Cen) (although many more fainter stars are also seen). The initial results of this stellar calibration will be presented and compared with the pre-flight and dayglow modeling results.
Author
Broadband; Calibrating; Spectrographs; Photometers; Geocoronal Emissions; Far Ultraviolet Radiation; Cameras; Stellar Luminosity

20000109816 Stanford Univ., Stanford, CA USA
Semiconductor In-line Fiber Devices for Optical Communication Systems ***Final Report, 1 Apr. 1998-31 Mar. 2000***
Harris, J. S.; Aug. 21, 2000; 31p; In English
Contract(s)/Grant(s): N00014-98-1-0537
Report No.(s): AD-A381265; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A high-performance optical communication system requires high-performance optoelectronic devices. The conventional approach to fabricating fiber-coupled devices involves the interruption of the fiber and the insertion of the device. Several drawbacks are associated with this approach, including high insertion loss, mechanical instability, and high packaging costs. In-line fiber devices, in which light is evanescently coupled between single mode fibers and multimode high index waveguides, offer solutions to these problems. Materials that have been used in the implementation of in-line fiber devices include liquid crystals, electro-optic polymers and lithium niobate substrates. Gallium arsenide and other compound semiconductor devices offer significant advantages over the above materials in that they can be monolithically integrated with lasers and high-speed electronics, thereby reducing fabrication costs. In addition, the sharp index contrast between the semiconductor and the fiber leads to wavelength-selective coupling, which can be exploited for WDM applications. The goal of this project is to demonstrate various compound semiconductor in-line fiber devices. The operation of these devices requires evanescent wave coupling, and hence phase-matching, between a side-polished single mode fiber and a high-index semiconductor waveguide. The large index contrast between the semiconductor and the fiber can be overcome by the use of dielectric mirrors in the semiconductor waveguide. The mirrors can be designed to provide high reflection for a specific mode angle, therefore the optical wave inside the semiconductor waveguide can propagate with an effective index much lower than the material index. This class of optical waveguides, where guiding is achieved by reflections from dielectric mirrors rather than total internal reflection at dielectric interfaces, is commonly referred to as anti-resonant reflecting optical waveguides (ARROW).
DTIC
Optical Communication; Optical Waveguides; Electro-Optics; Optoelectronic Devices; Fabrication; Semiconductor Devices

20000109827 California Univ., Dept. of Atmospheric Sciences, Los Angeles, CA USA

Radiative Transfer and Satellite Remote Sensing of Cirrus Clouds Using FIRE-2-IFO Data ***Final Report***

[2000]; 3p; In English

Contract(s)/Grant(s): NAG1-1966; NAG1-1719; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Under the support of the NASA grant, we have developed a new geometric-optics model (GOM2) for the calculation of the single-scattering and polarization properties for arbitrarily oriented hexagonal ice crystals. From comparisons with the results computed by the finite difference time domain (FDTD) method, we show that the novel geometric-optics can be applied to the computation of the extinction cross section and single-scattering albedo for ice crystals with size parameters along the minimum dimension as small as approximately 6. We demonstrate that the present model converges to the conventional ray tracing method for large size parameters and produces single-scattering results close to those computed by the FDTD method for size parameters along the minimum dimension smaller than approximately 20. We demonstrate that neither the conventional geometric optics method nor the Lorenz-Mie theory can be used to approximate the scattering, absorption, and polarization features for hexagonal ice crystals with size parameters from approximately 5 to 20. On the satellite remote sensing algorithm development and validation, we have developed a numerical scheme to identify multilayer cirrus cloud systems using AVHRR data. We have applied this scheme to the satellite data collected over the FIRE-2-IFO area during nine overpasses within seven observation dates. Determination of the threshold values used in the detection scheme are based on statistical analyses of these satellite data.

Derived from text

Radiative Transfer; Remote Sensing

20000109991 Defence Science and Technology Organisation, Electronic Warfare Div., Salisbury, Australia

Measurements of Near Sea Surface Infrared Propagation

Frost, Shaun M., Defence Science and Technology Organisation, Australia; October 1999; 30p; In English; Original contains color illustrations

Report No.(s): DSTO-TR-0994; DODA-AR-011-492; Copyright; Avail: Issuing Activity

A facility to perform spectral atmospheric transmission measurements has been developed. Measurements have been made of the atmospheric infrared transmission near the sea surface. Spectral transmission profiles were measured for a number of ranges using a fourier transform spectrometer. The results have been compared to the predictions of the MODTRAN atmospheric transmission model.

Author

Spectrum Analysis; Atmospheric Circulation; Near Infrared Radiation

20000110249 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR

Experience of development and operation of the vacuum ultraviolet spectrometer on the base of the synchrotron radiation source SBIR-I

Svechnikov, N.; Stankevich, V. G.; Kaznacheev, K.; Dec. 31, 1994; 44p; In Russian; In English

Report No.(s): DE98-628555; IAE-5775/14; No Copyright; Avail: Department of Energy Information Bridge

This work presents an atomized ultra-high vacuum spectrometer for performed optical measurements on emission, luminescence excitation, reflectivity and transmission spectra of solids, in the excitation energy range from 4 to 30 at, the simple temperature reaching the values from 5 K to 300 K. Also given are the practical advices on reliable explication of the similar type complex physical set-up.

NTIS

Ultraviolet Spectrometers; Synchrotron Radiation; Optical Measurement; Radiation Sources

20000110526 Southwest Virginia Community Coll., Engineering Div., Richlands, VA USA

Comparison of the Sensitivity of Systems for the Detection of Light in the Infrared Wavelengths When Used With a Monochromator

Hopkins, Thomas E., Southwest Virginia Community Coll., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 64; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The specific problem addressed in this investigation was the best method of measuring the spectral properties of the fluorescence out of a fiber laser near 940 nm. The investigation began when the level of detection of the fluorescence was not satisfactory when using the Hewlett Packard Optical Spectrum Analyzer with a multimode fiber. We wanted to investigate whether the measurement could be accomplished better with a monochromator using an APD, PMT, etc. Two methods using the monochromator were employed. The first method was using a laser, monochromator with a chopper, a lock-in amplifier, x-y recorder and a photo-

detector. The detectors employed were the photomultiplier tube (PMT), small-area PIN photodiode, and large-area PIN photodiode. The sensitivity of these configurations were from 100 pw to 1.14 nW for wavelengths near 830 nm. The sensitivity for these methods were insufficient by 1 - 2 orders of magnitude. The reason for the insufficient sensitivity was the noise induced by the lock-in amplifiers onto the signal from the detector. This phenomenon caused further investigation into using a laser, monochromator without a chopper, a transimpedence amplifier, x-y recorder and a photodetector. The detectors employed were the small-area PIN photodiode, large-area PIN photodiode, avalanche photodetector (APD), and photomultiplier tube. The sensitivity of these configurations were from 2.5 pW to 200 pW for wavelengths near 830 nm.
Derived from text
Infrared Spectra; Light (Visible Radiation); Monochromators; Sensitivity; Detection; Wavelengths

20000110941 NASA Langley Research Center, Hampton, VA USA
Modulated FT- Raman Fiber-Optic Spectroscopy: A technique for Remotely Monitoring High-Temperature Reactions in Real-Time
Cooper, John B., Old Dominion Univ., USA; Wise, Kent L., Old Dominion Univ., USA; Jensen, Brian J., NASA Langley Research Center, USA; Analytical Chemistry; 1997; ISSN 0003-2700; Volume 69, No. 11, pp. 1973-1978; In English
Contract(s)/Grant(s): NGT1-52124; NSF DMR-94-14000; Copyright; Avail: Issuing Activity

A modification to a commercial FT-Raman spectrometer is presented for the elimination of thermal backgrounds in FT-Raman spectra. The modification involves the use of a mechanical chopper to modulate the CW laser, remote collection of the signal via fiber optics, and connection of a dual-phase digital signal processor lock-in amplifier between the detector and the spectrometer's collection electronics to demodulate and filter the optical signals. The resulting modulated FT-Raman fiber-optic spectrometer is capable of completely eliminating thermal backgrounds at temperatures exceeding 370 C. In addition, the signal/noise of generated Raman spectra is greater than for spectra collected with the conventional FT-Raman under identical conditions and incident laser power. This is true for both room-temperature and hot samples. The method allows collection of data using preexisting spectrometer software. The total cost of the modification (excluding fiber optics) is approximately $3000 and requires less than 2 h to implement. This is the first report of Fr-Raman spectra collected at temperatures in excess of 300 C in the absence of thermal backgrounds.
Author
Fiber Optics; High Temperature; Raman Spectroscopy; Real Time Operation; Fast Fourier Transformations

20000113968 Rochester Univ., Dept. of Chemistry, NY USA
Molecular Nonlinear Optical Susceptibilities in Condensed Phases ***Final Report, 1 Apr. - 30 Nov. 1999***
Makumel, Shaul; Nov. 30, 1999; 16p; In English
Contract(s)/Grant(s): F49620-99-1-0226
Report No.(s): AD-A382690; AFRL-SR-BL-TR-00-0461; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A unified microscopic theoretical framework for the calculation of optical excitations in molecular and semiconductor materials was developed. The hierarchy of many-body density matrices for a pair-conserving many-electron model and the Frenkel excitons model was rigorously truncated to a given order in the radiation field. Closed equations of motion were derived for five generating functions representing the dynamics up to third order in the laser field including phonon degrees of freedom as well as all direct and exchange-type contributions to the Coulomb interaction. by eliminating the phonons perturbatively, we obtained equations that, in the case of the many-electron system, generalize the semiconductor Bloch equations, are particularly suited for the analysis of the interplay between coherent and incoherent dynamics including many-body correlations, and lead to thermalized excitons (rather than single-particle) distributions at long times. A complete structural equivalence with the Frenkel excitons model of molecular materials was established.
DTIC
Nonlinear Optics; Semiconductors (Materials); Nanostructure (Characteristics)

20000114860 Columbia Univ., Radiation Lab., New York, NY USA
DURIP: Instrumentation for Precision Rapid Prototyping of Systems for Optoelectronic Circuits and Devices ***Final Report, 1 Mar. 1998 - 29 Feb. 2000***
Osgood, Richard M., Jr.; May 31, 2000; 9p; In English
Contract(s)/Grant(s): F49620-98-1-0271; AF Proj. 3484
Report No.(s): AD-A382471; AFRL-SR-BL-TR-00-0469; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This proposal requested instrumentation to make our direct writing instrumentation at Columbia capable of sub micrometer overlay and registration and to provide new capability for testing integrated optical devices. This instrumentation thus included

the purchase of new more rugged laser systems and optical stages and optics. Additional computers were needed to update the control systems for the apparatus and make them more compatible with in situ control. In addition two new, more-stable laser tubes were included to improve writing reliability. Additional instrumentation for subsequent lithographic patterning was also to be purchased. Finally a new optical system for testing The fabrication quality was to be purchased.
DTIC
Optoelectronic Devices; Prototypes; Optical Equipment; Fabrication; Precision

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PLASMA PHYSICS

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

20000109786 Princeton Plasma Physics Lab., Princeton, NJ USA
Theory of Perturbed Equilibria for Solving the Grad-Shafranov Equation
Pletzer, A.; Zakharov, L. E.; Jul. 01, 1999; 15p; In English
Report No.(s): DE00-008933; PPPL-3352; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The theory of perturbed magnetohydrodynamic equilibria is presented for different formulations of the tokamak equilibrium problem. For numerical codes, it gives an explicit Newton scheme for solving the Grad-Shafranov equation subject to different constraints. The problem of stability of axisymmetric modes is shown to be a particular case of the equilibrium perturbation theory.
NTIS
Perturbation Theory; Magnetohydrodynamics

20000109787 Princeton Plasma Physics Lab., Princeton, NJ USA
Real Time Control System for the National Spherical Torus Experiment (NSTX)
Neumeyer, C.; Gates, D.; Hatcher, R.; Kaye, S.; Gibney, T.; Jun. 01, 1999; 7p; In English, 14-18 Jun. 1999, Santa Fe, NM, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE00-007817; CFPAPER-4038; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
No abstract prepared.
NTIS
Tokamak Devices; Process Control (Industry); Product Development

20000109788 Princeton Plasma Physics Lab., Princeton, NJ USA
Control System Development Plan for the National Spherical Torus Experiment
Neumeyer, C.; Mueller, D.; Gates, D. A.; Ferron, J. R.; Jun. 01, 1999; 5p; In English, 14-18 Jun. 1999, Santa Fe, NM, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE00-007700; CFPAPER-4037; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
No abstract prepared.
NTIS
Control Systems Design; Process Control (Industry); Product Development

20000109933 Centre d'Etude de l'Energie Nucleaire, Mol, Belgium
Annual report for the steering committee of the association Euratom-Belgian State for fusion 1996 ***Annual Report***
Moons, F.; Bogaerts, W.; Decreton, M.; Biver, E.; Coenen, S.; Sep. 30, 1996; 36p; In English
Report No.(s): DE98-626872; BLG-724; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report is prepared for the annual steering committee meting of the Association Euratom - Belgian State for Fusion. The period October 1995 to September 1996 is reported on.The fusion technology work performed at the Belgian Nuclear Research Centre SCK/CEN, the Department of Metallurgy and Materials Engineering of the Louvain University (Belgium) and S.A. Gradel, a Luxemburg company, is described.
NTIS
Nuclear Research; Beryllium; Irradiation; Blankets (Fusion Reactors)

20000110020 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR

Investigation by the Rutherford backscattering method of impurity deposited on the T-3M tokamak diaphragm

Danelyan, L. S.; Egorova, I. M.; Kulikauskas, V. S.; Baratov, D. G.; Belykh, T.; Dec. 31, 1994; 14p; In Russian; In English

Report No.(s): DE98-628551; IAE-5752/1; No Copyright; Avail: Department of Energy Information Bridge

The Rutherford backscattering of helium-4 ions was used for investigation of impurity deposited on the annular graphite diaphragm as a result of the interaction between hydrogen plasma and liquid-metal spray limiter. The experimental RBS spectra distributions of the impurity elements surface densities along the direction from plasma to the chamber wall are presented as depth of the elements. The erosion coefficient of the main liquid-metal limiter element has been estimated.

NTIS

Impurities; Tokamak Devices; Plasma Physics

20000110023 Princeton Plasma Physics Lab., Princeton, NJ USA

Properties of High Beta, Quasi-Axisymmetric NCSX Stellarator Configurations

Boozer, A.; Reiman, A.; Monticello, D.; Fu, G. Y.; Ku, L. P.; Nov. 01, 1999; 11p; In English

Report No.(s): DE00-014502; PPPL-3384; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Quasi-axisymmetry, external kinks and ballooning stability are studied with respect to the plasma shaping and the variation in the pressure and current profiles for NCSX. We show that while the kink stability may require a delicate boundary shaping, most quasi-axisymmetry may be achieved using a few low order modes that eliminate the large mirror fields arising partly from boundary shaping for the kink stability. In addition, we demonstrate that the kink and ballooning instability may be improved in the NCSX configurations by a more peaked pressure profile or a broader current profile. Finally, we show numerically that it is possible to construct a quasi-axisymmetric configuration that is stable to the external kink at all current levels for which the edge rotational transform is less than 0.5.

NTIS

Plasma Physics; Stellarators

20000110039 Princeton Plasma Physics Lab., Princeton, NJ USA

Optical and Mechanical Design of C-Mod Motional Stark Effect Diagnostic

Simon, D. I.; Marmar, E.; Bretz, N. L.; Bravenec, R.; Parsells, R. F.; Nov. 01, 1999; 3p; In English

Report No.(s): DE00-014501; PPPL-3383; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A Motional Stark Effect (MSE) instrument is being installed on the Alcator C-Mod tokamak at MIT. This MSE diagnostic will provide measurements of the spatial profile of the internal poloidal magnetic field. The MSE has its primary collection optics inside the vacuum vessel. The light collected by the internal optics passes through a vacuum window and is relayed to a fiber optic array. The MSE optics are shared by a Beam Emission Spectroscopy (BES) diagnostic which measures electron density fluctuations and their spatial correlations. This optical system requires high throughput and spatial resolution of less than 1 cm at the focal plane in the plasma.The design requirements for the internal optics also include the effects associated with plasma impingement, plasma disruptions, and thermal excursions. The parameters that affect polarization measurement include the location and orientation of optical elements, the choice of substrates and optical materials. These unique design requirements led to a number of interesting optical and mechanical design features which are presented here.

NTIS

Optical Equipment; Stark Effect; Tokamak Devices; Plasma Physics; Design Analysis

20000110040 Princeton Plasma Physics Lab., Princeton, NJ USA

NSTX Filament Preionization and Glow Discharge Cleaning Systems

Kugel, W. H. W.; Nov. 01, 1999; 4p; In English

Report No.(s): DE00-014466; PPPL-3381; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Initial NSTX GDC experiments were performed with one moveable anode and a biased filament preionization system that allowed D2 and He Glow Discharge breakdowns at the actual operating pressure, voltage and current. The biased filament system was also operated continuously during ohmic operations, and used to reduce volt-sec consumption for February 1999 plasma discharges up to 280 KA. An upgraded system has been installed with 2 fixed wall anodes and 3 biased filaments; 2 on the mid-plane and one in the divertor region; all separately controllable remotely using a PLC system. Recent applications include assisting in preionization for 800 KA plasma discharges.

NTIS

Glow Discharges; Cleaning

20000110041 Princeton Plasma Physics Lab., Princeton, NJ USA

NSTX High Temperature Sensor Systems

McCormack, B.; Kugel, H. W.; Goranson, P.; Kaita, R.; Nov. 01, 1999; 6p; In English

Report No.(s): DE00-014463; PPPL-3380; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The design of the more than 300 in-vessel sensor systems for the National Spherical Torus Experiment (NSTX) has encountered several challenging fusion reactor diagnostic issues involving high temperatures and space constraints. This has resulted in unique miniature, high temperature in-vessel sensor systems mounted in small spaces behind plasma facing armor tiles, and they are prototypical of possible high power reactor first-wall applications. In the Center Stack, Divertor, Passive Plate, and vessel wall regions, the small magnetic sensors, large magnetic sensors, flux loops, Rogowski Coils, thermocouples, and Langmuir Probes are qualified for 600 C operation. This rating will accommodate both peak rear-face graphite tile temperatures during operations and the 350 C bake-out conditions. Similar sensor systems including flux loops, on other vacuum vessel regions are qualified for 350 C operation. Cabling from the sensors embedded in the graphite tiles follows narrow routes to exit the vessel. The detailed sensor design and installation methods of these diagnostic systems developed for high-powered ST operation are discussed.

NTIS

Plasma Physics; Temperature Sensors; Tokamak Devices; Fusion Reactors; Power Reactors

20000110042 Princeton Plasma Physics Lab., Princeton, NJ USA

Observations of Flaking of Co-deposited Layers in TFTR

Gentile, C. A.; Skinner, C. H.; Young, K. M.; Nov. 01, 1999; 4p; In English

Report No.(s): DE00-014457; PPPL-3379; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Flaking of co-deposited layers in the Tokamak Fusion Test Reactor (TFTR) has been observed after the termination of plasma operations. This unexpected flaking affects approximately 15% of the tiles and appears on isotropic graphite tiles but not on carbon fiber composite tiles. Samples of tiles, flakes and dust were recently collected from the inside of the vacuum vessel and will be analyzed to better characterize the behavior of tritium on plasma facing components in DT fusion devices.

NTIS

Plasma Physics; Flaking; Tokamak Devices; Fusion Reactors

20000110043 Princeton Plasma Physics Lab., Princeton, NJ USA

Excitation of Zonal Flow by Drift Waves in Toroidal Plasmas

Chen, L.; White, R.; Lin, Z.; Nov. 01, 1999; 10p; In English

Report No.(s): DE00-014454; PPPL-3378; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An analytical dispersion relation is derived which shows that, in toroidal plasmas, zonal flows can be spontaneously excited via modulations in the radial envelope of a single-n coherent drift wave, with n the toroidal mode number. Predicted instability features are verified by 3D global gyrokinetic simulations of the ion-temperature-gradient mode. Nonlinear equations for mode amplitudes demonstrate saturation of the linearly unstable pump wave and bursting behaviour in the drift-wave intensity and zonal flows.

NTIS

Plasma Physics; Excitation; Toroidal Plasmas; Wave Dispersion; Magnetohydrodynamic Flow

20000110044 Princeton Plasma Physics Lab., Princeton, NJ USA

Small-action Particles in a Tokamak in the Presence of an n = 1 Mode

White, R. B.; Lutsenko, V. V.; Nov. 01, 1999; 7p; In English

Report No.(s): DE00-014411; PPPL-3376; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

It is found that an m = n = 1 mode with the amplitude exceeding a certain threshold can lead to stochastic motion of energetic ions in tokamaks, the large orbit width particles (potatoes) being most easily affected. An n = 1 mode can redistribute particles also in the absence of stochasticity but only when the perturbation is quickly switched on/off, e.g., due to sawtooth crash. In the latter case, the perturbation results in regular motion of particles around a certain helical orbit, at which a resonance driven by the mode but having no amplitude threshold takes place.

NTIS

Plasma Physics; Tokamak Devices

20000110045 Princeton Plasma Physics Lab., Princeton, NJ USA
Transition Less Enhanced Confinement and the Role of Radial Electric Field Shear
Coppi, B.; Ernst, D. R.; Bell, M. G.; Bell, R. E.; Budny, R. V.; Oct. 01, 1999; 24p; In English
Report No.(s): DE00-014407; PPPL-3375; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Evidence for the role of radial electric field shear in enhanced confinement regimes attained without sharp bifurcations or transitions is presented. Temperature scans at constant density, created in the reheat phase following deuterium pellet injection into supershot plasmas in the Tokamak Fusion Test Reactor (J.D. Strachan, et al., Phys. Rev. Lett. 58 (1987) 1004) are simulated using a first-principles transport model. The slow reheat of the ion temperature profile, during which the temperature nearly doubles, is not explained by relatively comprehensive models of transport due to Ion Temperature Gradient Driven Turbulence (ITGDT), which depends primarily on the (unchanging) electron density gradient. An extended model, including the suppression of toroidal ITGDT by self-consistent radial electric field shear, does reproduce the reheat phase.
NTIS
Plasma Physics; Electric Fields; Confinement

20000110047 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
Feedback stabilization of axisymmetric modes in the TCV tokamak using active coils inside and outside the vacuum vessel
Hofmann, F.; Dutch, M. J.; Favre, A.; Martin, Y.; Moret, J. M.; Dec. 31, 1997; 22p; In English
Report No.(s): DE98-616925; LRP-593/97; No Copyright; Avail: Department of Energy Information Bridge

A new vertical position control system, including an internal active coil, has become operational on TCV. The new system has made it possible to stabilize plasmas with open-loop growth rates up to 4400 sec(sup -1), currents up to 1.0 MA, and elongations up to 2.58. The closed-loop stability of the new system has been analyzed with a numerical model in which the plasma is assumed undeformable, and the power supply outputs are delayed with respect to their inputs. Model predictions agree with the main experimental results.
NTIS
Plasma Physics; Stabilization; Feedback Control; Tokamak Devices; Electric Coils

20000110048 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
External kinks in plasmas with helical boundary deformation and net toroidal current
Ardelea, A.; Nov. 30, 1997; 111p; In English
Report No.(s): DE98-616924; LRP-592/97; No Copyright; Avail: Department of Energy Information Bridge

The investigation of the global ideal magnetohydrodynamic (MHD) stability of plasmas with helical boundary shape and nonvanishing toroidal plasma current constitutes the principal aim of this work. Global external modes with small values of m,n (typically n = 1,2,3 and m = n+1) are studied, where m and n are the poloidal and toroidal mode numbers, respectively. The first and main part of the work concentrates on fixed boundary equilibria generated by systematically varying parameters such as the type and the magnitude of the boundary deformation, the number of equilibrium field periods N(sub per), the aspect ratio, the toroidal current density profile, (beta) and the pressure profile. Due to the periodicity of the equilibrium, couplings between Fourier perturbation components with different toroidal mode numbers n occur and lead to the apparition of families of modes. The study of a particular (m,n) mode has to take into account all (m(sub l), n(sub l)) perturbation components with n(sub 1) belonging to the same family as n. The stability analysis is carried out in the parameter region where the inverse rotational transform (the safety factor in the traditional tokamak notation) q(<=)2.0 and (beta)(<=)2%. A particular property of the configurations investigated is that equilibrium Fourier components (m(sub e), N(sub per)n(sub e)) which are involved in the couplings between the (m,n) mode studied and the (m(sub k),n(sub k)) perturbation components with m(sub k)>n(sub k)>n that exhibit resonances in the q>1 region are very small. As a consequence, the contributions of the (m,n) x (m(sub k),n(sub k)) couplings to the potential energy are very weak. It is shown that a helical boundary deformation can stabilize the n=1,2,3 external modes; if (delta) is a measure of the plasma boundary deformation, then windows of stability ((delta)(sub min), (delta)(sub max)) may exist for a large variety of equilibrium parameters.
NTIS
Deformation; Toroidal Plasmas; Magnetohydrodynamic Stability; Plasma Physics

20000110049 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
Pressure and conductivity profiles in ohmic TCV discharges
Weisen, H.; Behn, R.; Furno, I.; Moret, J. M.; Sauter, O.; Nov. 30, 1997; 14p; In English
Report No.(s): DE98-616923; LRP-591/97; No Copyright; Avail: Department of Energy Information Bridge

A large variety of plasma conditions has been created in TCV (Tokamak a Configuration Variable, B(sub T)<1.5T, R(sub 0)=0.88m, a<0.25m). They include elongations in the 1 to 2.58, triangularities between -0.7 and 1 as well as 'square' shapes and plasma currents in the range 0.1-1MA. Over the entire range of quasi-stationary ohmic conditions investigated we observe a correlation between electron pressure profiles and conductivity profiles, suggesting that <p>/p(0)=<j>/j(0), where <> refers to an average over the volume or respectively the cross sectional area of the plasma. The profiles become broader as the average current density is increased. These 'profile consistency' features are apparent agreement with theoretical considerations based on minimum energy states of the plasma or on stationary entropy. Further analysis of the experimental evidence, together with a simple model of the current profile based on marginal stability to the internal kink mode in the core and neoclassical conductivity in the confinement zone, however shows that the observations can be accounted for by the effects of sawtooth activity.
NTIS
Plasma Physics; Tokamak Devices; Pressure Distribution; Electron Pressure

20000110050 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
Papers presented at the European fusion theory conference
Oct. 31, 1997; 34p; In English; 7th
Report No.(s): DE98-616922; LRP-590/97; No Copyright; Avail: Department of Energy Information Bridge
In this report one invited paper and six contributed papers presented by the CRPP Theory Group at the 7. European Fusion Theory Conference in Juelich are compiled.
NTIS
Conferences; Tokamak Devices

20000110051 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
Prediction of Alfven eigenmode dampings in the Joint European Torus
Jaun, A.; Fasoli, A.; Heidbrink, W. W.; Oct. 31, 1997; 5p; In English
Report No.(s): DE98-616921; LRP-589/97(ANNEX); No Copyright; Avail: Department of Energy Information Bridge
Predictions from a gyrokinetic plasma model reproduce for the first time the evolution of Alfven eigenmode dampings measured in JET over a range of discharges, providing for a credible capability to predict the stability of perturbations which are known to be near to marginal in the International Thermonuclear Experimental Reactor (ITER). The coupling between global shear- and kinetic-Alfven waves is responsible for the main source of damping through resonant interactions and can be an order of magnitude larger than the fluid predictions which neglect global kinetic effects.
NTIS
Plasma Physics; Plasma Waves; Thermonuclear Reactions; Landau Damping

20000110052 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
Resonance absorption and continuum damping
Jaun, A.; Appert, K.; Vaclavik, J.; Villard, L.; Hellsten, T.; Oct. 31, 1997; 5p; In English
Report No.(s): DE98-616920; LRP-589/97; No Copyright; Avail: Department of Energy Information Bridge
The absorption of power is studied with fluid and gyrokinetic plasma models, when two Alfven or ion-ion hybrid resonances provide for a weak damping in a partially standing wave-field. Examples chosen in slab and toroidal geometry show that the fluid predictions based on resonance absorption are generally very different from the Landau damping of mode-converted slow down. They in particular suggest that the continuum damping of toroidal Alfven eigenmodes (TAE) and the power deposition profiles obtained in the ion-cyclotron range of frequencies (ICRF) using fluid plasma models are very misleading.
NTIS
Plasma Physics; Absorption; Continuums; Landau Damping; Magnetohydrodynamic Waves; Standing Waves

20000110053 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
Degree of dissociation measured by FTIR absorption spectroscopy applied to VHF silane plasmas
Sansonnens, L.; Howling, A. A.; Hollenstein, C.; Oct. 31, 1997; 14p; In English
Report No.(s): DE98-616919; LRP-588/97; No Copyright; Avail: Department of Energy Information Bridge
In situ Fourier transform infrared (FTIR) absorption spectroscopy has been used to determine the fractional depletion of silane in a radio-frequency (rf) glow discharge. The technique used a simple single pass arrangement and was implemented in a large area industrial reactor for deposition of amorphous silicon. Measurements were made on silane plasmas for a range of excitation frequencies. It was observed that at constant plasma power, the fractional depletion increased from 35% at 13.56 MHz to 70%

at 70 MHz. With a simple model based on the density continuity equations in the gas phase, it was shown that this increase is due to a higher dissociation rate and is largely responsible for the observed increase in the deposition rate with the frequency.
NTIS
Dissociation; Plasma Physics; Silanes; Glow Discharges

20000110054 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
High-performance digital control system for TCV
Lister, J. B.; Dutch, M. J.; Milne, P. G.; Means, R. W.; Oct. 31, 1997; 9p; In English
Report No.(s): DE98-616918; LRP-586/97; No Copyright; Avail: Department of Energy Information Bridge

The TCV hybrid analogue-digital plasma control system has been superseded by a high performance Digital Plasma Control System, DPCS, made possible by recent advances in off the shelf technology. We discuss the basic requirements for such a control system and present the design and specifications which were laid down. The nominal and final performances are presented and the complete design is given in detail. The integration of the new system into the current operation of the TCV tokamak is described. The procurement of this system has required close collaboration between the end-users and two commercial suppliers with one of the latter taking full responsibility for the system integration. The impact of this approach on the design and commissioning costs for the TCV project is presented. New possibilities offered by this new system are discussed, including possible work relevant to ITER plasma control development.
NTIS
Plasma Physics; Plasma Control; Tokamak Devices; Thermonuclear Reactions

20000110055 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
Papers presented at the 1997 international workshop on diagnostics for experimental fusion reactors
Lister, J. B.; Nieswand, C.; Oct. 31, 1997; 16p; In English
Report No.(s): DE98-616917; LRP-585/97; No Copyright; Avail: Department of Energy Information Bridge

The report includes one invited and one contributed paper produced at the CRPP, Lausanne, which were presented at the 1997 Varenna workshop.
NTIS
Conferences; Diagnosis; Fusion Reactors; Plasma Physics

20000110072 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
ICH/FWCD system design for KSTAR
Bae, Y. D.; Kwak, J.; Han, J.; Ju, M.; Hong, B.; Jul. 31, 1997; 64p; In English
Report No.(s): DE98-622117; KAERI/TR-892/97; No Copyright; Avail: Department of Energy Information Bridge

The ICH/FWCD system for KSTAR shall initially be configured to provide 6 MW power to the plasma with one antenna. The system can be upgraded to provide 12 MW of power to the plasma with the addition of a second system that is duplicate of the first. The initial KSTAR ion cyclotron system consist of one port-mounted antenna that have four current straps. Each strap, using appropriate tuning, matching, and decoupling circuitry will be driven by an independent rf power source. The goal of this ICH/FWCD system is to deliver up to 6 MW of power to the plasma under a variety of plasma conditions. In this report, the plasma loading for various plasma conditions is computed by RANT3D code; electric property of antenna, i.e. inductance, capacitance and mutual coupling are examined; and then a brief description of the overall ICH/FWCD system is given.
NTIS
Plasma Physics; Ion Cyclotron Radiation

20000110073 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Electrical design of the ICH antenna in KSTAR
Han, J. M.; Kwak, J.; Bae, Y.; Ju, M.; Hong, B.; Jul. 31, 1997; 21p; In English
Report No.(s): DE98-622116; KAERI/TR-891/97; No Copyright; Avail: Department of Energy Information Bridge

The analysis of the electrical characteristics of the RF antenna in KSTAR is described. Thick straps had lower peak voltages and electric fields than thin straps. Septum position has negligible effect on peak fields for given power.
NTIS
Antennas; Plasma Physics

20000110085 Japan Atomic Energy Research Inst., Tokyo, Japan

Development of a current-type PWM converter with high power factor. 1

Miura, Y.; Matsukawa, M.; Miyachi, K.; Kimura, T.; Jan. 31, 1998; 49p; In Japanese; In English

Report No.(s): DE98-744697; JAERI-TECH-98-001; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A power supply system for superconducting poloidal field coils of a next generation tokamak-type fusion device can be operated on the relatively low voltage for the duration of discharge except the plasma initiation. In the case of the conventional phase-controlled thyristor converters are adopted in such a system, the input power factor would be low in average, and a reactive power fluctuation caused by the change of DC output voltage may produce serious effects on the commercial transmission line. From the above viewpoint, a current-type PWM (Pulse Width Modulation) converter, which can work with the power factor of unity for the input power, is regarded as one of the promising candidates of the converters for the power supplies of next generation fusion devices. Hence, a 100kW-class current-type PWM converter has been developed by using IGBT (Insulated Gate Bipolar Transistor) as switching devices. In this development, the basic performance has been preliminary investigated whether this converter is applicable to the power supply for the next generation fusion device. In addition, two different PWM control methods were examined whether these methods can realize a unit power factor and suppress the transient oscillation of converter input current at the same time in case that the reference of DC output current is changed rapidly.

NTIS

Pulse Duration Modulation; Superconducting Magnets; Field Coils; Electric Power Supplies

20000110086 Japan Atomic Energy Research Inst., Tokyo, Japan

Development of new CICU

Aoyagi, T.; Sato, M.; Sakata, S.; Matsuda, T.; Feb. 28, 1998; 99p; In Japanese; In English

Report No.(s): DE98-744696; JAERI-TECH-97-073; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In JT-60 data processing system, workstations have been used to replace aged mini-computers which have been difficult to maintain their hardware and software. The communication computer MMI was replaced in 1993 and the real time processor RTP in 1994. The new CAMAC interface control unit CICU has been developed and tested. It is now at the final step to replace the old mini-computer system. In this report, an outline of new CICU consisting of a workstation with VMEbus and a software design are described.

NTIS

Data Processing Equipment; Data Acquisition; Data Processing

20000110088 National Inst. for Fusion Science, Nagoya, Japan

Option of ICRF ion heating scenario in Large Helical Device

Vdovin, V.; Watari, T.; Fukuyama, A.; Jul. 31, 1997; 24p; In eng

Report No.(s): DE98-727523; NIFS-502; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Specific behavior of confining magnetic field in Large Helical Device suppresses tokamak-like ion heating scheme for ion cyclotron plasma heating with outside ICRF antenna. Respectively, the basic ICRF scenario with D(H) plasma will heat the electrons, as have been shown in stellarator CHS experiments. To overcome this difficulty, we propose to use in LHD high magnetic field side antenna operating in 'heavy' minority heating scenarios H(D) or H(He-3), where brackets indicate minority ions. We show analytically that predominantly heated in this scenario will be the minority ions, subsequently transferring their energy to bulk proton ions. Another proposed scenario operates with 'light' ion minority scheme like D(H), but with addition of third isotope ion component like C-13, Ne-21, Li-7, etc.. These third isotope ions eliminate degeneration of second harmonic frequency with fundamental frequency of minority ion(H) or second harmonics of deuterium ions. Isotopic ions will be heated due to a mode converted Ion Bernstein Waves close to second harmonic ion cyclotron layer (omega = 2.omega(sub ci)).

NTIS

Ion Cyclotron Radiation; Radio Frequency Heating; Plasma Control; Heliotrons; Tokamak Devices

20000110091 Oak Ridge National Lab., TN USA

Radiation Shielding for Fusion Reactors

Santoro, R. T.; Nov. 13, 1999; 8p; In English

Report No.(s): DE00-014615; ORNL/CP-105029; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Radiation shielding requirements for fusion reactors present different problems than those for fission reactors and accelerators. Fusion devices, particularly tokamak reactors, are complicated by geometry constraints that complicate disposition of fully

effective shielding. This paper reviews some of these shielding issues and suggested solutions for optimizing the machine and biological shielding. Radiation transport calculations are essential for predicting and confirming the nuclear performance of the reactor and, as such, must be an essential part of the reactor design process. Development and optimization of reactor components from the first wall and primary shielding to the penetrations and containment shielding must be carried out in a sensible progression. Initial results from one-dimensional transport calculations are used for scoping studies and are followed by detailed two- and three-dimensional analyses to effectively characterize the overall radiation environment. These detail model calculations are essential for accounting for the radiation leakage through ports and other penetrations in the bulk shield. Careful analysis of component activation and radiation damage is cardinal for defining remote handling requirements, in-situ replacement of components, and personnel access at specific locations inside the reactor containment vessel.
NTIS
Radiation Shielding; Fusion Reactors; Tokamak Devices; Reactor Design; Nuclear Reactors; Plasma Physics

20000110244 Princeton Plasma Physics Lab., Princeton, NJ USA
New Electron Cyclotron Emission Diagnostic Based Upon the Electron Bernstein Wave
Efthimion, P. C.; Hosea, J. C.; Kaita, R.; Majeski, R.; Taylor, G.; May 01, 1999; 6p; In English; 13th; Applications of Radio Frequency Power to Plasmas, 12-14 Apr. 1999, Annapolis, MD, USA
Report No.(s): DE00-006797; CFPAPER-4025; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Most magnetically confined plasma devices cannot take advantage of standard Electron Cyclotron Emission (ECE) diagnostics to measure temperature. They either operate at high density relative to their magnetic field or they do not have sufficient density and temperature to reach the blackbody condition. The standard ECE technique measures the electromagnetic waves emanating from the plasma. Here we propose to measure electron Bernstein waves (EBW) to ascertain the local electron temperature in these plasmas. The optical thickness of EBW is extremely high because it is an electrostatic wave with a large k(sub i). One can reach the blackbody condition with a plasma density approximately equal to 10(exp 11) cm(exp -3) and electron temperature approximately equal to 1 eV. This makes it attractive to most plasma devices. One serious issue with using EBW is the wave accessibility. EBW may be accessible by either direct coupling or mode conversion through an extremely narrow layer (approximately 1-2 mm) in low field devices.
NTIS
Plasmas (Physics); Cyclotron Radiation; Electrostatic Waves; Plasma Control; Diagnosis

20000110245 Princeton Plasma Physics Lab., Princeton, NJ USA
Fusion Concept Exploration Experiments at PPPL
Stewart Zweben,; Samuel Cohen,; Hantao Ji,; Robert Kaita,; Richard Majeski,; May 01, 1999; 13p; In English
Report No.(s): DE00-006796; CFPAPER-4024; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Small 'concept exploration' experiments have for many years been an important part of the fusion research program at the Princeton Plasma Physics Laboratory (PPPL). this paper describes some of the present and planned fusion concept exploration experiments at PPPL. These experiments are a University-scale research level, in contrast with the larger fusion devices at PPPL such as the National Spherical Torus Experiment (NSTX) and the Tokamak Fusion Test Reactor (TFTR), which are at 'proof-of-principle' and 'proof-of-performance' levels, respectively.
NTIS
Fusion Reactors; Plasma Physics; Tokamak Devices; Thermonuclear Reactions

20000110246 Oak Ridge National Lab., TN USA
Fusion Materials Semiannual Progress Report for Period Ending December 31, 1998, *Period ending 31 Dec. 1998*
Rowcliff, A. F.; Burn, G.; Apr. 01, 1999; 380p; In English
Report No.(s): DE00-006717; ORNL/M-6712; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This is the twenty-fifth in a series of semiannual technical progress reports on fusion materials. This report combines the full spectrum of research and development activities on both metallic and non-metallic materials with primary emphasis on the effects of the neutronic and chemical environment on the properties and performance of materials for in-vessel components. This effort forms one element of the materials program being conducted in support of the Fusion Energy Sciences Program of the U.S. Department of Energy. The other major element of the program is concerned with the interactions between reactor materials and the plasma and is reported separately.
NTIS
Plasmas (Physics); Reactor Materials; Thermonuclear Reactions; Fusion Reactors

20000110251 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR

Investigation of periodic systems by means of the generalized Hill method

Baitin, A. V.; Ivanov, A.; Dec. 31, 1994; 24p; In English

Report No.(s): DE98-628557; IAE-5792/1; No Copyright; Avail: Department of Energy Information Bridge

We propose the new method of investigation of infinite periodic determination which is a generalized Hill method. This method has been used for finding of the characteristic value for the Hill equation. finding the band structure of the one-dimensional periodic and obtaining of the dispersion equation for the electromagnetic wave propagation in the waveguide by plasma arbitrary periodic density modulation by plasma arbitrary periodic density modulation.

NTIS

Plasma Physics; Electromagnetic Wave Transmission

20000110598 Princeton Plasma Physics Lab., Princeton, NJ USA

Numerical Study of Tilt Stability of Prolate Field-reversed Configurations

H. Ji, M.; Kulsrud, R.; Jun. 21, 2000; 34p; In English

Report No.(s): DE00-756892; PPPL-3456; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Global stability of the Field-Reversed Configuration (FRC) has been investigated numerically using both 3D MHD and hybrid (fluid electron and deltaf particle ion) simulations. The stabilizing effects of velocity shear and large ion orbits on the n = 1 internal tilt mode in the prolate FRCs have been studied. Sheared rotation is found to reduce the growth rate, however a large rotation rate with Mach number of M greater than or approximately equal to 1 is required in order for significant reduction in the instability growth rate to occur. Kinetic effects associated with large thermal ion orbits have been studied for different kinetic equilibria. Our simulations show that there is a reduction in the tilt mode growth rate due to finite ion Larmor radius (FLR) effects, but complete linear stability has not been found, even when the thermal ion gyroradius is comparable to the distance between the field null and the separatrix. The instability existing beyond the FLR theory threshold could be due to the resonant interaction of the wave with ions whose Doppler shifted frequency matches the betatron frequency.

NTIS

Magnetohydrodynamic Stability; Plasma Equilibrium; Magnetohydrodynamics; Ions; Magnetic Field Configurations

20000110599 Princeton Plasma Physics Lab., Princeton, NJ USA

Diagnostics for Liquid Lithium Experiments in CDX-U

Kaita, R.; Efthimion, P.; Hoffman, D.; Jones, B.; Kugel, H.; Jun. 21, 2000; 12p; In English

Report No.(s): DE00-756819; PPPL-3455; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A flowing liquid lithium first wall or divertor target could virtually eliminate the concerns with power density and erosion, tritium retention, and cooling associated with solid walls in fusion reactors. to investigate the interaction of a spherical torus plasma with liquid lithium limiters, large area divertor targets, and walls, discharges will be established in the Current Drive Experiment-Upgrade (CDX-U) where the plasma-wall interactions are dominated by liquid lithium surfaces. Among the unique CDX-U lithium diagnostics is a multi-layer mirror (MLM) array, which will monitor the 135 Li-III line for core lithium concentrations. Additional spectroscopic diagnostics include a grazing incidence XUV spectrometer (STRS) and a filterscope system to monitor Da and various impurity lines local to the lithium limiter. Profile data will be obtained with a multichannel tangential bolometer and a multipoint Thomson scattering system configured to give enhanced edge resolution. Coupons on the inner wall of the CDX-U vacuum vessel will be used for surface analysis. A 10,000 frame per second fast visible camera and an IR camera will also be available.

NTIS

Tokamak Devices; Spectroscopy; Liquid Lithium; Spherical Plasmas; Plasmas (Physics); Fusion Reactors

20000110600 Princeton Plasma Physics Lab., Princeton, NJ USA

Initial operation of NSTX with plasma control

Gates, D.; Bell, M.; Ferron, J.; Kaye, S.; Menard, J.; Jun. 13, 2000; 7p; In English

Report No.(s): DE00-756721; PPPL-3453; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

First plasma, with a maximum current of 300kA, was achieved on NSTX in February 1999. These results were obtained using preprogrammed coil currents. The first controlled plasmas on NSTX were made starting in August 1999 with the full 1MA plasma current achieved in December 1999. The controlled quantities were plasma position (R,Z) and current (Ip). Variations in the plasma shape are achieved by adding preprogrammed currents to those determined by the control parameters. The control system is fully digital, with plasma position and current control, data acquisition, and power supply control all occurring in the same four-processor real time computer. The system uses the PCS (Plasma Control Software) system designed at General Atomics. Modular

control algorithms, specific to NSTX, were written and incorporated into the PCS. The application algorithms do the actual control calculations, with the PCS handling data passing. The control system, including planned upgrades, will be described, along with results of the initial controlled plasma operations. Analysis of the performance of the control system will also be presented.
NTIS
Automatic Control; Computer Programs; Plasma Control; Real Time Operation

20000110601 Princeton Plasma Physics Lab., Princeton, NJ USA
Drift mode calculations for the Large Helical Device
Rewoldt, G.; Ku, L. P.; Tang, W. M.; Sugama, H.; Nakajima, N.; Jun. 08, 2000; 20p; In English
Report No.(s): DE00-756594; PPPL-3451; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A fully kinetic assessment of the stability properties of toroidal drift modes has been obtained for a case for the Large Helical Device (LHD). This calculation retains the important effects in the linearized gyrokinetic equation, using the lowest-order ”ballooning representation” for high toroidal mode number instabilities in the electrostatic limit. Results for toroidal drift waves destabilized by trapped particle dynamics and ion temperature gradients are presented, using three-dimensional magnetohydrodynamics equilibria reconstructed from experimental measurements. The effects of helically-trapped particles and helical curvature are investigated.
NTIS
Plasma Drift; Magnetohydrodynamic Stability; Magnetohydrodynamics; Trapped Particles; Stellarators; Heliotrons

20000110606 Princeton Plasma Physics Lab., Princeton, NJ USA
Engineering design of the National Spherical Torus Experiment
Neumeyer, C.; Heitzenroeder, P.; Spitzer, J.; May 11, 2000; 81p; In English
Report No.(s): DE00-755357; PPPL-3446; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

NSTX is a proof-of-principle experiment aimed at exploring the physics of the ’spherical torus’ (ST) configuration, which is predicted to exhibit more efficient magnetic confinement than conventional large aspect ratio tokamaks, amongst other advantages. The low aspect ratio (R/a, typically 1.2--2 in ST designs compared to 4--5 in conventional tokamaks) decreases the available cross sectional area through the center of the torus for toroidal and poloidal field coil conductors, vacuum vessel wall, plasma facing components, etc., thus increasing the need to deploy all components within the so-called ’center stack’ in the most efficient manner possible. Several unique design features have been developed for the NSTX center stack, and careful engineering of this region of the machine, utilizing materials up to their engineering allowables, has been key to meeting the desired objectives. The design and construction of the machine has been accomplished in a rapid and cost effective manner thanks to the availability of extensive facilities, a strong experience base from the TFTR era, and good cooperation between institutions.
NTIS
Toroidal Plasmas; Tokamak Devices; Fusion Reactors; Toruses; Reactor Materials

20000110610 Princeton Plasma Physics Lab., Princeton, NJ USA
New understanding of poloidal rotation measurements in a tokamak plasma
Bell, R. E.; Synakowski, E. J.; May 15, 2000; 17p; In English
Report No.(s): DE00-755072; PPPL-3447; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Significant atomic physics corrections to the measured poloidal velocity using charge exchange spectroscopy have been neglected when interpreting impurity poloidal velocity. In the presence of a magnetic field, the gyro motion of the impurity ion along with the finite lifetime of the observed state results in an additional line shift that scales with ion temperature and magnetic field strength. Effects of collisions on the lifetime of excited states, cascades from higher longer-lived n levels, and charge exchange from excited beam neutrals are calculated to determine necessary corrections to the measured poloidal velocity. The accuracy of computed corrections is tested utilizing symmetric upward and downward views from the TFTR poloidal rotation diagnostic.
NTIS
Tokamak Devices; Spectroscopy; Plasma Diagnostics; Fusion Reactors; Atomic Physics; Plasmas (Physics)

20000110615 Princeton Plasma Physics Lab., Princeton, NJ USA
National Spherical Torus Experiment (NSTX)
Masayuki Ono,; Apr. 22, 2000; 12p; In English
Report No.(s): DE00-754424; PPPL-3445; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The main aim of National Spherical Torus Experiment (NSTX) is to establish the fusion physics principles of the innovative spherical torus (ST) concept. Physics outcome of the NSTX research program is relevant to near-term applications such as the Volume Neutron Source (VNS) and burning plasmas, and future applications such as the pilot and power plants. The NSTX device began plasma operations in February 1999 and the plasma current was successfully ramped up to the design value of 1 million amperes (MA) on December 14, 1999. The CHI (Coaxial Helicity Injection) and HHFW (High Harmonic Fast Wave) experiments have also started. Stable CHI discharges of up to 133 kA and 130- msec duration have been produced using 20 kA of injected current. Using eight antennas connected to two transmitters, up to 2 MW of HHFW power was successfully coupled to the plasma. The Neutral-beam Injection (NBI) heating system and associated NBI-based diagnostics such as the Charge-exchange Recombination Spectrometer (CHERS) will be operational in October 2000.
NTIS
Plasma Heating; Plasma Diagnostics; Neutral Beams; Beam Injection; Plasmas (Physics); Toruses

20000110618 Princeton Plasma Physics Lab., Princeton, NJ USA
Direct Electron Heating at Moderate Harmonic Number for Compact Ignition Devices
Majeski, R.; Jul. 01, 1999; 6p; In English; 13th; Radio Frequency Power in Plasmas, 12-14 Apr. 1999, Annapolis, MD, USA
Contract(s)/Grant(s): DE-AC02-76CH-03073
Report No.(s): DE00-008576; CFPAPER-4041; No Copyright; Avail: Department of Energy Information Bridge
Direct electron heating of compact ignition devices by radio-frequency power in the 300 - 400 MHz range is discussed. The possible advantage of this approach to heating an ignition device, as opposed to resonant heating of an ion population, is the insensitivity to the exact value of the magnitude field. Heating with central power deposition during a toroidal field ramp is therefore possible.
NTIS
Electron Cyclotron Heating; Electron Cyclotron Resonance; Plasma Resonance; Toroidal Plasmas

20000113919 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Parallel Jacobi-Davidson Method for Solving Generalized Eigenvalue Problems in Linear Magnetohydrodynamics. Modelling, Analysis and Simulation
Nool, M., Center for Mathematics and Computer Science, Netherlands; vanderPloeg, A., Center for Mathematics and Computer Science, Netherlands; Nov. 1997; 38p; In English
Report No.(s): PB2000-104686; MAS-R9733; Copyright; Avail: Issuing Activity
We study the solution of generalized eigenproblems generated by a model which is used for stability investigation of tokamak plasmas. The eigenvalue problems are of the form A*x = lambda*B*x, in which the complex matrices A and B are block tridiagonal, and B is Hermitian positive definite. The Jacobi-Davidson method appears to be an excellent method for parallel computation of a few selected eigenvalues, because the basic ingredients are matrix-vector products, vector updates, and inner products. The method is based on solving projected eigenproblems of order typically less than 30. The computation of an approximate solution fo a large system of linear equations is usually the most expensive step in the algorithm. by using a suitable preconditioner, only a moderate number of steps of an inner iteration is required in order to retain fast convergence for the JD process. Several preconditioning techniques are discussed. It is shown, that for our application, a proper preconditioner is a complete block LU decomposition, which can be used for the computation of several eigenpairs. Reordering strategies based on a combination of block cyclic reduction and domain decomposition result in a well-parallelizable preconditioning technique. Results obtained on 64 processing elements of both a Cray T3D and T3E will be shown.
Author
Eigenvalues; Magnetohydrodynamics; Plasmas (Physics); Convergence; Linear Equations; Algorithms; Preconditioning; Matrices (Mathematics)

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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.

20000109778 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR

Cross-section TEM investigation of the structural modifications in silicon irradiated successively by the ions N(sup +) and He(sup +) or Ar(sup 8+) and He(sup +)

Reutov, V. F.; Sokhatskij, A. S.; Dec. 31, 1997; 15p; In Russian; In English

Report No.(s): DE98-621551; JINR-R-14-97-216; No Copyright; Avail: Department of Energy Information Bridge

The present work deals with the behaviour of He-ion produced radiation defects in crystalline silicon near the boundary of the amorphous layer formed by ions of chemically active (N) and passive (Ar) elements. The TEM-'cross-section' method was used for sample analysis. The boundary of the amorphous layer formed by the chemically active ions of nitrogen was found to show hettering property relative to the radiation defects. Whereas the boundary of the amorphous layer formed by the inert has ions did not show the same property.

NTIS

Crystal Structure; Irradiation; Crystallinity

20000109779 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR

Rapid TEM method for the study of structural modifications in semiconductors along the paths of charged particles

Reutov, V. F.; Sokhatskij, A. S.; Dec. 31, 1997; 15p; In Russian; In English

Report No.(s): DE98-621550; JINR-R-14-97-199; No Copyright; Avail: Department of Energy Information Bridge

The present work outlines a rapid 'cross-section' method which allows the investigation of samples immediately after irradiation. The proposed method consists of the following steps: preparation of a thin (about 0.2 (mu)m) wafer, e.q. Si, with a flat butt surface by the special chemical technique of jet polishing; irradiation with an ion beam so that the bombarded crystallographic butt surfaces of the thin wafers be oriented perpendicular to the particle beam; TEM-analysis. The results of the experiments on thin Si wafers irradiated with an ion beam perpendicularly to their butt indicate that the structural features formed under such conditions (i.e. accumulations of defects, amorphous layers, end of range defects, nuclear tracks etc.) are similar to those formed in the irradiation of massive samples.

NTIS

Semiconductors (Materials); Irradiation; Crystal Structure

20000109800 Materials Research Society, Warrendale, PA USA

Materials Issues and Modeling for Device Nanofabrication, Volume 584, Held November 29-December 2, 1999, Boston, Massachusetts, USA

Merhari, Lhadi; Wilie, Luc T.; Gonsalves, Kenneth E.; Gyure, Mark F.; Matsui, Shinji; Dec. 02, 1999; 338p; In English

Contract(s)/Grant(s): N00014-00-1-0065; NSFDMR99-86520

Report No.(s): AD-A381210; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The exploding market of information technology requires ultra-high-speed integrated circuits, which imposes formidable challenges in terms of nanofabrication, advanced materials, atomic scale measurements and modeling. The enormous costs of next-generation lithographic machines to mass produce integrated circuits with sub-100 nm resolution justify alternative approaches where the use of advanced materials and techniques for nanofabrication including epitaxial growth, and their powerful modeling, can lead to more cost-effective strategies. This volume contains most of the papers that were presented during Symposium J, "Advanced Materials and Techniques for Nanolithography," and Symposium N, "Atomic Scale Measurements and Atomistic Models of Epitaxial Growth and Lithography," at the 1999 MRS Fall Meeting in Boston, Massachusetts. Because of the complementary nature of the two subject matters, particularly in their applicability to device nanofabrication, it was felt that a combined proceedings volume offered the best way to present the findings in a unified and comprehensive manner. The editors trust that the reader will find here a nice overview of the state of the art, both theoretical and experimental, as well as an indication of the future trends and remaining challenges in this technologically important field.

DTIC

Conferences; Nanotechnology; Fabrication; Epitaxy; Lithography

20000109846 National Academy of Sciences - National Research Council, Huntsville, AL USA

BEAM-ish: A Graphical User Interface for the Physical Characterization of Macromolecular Crystals

Lovelace, Jeff, Toledo Univ., USA; Snell, Edward H., NASA Marshall Space Flight Center, USA; Pokross, Matthew, Toledo Univ., USA; Arvai, Andrew S., Area Detector Systems Corp., USA; Nielsen, Chris, Area Detector Systems Corp., USA; Nguyen, Xuong, California Univ., USA; Bellamy, Henry D, Stanford Synchrotron Radiation Lab., USA; Borgstahl, Gloria E. O., Toledo Univ., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Crystal mosaicity is determined from the measurement of the reflection angular width and can be used as an indicator of crystal perfection. A new method has been developed that combines the use of unfocused synchrotron radiation, super-fine phi slicing and a CCD area detector to simultaneously measure the mosaicity of hundreds of reflections . The X-ray beam characteristics and Lorentz correction are deconvoluted from the resulting reflection widths to calculate the true crystal mosaicity.

Author

Crystals; Crystal Structure; Crystallography

20000109918 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR

Transmission electron microscopy study of helium saturated and post-irradiation phase recrystallized carbon steel

Reutov, V. F.; Semina, V. K.; Sokhatskij, A. S.; Dec. 31, 1997; 11p; In Russian; In English

Report No.(s): DE98-618200; JINR-R-14-97-145; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Structure of carbon steel irradiated with high energy (alpha)-particles and post-irradiation crystallized was studied by transmission electron microscopy. It was found that reasons of observed refining of grain structure and simultaneous decreasing of pearlite fraction are helium holes formation and carbon atoms capture by them.

NTIS

Carbon Steels; Helium; Irradiation; Transmission Electron Microscopy

20000109919 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR

Neutron diffraction study of structural changes in ammonium halides Nd4Br and Nd4Cl under high pressure ***Neutron diffraction study of structural changes in ammonium halides ND***

Balagurov, A. M.; Kozlenko, D. P.; Savenko, B. N.; Glazkov, V. P.; Somenkov, V. A.; Dec. 31, 1997; 15p; In Russian; In English

Report No.(s): DE98-618201; JINR-R-14-97-147; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Structural changes in ammonium halides Nd4Br and Nd4Cl at pressures up to 45 kbar and up to 35 kbar, respectively, have been studied with the DN-12 diffractometer at the IBR-2 pulsed reactor. For both systems, the equation of state and the position parameter of deuterium atoms as functions of pressure were obtained. The obtained equations of state are nearly the same as the ones for the nondeuterated systems NH4Br and NH4Cl obtained by the piston displacement technique. It was found that the order - disorder phase transition from the phase in which the ammonium tetrahedra are randomly oriented (CsCL-type cubic structure, space group Pm3m) into the phase in which the ammonium tetrahedra are oriented in parallel (CsCL-type cubic structure, space group P4 bar 3m), occurs at equal critical value of the position parameter u=0.153 +/- 0.002 in both systems. It appears to be valid for all of the ammonium halides, and, possibly, for other similar compounds.

NTIS

Ammonium Compounds; Halides; Neutron Diffraction; Pressure Dependence; High Pressure

20000109920 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR

Quadrupolar effects in PrCu2Si2 and NdCu2Si2 compounds ***Quadrupolar effects in PrCu***

Muzychka, A.; Dec. 31, 1997; 27p; In Russian; In English

Report No.(s): DE98-618202; JINR-R-14-97-154; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Small absolute value of crystal electric field gradient together with f-p hybridization are reasons of an anomalous quadrupolar phenomena in ternary compounds R-C-Si (R=Pr,Nd) of 1-2-2 series. The quadrupolar Kondo-effect takes place in PrCu2Si2 compound. There are two variants of crystal field (CF) in NdCu2Si2 compound due to temperature. The anomalous CF with significant mixing part is realized at high temperatures. The normal CF without mixing component takes place at low temperatures.

NTIS

Kondo Effect; Electric Fields; Crystal Field Theory; Gradients

20000110019 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR

Gliding reflection of positrons from slanting cut crystal

Bobrova, T. A.; Ognev, L.; Dec. 31, 1994; 14p; In English

Report No.(s): DE98-628552; IAE-5756/11; No Copyright; Avail: Department of Energy Information Bridge

The phenomenon of occurrence or absence of reflected positron beam depending on direction of gliding over slanting cut crystal is studied. The method of numerical integration of Schroedinger equation was applied to simulation of processes of coherent scattering of positron beams on near surface layers of single crystal. The method can be proposed as a practical probe of surface structure with a number of structural disturbances and also for calculation of RHEED.
NTIS
Gliding; Positrons; Reflection; Particle Beams

20000110046 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma (CRPP), Switzerland
Optimum third harmonic generation efficiency in the far infrared in Si, GaAs and InP
Brazis, R.; Raguotis, R.; Siegrist, M. R.; Dec. 31, 1997; 10p; In English
Report No.(s): DE98-616926; LRP-594/97; No Copyright; Avail: Department of Energy Information Bridge
We investigate by means of a Monte Carlo technique the nonlinear drift response of electrons to high power electromagnetic waves in Si, GaAs and InP. The first and third harmonic drift velocity amplitudes and phases are presented as function of the pumping wave frequency in the range of 200 to 500 GHz. The third harmonic generation efficiency is found to reach a maximum at a pumping wave amplitude of 10-25 kV/cm depending on the material and the lattice temperature. Cooling down to liquid nitrogen temperature results in an improvement of the efficiency by a factor of 2 to 10, depending on the material and the pumping wave amplitude. Cooled GaAs and InP are both an order of magnitude more efficient than Si at ambient temperature, for which to date the best measured performance has been reported.
NTIS
Harmonic Generations; Far Infrared Radiation

20000110102 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Magnetic excitations in intermediate valence semiconductors with singlet ground state
Kikoin, K. A.; Mishchenko, A.; Dec. 31, 1994; 16p; In English
Report No.(s): DE98-628546; IAE-5717/1; No Copyright; Avail: Department of Energy Information Bridge
The explanation of the origin inelastic peaks in magnetic neutron scattering spectra of the mixed-valent semiconductor SmB(sub 6) is proposed. It is shown that the excitonic theory of intermediate valence state not only gives the value of the peak frequency but also explains the unusual angular dependence of intensity of inelastic magnetic scattering and describes the dispersion of magnetic excitations in good agreement with experiment.
NTIS
Excitation; Inelastic Scattering; Neutron Scattering; Magnetic Fields

20000110212 Australian Inst. of Nuclear Science and Engineering, Lucas Heights, Australia
10th Australian conference on nuclear techniques of analysis. Proceedings
Dec. 31, 1998; 259p; In English; 10th; Australian conference on nuclear techniques of analysis
Report No.(s): DE98-626011; INIS-AU-0010; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
These proceedings contains abstracts and extended abstracts of 80 lectures and posters presented at the 10th Australian conference on nuclear techniques of analysis hosted by the Australian National University in Canberra, Australia from 24-26 of November 1997. The conference was divided into sessions on the following topics: ion beam analysis and its applications; surface science; novel nuclear techniques of analysis; characterization of thin films, electronic and optoelectronic material formed by ion implantation; nanometre science and technology; and plasma science and technology. A special session was dedicated to new nuclear techniques of analysis, future trends and developments. Separate abstracts were prepared for the individual presentation included in this volume.
NTIS
Conferences; Research and Development; Nondestructive Tests; Ion Beams; Ion Implantation; Nuclear Radiation; Measuring Instruments; Materials Tests

20000110253 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Stochastic approach to lattice vibration simulation in strongly anharmonic crystals: Possible breaking of phonon oscillation picture
Gornostyrev, Y.; Katsnel'son, M. I.; Tret'yakov, S. V.; Trefilov, A.; Dec. 31, 1994; 35p; In Russian; In English
Report No.(s): DE98-628559; IAE-5801/1; No Copyright; Avail: Department of Energy Information Bridge

It is shown that the description of strongly anharmonic crystals may be non adequately. Given results demonstrate peculiarities of lattice oscillations in the framework of this picture. Analysis of the results allows to give the qualitative explanation for the unusual features of lattice dynamics of titanium, zirconium and their based alloys.
NTIS
Lattice Vibrations; Crystal Lattices; Computerized Simulation

20000110256 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Determination of parameters of the crystal electric field in the compounds on the base of rare earth elements with low symmetry of local surrounding
Klement'ev, E.; Dec. 31, 1994; 44p; In Russian; In English
Report No.(s): DE98-628563; IAE-5822/9; No Copyright; Avail: Department of Energy Information Bridge
The method of determination of the crystalline electric field parameters (CEF) in rare-earth compounds with low symmetry of local surrounding is presented. This method is based on the analysis of the inelastic neutron scattering data. Advantages of the presented method have been illustrated by the determination of true CEF parameters of orthorhombic compounds RNiSn and RNi.
NTIS
Crystal Field Theory; Rare Earth Elements; Crystal Structure

20000110569 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Report on the results of efforts for fiscal 1997. Development of technologies for creating high-quality crystal materials for low-loss power control devices
Mar. 31, 1998; 270p; In Japanese; In English
Report No.(s): DE99-736796; ETDE/JP-99736796; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Basic technologies are developed for the manufacture of high-quality crystal materials large in diameter and homogeneous in property which will allow power control semiconductor devices to grow more sophisticated in function and to be lower in the loss they suffer. Physical properties of molten semiconductor and the like are measured accurately, which include surface tension, density, viscosity, electric conductivity, thermal conductivity, emissivity, diffusion coefficient, vapor pressure, heat capacity, contact angle, and solid solution equilibrium distribution coefficient. In computer-aided simulation, as in the previous year, simulation codes are developed for the analysis of flow, temperature distribution, and diffusion behavior in the gas phase; simulation codes are developed for the analysis of 3D unsteady thermal flows in the melt; and a main program is developed which governs experimental calculations. As for experiments in model Czochralski crucibles, small crucible are used in which experiments are conducted in the temperature range of normal to 200 C for the acquisition of experimental data for verification. Measured by use of the model crucibles are the temperature distribution in the bath, the surface flow speeds, and the flows inside the melt.
NTIS
Crystals; Control Equipment

20000110583 NASA Marshall Space Flight Center, Huntsville, AL USA
Quantifying Main Trends in Lysozyme Nucleation: The Effect of Precipitant Concentration and Impurities
Burke, Michael W., Alliance for Microgravity Materials Science and Applications, USA; Judge, Russell A., Alliance for Microgravity Materials Science and Applications, USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only
Full factorial experiment design incorporating multi-linear regression analysis of the experimental data allows the main trends and effects to be quickly identified while using only a limited number of experiments. These techniques were used to identify the effect of precipitant concentration and the presence of an impurity, the physiological lysozyme dimer, on the nucleation rate and crystal dimensions of the tetragonal form of chicken egg white lysozyme. Increasing precipitant concentration was found to decrease crystal numbers, the magnitude of this effect also depending on the supersaturation. The presence of the dimer generally increased nucleation. The crystal axial ratio decreased with increasing precipitant concentration independent of impurity.
Author
Impurities; Lysozyme; Nucleation; Concentration (Composition); Dimers; Precipitates

20000110584 NASA Marshall Space Flight Center, Huntsville, AL USA
The Preparation Conditions of Chromium Doped ZnSe and Their Effect on The Infrared Luminescence Properties
Burger, A., Fisk Univ., USA; Chattopadhyay, K., Fisk Univ., USA; Ndap, J.-O., Fisk Univ., USA; Ma, X., Fisk Univ., USA; Morgan, S. H., Fisk Univ., USA; Rablau, C. I., West Virginia Univ., USA; Su, C.-H., NASA Marshall Space Flight Center, USA; Feth,

S., NASA Marshall Space Flight Center, USA; Page, Ralph H., Lawrence Livermore National Lab., USA; Schaffers, Kathleen I., Lawrence Livermore National Lab., USA; Rose, M. Franklin, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 12th; Crystal Growth and Epitaxy, 13-18 Aug. 2000, Vail, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We report the investigation by photoluminescence lifetime measurements of the near-IR emissions from a series of chromium-doped ZnSe samples, correlated to their preparation conditions. The samples were polycrystalline or single crystals prepared by post growth diffusion doping or single crystals doped during growth by the Physical Vapor Transport method. Room temperature lifetime values between 6 and 8 microseconds were measured for samples with Cr (2+) concentrations from low 10 (exp 17) to high 10 (exp 18) per cubic centimeter range. Lifetime data taken down to 78 K was found to be rather temperature independent, reconfirming previous reports indicating a quantum yield of the corresponding emission of close to 100% at room temperature. A strong decrease in the room temperature lifetime was found for chromium concentrations higher than 10 (exp 19) per cubic centimeter.

Author

Near Infrared Radiation; Photoluminescence; Doped Crystals; Chromium; Zinc; Selenium

20000110587 NASA Marshall Space Flight Center, Huntsville, AL USA

Homoepitaxial ZnO Film Growth

Zhu, Shen, Universities Space Research Association, USA; Su, C-H, NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Harris, M. T., Air Force Research Lab., USA; Callahan, M. J., Air Force Research Lab., USA; McCarty, P., Alabama Univ., USA; George, M. A., Alabama Univ., USA; [2000]; 1p; In English; Physics and Chemistry of II-VI Materials, 30 Oct. - 2 Nov. 2000, Albuquerque, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only

ZnO films have high potential for many applications, such as surface acoustic wave filters, UV detectors, and light emitting devices due to its structural, electrical, and optical properties. High quality epitaxial films are required for these applications. The Al2O3 substrate is commonly used for ZnO heteroepitaxial growth. Recently, high quality ZnO single crystals are available for grow homoepitaxial films. Epitaxial ZnO films were grown on the two polar surfaces (O-face and Zn-face) of (0001) ZnO single crystal substrates using off-axis magnetron sputtering deposition. As a comparison, films were also deposited on (0001) Al2O3 substrates. It was found that the two polar ZnO surfaces have different photoluminescence (PL) spectrum, surface structure and morphology, which strongly influence the epitaxial film growth. The morphology and structure of homoepitaxial films grown on the ZnO substrates were different from heteroepitaxial films grown on the Al2O3. An interesting result shows that high temperature annealing of ZnO single crystals will improve the surface structure on the O-face surface rather than the opposite surface. The measurements of PL, low-angle incident x-ray diffraction, and atomic force microscopy of ZnO films indicate that the O-terminated surface is better for ZnO epitaxial film growth.

Author

Epitaxy; Zinc Oxides; Metal Films; Crystal Growth; Aluminum Oxides; Single Crystals

20000110612 Ames Lab., IA USA

Wave Propagation in Ordered, Disordered, and Nonlinear Photonic Band Gap Materials

Lidorikis, E.; Dec. 10, 1999; 156p; In English

Report No.(s): DE00-754789; IS-T 1890; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

No abstract prepared.

NTIS

Order-Disorder Transformations; Wave Propagation; Nonlinear Optics; Photonics

20000110613 Federal Energy Technology Center, Morgantown, WV USA

Experimental study of the effects of annealing time, equilibrium angle, and absolute misorientation angle on thermal grain-boundary groving in cube-texture nickel

Conrad J. Simon,; May 01, 1999; 94p; In English

Report No.(s): DE00-754431; DE-AC22-95PC95231-28; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Several technical problems are associated with the rolling-assisted biaxially-textured substrates (RABiTS) method of fabricating long lengths of high-temperature superconducting wire. For example, controlling or eliminating thermal grain-boundary groove defects on the Ni base layer of the substrate is an important concern. Thermal grooves on the surface of the Ni may have the potential to cause cracks or growth defects to form in the buffer and superconducting layers which are epitaxially deposited on the Ni. Thus, the effects of annealing time, equilibrium angle, and absolute misorientation angle on thermal grain-boundary

grooving in cube-textured nickel were investigated. Small samples of RABiTS Ni were recrystallized at 800 C for times of 10, 30, 60, and 120 minutes to produce diffusion-induced thermal grooves on their surfaces. The linear dimensions and equilibrium angles these grooves were measured using atomic force microscopy. The misorientations of grains at triple point junctions were measured using electron back-scatter diffraction, and the cube-texture of the samples was analyzed with x-ray diffraction. Grain size measurements were also made on each sample. The linear dimensions of grooves evolved with annealing time in accordance with Mullins' theory of thermal grooving. Average groove depths increased with increasing equilibrium angle; however, there was only a slight tendency for groove depth to increase with increasing absolute misorientation angle. In general, groove depths did not exceed 650 (angstrom). The cube texture and grain size of the samples were typical of RABiTS Ni.
NTIS
High Temperature Superconductors; Nickel; Textures; Metal Surfaces; Wire; Defects; Fabrication

20000110614 Federal Energy Technology Center, Morgantown, WV USA
Development of in-situ control diagnostics for application of epitaxial superconductor and buffer layers
Winkleman, B. C.; Giel, T. V.; Jason Cunningham,; Jul. 30, 1999; 32p; In English
Report No.(s): DE00-754430; DE-AC22-95PC95231-27; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The recent achievements of critical currents in excess of 1 x 10(exp 6) amp/sq. cm at 77 K in YBCO deposited over suitably textured buffer/substrate composites have stimulated interest in the potential fabrication of these coated conductors as wire. Numerous approaches and manufacturing schemes for producing coated conductor wire are currently being developed. Recently, under the US DOE's sponsorship, the University of Tennessee Space Institute performed an extensive evaluation of leading coated conductor processing options. In general, it is their feeling that the science and chemistry that are being developed in the coated conductor wire program now need proper engineering evaluation to define the most viable options for a commercial fabrication process. All fabrication processes will need process control measurements. This report provides a specific review of the needs and available technologies for process control for many of the coated conductor processing options. This report also addresses generic process monitoring areas in which additional research and development is needed. The concentration is on the two different approaches for obtaining the textured substrates that have been identified as viable candidates. These are the Los Alamos National Laboratory's ion-beam assisted deposition, called IBAD, to obtain a highly textured yttria-stabilized zirconia (YSZ) buffer on nickel alloy strips, and Oak Ridge National Laboratory's rolling assisted, bi-axially textured substrate option called RABiTS(TM).
NTIS
YBCO Superconductors; Fabrication; Process Control (Industry); Wire; Yttria-Stabilized Zirconia; Metal Strips; Ion Beams; Epitaxy

20000110633 Institute of Physical and Chemical Research, Tokyo, Japan
"1/8 Effect" in High-T c Superconductors: Bi-2212 and YBCO Systems
Watanabe, Isao, Institute of Physical and Chemical Research, Japan; Akosima, Megumi, Tohoku Univ., Japan; Aoyama, Masashi, Tohoku Univ., Japan; Koike, Yoji, Tohoku Univ., Japan; Ohira, Seiko, Institute of Physical and Chemical Research, Japan; Higemoto, Wataru, High Energy Accelerator Research Organization, Japan; Nagamine, Kanetada, Institute of Physical and Chemical Research, Japan; RIKEN Review: Focused on Frontiers of Magnetism Studies with Microscopic Probes; April 2000; ISSN 0919-3405, No. 27, pp. 45-46; In English; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Muon spin relaxation ((mu)SR) measurements were applied to Bi2SR2Ca(1-y),(Cu(1-y)Zn(y))2O(8+delta) and YBa2Cu(3-2y)Zn(2y)O(7-delta), around the hole concentration rho = 1/8 per Cu. An enhancement of the dynamical muon-spin depolarization rate was observed at low temperatures in both systems, indicating an enhancement of the magnetic correlation between Cu spins. Our (mu)SR results on both systems suggest the existence of the so-called 1/8-effect. The field dependence of the dynamical muon-spin depolarization rate in the Zn-substituted Bi-2212 system around the hole concentration rho = 1/8 per Cu shows square-root dependence at 0.30 K. This square-root field dependence can be explained by the existence of a one-dimensional stripe correlation between spins and holes.
Author
YBCO Superconductors; High Temperature Superconductors; Muon Spin Rotation; Magnetic Relaxation

20000111077 NASA Marshall Space Flight Center, Huntsville, AL USA
A Novel Approach to Solving the Problem of Needle Microcrystals (A Case Study of Ribosome Crystals)
Karpova, Elizaveta A., NASA Marshall Space Flight Center, USA; Tarahovsky, Yuri S., Academy of Sciences (USSR), USSR; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Different morphology crystals (needle, rod-tetragonal and wedge-shaped) were grown from the same solution of ribosome; furthermore, in the same drop using 10- 15% 2-methyl-2,4pentanediol as a precipitant. The crystals appeared in 5-48 hours. Observations of the kinetics of crystals appearance lead to the conclusion that higher supersaturation of ribosome solution produces needle-shaped crystals, while the tetragonal-rod and the wedge-shaped crystals grow at lower supersaturation. The ribosome packing in the crystals was characterized by electron microscopy (EM). An analysis of EM ultrathin sections indicates that the unit cells, with a high degree of probability, are the same in the crystals of different morphology. The data obtained suggests how to shift the process of crystal formation from the needles to the crystals with comparative size in all three dimensions.
Author
Morphology; Crystal Growth; Microcrystals; Methyl Compounds; Data Acquisition

20000111080 NASA Marshall Space Flight Center, Huntsville, AL USA
Role of Vibration-Induced Streaming in Float-Zone Crystal Growth
Anilkumar, A. V., Vanderbilt Univ., USA; Grugel, R. N., NASA Marshall Space Flight Center, USA; Lee, C. P., Vanderbilt Univ., USA; [2000]; 1p; In English; Aerospace Science Meeting, 8-12 Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This presentation will examine in detail the role of vibration-induced streaming flow in the context of float-zone crystal growth. It is very well known that during float-zone materials processing, the naturally occurring temperature gradients along the zone surface impose a thermocapillary flow in the zone. Under certain processing conditions, the thermocapillary flow can also become nonsteady (oscillatory). The presence of thermocapillary flow is detrimental to crystal quality, for it can promote non-uniform dopant distribution and crystal striations. to null this effect we have imposed a counter streaming flow in the zone, via end-wall vibration. This technique has been adapted to float-zone processing of Sodium Nitrate-Barium Nitrate eutectic alloys, under both steady and nonsteady thermocapillary flow conditions. The beneficial effects of counter streaming flow have been clearly brought out through the before and after comparisons of the crystal microstructure. In addition, we are also examining the theoretical underpinnings of the balancing of thermocapillary flows with vibration-driven counter flows in float-zones.
Author
Crystal Growth; Zone Melting; Vibration Effects; Steady Flow; Capillary Flow; Barium Alloys

20000112921 NASA Marshall Space Flight Center, Huntsville, AL USA
Control of Melt Convection Using Traveling Magnetic Fields
Mazuruk, Konstantin, NASA Marshall Space Flight Center, USA; [2000]; 7p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An axisymmetric traveling magnetic wave induces a meridional base flow in a cylindrical zone of an electrically conducting liquid. This remotely induced flow can be conveniently controlled, in magnitude and direction, and can have benefits for crystal growth applications. In particular, it can be used to offset natural convection. Theoretical basics of this new technological method are presented.
Author
Magnetic Fields; Convective Flow; Melts (Crystal Growth); Meridional Flow

20000113838 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Electron-phonon interaction of strong correlated systems. Strong coupling limit
Moskalenko, V. A.; Dec. 31, 1997; 11p; In Russian; In English
Report No.(s): DE98-627240; JINR-R-17-97-248; No Copyright; Avail: Department of Energy Information Bridge

The Hubbard-Holstein model, containing interaction between localized electrons and dispersionless phonons, is investigated. The frequency of collective mode of the phonon cloud surrounding polaron is determined in strong coupling limit. The influence of this mode radiation and adsorption processes on the energy spectrum of both localized and delocalized polarons is established. The motion of the delocalized polarons is described in the chain diagram approximation, that is without taking into account many-particles irreducible Green functions of polarons.
NTIS
Electron Phonon Interactions; Particle Interactions

20000113839 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR
Optical constants of high temperature superconductor YBa2Cu3O(7-(delta) in a large spectral range
Tyutyunnikov, S. I.; Shalyapin, V. N.; Shashkov, S. N.; Scintee, N.; Dec. 31, 1997; 12p; In Russian; In English
Report No.(s): DE98-627239; JINR-R-14-97-299; No Copyright; Avail: Department of Energy Information Bridge

The paper presents the results on measurement of reflection spectra of superconducting YBa2Cu3O(7-(delta)) films in the (nu)=10-30000 cm(exp -1) spectral range. by means of the Kramers-Kronig method the real and imaginary part of dielectric permeability of the optical conductivity spectral dependencies were obtained. For the superconducting phase the (nu)(sub 1)=155 cm(exp -1), (nu)(sub 2)=325 cm(exp -1), (nu)(sub 3)=573 cm(exp -1) phonon modes were obtained. In the spectrum visible part the optical gap value related to the E(sub g)=2.1 eV charge transfer was determined. Near the optical gap an absorption line at Tis less than 150 K was found.
NTIS
Superconducting Films; Optical Reflection; YBCO Superconductors

20000113840 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Dynamics of Ni64Zr36 metallic glass by neutron scattering with isotope contrast
Syrykh, G. F.; Zemlyanov, M. G.; Ishmaev, S. N.; Chimid, G.; Dec. 31, 1997; 8p; In Russian; In English
Report No.(s): DE98-627238; JINR-R-14-97-297; No Copyright; Avail: Department of Energy Information Bridge
Inelastic neutron scattering study with isotope substitution for Ni has been performed on the Ni64Zr36 amorphous alloy. The measurements were made for two samples: 1) natural mixture of Ni isotopes and 2) 99.5% enriched Ni-60 isotope (neutron cross-sections - 18 barns and 1.08 barns, respectively). This has enabled the model-independent reconstruction of the Ni and Zr partial vibrational density of states. Weakening of the interatomic interaction constant for Ni atoms has been established.
NTIS
Nickel Isotopes; Metallic Glasses; Neutron Scattering; Inelastic Scattering

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PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

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

20000109923 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Riemann surfaces of some static dispersion models and projective spaces
Meshcheryakov, V. A.; Dec. 31, 1997; 12p; In Russian; In English
Report No.(s): DE98-618205; JINR-R-2-97-107; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The S-matrix in the static limit of a dispersion relation has a finite order N and is a matrix of meromorphic functions of energy (omega) in the plane with cuts (-(infinity), -1), (+1, +(infinity)). In the elastic case it reduces to N functions S(sub i)((omega)) from the physical sheet to unphysical ones can be treated as a nonlinear system of difference equations. It is shown that a global analysis of this system can be carried out effectively in projective spaces P(sub N) and P(sub N+1). The connection between spaces P(sub N) and P(sub N+1) is discussed.
NTIS
Riemann Manifold; Static Models

20000110090 Joint Inst. for Nuclear Research, Laboratory of High Energies, Dubna, USSR
Final state interaction in multichannel quantum systems and pair correlations of non-identical and identical particles at small relative velocities
Lednicky, R.; Lyuboshits, V. L.; Lyuboshits, V. V.; Dec. 31, 1997; 31p; In Russian; In English
Report No.(s): DE98-627241; JINR-R-2-97-290; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The influence of final state interaction on the pair correlations of identical and non-identical particles at small relative velocities is investigated in the framework of the source model. Both the elastic scattering of final particles and binary reactions in the final state are taken into account. In connection with this, the low-energy s-wave multichannel scattering of neutral and charged particles has been analyzed. Using the unitarity condition for scattering amplitudes, the integral relations for wave functions of relative motion in two-particle quantum systems with an arbitrary number of bound channels have been derived; for charged particles the contribution of Coulomb interaction is involved. On the basis of the developed formalism, the approximate analytical formulae have been obtained which express pair correlation functions of neutral and charged particles through scattering amplitudes and their momentum derivatives. The matrix parametrization of s-wave multichannel scattering amplitudes, satisfying the unitarity condition and generalizing the well-known one-channel ''effective radius'' approximation, has been considered. The

possibilities of applying isotopic relations for scattering lengths and amplitudes to the description of pair correlations, like (pi(sup +)pi(sup -), pi(sup 0)pi(sup 0)), (pi(sup -)p, pi(sup 0)n), (K(sup +)K(sup -), K(sub S)(sup 0)K(sub S)(sup 0)), are discussed.
NTIS
Charged Particles; Neutral Particles; Coulomb Collisions; Correlation; Quantum Mechanics

20000110184 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
New degrees of freedom of spectral control of physical systems: Changing 'nonphysical' spectral parameters
Zakhar'ev, B. N.; Chabanov, V. M.; Torchinov, V. V.; Dec. 31, 1998; 15p; In Russian; In English
Report No.(s): DE99-614527; JINR-R-4-98-176; No Copyright; Avail: Department of Energy Information Bridge

The possibilities of transformations of quantum systems in the inverse problem approach are supplemented by exact models of creation of non-normalizable states in supersymmetrical quantum mechanics (SUSYQ). The apparat of SUSYQ-transformations allows one to change spectral weight factors for all (infinite number (exclamation-point)) physical states simultaneously using simple analytical expressions for creation of 'nonphysical' states. The corresponding exactly solvable models enrich our intuition of the directed influence on quantum systems. The effect is demonstrated of spatial shifts of the chosen bound state (physical) while nonphysical state is approaching it. That resembles the spatial repulsion of physical states which approach one another on the energy scale.
NTIS
Spectrum Analysis; Degrees of Freedom; Quantum Mechanics

20000110206 Oslo Univ., Norway
Tests of the Electroweak Theory with the DELPHI detector at LEP
Dam, M.; Apr. 30, 1995; 290p; In English
Report No.(s): DE98-626456; NEI-NO-894; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this thesis, precision tests of the electroweak theory with the DELPHI detector at LEP are presented. Two main areas of experimental investigation have been pursued. In the first, the Z(o) resonance parameters were determined through precise measurements of the cross section for Z(o) production and decay into hadronic and leptonic final states at several collision energies close to the peak of the resonance. Precise measurements of the resonance parameter (the mass, the width, and the peak cross section) provide interesting constraints on the electroweak theory. In particular, the width and the peak cross section depend on the number of neutrino species in nature. The LEP data showed that the number of neutrinos is three. In the second main area of investigation the longitudinal polarisation of tau leptons produced in Z(o) decays was determined. The polarisation and its dependence on the production polar angle was deduced from an analysis of the kinematics of the tau decay products. About 40x10(exp 3) tau pair events from Z(o) decays were analysed. Assuming electron-tau universality the results of the measurement can be expressed in terms of the effective weak mixing angle.
NTIS
Electroweak Model; Storage Rings (Particle Accelerators); Neutrinos; Particle Decay; Particle Production; Bosons; Hadrons; Leptons

20000110233 Joint Inst. for Nuclear Research, Lab. of Computing Techniques and Automation, Dubna, USSR
Analysis of exotic structure K(1630) (yields) K(sub s)(sup 0)(pi)(sup +)(pi) (sup -)
Karnaukhov, V. M.; Moroz, V. I.; Koka, K.; Dec. 31, 1998; 20p; In Russian; In English
Report No.(s): DE99-614523; JINR-R-1-98-169; No Copyright; Avail: Department of Energy Information Bridge

Processes with a narrow structure at M(approx) 1.63 GeV/c(sup 2) in the effective mass spectrum of K(sub s)(sup 0)(pi)(sup +)(pi)(sup -) are selected at study of 16 GeV/c (pi)(sup -)p interactions. The structure is produced in processes with large momenta transfers. Peculiarities of kinematical distributions are found for events from the structure region. These peculiarities are connected, possibly, with inner clusterization mechanism and spin of exotic resonant state.
NTIS
Momentum Transfer; Structures

20000110236 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
L(sub n)-bar, g-spaces: General relativity over V(sub 4)-bar - spaces
Manoff, S.; Kolarov, A.; Dimitrov, B.; Dec. 31, 1998; 25p; In English
Report No.(s): DE99-614520; JINR-E-5-98-184; No Copyright; Avail: Department of Energy Information Bridge

The results from the considerations of differentiable manifolds with contravariant and covariant affine connections and metrics are specialized for the case of (L(sub n) bar, g)-spaces with metric transport (nabla)(sub (xi)) g = 0 for all (xi) is T (M), g(sub

ij;k) = 0 and f(sub j)(sup i) = e(sup phi) (center-dot) g(sub j)(sup i) the s.c. (pseudo)Riemannian spaces with contravariant and covariant symmetric affine connections. Einstein's theory of gravitation is considered in (pseudo)Riemannian spaces with different (not only by sign) contravariant and covariant affine connections V(sub n)(bar)-spaces, n + 4. The Euler-Lagrange equations and the corresponding energy-momentum tensors (EMT-s) are obtained and compared with the Einstein equations and the EMT-s in V(sub 4)-spaces. The geodesic and autoparallel equations in V(sub 4) bar -spaces are found as different equations in contrast to the case of V(sub 4) -spaces.
NTIS
Manifolds (Mathematics); Riemann Manifold

20000110250 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Algorithm for research of mathematical physics equations symmetries: Symmetries of the free Schroedinger equation
Kotel'nikov, G.; Dec. 31, 1994; 24p; In English
Report No.(s): DE98-628556; IAE-5778/1; No Copyright; Avail: Department of Energy Information Bridge
An algorithm id proposed for research the symmetries of mathematical physics equation. The application of this algorithm to the Schroedinger equation permitted to establish, that in addition to the known symmetry the Schroedinger equation possesses also the relativistic symmetry.
NTIS
Theoretical Physics; Schroedinger Equation

20000113843 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Direct mode summation for the Casimir energy of a solid ball
Brevik, I.; Nesterenko, V. V.; Pirozhenko, I. G.; Dec. 31, 1997; 19p; In English
Report No.(s): DE98-627226; JINR-E-2-97-307; No Copyright; Avail: Department of Energy Information Bridge
The Casimir energy of a solid ball placed in an infinite medium is calculated by a direct frequency summation using the contour integration. First it is assumed that the permittivity and permeability of the ball and medium satisfy the condition (epsilon)(sub 1)(mu)(sub 1)=(epsilon)(sub 2)(mu)(sub 2). Then the calculations are extended to the dilute dielectric ball ((epsilon)(sub 1)-(epsilon)(sub 2))(sup 2)/((epsilon)(sub 1)+(epsilon)(sub 2))(sup 2)<< 1. The Casimir energy for the last configuration turns out to be positive, it being increased when the radius of the ball decreases. The latter eliminates completely the possibility of explaining, via the Casimir effect, the sonoluminescence for bubbles in a liquid.
NTIS
Frequencies; Energy

20000113845 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Dual symmetry in gauge theories
Koshkarov, A. L.; Dec. 31, 1997; 27p; In English
Report No.(s): DE98-627223; JINR-E-2-97-249; No Copyright; Avail: Department of Energy Information Bridge
Continuous dual symmetry in electrodynamics, Yang-Mills theory and gravitation is investigated. Dual invariant which leads to badly nonlinear motion equations is chosen as a Lagrangian of the pure classical dual nonlinear electrodynamics. In a natural manner some dual angle which is determined by the electromagnetic strengths at the point of the time-space appears in the model. Motion equations may well be interpreted as the equations of the standard Maxwell theory with source. Alternative interpretation is the quasi-Maxwell linear theory with magnetic charge. Analogous approach is possible in the Yang- Mills theory. In this case the dual-invariant non-Abelian theory motion equations possess the same instanton solutions as the conventional Yang-Mills equations have. An Abelian two-parameter dual group is found to exist in gravitation. Irreducible representations have been obtained: the curvature tensor was expanded into the sum of twice anti-self-dual and self-dual parts. Gravitational instantons are defined as (real)solutions to the usual duality equations. Central symmetry solutions to these equations are obtained. The twice anti-self-dual part of the curvature tensor may be used for introduction of new gravitational equations generalizing Einstein''s equations. However, the theory obtained reduces to the conformal-flat Nordstroem theory.
NTIS
Gauge Theory; Symmetry; Electrodynamics; Yang-Mills Theory; Gravitation

20000113846 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR
Dynamical analogy of the Cabibbo-Kobayashi-Maskawa matrices (with CP-violation)
Beshtoev, K.; Dec. 31, 1997; 16p; In English
Report No.(s): DE98-627222; JINR-E-2-97-210; No Copyright; Avail: Department of Energy Information Bridge

The dynamical analogy of the Cabibbo-Kobayashi-Maskawa matrices is built, i.e., the phenomenological expansion of the weak interaction theory by the inclusion of four doublets of the charged-vector bosons B(sup (+/-)), C(sup (+/-)) , D(sup (+/-)), E(sup (+/-)), leading to transitions between the quark families, and of four doublets of the charged-vector bosons X(sub 1)(sup (+/-)), X(sub 2) (sup (+/-)), X(sub 3)(sup (+/-)), X(sub 4)(sup (+/-)), leading to transitions between the lepton families, is suggested. The bosons E(sup (+/-)), X(sub 4)(sup (+/-)) realize CP-violation. This expansion works only at a tree level. An estimation of the boson masses is performed. The quasi-elastic processes proceeding through an exchange of the bosons and the production cross sections are given.
NTIS
Analogies; Invariance; Weak Interactions (Field Theory); Matrices (Mathematics)

20000113847 Joint Inst. for Nuclear Research, Lab. of High Energies, Dubna, USSR
NNLO QCD analysis of CCFR data on xF(sub 3) structure function and Gross-Llewellyn Smith sum rule with higher twist and nuclear corrections
Sidorov, A. V.; Tokarev, M. V.; Dec. 31, 1997; 15p; In English
Report No.(s): DE98-627221; JINR-E-2-97-203; No Copyright; Avail: Department of Energy Information Bridge
A detailed NNLO QCD analysis of new CCFR data on xF(sub 3) structure function including the target mass, higher twist and nuclear corrections was performed and parametrizations of the perturbative and power terms of the structure function were constructed. The results of QCD analysis of the structure function were used to study the Q(sup 2)-dependence of the Gross-Llewellyn Smith sum rule. The (alpha)(sub S)/(pi)-expansion of S(sub GLS)(Q(sup 2)) was studied and parameters of the expansion were found to be s(sub 1) =2.74(+/-)0.01, s(sub 2)=-2.22(+/-)0.23, s(sub 3)=-7.86(+/-)1.74 which are in good agreement with the perturbative QCD predictions for the Gross-Llewellyn Smith sum rule in the next-to-leading and next-to-next-to-leading order.
NTIS
Quantum Chromodynamics; Correction

20000114810 Paul Scherrer Inst., Villigen, Switzerland
Path integrals in quantum physics: Lectures given at ETH Zurich during summer semester 1997
Rosenfelder, R.; Dec. 31, 1997; 127p; In German; In English
Report No.(s): DE98-616932; PSI-97-12; No Copyright; Avail: Department of Energy Information Bridge
This lectures aim at giving graduate students an introduction to a working knowledge of path integral methods in a wide variety of fields in physics. Consequently, the the lecture notes are organized in three main parts dealing with non-relativistic quantum mechanics, many-body physics and field theory. In the first part the basic concepts of path integrals are developed in the usual heuristic, non-mathematical way followed by the standard examples of quadratic Lagrangians for which the path integrals can be solved exactly. Applications include semi-classical expansions, scattering problems and the representation of Green functions as path integrals. In the last chapter of this part it is shown how (euclidean) path integrals can be treated numerically by Monte-Carlo methods with a program for the anharmonic oscillator as an explicit example. The second part deals with the application of path integrals in statistical mechanics and many-body problems. Various chapters treat the partition functions, the polaron problem as a non-relativistic field theory and path integrals over ordinary and Grassmannian coherent states. Perturbation theory and the diagrammatic rules are derived in an unified way for both bosons and fermions and illustrated by simple examples. Finally, in the third part path integrals in relativistic quantum field theory are discussed. Standard topics like the generating functional for Green functions, perturbative expansions, effective actions and quantization of gauge theories are treated. Some special applications (the wordline formalism and spin in relativistic path integrals, the derivation of anomalies by path integral methods) are contained in additional chapters. The last section tries to give a simple introduction into lattice (gauge) field theory including a numerical example which can be run on a PC. The set of problems which accompanied the lectures is also included in the present notes.
NTIS
Integrals; Quantum Mechanics; Field Theory (Physics); Many Body Problem; Statistical Mechanics

20000114814 Centre National de la Recherche Scientifique, Lab. de Physique Subatomique et des Technologies Associees, Nantes, France
Search for production of strangelets in quark matter using particle correlations
Soff, S.; Ardouin, D.; Spieles, C.; Bass, S. A.; Stoecker, H.; Dec. 31, 1997; 20p; In English
Report No.(s): DE98-617549; SUBATECH-97-14; No Copyright; Avail: Department of Energy Information Bridge

A new technique for observing the strangelet production in quark matter based on unlike particle correlations is presented. A simulation is presented with a two-phase thermodynamical model.
NTIS
Quarks; Strangeness; Matter (Physics)

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

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

20000110509 Old Dominion Univ., Norfolk, VA USA
1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, *7 Jun. - 13 Aug. 1999*
Tiwari, Surendra N., Compiler, Old Dominion Univ., USA; Murray, Deborah B., Compiler, Old Dominion Univ., USA; August 2000; 112p; In English; See also 20000110510 through 20000110545
Contract(s)/Grant(s): NGT1-52208
Report No.(s): NASA/CR-2000-210092; NAS 1.26:210092; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Since 1964, the National Aeronautics and Space Administration (NASA) has supported a program or summer faculty fellowships for engineering and science educators. In a series of collaborations between NASA research and development centers and nearby universities, engineering faculty members spend 10 weeks working with professional peers on research. The Summer Faculty Program Committee of the American Society for Engineering Education supervises the programs. Objectives: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate and exchange ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of participants' institutions; (4) to contribute to the research objectives of the NASA center. Program Description: College or university faculty members will be appointed as Research Fellows to spend 10 weeks in cooperative research and study at the NASA Langley Research Center. The Fellow will devote approximately 90 percent of the time to a research problem and the remaining time to a study program. The study program will consist of lectures and seminars on topics of interest or that are directly relevant to the Fellows' research topics. The lecture and seminar leaders will be distinguished scientists and engineers from NASA, education, and industry.
Author
Education; Engineering; NASA Programs; Summer

20000110513 Old Dominion Univ., Dept. of Foreign Languages, Norfolk, VA USA
NASA/NSU/NAF Pre-Service Teacher Institute
Brignoni, Gladys, Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 50; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Over the past decade, American citizens have become increasingly aware of the quality of education provided to the nation's youth and the resultant state of their intellectual skills. Several factors have pushed concern about the quality of the nation's science and mathematics education to the fore. First, test results of student performance in science and mathematics and related subject areas indicate that America's students perform poorly in comparison to students of other Western industrialized countries. Second, the USA appears to be losing its competitive advantage in the world economy and a portion of this loss relates to technology intensive industries and services. Related to these concerns, the average citizen needs to understand science and mathematics better as we enter a more technologically-intensive, global economy in the 2lst century. On July National Science Board issued a statement urging "all stakeholders 1998, the in our vast grass-roots system of K-12 education to develop a nation-wide consensus for a common core of knowledge and competency in mathematics and science". In response to this drive, NASA and Norfolk State University combined their efforts to design and offer a Pre-service Teacher Institute to increase participants' skills in teaching mathematics and science while incorporating technology in the curriculum. It was hoped that this would be achieved through the development of a problem-based Aeronautics theme. This year's theme was "To Mars and Back". This particular mission entailed the following scenario: "There are rocks on Mars that have medicinal properties, which will cure all of the ills on Earth. Your job is to harvest those rocks and return them safely to Earth". Students were randomly divided into various flight teams. Each flight team had to address one aspect of this mission and present it to the class. In addition to offering this institute to pre-service teachers, National Aeronautics and Space Administration (NASA) Norfolk State University (NSU) and National Science Foundation

(NSF) decided to initiate a similar institute for university faculty members, involved in k-12 teacher preparation and enhancement. My particular involvement in this project entailed the design and the implementation of such institute.
Derived from text
Instructors; Mathematics; Science; NASA Programs

20000110528 Virginia Best Practice Centers, Virginia Beach, VA USA
Educational Outreach and Advocacy Plan: Cultivating Langley Research Center Advocacy Through Educational Opportunities
House, Patricia L., Virginia Best Practice Centers, USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 66; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

At no time in American history has education and the acquisition of knowledge been more in the forefront than in the present. At the same time, many challenges confront public and private educational organizations requiring them to adjust to profound and rapid technological and social changes. Perhaps one of the greatest challenges is determining how to function and operate in a national ”knowledge-based” economy that is constantly being reshaped by advances made in Information and communications technology. The new economy is redefining the classrooms educator, and learner. With worldwide access to knowledge through the Internet and the World Wide Web, schools will be thought of less as buildings or facilities and more as communities of knowledge and learners. The challenges facing education are further complicated by an accelerating rate of technological and social change that dramatically increases the rate at which data, Information, and knowledge are rendered obsolete. Since its creation in 1958, the National Aeronautics and Space Administration (NASA) has had a strong commitment to education- This emphasis has been reinforced in NASA Administrator Daniel Goldin’s congressional address, the NASA Strategic Plan 1998, and the NASA Implementation Plan for Education 1999-2003. NASA and the lAngley Research Center (LaRC) are natural partners in the educational efforts of the educational community, especially in the areas of science, mathematics, geography, engineering, and technology. LaRC’s specialized facilities and personnel, close working relations with the research and development community, and technological capabilities are leading factors in LaRC’s Office of Education’s efforts to cultivate and advance its advocacy role in education and outreach. An outreach and advocacy plan for cultivating LaRC advocacy through educational opportunities was designed. Input from representatives of all programs within the LaRC Office of Education, research investigations, and data analysis and interpretation were utilized in the plan’s development. The plan includes background information, a rationale, advocacy considerations, goals, objectives, major actions, and recommendations Specific initiatives categorized for students, educators, and national community leaders are proposed in the plan. Each initiative contains strategies, timelines, estimated costs, and anticipated impacts. Functional responsibilities within the Office of Education are designated for each initiative. The plan was submitted to the Director of the Office Education, who, in turn, presented it to the LaRC Senior Council. An implementation plan will be developed for executing the research and advocacy plan.
Author
Education; NASA Programs; Project Planning

20000110543 Old Dominion Univ., Dept. of Engineering Management, Norfolk, VA USA
An Analysis of Technology Supported Learning Infrastructure Using Technology Policy Modelling Techniques
Young, Rochelle K., Old Dominion Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 83; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Technology supported and distance learning capability permits many Federal Agencies, including NASA to provide the best and most flexible training opportunities to their employees. Learners have access to multimedia instruction, synchronous and asynchronous instruction, as well as televised instruction from world-renowned experts in a variety of areas. Administering these programs are challenging because of the amount of resources needed for smooth and effective operations. In order to consider all aspects of TSL, such as web-based instruction, distance learning, and etc., it was necessary to consider how these types of technology affect NASA training operations at every level of the organization. A Technology Policy Modeling tool was used to explore the possibility of developing TSL collaborative arrangements throughout NASA, though similar models exists in other Federal Agencies,the focus of this study was specific to NASA. This modeling tool sought to determine whether or not one or many governing bodies should monitor NASA training centers; how new policy would affect training throughout NASA, and finally determine what are the economic implications of technology supported learning through NASA. Several research centers participated in surveys that addressed distance learning objectives and goals as well as goals in other input from NASA training centers. Statistical analysis and contextual interpretations were conducted on the data collected. Based on these analysis tools and

supporting literature, it is concluded that more research in technology policy development is needed to determine how to provide technology policy for NASA's training mission.
Author
Learning; Technologies; Policies; Models

20000113066 Michigan Univ., Dept. of Materials Science and Engineering, Ann Arbor, MI USA
The Advanced Materials and Processing Education Center
Goldman, R. S., Michigan Univ., USA; Clark, D., Michigan Univ., USA; Ghosh, A., Michigan Univ., USA; Kendig, L. P., Michigan Univ., USA; Mansfield, J. F., Michigan Univ., USA; McIntyre, K., Michigan Univ., USA; Pan, X., Michigan Univ., USA; Worth, K., Michigan Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 543-545; In English; See also 20000113027; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We are developing a state-of-the-art Materials Education Facility, the Advanced Materials and Processing Education Center (AMPEC) by expanding our current laboratory capabilities and incorporating the latest in computer technology. AMPEC includes modern facilities for metallography, microscopy, heat treatment, mechanical testing, scanning electron microscopy, and injection molding. In the past year, we have added a number of undergraduate facilities, including a Workstation Center, an X-ray Facility, a Scanning Probe Microscopy Facility, and an Electronic Properties Laboratory. In this talk, I will discuss the new laboratory modules we have begun to incorporate into our undergraduate curriculum, particularly in the area of electronic, magnetic, and optical materials. I will also discuss some of our future plans, include the addition of both a Dielectric Measurements Laboratory and a Casting Facility.
Author
Laboratories; Metallography; Research Facilities; Education

20000113067 National Composites Center, Kettering, OH USA
Preview of New: Update 2000
Lee, Richard E., National Composites Center, USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 547-571; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This presentation reviews the history of the National Composites Center (NCC), its mission, the facilities, and the operation. The NCC is not a production facility or a research facility. Its mission is to promote, develop, demonstrate and support commercialization of composite materials and processes that provide significant commercial advantages through partnerships with industry, academic and government.
CASI
Commercialization; Industries; Composite Materials

20000113070 Michigan Univ., Dept. of Materials Science and Engineering, Ann Arbor, MI USA
Teenaged Materials Science
Millunchick, Joanna Mirecki, Michigan Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 605-616; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

There is a program at the University of Michigan to introduce 7th and 8th grade girls to the fields of engineering, science and technology. This presentation concentrates on the instruction of the materials sciences. Using materials which the young women are familiar with, the program concentrates on how materials issues impact their daily lives.
CASI
Education; Females; Transfer of Training; Materials Science

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20000110093 Employment and Training Administration, Office of Workforce Security, Washington, DC USA
UI PERFORMS ***Annual Report***
Aug. 2000; 288p; In English; Original contains color illustrations
Report No.(s): PB2000-107712; No Copyright; Avail: National Technical Information Service (NTIS)

This CY 1999 report is the third comprehensive UI PERFORMS Annual Report. It is intended to give a representative overview of Unemployment Insurance operational performance during the 12 months ending December 31, 1999. Thus, it presents the results of key indicators of the full range of UI operational performance-benefits, appeals, tax and cash management. At various times, the Department may supplement this report with reports in greater depth on individual areas, or presents the same material using a different format.
NTIS
Insurance (Contracts); Employment

20000112927 RAND Corp., Santa Monica, CA USA
Applying Non-Parametric Methods for Calculating and Analyzing Inventory Reorder Points to Military Supply Systems with Stochastic Demands and Fixed or Variable Lead Times ***Final Report***
Fricker, Ronald D., Jr.; Goodhart, Christopher A.; Jun. 24, 1999; 28p; In English
Report No.(s): AD-A380267; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper develops and applies a nonparametric bootstrap methodology for setting inventory reorder points and a simple inequality for identifying existing reorder points that are unreasonably high. We demonstrate that an empirically-based bootstrap method is both feasible and calculable for large inventories by applying it to the 1st Marine Expeditionary Force General Account, an inventory consisting of $20-30 million of stock for 10-20,000 different types of items. Further, we show that the bootstrap methodology works significantly better than the existing methodology based on mean days of supply. In fact, we demonstrate performance equivalent to the existing system with a reduced inventory at one-half to one- third the cost; conversely, we demonstrate significant improvement in fill rates and other inventory performance measures for an inventory of the same cost.
DTIC
Stochastic Processes; Inventories

20000113060 Owens Community Coll., Dept. of Industrial and Engineering Technologies, Toledo, OH USA
Corporate Partnerships: Win-Win-Win
Devier, David H., Owens Community Coll., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 481-488; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

As we approach the turn of the twenty-first century in America we find a dynamic educational environment at all levels. The demands on educational institutions, kindergarten through adult, are higher than ever before. The types of work available to entry level workers today are considerably different than just a generation ago. The low skill-high paying factory jobs of the past are no longer easily attainable to young workers, or displaced workers for that matter. Today, more than ever before, entry level workers must have special skills to be employable in any position which offers high compensation. The only work remaining for the unskilled and under skilled work force is in the service and raw labor sector which offers compensation at only the minimum way level. This is true for the types of positions which historically did not require advanced college training such as auto mechanics and diesel technicians. Today one cannot learn on the job the high tech skills required to diagnose and repair a $30,000 sport utility vehicle or trouble shoot an electronic problem on a $ 100,000 farm tractor. The days of the backyard mechanic who can walk into an auto dealership and sign on as a technician are gone. Now these dealers demand entry level employees who already have the required skills and corporations are demanding that the dealers have certified, well trained workers for all warranty work. To make matters more difficult, the young people of today do not generally see such positions as auto technicians as desirable while at the same time the demand for such workers is overwhelming. There in lies the focus of the corporate programs which have been developed at Owens Community college and other two year institutions. The goal of each program is to meet the demand for high skilled entry level employees for occupations where it is difficult to fill the positions. The corporate partnerships bring together the corporation, such as John Deere or General Motors, the dealerships, and the college to recruit, support, and train the students. Most programs are fall two-year associate degrees with summer internships at the dealerships. The remainder of this paper will discuss

the details of the Owens Community College corporate partnerships and make suggestions for similar endeavors at other institutions.
Author
Education; Personnel; Universities; Cooperation; Industries

20000113408 Defence Science and Technology Organisation, Maritime Platforms Div., Melbourne, Australia
The Role of System Modelling and Simulation in Royal Australian Navy Capability Management
Saunders, David, Defence Science and Technology Organisation, Australia; Tyndall, Moya, Defence Science and Technology Organisation, Australia; Whitehouse, Tom, Defence Science and Technology Organisation, Australia; July 2000; 38p; In English
Report No.(s): DSTO-GD-0244; DODA-AR-011-483; Copyright; Avail: Issuing Activity

This report examines the Navy Capability Management process that has evolved from the 1995 review of RAN logistics support and in response to the more-recent Government focus on output based management of ADF assets. This report seeks to show that capability management should be based on quantitative measures, including the insertion of Measures of Performance and Measures of Effectiveness at appropriate points in the management process. Capability management must also refer to operational requirements and is therefore a requirements-driven process. However, the principal difficulty with this management process is the lack of processes and supporting tools. Modelling and simulation are presented in this report as a means of addressing this difficulty. The main purpose of modelling and simulation is to predict the behaviour of ADF assets (RAN platforms and platform systems) in response to their environments. Environments in this context refer to changing operational requirements and constraints both within and external to the model. Capability management is a forward-looking, dynamic process and therefore there is a need to develop matching dynamic models as capability management tools. There is no single model that can be generally applied to the many capability management problems however; modelling may be applied effectively to address specific management and technical issues. Models representing the RAN platforms and platform systems, when applied in a simulation process under a range of conditions, can provide useful capability management information. This information may be used to develop appropriate quantitative performance measures.
Author
Management Information Systems; Systems Simulation; Dynamic Models

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DOCUMENTATION AND INFORMATION SCIENCE

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

20000109772 Amsterdam Univ., Netherlands
Modeling Transport Phenomena within the FSU Information Analysis System ***Final Report***
Masuch, J. M. F., Amsterdam Univ., Netherlands; May 31, 2000; 37p; In English
Contract(s)/Grant(s): N68171-99-C-9027
Report No.(s): AD-A381028; R/D-8837-EN-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the technical methods for organizing, documenting, and archiving an Oracle 8.i Relational Database Management System (RDBMS). These procedures are required by the Ministry of Defense (MOD), Scientific Center for the Safety and Security of Technical Means (SCSSTM) in St. Petersburg, Russia for emergency operations within the Information Analysis System (IAS) and the emerging Center for Technical Diagnostics (CTD). In this report, an integrated methodology for documenting an existing Oracle 8.i Instance is provided. In this terminology, the word Instance is used to define the organization and operating state of the database (IAS or CTD). by using these steps a DBA can create a series of scripts that allow documentation and, if required, recreation of an Oracle 8.i RDBMS under emergency operations. This research demonstrates techniques that can be used in creating these scripts. The source code for the database object information is provided. The documentation is for the future development of the CTD laboratory information management systems (LIMs). Since new systems may interface with the current IAS Oracle RDBMS, attention is required to ensure the proper exchange of data structures and related LIMs measurements. This report describes the data dictionary (lookup) components that will be required for efficient operations and examines the basic methods for controlling two or more systems (log documentation). Housed in separate networks, these systems may be physically disconnected from one another due to security limitations within the SCSSTM. For this reason, a common data dictionary must be developed that will be used by each independent network. Once this common structure is established, data can be

transferred on physical media (tape, cartridge, etc.) without loss of attribute information. This research, and future efforts, will ensure a safe and effective transfer of topographic data between the IAS and CTD for MOD mission requirements.
DTIC
Information Management; Management Systems; Data Base Management Systems; Systems Management; Information Systems; Information Analysis

20000109815 Naval Postgraduate School, Monterey, CA USA
Structured Managerial Approach to Decision Processes Shaping Information Technology in Non-IT Organizations
Ana, Gabriel V.; Jun. 2000; 196p; In English
Report No.(s): AD-A381262; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This thesis purpose is to address the inter-disciplinary area of managerial decisions concerning IT structures in non-IT organizations. it is neither intended as a review of general managerial theory, nor aimed at the technical aspects involved. It rather approaches the IT support implementation and revising from a practical managerial perspective, attempting to systematize and streamline the decision-making process. Both managerial theory and technological dimension are considered equally important, but called upon only when and at the necessary extent they are required to lay the basis for making decisions. Between the large knowledge base in the managerial field on one hand, and the newer but dynamic IT-related sciences on the other, there is a gray area avoided by both management scholars and computer scientists. The first group sees IT as merely a tool, without accepting they have to deal with the transformational effect of technological developments. It is characteristic for the exponents of this school to label IT people as ”technical” and to discount the specific impact of this particular technology on organizations. The second group, in a continual effort to keep up with the technological boom, is drifting away from the social and organizational issues of IT to focus on the technical side, without acknowledging other managerial dimensions than the one centered on the IT structures as its object. Both sides tend to focus research in their respective areas, leaving managers of non-IT organizations with an inadequate choice between the two approaches. This thesis is aimed towards bridging the resulting inter-disciplinary gap with a flowchart model for the decision process in the analyzed area, using as modules applicable techniques and methods from both managerial and computer science fields, presented in practical operational form.
DTIC
Management Planning; Decision Making; Information Systems

20000109953 MRJ Technology Solutions, Moffett Field, CA USA
DMFS: A Data Migration File System for NetBSD
Studenmund, William, MRJ Technology Solutions, USA; [1999]; 2p; In English; USENIX, 18-23 Jun. 2000, San Diego, CA, USA
Contract(s)/Grant(s): RTOP 519-40-52; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

I have recently developed dmfs, a Data Migration File System, for NetBSD. This file system is based on the overlay file system, which is discussed in a separate paper, and provides kernel support for the data migration system being developed by my research group here at NASA/Ames. The file system utilizes an underlying file store to provide the file backing, and coordinates user and system access to the files. It stores its internal meta data in a flat file, which resides on a separate file system. Our data migration system provides archiving and file migration services. System utilities scan the dmfs file system for recently modified files, and archive them to two separate tape stores. Once a file has been doubly archived, files larger than a specified size will be truncated to that size, potentially freeing up large amounts of the underlying file store. Some sites will choose to retain none of the file (deleting its contents entirely from the file system) while others may choose to retain a portion, for instance a preamble describing the remainder of the file. The dmfs layer coordinates access to the file, retaining user-perceived access and modification times, file size, and restricting access to partially migrated files to the portion actually resident. When a user process attempts to read from the non-resident portion of a file, it is blocked and the dmfs layer sends a request to a system daemon to restore the file. As more of the file becomes resident, the user process is permitted to begin accessing the now-resident portions of the file. For simplicity, our data migration system divides a file into two portions, a resident portion followed by an optional non-resident portion. Also, a file is in one of three states: fully resident, fully resident and archived, and (partially) non-resident and archived. For a file which is only partially resident, any attempt to write or truncate the file, or to read a non-resident portion, will trigger a file restoration. Truncations and writes are blocked until the file is fully restored so that a restoration which only partially succeed does not leave the file in an indeterminate state with portions existing only on tape and other portions only in the disk file system. We chose layered file system technology as it permits us to focus on the data migration functionality, and permits end system administrators to choose the underlying file store technology. We chose the overlay layered file system instead of the null layer for two reasons: first to permit our layer to better preserve meta data integrity and second to prevent even root processes from accessing migrated files. This is achieved as the underlying file store becomes inaccessible once the dmfs layer is mounted. We are quite pleased with how the layered file system has turned out. of the 45 vnode operations in NetBSD, 20 (forty-four percent) required

no intervention by our file layer - they are passed directly to the underlying file store. of the twenty five we do intercept, nine (such as vop_create()) are intercepted only to ensure meta data integrity. Most of the functionality was concentrated in five operations: vop_read, vop_write, vop_getattr, vop_setattr, and vop_fcntl. The first four are the core operations for controlling access to migrated files and preserving the user experience. vop_fcntl, a call generated for a certain class of fcntl codes, provides the command channel used by privileged user programs to communicate with the dmfs layer.
Author
Data Systems; Document Storage; Computer Programs

20000109992 Defence Science and Technology Organisation, Joint Systems Branch, Salisbury, Australia
Information Superiority, Network Centric Warfare and the Knowledge Edge
Burke, Martin, Defence Science and Technology Organisation, Australia; July 2000; 24p; In English
Report No.(s): DSTO-TR-0997; DODA-AR-011-495; Copyright; Avail: Issuing Activity

The report notes that a socio-cultural phenomenon has occurred in the Defence community whereby it is has become commonplace for the assumption to be made that success in various types of modem warfare will be assured if Information Superiority can be achieved. It presents outline arguments that suggest that this assumption is fallacious. It concludes that: (1) Success in Network Centric Warfare requires Knowledge Superiority and benefits from Information Superiority. (2) Success in Maneuver Warfare requires Knowledge Superiority and benefits from Information Superiority. (3) A Decision Edge requires a Knowledge Edge and benefits from an Information Edge.
Author
Warfare; Networks; Information Management

20000110204 Oslo Univ., Fysisk Inst., Norway
WASAT. A graphical user interface for visualization of wave spectrograms
Joergensen, R.; Dec. 31, 1996; 30p; In English
Report No.(s): DE98-626463; OUP-96-13; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The report describes a technique for the decoding and visualization of sounding rocket data sets. A specific application for the visualization of three dimensional wave HF FFT spectra obtained from the SCIFER sounding rocket launched January 25, 1995, is made. The data set was decoded from its original data format which was the NASA DITES I/II format. A graphical user interface, WASAT (WAve Spectrogram Analysis Tool), using the Interactive Data Language was created. The data set was visualized using IDL image tools overlayed with contour routines. The user interface was based on the IDL widget concept.
NTIS
Fast Fourier Transformations; Graphical User Interface; Spectrograms; Microwave Spectra; Wave Propagation

20000110211 Institution of Electrical Engineers, London, UK
Proceedings of the 2nd Mediterranean Conference on Information Technology Applications (ITA '97)
Spyrou, S.; Dec. 31, 1997; 123p; In English; 2nd; Mediterranean conference on Information Technology Applications (ITA'97); Also pub. as ISBN 9963-8275-0-0
Report No.(s): DE98-626012; INIS-CY-0003; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the proceedings of the 2nd Mediterranean Conference on Information Technology Applications, held in Nicosia, Cyprus, between 6-7 November, 1997. It contains 16 papers. Two of these fall within the scope of INIS and are dealing with Telemetry, Radiation Monitoring, Environment Monitoring, Radiation Accidents, Air Pollution Monitoring, Diagnosis, Computers, Radiology and Data Processing.
NTIS
Conferences; Information Systems; Technology Utilization; Pollution Monitoring; Air Pollution

20000110276 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
The Martian Archives: Now and Future
Arvidson, R. E., Washington Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Surveyor Program includes the Mars Global Surveyor now orbiting the planet, the Mars 98 orbiter and lander, the 2001 orbiter and lander, and the sample return missions planned for the 2003-2008 launch opportunities. The Program has adopted a common set of guidelines for generating and validating archives, along with transfer of the archives to the Planetary Data System (PDS) for use by the scientific community. These guidelines are published as the Mars Surveyor Program Data Management Plan.

The guidelines focus on the use of PDS standards to generate documented archives of level 0 and derived data products, with a baseline period of six months from receipt of telemetry data to release of archives generated from the raw data. Each project within the Program is expected to write and follow a detailed Archive Plan, based on the guidelines. Additional information is contained in the original extended abstract.
Author
Data Systems; Mars (Planet); Project Management; Information Transfer; Standards; World Wide Web

20000110283 Oregon State Univ., Coll. of Oceanic and Atmospheric Sciences, Corvallis, OR USA
Variability on Intermediate Time Scales in the Mars Pathfinder MET Data
Barnes, Jeffrey R., Oregon State Univ., USA; Bennett, S., Oregon State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The temperature and pressure data collected by the Mars Pathfinder (MPF) mission exhibit distinct improvements in several respects over data from the Viking Landers. In particular, MPF temperatures were measured simultaneously at three heights above the surface and were less distorted by the physical presence of the spacecraft than was the case for the Viking Landers. Also, the MPF pressure sensor's digital readouts have 14-bit precision vs. the 10-bit precision of the Viking Landers. In most observation sessions, sampling rates were also higher than those of the Viking Landers and MPF was the first mission to observe entire sols at high sampling rates. These improvements in the collected data make possible the clear detection of features and events at the MPF site that were undetectable or only marginally detectable in the Viking data. Our main focus to date has been on the four sessions that contain complete coverage of entire sols (sols 25, 32, 38, and 55) and the session covering sol 68, though analyses of this session have been limited due to two large gaps in the data. In each of these sessions certain striking features appear. In the daytime, the dominant features in the temperature measurements are the rapidly increasing mean temperature after sunrise until mid-afternoon, the even more steeply decreasing temperatures thereafter until around sunset, the high variance of temperatures beginning at 0730-0830 Local True Solar Time (LTST) and continuing until 1600-1630 LTST, and a quasi-periodic (or possibly periodic) oscillation of the short-term mean apparent during the time of high variance. We attribute the time of high variance to convective activity from solar heating. Beginning near sunset, the steep temperature drop was interrupted by brief (about 30 minutes) episodes of fluctuating temperatures, during which the short-term mean temperature might level off or even increase slightly. Two possible explanations for these episodes are cold air drainage events and "bursting" events associated with the collapse of the daytime planetary boundary layer. The rate of temperature decrease lessened considerably when the temperature returned to approximately the same point it had reached by the onset of high variability in the morning. For the rest of each night, the temperature decrease slowed and showed low-amplitude fluctuations on several time scales. Diurnal and semidiurnal pressure tidal modes were easily detected in the Viking data, and crude estimates of the amplitudes of modes 3 and 4 were marginally possible. The vastly improved MPF pressure sensor's nominal precision was .241 microbar vs. Viking's about 88 microbars, which has allowed analysis of the higher-order tidal amplitudes. We find that the amplitudes of modes 3, 5, 7, 9, and 11 are much smaller than the amplitudes of the adjacent even-numbered modes, which suggests that non-linear interaction of tidal modes redistributes energy in favor of the even-numbered modes beyond mode 2 (semidiurnal) up through mode 12. The pressure records of all four complete-sol sessions and the sol 68 session show interesting features. The diurnal pressure maximum occurred at 0800-0845 LTST each sol, after which the pressure fell throughout the day until reaching the minimum around 1800 LTST. The minimum was then followed immediately by a very sharp rise in pressure over the next two hours and then a small drop over a period ranging from .75 to 2.0 hours. Thereafter, the pressure resumed its rise at a slower rate than the initial rise after the pressure minimum. GCM simulations with uniform atmospheric dust distributions appear to be capable of representing much of the structure of the diurnal pressure cycles for this season and region.
Author
Diurnal Variations; Mars (Planet); Mars Atmosphere; Mars Environment; Planetary Meteorology; Atmospheric Temperature; Planetary Temperature

20000110348 Geological Survey, Flagstaff, AZ USA
PIGWAD: Planetary Interactive GIS on the Web Analyzable Database
Hare, T. M., Geological Survey, USA; Tanaka, K. L., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We are producing a web-based, user-friendly interface built on a powerful Geographic Information System (GIS), that will integrate statistical and spatial relational tools for analyses of planetary datasets. The interface, known as "Planetary Interactive GIS-on-the-Web Analyzable Database" (PIGWAD), will provide database support for the research and academic planetary sci-

ence communities, particularly for geologic mapping and other surface-related investigations. Additional information is contained in the original extended abstract.
Author
Data Bases; Geographic Information Systems; Mapping; Planetary Bases

20000110379 Geological Survey, Flagstaff, AZ USA
A Database of Viking Orbiter Image Coverage of Mars for Cartographic and Scientific Use
Kirk, R., Geological Survey, USA; Barrett, J., Geological Survey, USA; Howington-Kraus, E., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Viking Orbiters 1 and 2 collectively returned more than 46,000 images of Mars between 1976 and 1980. Numerous observation sequences with different objectives resulted in an extremely complex and heterogeneous image set which is difficult to exploit fully in cartographic and scientific studies. Digital databases of the VO images include flat tables of metadata on CD-ROM with the images and the PDS Mars Geoscience Navigator , which allows graphical and forms-based searching for particular images but does not provide an easy way to compare images and identify stereo pairs. A hardcopy catalog of potential stereopairs exists but is difficult to use and does not show stereo coverage in relation to surface features. Unpublished hemispheric maps of the highest resolution image coverage provide another fragment of useful information. None of these resources incorporate updated information about image locations that is generated as a byproduct of mapping. to better support our activities in topographic mapping and global geodesy/cartography we have therefore created a simple yet flexible database of the VO im-ages by extracting a subset of geometric metadata from the most up-to-date records at the USGS, Flagstaff, and writing customized software to analyze and display selected aspects of these data. Additional information is contained in the original extended abstract.
Author
Data Bases; Geodesy; Geology; Mapping; Mars Photographs; Mars Surface

20000110383 Lunar and Planetary Inst., Houston, TX USA
Comparison of 1969 IRS and 1971 IRIS Spectra to TES
Kirkland, L. E., Lunar and Planetary Inst., USA; Herr, K. C., Aerospace Corp., USA; Forney, P. B., Lockheed Martin Missiles and Space, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Three spacecraft have carried spectrometers that returned thermal infrared spectra of Mars: the 1969 Mariner Mars 7 Infrared Spectrometer (IRS; 1.8 - 14.2 micron), 1971 Mariner Mars Infrared Interferometer Spectrometer (IRIS; 5 - 50 micron); and 1997 Thermal Emission Spectrometer (TES (6 - 50 micron)). Each instrument measured spectra with different characteristics, so each data set provides complementary information that can be used to examine the composition of surface materials. Any spectral interpretation should be consistent with data from all three of these data sets. We recently recovered the IRS data set from the original data tapes, calibrated, and released spectra that measured from 3.7 - 14.2 micron. IRS provides high quality coverage of the informative overtone spectral region, which runs from approximately 3 - 7 micron. IRIS measured with the highest spectral resolution, which allows the best separation of surface and atmospheric features, and the best definition of band shape. TES measures with the highest spatial resolution and coverage, which permits the most detailed mapping of spectral types. Additional information is contained in the original extended abstract.
Author
Infrared Interferometers; Infrared Spectra; Infrared Spectrometers; Spectral Resolution

20000110398 Oxford Univ., Dept. of Physics, Oxford, UK
Data Assimilation for the Atmosphere of Mars
Lewis, S. R., Oxford Univ., UK; Read, P. L., Oxford Univ., UK; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; Sponsored in part by the Astronomy Research Council; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Given the quantity of data expected from current and forthcoming spacecraft missions to Mars, it is possible to propose the use of data assimilation as a means of atmospheric analysis for the first time for a planet other than the Earth. Several groups have described plans to develop assimilation schemes for Mars. Data assimilation is a technique for the analysis of atmospheric observations which combines currently valid information with prior knowledge from previous observations and dynamical and physical constraints, via the use of a numerical model. Despite the number of new missions, observations of the atmosphere of

Mars in the near future are still likely to be sparse when compared to those of the Earth, perhaps comprising one orbiter and a few surface stations at any one time. Data assimilation is useful as a means to extract the maximum information from such observations, both by a form of interpolation in space and time using model constraints and by the combination of information from different observations, e.g. temperature profiles and surface pressure measurements which may be irregularly distributed. The procedure can produce a dynamically consistent set of meteorological fields and can be used directly to test and refine an atmospheric model against observations. A sequential data assimilation scheme for the atmosphere of Mars has been implemented, derived from the analysis correction scheme, which was, until recently, used operationally for weather forecasting at the UK Meteorological Office. The scheme has been interfaced with the Mars General Circulation Model (MGCM) currently under simultaneous development at Oxford and at Laboratoire de Meteorologie Dynamique du CNRS in Paris. The MGCM is typically run with a spectral truncation at wavenumber 31 in the horizontal, roughly equivalent to a 96_48 (3.75_) grid, with 25 vertical levels from the surface to almost 100 km altitude. Additional information is contained in the original extended abstract.
Author
Atmospheric General Circulation Models; Mars Atmosphere; Mars (Planet); Data Reduction; Interpolation

20000110501 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
Preliminary Science Results from the Recalibration of IMP Images
Yingst, R. A., Arizona Univ., USA; Reid, R. J., Arizona Univ., USA; Smith, P. H., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Imager for Mars Pathfinder (IMP) has provided images of the Mars Pathfinder (MPF) landing site in 15 geology filters, designed to reveal the composition and mineralogy of the landing site. A first calibration of these images has yielded a wealth of geologic results. Local rocks and soils have been classified based upon spectral signature, spectra have been correlated with APXS data, and many of the photometric properties of the surface materials have been determined. The compositional connection between local rocks and soils has been examined, and it has been suggested that the ferric soils are not solely products of weathering of the local rocks. Several issues remain unresolved, however, including the determination of ferric phases in rocks and/or soils and the apparent lack of any pyroxene band in rock spectra. Recalibration of the IMP images has provided spectral details that clarify many of these early results.
Author
Rocks; Soils; Spectral Signatures; Mars Surface; Mars (Planet)

20000110529 NASA Langley Research Center, Hampton, VA USA
Supporting NASA Facilities Through GIS
Ingham, Mary E., NASA Langley Research Center, USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 67; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The NASA GIS Team supports NASA facilities and partners in the analysis of spatial data. Geographic Information System (G[S) is an integration of computer hardware, software, and personnel linking topographic, demographic, utility, facility, image, and other geo-referenced data. The system provides a graphic interface to relational databases and supports decision making processes such as planning, design, maintenance and repair, and emergency response.
Derived from text
Geographic Information Systems; NASA Programs

20000112916 Naval Postgraduate School, Monterey, CA USA
Development of a Prototype Relational Database System for Managing Fleet Battle Experiment Data
Colon, Kevin; Jun. 2000; 256p; In English
Report No.(s): AD-A380771; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This research develops a prototype relational database system for storing and managing Fleet Battle Experiment (FBE) data. It is the first step in constructing a knowledge-base system for such data. The objective is to create a relational database capable of generating information from past experiments for analysis and lessons learned to benefit future experiments. Research methodology included literature research of application development methodologies and database systems, as well as observing a FBE and gathering system requirements information from personnel that plan, configure, and participate in FBEs and war games. Development of the system involved designing a schema (data model) that consists of entities, attributes, and relationships of the FBE environment. The data model is transaction- (event-) based and concentrates on information flow in order to categorize and store the data. These events provide the logical links between the identified entities and the capability to query the system for

desired information. Finally, a prototype application against the data model was developed to facilitate data entry, modification, and querying.
DTIC
Relational Data Bases; Computerized Simulation; War Games; Information Flow

20000112961 MRJ Technology Solutions, Moffett Field, CA USA
Vnode Layering Changes in NetBSD Version 1.5, 1.5
Studenmund, William, MRJ Technology Solutions, USA; [2000]; 3p; In English; USENIX, 18-23 Jun. 2000, San Diego, CA, USA
Contract(s)/Grant(s): RTOP 519-40-52; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper, I describe changes to the vnode layer in NetBSD between versions 1.4 and 1.5 to assist layered filesystems. The major feature of these chano,es on the whole is that layered filesystems are now sufficiently robust for production applications. These changes divide readily into three groups: modifications to vnode locking along the lines suggested by Heidemann, changes to the vnode locking protocol, and the introduction of an overlay filesystem. In addition to describing these changes, I will describe the testing we have performed.
Derived from text
Protocol (Computers); Locking

20000113062 Michigan Univ., Materials Science and Engineering Dept., Ann Arbor, MI USA
The Materials Education Library: Sharing Educational Resources Via The World Wide Web
Clark, Darcy J. M., Michigan Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 499-511; In English; See also 20000113027; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The Materials Education Library (MEL) is an online library of multimedia content for materials educators. It's main objective is to promote the sharing of educational content amongst the materials education community. The objective of this article is to demonstrate how the MEL operates, e.g. how do you get content out of the library, how do you contribute your own content.
Author
Education; Libraries; Multimedia; World Wide Web; Materials Science

20000113822 Air Force Office of Scientific Research, Bolling AFB, Communications and Technical Information, Washington, DC USA
Research Highlights
Amand, Angela, Editor, Air Force Office of Scientific Research, Bolling AFB, USA; May - June 2000; 4p; In English
Report No.(s): AD-A379214; No Copyright; Avail: Defense Technical Information Center (DTIC)

Research Highlights is published every two months by the Air Force Office of Scientific Research. This newsletter provides brief descriptions of AFOSR basic research activities including topics such as research accomplishments, examples of technology transitions and technology transfer, notable peer recognition awards and honors, and other research program achievements. The purpose is to provide Air Force, DoD, government, industry and university communities with brief accounts to illustrate AFOSR support of the Air Force mission. This current report contains the following sections: (1) breakthrough in infrared technology using semiconductor quantum dots; (2) Dr. Michael R. Berman is a recipient of the 1999 Arthur S. Flemming Award for the year 1999; (3) The DoD Engineer and Scientists Exchange Program, or ESEP, the profile of John D. Corley, Air Force Research Laboratory Munitions Directorate.
CASI
Detection; Quantum Dots; Research and Development; Infrared Radiation

20000113828 Oak Ridge Inst. for Science and Education, TN USA
How to Overcome Information Anxiety: Assignment and Use of DoD Distribution Statements for Technical Documents, Volume 2, Participant Manual
May 1998; 298p; In English
Contract(s)/Grant(s): DE-AC05-76OR00033
Report No.(s): AD-A379184; DTIC*-TR-2000/7-V2; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This course on DoD distribution statements is in two volumes. The Participant Guide contains a set of the instructor's slides and reference materials. The course is intended to offer DoD staff and contractors a basic understanding of the rationale and

mechanics of properly assigning distribution statements to DoD technical documents. While other markings are applied to DoD technical documents, this course only covers distribution statements.
DTIC
Information Dissemination; Education; Information Systems; Documents

20000114852 RAND Corp., Santa Monica, CA USA
The Global Course of the Information Revolution: Technological Trends
Anderson, Robert H.; Anton, Philip S.; Bankes, Steven C.; Bikson, Tora K.; Caulkins, Jonathan; Jan. 2000; 118p; In English
Report No.(s): AD-A381930; RAND/CF-157-NIC; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

RAND has undertaken a three-year effort, sponsored by the National Intelligence Council, to study some of the key changes expected worldwide as a result of the continuing information revolution. A first conference in a series was held November 16-18, 1999 in Washington, DC, concentrating on potential political, economic, and social consequences of this revolution, with special attention focused on differential impacts possible in differing countries, regions, and cultures of the world. A second conference in this series, reported on here, was held May 10-12, 2000, in Pittsburgh PA. It concentrated on technical trends in the information revolution, focusing in particular on the resulting new artifacts and services that might become widespread during the next 20 years, thereby affecting individuals, organizations, nations, and cultures worldwide. This conference attempted to get beyond Moore's Law (an expected doubling of the density of integrated circuits on a silicon chip every 18 months or so), to ask about specific artifacts, devices, and services that might be developed, with attention to those likely to have differential impacts on various countries, regions, and cultures of the world. The conference was designed to illuminate the assumptions underlying various predictions and estimates, so that these could be examined for mutual consistency and likelihood.
DTIC
Conferences; Impact; Information Systems; Predictions; Integrated Circuits; Chips; Technology Assessment

20000114861 Army Construction Engineering Research Lab., Champaign, IL USA
Quality Assurance/Quality Control Procedures for ITAM GIS Databases ***Final Report***
Johnston, Douglas M.; Timlin, Diane M.; Szafoni, Diane L.; Casanova, Jason J.; Dilks, Kelly M.; Aug. 2000; 131p; In English
Report No.(s): AD-A382487; ERDC/CERL-TR-00-20; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Geographic information creates unique challenges and opportunities for realizing the mission objectives of the U.S. Army, both in tactical operations and in readiness preparation. It is estimated the Federal Government spends over $3 billion on spatial data in each fiscal year and Geographic Information Systems (GISs) have been implemented at nearly every U.S. Army installation in the USA. In spite of the large investment in digital geographic information and systems, numerous challenges to effective creation, analysis, and delivery of geographic information exist. This research used a combination of theoretical work on the nature of geospatial data quality and a case study to assess the requirements for conducting a data quality assessment. The project develops and tests procedures for performing assessment of the quality of an existing data set (specifically, selected data from the Integrated Training Area Management (ITAM) GIS database in use at Fort Hood, TX). The procedures are intended to be generalizable to other installation ITAM data sets.
DTIC
Geographic Information Systems; Data Bases; Digital Data; Quality Control; Data Management

20000114862 Army War Coll., Strategic Studies Inst., Carlisle Barracks, PA USA
The Information Revolution and National Security
Copeland, Thomas E., Editor; Aug. 2000; 145p; In English
Report No.(s): AD-A382498; ISBN 1-58487-031-1; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The current era has seen more rapid and extensive change than any time in human history. The profusion of information and the explosion of information technology is the driver, reshaping all aspects of social, political, cultural, and economic life. The effects of the information revolution are particularly profound in the realm of national security strategy. They are creating new opportunities for those who master them. The U.S. military, for instance, is exploring ways to seize information superiority during conflicts and thus gain decisive advantages over its opponents. But the information revolution also creates new security threats and vulnerabilities. No nation has made more effective use of the information revolution than the USA, but none is more dependent on information technology. to protect American security, then, military leaders and defense policymakers must understand the information revolution.
DTIC
Information Management; Information Systems; Security

20000114872 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Report to the Attorney General, Department of Justice. Information Teechnology: INS Needs to Better Manage the Development of Its Enterprise Architecture
Aug. 2000; 23p; In English
Report No.(s): AD-A382581; GAO/AIMD-00-212; B-285590; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

INS' Office of Information Resources Management(OIRM) has, in isolation from INS business owners, put together a bottom-up description of INS' current IT environment and it has mapped its software applications to INS' three major business areas. This is a reasonable start to describing INS' current architectural environment. However, important steps still need to be accomplished, such as linking the systems environment description to a decomposed view of INS' business areas, including each area's component business functions and subfunctions, and information needs and flows among functions and subfunctions. Doing this with any degree of reliability, however, requires business owners to validate the resultant linkages. Also, INS has not begun developing either a target architecture or a plan for sequencing between its current architecture and a target architecture. In lieu of the target architecture, OIRM is developing what it calls an initial target architecture is a 2-year plan for correcting known system-level problems. However, such an approach does not satisfy federal and private sector guidance on the origin, content, and purpose of a target architecture. Rather, this plan will basically describe near-term system maintenance efforts and will not provide a definition of the business and systems environments needed to optimize INS' mission performance.
DTIC
Optimization; Management Information Systems; Information Management; Reliability; Architecture (Computers); Computer Networks

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20000110521 Christopher Newport Univ., ASEE Professor, Newport News, VA USA
Implementation of the Full Cost Program in the New IFM System
Gosselin, David J., Christopher Newport Univ., USA; 1999 NASA - ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; August 2000, pp. 59; In English; See also 20000110509; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Conducted a review of the Full Cost in NASA process as it will interface in the new Integrated Financial Management (IFM) system. Federal government standards require agencies to begin Full Cost reporting in FY 2000. An investigation was conducted as to just what the new IFM system will provide in the way of Full Cost data reporting and whether it conforms to the requirements of the NASA Full Cost Implementation Guide. The evaluation of this process is still ongoing at this time.
Author
Costs; Financial Management

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

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

20000109869 Norwegian Defence Research Establishment, Kjeller, Norway
Technology, Defence, and Force Structures *Teknologi, Forsvar og Forsvarsstrukturer*
Solstrand, Ragnvald H., Norwegian Defence Research Establishment, Norway; Aug. 10, 2000; 82p; In Norwegian
Contract(s)/Grant(s): FFISYS Proj. 779/161
Report No.(s): FFI/RAPPORT-2000/03429; ISBN-82-464-0440-7; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report documents the work done under the Defense Analysis 2000 related to trends in technology development and how these trends may create new possibilities for cost effective systems and solutions in the force structure of a small country like Norway. The strategic implications of technology development are broadly discussed, against the background of NATO's ongoing Defence Capabilities Initiative. This is then taken down to the national Norwegian planning level, outlining the main problems

encountered with respect to cost effective use of new technologies in the future Norwegian force structure. Finally, some of the most promising new technology based force components that are identified and evaluated in Defence Analysis 2000 are described, and the process towards making final decisions on the use of new technology in a 2020 force structure is outlined.
Author
Trends; Technological Forecasting; Research and Development

88
SPACE SCIENCES (GENERAL)

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

20000110269 Lunar and Planetary Inst., Houston, TX USA
The Fifth International Conference on Mars
5th International Conference on Mars; July 1999; In English; 5th; 5th International Conference on Mars, 19-24 July 1999, Pasadena, CA, USA; Sponsored by California Inst. of Tech., USA; See also 20000110270 through 20000110508; CD-ROM contains the entire conference proceedings presented in PDF format
Contract(s)/Grant(s): NASW-4574
Report No.(s): LPI-Contrib-972; No Copyright; Avail: CASI; C01, CD-ROM

Papers about Mars and Mars exploration are presented, covering topics such as Martian history, geology, volcanism, channels, moons, atmosphere, meteorology, water on the planet, and the possibility of life. The unmanned exploration of Mars is discussed, including the Phobos Mission, the Mars Observer, and the Mars sample return missions. Issues dealing with manned exploration of Mars are examined, such as the reasons for exploring Mars, mission scenarios, a transportation system for routine visits, technologies for Mars expeditions, the human factors for Mars missions, life support systems, living and working on Mars, and the report of the National Commission on Space.
CASI
Conferences; Mars Exploration; Mars Missions; Mars Surface; Mars (Planet); Mars Atmosphere; Mars Environment

20000112955 NASA Glenn Research Center, Cleveland, OH USA
NDE Methodologies for Composite Flywheels Certification
Baaklini, George Y., NASA Glenn Research Center, USA; Konno, Kevin E., NASA Glenn Research Center, USA; Martin, Richard E., Cleveland State Univ., USA; Thompson, Richard, Texas Univ., USA; October 2000; 20p; In English; Power Systems, 31 Oct. - 2 Nov. 2000, San Diego, CA, USA; Sponsored by Society of Automotive Engineers, Inc., USA
Contract(s)/Grant(s): RTOP 494-29-11
Report No.(s): NASA/TM-2000-210473; E-12468; NAS 1.15:210473; Rept-00PS-63; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Manufacturing readiness of composite rotors and certification of flywheels depend in part on the maturity of nondestructive evaluation (NDE) technology for process optimization and quality assurance, respectively. Capabilities and limitations of x-ray-computed tomography and radiography, as well as advanced ultrasonics were established on NDE ring and rotor standards with EDM notches and drilled holes. Also, intentionally seeded delamination, tow break, and insert of bagging material were introduced in hydroburst-rings to study the NDE detection capabilities of such anomalies and their effect on the damage tolerance and safe life margins of subscale rings and rotors. Examples of possible occurring flaws or anomalies in composite rings as detected by NDE and validated by destructive metallography are shown. The general NDE approach to ensure quality of composite rotors and to help in the certification of flywheels is briefly outlined.
Author
Certification; Composite Materials; Flywheels; Nondestructive Tests; Quality Control

89
ASTRONOMY

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

20000109898 Tuorla Observatory, Pikkio, Finland

Intensive Monitoring of OJ 287

Pursimo, T., Tuorla Observatory, Finland; Takalo, L. O., Tuorla Observatory, Finland; Sillanpaa, A., Tuorla Observatory, Finland; Kidger, M., Instituto de Astrofisica de Canarias, Spain; Lehto, H. J., Tuorla Observatory, Finland; Heidt, J., Landessternwarte auf dem Koenigstuhl, Germany; Charles, P. A., Oxford Univ., UK; Aller, H., Michigan Univ., USA; Beckmann, V., Hamburger Sternwarte G.m.b.H., Germany; [2000]; 16p; In English

Contract(s)/Grant(s): MURST-Cofin98-02-32; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present intensive optical, infrared, and radio monitoring observations of the BL Lac object OJ 287, taken between the years 1993-1998. Two large optical outbursts were detected at the predicted times in November 1994 and December 1995. The detection of these outbursts supports the binary black hole model for OJ 287. Optical and radio polarisation observations show large variability in the degree of polarisation and position angle, very similar to those observed during the 1983/84 outburst in OJ 287. The polarisation position angles show very similar behaviour during these observations, indicating that, at least, the magnetic field orientations in radio and optical bands are related in OJ 287. Optical and infrared light curves show continuous variability in time scales ranging from tens of minutes to years. In the radio bands we have observed some of the lowest ever measured flux levels. During the first optical outburst in November 1994 the observed radio flux was very low, but during the second optical outburst also radio bands showed high flux levels. This is a puzzling observation, which can hopefully be used for discriminating between different outburst models. On top of the large outbursts OJ 287 has displayed flaring activity in time scales from days to weeks and shorter time scale flickering.

Author

Binary Stars; Bursts; BL Lacertae Objects; Infrared Radiation; Magnetic Fields; Visual Observation

20000109969 NASA Goddard Space Flight Center, Greenbelt, MD USA

Atomic Data Needs for X-ray Astronomy

Bautista, Manuel A., Editor, NASA Goddard Space Flight Center, USA; Kallman, Timothy R., Editor, NASA Goddard Space Flight Center, USA; Pradhan, Anil K., Editor, Ohio State Univ., USA; October 2000; 186p; In English, 16-17 Dec. 1999, Greenbelt, MD, USA; See also 20000109970 through 20000109988

Report No.(s): NASA/CP-2000-209968; Rept-2000-04370-0; NAS 1.55:209968; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This publication contains written versions of most of the invited talks presented at the workshop on "Atomic Data Needs for X-ray Astronomy," which was held at NASA's Goddard Space Flight Center on December 16-17, 1999. The workshop was divided into five major areas: Observational Spectroscopy, Theoretical Calculations of Atomic Data, Laboratory Measurements of Atomic Parameters, Spectra Modeling, and Atomic Databases. These proceedings are expected to be of interest to producers and users of atomic data. Moreover, the contributions presented here have been written in a way that can be used by a general audience of scientists and graduate students in X-ray astronomy, modelling, and in computational and experimental atomic physics.

Derived from text

X Ray Astronomy; Data Bases; Atomic Physics; Conferences

20000109970 Space Research Organization Netherlands, Lab. for Space Research, Utrecht, Netherlands

Coronal Plasmas Modeling and the MEKAL code

Kaastra, Jelle S., Space Research Organization Netherlands, Netherlands; Mewe, Rolf, Space Research Organization Netherlands, Netherlands; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 161-165; In English; See also 20000109969; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

An overview is given of the current status of the spectral code development that takes place at SRON Utrecht.

Author

Coronas; Plasmas (Physics); Applications Programs (Computers); Astronomical Models

20000109971 NASA Goddard Space Flight Center, Greenbelt, MD USA

Spectroscopy and X-Ray Astronomy

Holt, Stephen S., NASA Goddard Space Flight Center, USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 1-4; In English; See also 20000109969; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The new x-ray astronomical observatories have sufficient spectroscopic capability to allow the determination of plasma conditions in the form of velocities, temperatures, densities, and turbulence parameters at levels that were previously unattainable. The utilization of these diagnostics are possible only if the atomic and plasma physics are well-enough understood to match the observational sensitivity.

Author

Spectroscopy; X Ray Astronomy; Astronomical Observatories

20000109972 Massachusetts Inst. of Tech., Center for Space Research, MA USA

Initial Results From The Chandra High Energy Transmission Grating Spectrometer

Canizares, C. R., Massachusetts Inst. of Tech., USA; Davis, D. S., Massachusetts Inst. of Tech., USA; Dewey, D., Massachusetts Inst. of Tech., USA; Flanagan, K. A., Massachusetts Inst. of Tech., USA; Houck, J., Massachusetts Inst. of Tech., USA; Huenemoerder, D. P., Massachusetts Inst. of Tech., USA; Marshall, H. L., Massachusetts Inst. of Tech., USA; Schattenburg, M. L., Massachusetts Inst. of Tech., USA; Schulz, N. S., Massachusetts Inst. of Tech., USA; Wise, M., Massachusetts Inst. of Tech., USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 5-9; In English; See also 20000109969

Contract(s)/Grant(s): NAS8-38249; SV1-61010; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The High Energy Transmission Grating Spectrometer (HETGS) on the Chandra X-ray Observatory provides spectral resolving powers of 200-1000 over the range 0.4-8.0 keV (1.5-30 A) with effective area of 2-200 square centimeters. Initial observations during the activation and calibration phases of the mission show that the HETGS is performing as predicted prior to Chandra launch. The talk presented very preliminary results that illustrate the power of the HETGS for performing detailed studies of a wide range of celestial sources, including plasma diagnostics. This written version gives a brief summary of that talk with examples of preliminary spectra of Capella, the Crab pulsar, SS433 and the SNR E0102-72.

Author

Gratings (Spectra); X Ray Astrophysics Facility; Spectral Resolution; X Ray Spectrometers; Energy Transfer

20000109973 Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany

First Results of the Chandra-LETGS

Predehl, P., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Aschenbach, B., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Braeuninger, H., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Burkert, W., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Burwitz, V., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Hartner, G., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Truemper, J., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Schmitt, J. H. M. M., Hamburg Univ., Germany; Brinkman, A. C., Space Research Organization Netherlands, Netherlands; Gunsing, C. J. T., Space Research Organization Netherlands, Netherlands; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 11-17; In English; See also 20000109969; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

We present the first results obtained with the Low Energy Transmission Grating Spectrometer (LETGS) onboard the Chandra X-ray Observatory. The LETGS covers the wavelength range between 5 and 175 A (2.5-0.07 keV) with a spectral resolution of about 0.06 A. A number of calibration measurements were carried out in order to determine the instrument's performance, i.e., spectral resolution, the wavelength scale accuracy, and the effective area. The spectral resolution of the instrument, dominated by the angular resolution of the mirror, is as specified and predicted on the basis of preflight measurements. The calibration of the effective area is still an ongoing process. A serious problem for the LETGS is the high background of the HRC-S detector which serves as readout of the grating spectra. The 'First Light' observation of the star Capella shows a beautiful line-rich spectrum. He-like triplet diagnostics could be applied for the first time to a star other than the Sun.

Author

X Ray Astrophysics Facility; Gratings (Spectra); Energy Transfer; Spectral Resolution; X Ray Spectrometers

20000109974 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Chandra and the Emission Line Project

Brickhouse, N. S., Smithsonian Astrophysical Observatory, USA; Drake, J. J., Smithsonian Astrophysical Observatory, USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 19-23; In English; See also 20000109969

Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Calibration data obtained for the Chandra High Energy Transmission Grating and the Low Energy Transmission Grating Spectrometers are allowing us to test plasma spectral models against bright coronal sources with a range of electron temperatures. The three Emission Line Project targets - Capella, Procyon, and HR 1099 - are bright, well-studied X-ray and EUV emitters. The goals of the Emission Line Project are to determine and verify accurate and robust diagnostics; to identify and prioritize problems in fundamental spectroscopy; and to accelerate the improvement of the atomic database needed for modeling.
Author
Emission Spectra; X Ray Astrophysics Facility; X Ray Astronomy; X Ray Spectra

20000109975 NASA Goddard Space Flight Center, Greenbelt, MD USA
Theoretical Calculations of Atomic Data for Spectroscopy
Bautista, Manuel A., NASA Goddard Space Flight Center, USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 25-40; In English; See also 20000109969; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Several different approximations and techniques have been developed for the calculation of atomic structure, ionization, and excitation of atoms and ions. These techniques have been used to compute large amounts of spectroscopic data of various levels of accuracy. This paper presents a review of these theoretical methods to help non-experts in atomic physics to better understand the qualities and limitations of various data sources and assess how reliable are spectral models based on those data.
Author
X Ray Spectroscopy; Atomic Physics; Atomic Structure; Mathematical Models; Data Processing; Excitation

20000109976 NASA Goddard Space Flight Center, Greenbelt, MD USA
Distorted Wave Calculation and Applications
Bhatia, A. K., NASA Goddard Space Flight Center, USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 41-63; In English; See also 20000109969; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Physical properties such as temperature and electron density of solar plasma and other astrophysical objects can be inferred from EUV and X-ray emission lines observed from space. These lines are emitted when the higher states of an ion are excited by electron impact and then decay by photon emission. Excitation cross sections are required for the spectroscopic analyses of the observations and various approximations have been used to calculate the scattering functions. One of them which has been widely used is a distorted wave approximation. This approximation, along with its applications to solar observations, is discussed. The Bowen fluorescence mechanism and optical depth effects are also discussed. It is concluded that such calculations are reliable for highly charged ions and for high electron temperatures.
Author
Wave Equations; Electronic Structure; Scattering Functions; Astrophysics

20000109977 Sheffield Hallam Univ., School of Science and Mathematics, Sheffield, UK
The RmaX Network: R-Matrix Calculations for X-Ray Atomic Processes
Berrington, Keith A., Sheffield Hallam Univ., UK; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 65-67; In English; See also 20000109969; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The RmaX network ('R-matrix for X-rays') has been formed to calculate using abinitio R-matrix techniques electron and photon collisional properties to higher precision than hitherto for transitions in the soft X-ray region, to improve understanding of the dynamics of X-ray transitions in astrophysical plasmas.
Author
Atomic Physics; Space Plasmas; X Rays; Photons; Matrix Theory; Electron Scattering

20000109978 Ohio State Univ., Dept. of Astronomy, Columbus, OH USA
The Iron Project
Pradhan, Anil K., Ohio State Univ., USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 69-75; In English; See also 20000109969; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Recent advances in theoretical atomic physics have enabled large-scale calculation of atomic parameters for a variety of atomic processes with high degree of precision. The development and application of these methods is the aim of the Iron Project. At present the primary focus is on collisional processes for all ions of iron, Fe I - FeXXVI, and other iron-peak elements; new work on radiative processes has also been initiated. Varied applications of the Iron Project work to X-ray astronomy are discussed, and more general applications to other spectral ranges are pointed out. The IP work forms the basis for more specialized projects such as the RmaX Project, and the work on photoionization/recombination, and aims to provide a comprehensive and self-consistent set of accurate collisional and radiative cross sections, and transition probabilities, within the framework of relativistic close

coupling formulation using the Breit-Pauli R-Matrix method. An illustrative example is presented of how the IP data may be utilized in the formation of X-ray spectra of the K alpha complex at 6.7 keV from He-like Fe XXV.
Author
Atomic Physics; Ions; Iron; Theoretical Physics; Electron Impact; Excitation

20000109979 Ohio State Univ., Dept. of Astronomy, Columbus, OH USA
Photoionization and Recombination
Nahar, Sultana N., Ohio State Univ., USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 77-84; In English; See also 20000109969; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Theoretically self-consistent calculations for photoionization and (e + ion) recombination are described. The same eigenfunction expansion for the ion is employed in coupled channel calculations for both processes, thus ensuring consistency between cross sections and rates. The theoretical treatment of (e + ion) recombination subsumes both the non-resonant recombination ("radiative recombination"), and the resonant recombination ("di-electronic recombination") processes in a unified scheme. In addition to the total, unified recombination rates, level-specific recombination rates and photoionization cross sections are obtained for a large number of atomic levels. Both relativistic Breit-Pauli, and non-relativistic LS coupling, calculations are carried out in the close coupling approximation using the R-matrix method. Although the calculations are computationally intensive, they yield nearly all photoionization and recombination parameters needed for astrophysical photoionization models with higher precision than hitherto possible, estimated at about 10-20% from comparison with experimentally available data (including experimentally derived DR rates). Results are electronically available for over 40 atoms and ions. Photoionization and recombination of He-, and Li-like C and Fe are described for X-ray modeling. The unified method yields total and complete (e+ion) recombination rate coefficients, that can not otherwise be obtained theoretically or experimentally.
Author
Photoionization; Recombination Coefficient; Astrophysics; Theoretical Physics; Ion Recombination

20000109980 Queens Univ., Dept. of Applied Mathematics and Theoretical Physics, Belfast, UK
K-Shell Photoionization of Fe
McLaughlin, B. M., Queens Univ., UK; Donnelly, D., Queens Univ., UK; Bell, K. L., Queens Univ., UK; Scott, M. P., Queens Univ., UK; Keenan, F. P., Queens Univ., UK; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 85-96; In English; See also 20000109969; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The status of K-shell photoionization of neutral iron has been reviewed. A comparison with the available experimental data and existing theoretical work is made for this important element. Several anomalies and features are illustrated and future directions of theoretical work are indicated.
Author
Iron; Photoionization; Electron States; Mathematical Models

20000109981 University of Western Michigan, Dept. of Physics, Kalamazoo, MI USA
The R-Matrix with Pseudostates Method
Gorczyca, T. W., University of Western Michigan, USA; Badnell, N. R., Strathclyde Univ., UK; Griffin, D. C., Rollins Coll., USA; Mitnik, D. M., Auburn Univ., USA; Pindzola, M. S., Auburn Univ., USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 97-102; In English; See also 20000109969; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

We review the development of pseudostate methods for treating electron-ion collision processes. We describe our implementation of these methods within the Wigner-Eisenbud R-matrix method. We present recent results for photoionization, electron-impact excitation, and electron-impact ionization, which demonstrate the importance of properly accounting for the two electron continuum. The comparison with experimental, as well as other theoretical, electron impact ionization results suggests that there may be inaccuracies in the overall normalization of earlier measurements. This is confirmed in the case of Al(2+) by a more recent experimental study. The implications regarding the use of excitation and ionization rates from existing databases for modeling astrophysical plasmas are discussed.
Author
Matrix Theory; Electron States; Ionic Collisions; Electron Scattering

20000109982 Lawrence Livermore National Lab., High Temperature and Astrophysics Div., Livermore, CA USA
Laboratory Data for X-Ray Astronomy
Beiersdorfer, P., Lawrence Livermore National Lab., USA; Brown, G. V., Lawrence Livermore National Lab., USA; Chen, H., Lawrence Livermore National Lab., USA; Gu, M.-F., Columbia Univ., USA; Kahn, S. M., Columbia Univ., USA; Lepson, J. K.,

California Univ., USA; Savin, D. W., Columbia Univ., USA; Utter, S. B., Lawrence Livermore National Lab., USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 103-116; In English; See also 20000109969
Contract(s)/Grant(s): NASA Order W-19127; W-7405-eng-48; NAG5-6731; NAG5-5123; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Laboratory facilities have made great strides in producing large sets of reliable data for X-ray astronomy, which include ionization and recombination cross sections needed for charge balance calculations as well as the atomic data needed for interpreting X-ray line formation. We discuss data from the new generation sources and pay special attention to the LLNL electron beam ion trap experiment, which is unique in its ability to provide direct laboratory access to spectral data under precisely controlled conditions that simulate those found in many astrophysical plasmas. Examples of spectral data obtained in the 1-160 A wavelength range are given illustrating the type of laboratory X-ray data produced in support of such missions as Chandra, X-Ray Multi-Mirror telescope (XMM), Advanced Satellite for Cosmology and Astrophysics (ASCA) and Extreme Ultraviolet Explorer Satellite (EUVE).
Author
Research Facilities; X Ray Astronomy; Data Processing; Ionization Cross Sections; Recombination Coefficient

20000109983 Liege Univ., Inst. de Physique Nucleaire Experimentale, Belgium
Time-Resolved Atomic Spectroscopy With Fast-Ion Beams, Heavy-Ion Storage Ring and Ion Traps
Traebert, Elmar, Liege Univ., Belgium; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 117-125; In English; See also 20000109969; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The understanding of the light received from astrophysical sources requires knowledge of atomic structure and dynamics, or of excitation cross sections and conditions, wavelengths and transition probabilities, f-values, branching ratios and level lifetimes. Fast ion beams (by beamfoil spectroscopy) and ion traps, as well as their cross-breed, the heavy-ion storage ring, can contribute to the field of X-ray astronomy. Fast-ion beam spectroscopy has a long track record in all spectral ranges, including Extreme Ultraviolet (XUV) and X-ray, with a plethora of data supporting astrophysics. In contrast, most of the time-resolved work with the ion trap techniques has been done in the Ultraviolet (UV) and Vacuum Ultraviolet (VUV)/Extreme Ultraviolet (EUV) above 100 Angstroms, but it can be extended into the region of interest.
Author
Ion Beams; Heavy Ions; Storage Rings (Particle Accelerators); X Ray Spectroscopy; Astrophysics; Ion Traps (Instrumentation); Time Dependence

20000109984 Lawrence Livermore National Lab., Livermore, CA USA
Tokamak Spectroscopy for X-Ray Astronomy
Fournier, Kevin B., Lawrence Livermore National Lab., USA; Finkenthal, M., Johns Hopkins Univ., USA; Pacella, D., Associazione EURATOM-ENEA Sulla Fusione, Italy; May, M. J., Johns Hopkins Univ., USA; Soukhanovskii, V., Johns Hopkins Univ., USA; Mattioli, M., Associazione EURATOM-ENEA Sulla Fusione, Italy; Leigheb, M., Associazione EURATOM-ENEA Sulla Fusione, Italy; Rice, J. E., Massachusetts Inst. of Tech., USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 127-133; In English; See also 20000109969
Contract(s)/Grant(s): W-7405-eng-48; EL9-1007A; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper presents the measured x-ray and Extreme Ultraviolet (XUV) spectra of three astrophysically abundant elements (Fe, Ca and Ne) from three different tokamak plasmas. In every case, each spectrum touches on an issue of atomic physics that is important for simulation codes to be used in the analysis of high spectral resolution data from current and future x-ray telescopes. The utility of the tokamak as a laboratory test bed for astrophysical data is demonstrated. Simple models generated with the HULLAC suite of codes demonstrate how the atomic physics issues studied can affect the interpretation of astrophysical data.
Author
Extreme Ultraviolet Radiation; Plasmas (Physics); Tokamak Devices; X Ray Astronomy; X Ray Spectra; Astrophysics

20000109985 Lawrence Livermore National Lab., Livermore, CA USA
X-Ray Photoionized Plasmas in the Laboratory
Heeter, R. F., Lawrence Livermore National Lab., USA; Eming, J. A., Lawrence Livermore National Lab., USA; Foord, M. E., Lawrence Livermore National Lab., USA; Thoe, R. S., Lawrence Livermore National Lab., USA; Springer, P. T., Lawrence Livermore National Lab., USA; Bailey, J., Sandia National Labs., USA; Cuneo, M., Sandia National Labs., USA; Deeney, C., Sandia National Labs., USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 135-142; In English; See also 20000109969
Contract(s)/Grant(s): W-7405-eng-48; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The advanced spectroscopic capabilities of the new X-ray telescopes Chandra and X-Ray Multi-Mirror Mission (XMM) lead to a need for improved benchmarking of models for the photoionized accretion-disk plasmas which represent over half of known astrophysical X-ray sources. We report the first laboratory experimental results using 120 TW, 180 eV Z-pinch plasmas to drive iron samples into the photoionized equilibrium. The pinch spectrum, temperature, power and uniformity have been characterized in order to qualify it as a photoionization driver. Preliminary time integrated (8 A to 18 A) and time-resolved (12.5 A to 16 A) absorption and emission spectra of photoionized L-shell Fe and K-shell Na and F were observed using X-ray crystal spectrometers. Plans for upcoming experiments are also discussed.
Author
Photoionization; Plasmas (Physics); X Ray Astronomy; Zeta Pinch

20000109986 Columbia Univ., Columbia Astrophysics Lab., New York, NY USA
Modeling X-Ray Photoionized Plasmas: Ion Storage Ring Measurements of Low Temperature Dielectronic Recombination Rate Coefficients for L-Shell Iron
Savin, D. W., Columbia Univ., USA; Badnell, N. R., Strathclyde Univ., UK; Bartsch, T., Justus Liebig-Univ., Germany; Brandau, C., Justus Liebig-Univ., Germany; Chen, M. H., Lawrence Livermore National Lab., USA; Grieser, M., Max-Planck-Inst. fuer Kernphysik, Germany; Gwinner, G., Max-Planck-Inst. fuer Kernphysik, Germany; Hoffknecht, A., Justus Liebig-Univ., Germany; Kahn, S. M., Columbia Univ., USA; Linkemann, J., Max-Planck-Inst. fuer Kernphysik, Germany; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 143-150; In English; See also 20000109969
Contract(s)/Grant(s): W-7405-eng-48; BMBF-06-GI-475; BMBF-06-GI-848; BMBF-06-HD-854I; NAG5-5123; NATO-CRG-950911; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche
Iron L-shell ions (Fe XVII to Fe XXIV) play an important role in determining the line emission and thermal and ionization structures of photoionized gases. Existing uncertainties in the theoretical low temperature dielectronic recombination (DR) rate coefficients for these ions significantly affects our ability to model and interpret observations of photoionized plasmas. To help address this issue, we have initiated a laboratory program to produce reliable low temperature DR rates. Here, we present some of our recent results and discuss some of their astrophysical implications.
Author
Iron; Low Temperature; Photoionization; Plasmas (Physics); Recombination Coefficient; Storage Rings (Particle Accelerators); Electron-Ion Recombination; X Ray Spectra

20000109987 Lawrence Livermore National Lab., Physics Dept., Livermore, CA USA
The Completeness Criterion in Atomic Modeling
Liedahl, Duane A., Lawrence Livermore National Lab., USA; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 151-159; In English; See also 20000109969
Contract(s)/Grant(s): W-7405-eng-48; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche
I discuss two variations on the completeness theme in atomic modeling; missing lines as they affect the performance of spectral synthesis codes, and missing configurations as they affect the theoretical emissivities of bright lines, with emphasis on the latter. It is shown that the detrimental effects of working with incomplete atomic models can overshadow those brought about by working with less-than-perfect atomic rates. Atomic models can be brought up to an acceptable level of completeness in a fairly straightforward manner, and on a reasonably short timescale, whereas the long-term goal of comprehensive accuracy is unlikely to be reached on the timescale of the current generation of X-ray observatories. A near-term, albeit imperfect, solution is to hybridize atomic models used to synthesize spectra. A hybrid atomic model is one for which a large-scale atomic model, in which completeness is achieved at the expense of accuracy, is augmented with more accurate atomic quantities as they become available.
Author
X Ray Astronomy; Atomic Physics; Mathematical Models

20000109988 Instituto Venezolano de Investigaciones Cientificas, Centro de Fisica, Caracas, Venezuela
Atomic Databases
Mendoza, Claudio, Instituto Venezolano de Investigaciones Cientificas, Venezuela; Atomic Data Needs for X-ray Astronomy; October 2000, pp. 167-171; In English; See also 20000109969; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche
Atomic and molecular data are required in a variety of fields ranging from the traditional astronomy, atmospherics and fusion research to fast growing technologies such as lasers, lighting, low-temperature plasmas, plasma assisted etching and radiotherapy. In this context, there are some research groups, both theoretical and experimental, scattered round the world that attend to most of this data demand, but the implementation of atomic databases has grown independently out of sheer necessity. In some cases the latter has been associated with the data production process or with data centers involved in data collection and evaluation; but

sometimes it has been the result of individual initiatives that have been quite successful. In any case, the development and maintenance of atomic databases call for a number of skills and an entrepreneurial spirit that are not usually associated with most physics researchers. In the present report we present some of the highlights in this area in the past five years and discuss what we think are some of the main issues that have to be addressed.
Author
Data Bases; Atomic Physics; World Wide Web

20000110096 Hertfordshire Univ., Dept. of Physical Sciences, Hatfield, UK
A High Resolution Radio Survey of Class I Protostars
Lucas, P. W., Hertfordshire Univ., UK; Blundell, Katherine, Oxford Univ., UK; Roche, P. F., Oxford Univ., UK; Monthly Notices Royal Astronomical Society; 2000; 16p; In English; Copyright; Avail: Issuing Activity

We report the results of a survey of low mass Class I protostars in the cm continuum. In the initial survey, seven sources in the Taurus star formation were observed with the Very Large Array (VLA) at 0".25 resolution. All seven sources drive CO outflows and display Herbig-Haro flows in the optical or near infrared wavebands. 4/7 sources were detected, two of which are new discoveries in systems of very low luminosity, one being the lowest luminosity system detected to date in the cm continuum. Notably, three sources were not detected in a 3-sigma limit of 0.10 mJy/beam, which indicates that significant cm continuum emission is not a universal feature of Class I systems with outflow activity. Subsequent observations of HH30, a more evolved Class II system, found no emission to a 3-sigma limit of 0.03 mJy/beam. After comparison with new infrared data, we suggest that the discriminating feature of the detected systems is a relatively high ionization fraction in the stellar wind. Temporal variability of the outflow may also play a role: only recently ejected knots may have sufficiently dense plasma to be optically thick to free-free emission, and hence produce detectable flux. The one relatively bright source, IRAS 04016 + 2610 (L1489 IRS), is clearly resolved on a 0".4 scale at 2 cm and 3.5 cm. Follow-up imaging with MERLIN did not detect this source with a 0".04 beam, indicating that the radio emission is generated in a region with a radius of about 25 au, which is broadly similar to the radius of the bipolar cavities inferred from models of near infrared data. Interpretation of this system is complicated by the existence of quadrupolar outflow, i.e. two bipolar outflows along roughly perpendicular axes, which we originally detected through polarimetric imaging. We present a near infrared H2 image in which a bow shock in the secondary outflow is clearly seen. This complicated structure may have been caused by a gravitational interaction between two protostars.
Author
Near Infrared Radiation; Radio Emission; Protostars

20000110133 NASA Goddard Space Flight Center, Greenbelt, MD USA
Ultraviolet Galaxy Counts From STIS Observations of The Hubble Deep Fields
Gardner, J. P., NASA Goddard Space Flight Center, USA; Brown, T. M., NASA Goddard Space Flight Center, USA; Ferguson, H. C., Space Telescope Science Inst., USA; [2000]; 1p; In English; 196th; Session 6: Cosmology and Large Scale Structure, 4-8 Jun. 2000, Rochester, NY, USA; Sponsored by American Astronautical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present galaxy counts in the near and far ultraviolet (NUV and FUV) obtained from Space Telescope Imaging Spectrograph (STIS) observations of portions of the Hubble Deep Field North, (HDFN), the Hubble Deep Field South, (HDFS) and a parallel field near the HDFN. All three fields have deep (AB>29) optical imaging, and we determine magnitudes by taking the ultraviolet flux detected within the limiting optical isophote. An analysis of the UV-optical colors of detected objects, combined with a visual inspection of the UV images, indicates that there are no detectable objects in the UV images which are not also detected in the optical. We measure the detection area and completeness as a function of magnitude by taking the size-magnitude distribution of galaxies in the entire HDFN WFPC2 V+I image, applying the measured UV-optical colors from the detected galaxies, and determining the total area over which each galaxy would have been detected in the UV images. The average area for the simulated galaxies in each UV magnitude bin, (including galaxies which would not be detected at all), provides the effective area and completeness for the bin. We test this procedure with Monte Carlo simulations. The galaxy counts reach to AB=29 in both the NUV and FUV; 1 magnitude fainter than the HDF F30OW counts, and 7 magnitudes fainter than balloon-based counts. We compare our measured counts to various models.
Author
Galaxies; Counting; Far Ultraviolet Radiation; Near Ultraviolet Radiation

20000110589 National Optical Astronomy Observatories, Tucson, AZ USA

The Age of the Inner Halo Globular Cluster NGC 6652

Chaboyer, Brian, Dartmouth Coll., USA; Sarajedini, Ata, Wesleyan Univ., USA; Armandroff, Taft E., National Optical Astronomy Observatories, USA; September 2000; 23p; In English

Contract(s)/Grant(s): NAS5-26555; GO-06517

Report No.(s): NOAO-Preprint-884; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Hubble Space Telescope (HST) (V,I) photometry has been obtained for the inner halo globular cluster NGC 6652. The photometry reaches approximately 4 mag below the turn-off and includes a well populated horizontal branch (HB). This cluster is located close to the Galactic center at RGC approximately equal to 2.0 kpc with a reddening of E(V-I) = 0.15 +/- 0.02 and has a metallicity of [Fe/H] approximately equal to -0.85. Based upon DELTA V (sup SGB) (sub HB), NGC 6652 is 11.7 plus or minus 1.6 Gyr old. Using A HB precise differential ages for 47 Tuc (a thick disk globular), M107 and NGC 1851 (both halo clusters) were obtained. NGC 6652 appears to be the same age as 47 Tuc and NGC 1851 (within +/- 1.2 Gyr), while there is a slight suggestion that M107 is older than NGC 6652 by 2.3 +/- 1.5 Gyr. As this is a less than 2 sigma result, this issue needs to be investigated further before a definitive statement regarding the relative age of M107 and NGC 6652 may be made.

Author

Globular Clusters; Halos; Chronology; Photometry; Stellar Evolution

20000110590 National Optical Astronomy Observatories, Tucson, AZ USA

The Luminosity Function of Magnitude and Proper-Motion Selected Samples: The Case of White-Dwarfs

Mendez, Rene A., Cerro Tololo Inter-American Observatory, Chile; Ruiz, Maria Teresa, Chile Univ., Chile; [2000]; 34p; In English; Sponsored in part by Catedra Presidencial en Ciencias and Fondecyt

Contract(s)/Grant(s): CPCF-1980659

Report No.(s): NOAO-Preprint-885; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The luminosity function of white dwarfs is a powerful tool for studies of the evolution and formation of the Milky Way. The (theoretical) white dwarf cooling sequence provides a useful indicator of the evolutionary time scales involved in the chronometry and star formation history of the galactic disk, therefore, intrinsically faint (& old) white dwarfs in the immediate solar neighborhood can be used to determine an upper limit for the age of the galactic disk. Most determinations of the white dwarf luminosity function have relied on the use of Schmidt's 1/V(sub max) method for magnitude and proper-motion selected samples, the behavior of which has been demonstrated to follow a minimum variance maximum-likelihood pattern for large samples. Additionally, recent numerical simulations have also demonstrated that the 1/V(sub max) provides a reliable estimator of the true LF, even in the case of small samples. However, the conclusions from all these previous studies have been based on noise-free data, where errors in the derived LF have been either assumed to follow a Poisson distribution (valid only for large samples), or where other simple estimates for the uncertainties have been used. In this paper we examine the faint-end (M(sub v greater than +14) behavior of the disk white dwarf luminosity function using the 1/V(sub max) method, but fully including the effects of realistic observational errors in the derived luminosity function. We employ a Monte Carlo approach to produce many different realizations of the luminosity function from a given data set with pre-specified and reasonable errors in apparent magnitude, proper motions, parallaxes and bolometric corrections. These realizations allow us to compute both a mean and an expected range in the luminosity function that is compatible with the observational errors. We find that current state-of-the art observational errors, mostly in the bolometric corrections and trigonometric parallaxes, play a major role in obliterating (real or artificial) small scale fluctuations in the luminosity function. We also find that a better estimator of the true luminosity function seems to be the median over simulations, rather than the mean. When using the latter, an age of 10 Gyr or older can not be ruled out from the sample of Leggett, Ruiz, and Bergeron (1998).

Author

Luminosity; White Dwarf Stars; Stellar Magnitude; Milky Way Galaxy; Kinematics

20000110935 Boston Univ., Dept. of Astronomy, Boston, MA USA

Continued RXTE Observations of Three Blazars ***Final Report, 1 May 1998 - 30 Apr. 2000***

Marscher, Alan P., Boston Univ., USA; [2000]; 4p; In English

Contract(s)/Grant(s): NAG5-7338; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project continued (during Cycle 3 of the RXTE mission) weekly observations of the quasars PKS 1510-089 and 3C 454.3 and the BL Lac object OJ 287. The data were analyzed by the PI and his graduate student. In the middle of Cycle 3, the PI changed the mode of observation of 3C 454.3, based on a report from another astronomer that observations with the ROSAT satellite had found a strong confusing X-ray source about 45 arcmin away. The RXTE observations, in which the flux was measured while pointing directly at 3C 454.3 and then 15' from 3C 454.3, in the direction away from the confusing source. The flux decreased

considerably, and so it appears that nearly all the X-ray flux measured by RXTE comes from the confusing source rather than the quasar. OJ 287 was detected only at one epoch of the Cycle 3 observations. This corresponded to a particularly quiet period for this source, when its flux at other wavebands was also low. From the single epoch of detection, no conclusions can be drawn concerning the general nature of the X-ray emission from this object. In contrast to the other two sources, the results of the observations of PKS 1510-089, when combined with data from cycles 3 and 4, are very interesting. The RXTE (2.4-20 keV) abd 14.5 GHz University of Michigan Radio Astronomy Observatory (UMRAO) light curves through the end of RXTE Cycle 4 are shown for PKS 1510-089. Visual inspection reveals an obvious correlation between the X-ray and 14.5 GHz light curves. While this is as expected in the SSC model in a source with simultaneous mm-wave (the photons thought to be scattered to X-ray energies) and cm-wave variations, the X-ray spectrum is flat (”energy” spectral index alpha = 0.2-0.5, where F (sub v) proportional to v (sup - alpha)) compared with the mm-wave synchrotron spectrum (alpha approximately equal to 0.8). The PI is currently engaged in theoretical work to determine whether this is possible for an SSC model.
Derived from text
X Ray Timing Explorer; BL Lacertae Objects; Radio Observation; Radio Astronomy

20000111069 NASA Goddard Space Flight Center, Greenbelt, MD USA
[SR II] Detected in a Nebular Filament Near Eta Carinae
Gull, T.R., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 4-8 Jun. 2000, Rochester, NY, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Observations with the Space Telescope Imaging Spectrograph on the Hubble Space Telescope reveal a peculiar emission line region in the close vicinity to Eta Carinae. The lines of [SRII], [MnII], [CoII], [TiII], [NiII] and [FeI] are detected in the 6400-7000 Angstrom spectral interval at a blue-shifted velocity of approximately 95 km/sec and seem to be associated with a long, narrow filament with dimensions of less than 0.5 inches by 1.1 inches. The filament is notable as it is separate both in velocity and structure from the bright emission of the Integral Nebula. This filament is buried within the Homunculus and is not visible in direct images which are dominated by reflection nebulosities. In our literature searches we have found no evidence of strontium emission lines in nebulae. We are aware of permitted transitions of strontium seen in AGB stars. S-processed elements like strontium are not expected in the ejecta of a massive star like Eta Carinae. Detection of [SRII] and the fact that the [NiII], [MnII] and [CoII] lines are unusually strong compared to [FeI] are quite a surprise. It has long been known that nitrogen is overabundant in the ejecta of Eta Carinae. Is this processed material from the present star(s)? Has there been processed material ejected from a more evolved companion? The situation is decidedly mysterious. This research has been supported by NASA through STScI grants and the STIS GTO funding.
Author
Nebulae; Strontium; Stellar Atmospheres; Massive Stars; Detection

20000111070 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Characteristic Dimension of Lyman-Alpha Forest Clouds Toward Q0957+561
Dolan, J. F., NASA Goddard Space Flight Center, USA; Michalitsianos, A. G., NASA Goddard Space Flight Center, USA; Hill, R. J., NASA Goddard Space Flight Center, USA; Nguyen, Q. T., San Diego State Univ., USA; [2000]; 2p; In English, 4-8 Jun. 2000, Rochester, NY, USA; Sponsored by American Astronomical Society, USA
Contract(s)/Grant(s): NSF AST-94-17035; No Copyright; Avail: Issuing Activity; Abstract Only

Far-ultraviolet spectra of the gravitational lens components Q0957+561 A and B were obtained with the Hubble Space Telescope Faint Object Spectrograph to investigate the characteristic dimension of Lyman-alpha forest clouds in the direction of the quasar. If one makes the usual assumption that the absorbing structures are spherical clouds with a single radius, that radius can be found analytically from the ratio of Lyman-alpha lines in only one line of sight to the number in both. A simple power series approximation to this solution, accurate everywhere to better than 1%, will be presented. Absorption lines in Q0957+561 having equivalent width greater than 0.3 A in the observer’s frame not previously identified as interstellar lines, metal lines, or higher order Lyman lines were taken to be Ly-alpha forest lines. The existence of each line in this consistently selected set was then verified by its presence in two archival FOS spectra with approximately 1.5 times higher signal to noise than our spectra. Ly-alpha forest lines appear at 41 distinct wavelengths in the spectra of the two images. One absorption line in the spectrum of image A has no counterpart in the spectrum of image B, and one line in image B has no counterpart in image A. Based on the separation of the lines of sight over the redshift range searched for Ly-alpha forest lines, the density of the absorbing clouds in the direction of Q0957+561 must change significantly over a radius R = 160 (+120, -70) h (sup -1) (sub 50) kpc (H (sub 0) 50 h (sub 50) km s (sup -1) kpc (sup -1), q (sub 0) = 1/2). The 95% confidence interval on R extends from (50 950) h (sup -1) (sub 50) kpc.
Author
Lyman Alpha Radiation; Quasars; Dimensions; Lyman Spectra

20000111076 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Chandra Observations of Hydra A

McNamara, Brian, Smithsonian Astrophysical Observatory, USA; [2000]; 1p; In English; Constructing the Universe with Clusters of Galaxies, 4-8 Jul. 2000, Paris, France

Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

We present Chandra X-ray Observations of the Hydra A cluster of galaxies, and we report the discovery of structure in the central 80 kpc of the cluster's X-ray-emitting gas. The most remarkable structures are depressions in the X-ray surface brightness, approx. 25 - 35 kpc diameter, that are coincident with Hydra A's radio lobes. The depressions are nearly devoid of X-ray-emitting gas, and there is no evidence for shock-heated gas surrounding the radio lobes. We suggest the gas within the surface brightness depressions was displaced as the radio lobes expanded subsonically, leaving cavities in the hot atmosphere. The gas temperature declines from 4 keV at 70 kpc to 3 keV in the inner 20 kpc of the brightest cluster galaxy (BCG), and the cooling time of the gas is approx. 600 Myr in the inner 10 kpc. These properties are consistent with the presence of a approx. 34 solar mass/yr cooling flow within a 70 kpc radius. Bright X-ray emission is present in the BCG surrounding a recently-accreted disk of nebular emission and young stars. The star formation rate is commensurate with the cooling rate of the hot gas within the volume of the disk, although the sink for the material that may be cooling at larger radii remains elusive.
Author

X Rays; Galactic Clusters; Star Formation Rate; Gas Heating; Emission; Brightness

20000111347 NASA Goddard Space Flight Center, Greenbelt, MD USA

Far UV Spectroscopy of eta Carinae

Iping, R. C., NASA Goddard Space Flight Center, USA; Sonneborn, G., NASA Goddard Space Flight Center, USA; Massa, D. L., Raytheon Information Technology and Scientific Services, USA; Hutchings, J. B., National Research Council of Canada, Canada; Gull, T. R., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 196th, 4-8 Jun. 2000, Rochester, NY, USA; Sponsored by American Astronomical Society, USA

Contract(s)/Grant(s): NAS5-32985; No Copyright; Avail: Issuing Activity

We present the first high spectral resolution observations of the Luminous Blue Variable eta Carinae between the Lyman limit and 1180 A. High resolution spectra (R approx. 20,000) were obtained with the Far Ultraviolet Spectroscopic Explorer (FUSE) satellite on Feb. 1 and Mar. 20, 2000. The observations were made with a 30 x 30 arcsec aperture and includes the entire Homunculus region. However, the spatial extent of the far UV flux is consistent with a point source. With the limited spatial resolution of the FUSE instrument, we can only constrain the far UV emission to be within +/- 5 arcsec of the star. The far UV spectrum of eta Car is dominated by strong absorption features of molecular hydrogen. The observed flux level at 1150A is approx. 4 times 10(exp 12) erg /cm(exp -2) /sec(exp -1) / A(exp -1) and decreases approximately linearly to approx. 920 A where converging H1 and H2 features completely blanket the spectrum. These observations were obtained as part of the FUSE Early Release Observation program.
Author

Blue Stars; Ultraviolet Astronomy; Supermassive Stars; Variable Stars

20000114853 Air Force Research Lab., Hanscom AFB, MA USA

The Midcourse Space Experiment Point Source Catalog Version 1.2 Explanatory Guide ***Interim Report***

Egan, M. P.; Price, S. D.; Moshir, M. M.; Cohen, M.; Tedesco, E.; Jun. 17, 1999; 119p; In English; Prepared in collaboration with Infrared Processing and Analysis Center, Vanguard Research, Inc., University of California, Berkeley, CA, Frontier Technolgies, Inc., Terrasystems, Inc., and Radex, Inc.

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A381933; AFRL-VS-TR-1999-1522; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This Explanatory Guide to the MSX Point Source Catalog briefly describes the instrumentation, and the experiments, which emphasized the areas that IRAS did not survey, and the Galactic Plane. A detailed discussion of the calibration and data processing follows. This guide then describes the catalog contents and presents analyses of the reliability of the quoted fluxes and positions, and the completeness and reliability of the catalog as a whole.
DTIC

Spaceborne Experiments; Catalogs (Publications); Data Processing; Instruments

90
ASTROPHYSICS

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

20000109819 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
Interferometric Techniques for Gravitational Wave Detection in Space ***Annual Report, FY 1999***
Stebbins, Robin T, Colorado Univ., USA; Bender, Peter L., Colorado Univ., USA; Oct. 16, 2000; 4p; In English
Contract(s)/Grant(s): NAG5-7638; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Laser Interferometer Space Antenna (LISA) mission will detect gravitational waves from galactic and extragalactic sources, most importantly those involving supermassive black holes. The primary goal of this project is to investigate stability and robustness issues associated with LISA interferometry. We specifically propose to study systematic errors arising from: optical misalignments, optical surface errors, thermal effects and pointing tolerances. This report covers the first fiscal year of the grant, from January 1st to December 31st 1999. We have employed an optical modeling tool to evaluate the effect of misplaced and misaligned optical components. Preliminary results seem to indicate that positional tolerances of one micron and angular tolerances of 0.6 millirad produce no significant effect on the achievable contrast of the interference pattern. This report also outlines research plans for the second fiscal year of the grant, from January 1st to December 31st 2000. Since the work under NAG5-6880 has gone more rapidly than projected, our test bed interferometer is operational, and can be used for measurements of effects that cause beam motion. Hence, we will design, build and characterize a sensor for measuring beam motion, and then install it. We are also planning a differential wavefront sensor based on a quadrant photodiode as a first generation sensor.
Derived from text
Research and Development; Gravitational Waves; Detection

20000109861 Submillimeter Observatory, Hilo, HI USA
The Alignment of the Magnetic Field and Collimated Outflows in Star Forming Regions-the Case of NGC 2071
Houde, Martin, Submillimeter Observatory, USA; Phillips, Thomas G., California Inst. of Tech., USA; Bastien, Pierre, Montreal Univ., Canada; Peng, Ruisheng, Submillimeter Observatory, USA; Yoshida, Hiroshige, Submillimeter Observatory, USA; [2000]; 12p; In English
Contract(s)/Grant(s): NSF AST-9615025
Report No.(s): Rept-2000-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The magnetic field is believed to play a crucial role in the process of star formation. From the support it provides during the initial collapse of molecular clouds to the creation of strong collimated jets responsible for large mass losses, current theories predict its importance in many different stages during the formation of star. Here we report on observational evidence which tests one aspect that can be inferred from these theories: the alignment between the local magnetic field and collimated bipolar outflows in such environments. There is good evidence of an alignment in the case of NGC 2071.
Author
Magnetic Fields; Star Formation; Collimation; Alignment

20000109894 NASA Marshall Space Flight Center, Huntsville, AL USA
Electrodynamic Balance for Studies of Cosmic Dust Particles
Spann, J. F., NASA Marshall Space Flight Center, USA; Abbas, M. M., NASA Marshall Space Flight Center, USA; Venturini, C. C., NASA Marshall Space Flight Center, USA; Comfort, R. H., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Knowledge of the formation and distribution of interstellar, interplanetary, and planetary dust grains, and their physical, chemical and optical characteristics provide valuable information about many issues dealing with the origin and formation of the solar system bodies, interplanetary and interstellar environments as well as various industrial processes. Understanding the microphysics of individual grains and their interaction with the surrounding, environment is key to properly model various conditions and interpret existing data. The theory and models of individual dust grains are well developed for environments that vary from dense planetary atmospheres to dusty plasmas to diffuse environments such as interplanetary space. However, experimental investigations of individual dust grains in equilibrium are less common, perhaps due to the difficulty of these experiments. Laboratory measurements of dust grains have primarily measured ensemble properties or transient properties of single grains. A technique developed in the 1950's for ion spectroscopy, generally referred to as a quadrupole trap has recently been employed as an electrodynamic balance to investigate single micron-sized dust grains and for atmospheric aerosol research. A description of the theoretical basis and the experimental setup of the electrodynamic balance being developed in our laboratory are given. This laboratory technique lends itself to many applications that relate to planetary atmospheres, heliospheric environments, pre-stellar and pre-

planetary conditions, and industrial settings. We present results from some recent experiments carried out to investigate the equilibrium potential of dust grains exposed to far ultraviolet light or to an electron beam. Some future experiments using an electrodynamic balance to investigate the optical characteristics, and condensation process involving dust grains in various astrophysical environments are discussed.
Author
Cosmic Dust; Planetary Atmospheres; Molecular Clouds; Electrodynamics

20000109957 NASA Ames Research Center, Moffett Field, CA USA
The Hummingbird GC-IMS: In Situ Analysis of a Cometary Nucleus
Kojiro, Daniel R., NASA Ames Research Center, USA; Carle, Glenn C., NASA Ames Research Center, USA; Cohen, Martin J., PCP, Inc., USA; Wernlund, Roger F., PCP, Inc., USA; Stimac, Robert M., PCP, Inc., USA; Takeuchi, Norishige, ManTech Systems Engineering Corp., USA; [2000]; 1p; In English; 8th; 8th International Conference of On-Site Analysis, 23-26 Jan. 2000, Las Vegas, NV, USA
Contract(s)/Grant(s): RTOP 344-36-30-28; No Copyright; Avail: Issuing Activity; Abstract Only

Comets are of enormous scientific interest for many reasons. They are primitive bodies that date back to the earliest stages of solar system formation and, because of their small size and because they have been stored in the outer reaches of the solar system, their pristine nature has been preserved better than for any other class of body. They are extremely rich in highly volatile elements, many in the form of ices, and are richer in organic matter than any other known solar system body. It is strongly suspected that in addition to their content of primordial solar nebular material, they also incorporate unprocessed matter from the interstellar medium. Impacts by comets occur onto all the planets and satellites, often with major consequences (e.g., the dinosaur extinction event at the KIT boundary), or sometimes just providing a spectacular cosmic event (e.g., the collision of comet Shoemaker-Levy 9 with Jupiter). A mission to analyze a cometary nucleus must be capable of detecting and identifying over 30 molecular species among several different chemical groups. The Hummingbird Mission will rendezvous with, orbit, characterize, and make multiple descents to the nucleus of a comet. Hummingbird will employ a Gas Chromatograph - Ion Mobility Spectrometer (GC-IMS) as part-of a suite of sophisticated instruments for a comprehensive in situ elemental, molecular, and isotopic analysis of the comet.
Author
Comet Nuclei; Gas Chromatography; Ion Mobility Spectroscopy; Space Missions

20000109964 NASA Ames Research Center, Moffett Field, CA USA
Synthesis of Large Molecules in Cometary Ice Analogs: Physical Properties Related to Self-Assembly Processes
Dworkin, Jason P., NASA Ames Research Center, USA; Sandford, Scott A., NASA Ames Research Center, USA; Deamer, David W., California Univ., USA; Gillette, J. Seb, Stanford Univ., USA; Zare, Richard N., Stanford Univ., USA; [1999]; 1p; In English; 1999 Meeting o BioAstronomy, Aug. 1999, Khilua, HI, USA
Contract(s)/Grant(s): RTOP 399-20-61; No Copyright; Avail: Issuing Activity; Abstract Only

The combination of realistic laboratory simulations and infrared observations have revolutionized our understanding of interstellar dust and ice-the main component of comets. Since comets and carbonaceous micrometeorites may have been important sources of volatiles and carbon compounds on the early Earth, their organic composition may be related to the origin of life. Ices on grains in molecular clouds contain a variety of simple molecules. The D/H ratios of the comets Hale-Bopp and Hyakutake are consistent with a primarily interstellar ice mixture. Within the cloud and especially in the presolar nebula through the early solar system, these icy grains would have been photoprocessed by the ultraviolet producing more complex species such as hexamethylenetetramine, polyoxymethylenes, and simple keones. We reported at the 1999 Bioastronomy meeting laboratory simulations studied to identify the types of molecules which could have been generated in pre-cometary ices. Experiments were conducted by forming a realistic interstellar mixed-molecular ice (H2O, CH3OH, NH3 and CO) at approximately 10 K under high vacuum irradiated with UV light from a hydrogen plasma lamp. The gas mixture was typically 100:50:1:1, however when different ratios were used material with similar characteristics was still produced. The residue that remained after warming to room temperature was analyzed by HPLC, and by several mass spectrometric methods. This material contains a rich mixture of complex compounds with mass spectral profiles resembling those found in IDPs and meteorites. Surface tension measurements show that an amphiphilic component is also present. These species do not appear in various controls or in unphotolyzed samples. Residues from the simulations were also dispersed in aqueous media for microscopy. The organic material forms 10-40 gm diameter droplets that fluoresce at 300-450 nm under UV excitation. These droplets have a morphology and internal structure which appear strikingly similar to those produced by extracts of the Murchison meteorite. Together, these results suggest a link between organic material photochemically synthesized on the cold grains in dense, interstellar molecular clouds and compounds that may have contributed

to the organic inventory of the primitive Earth. For example, the amphiphilic properties of such compounds permit self-assembly into the membranous boundary structures that required for the first forms of cellular life.
Author
Molecules; Cometary Atmospheres; Analogs; Physical Properties; Synthesis (Chemistry); Ice; Cosmic Dust

20000110134 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Dream of a Mission: Stellar Imager and Seismic Probe
Carpenter, Kenneth G., NASA Goddard Space Flight Center, USA; Schrijver, Carolus J., Stanford-Lockheed Inst. for Space Research, USA; [2000]; 1p; In English, 4-8 Jun. 2000, Rochester, NY, USA; Sponsored by American Astronautical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Stellar Imager and Seismic Probe (SISP) is a mission to understand the various effects of magnetic fields of stars, the dynamos that generate them, and the internal structure and dynamics of the stars in which they exist. The ultimate goal is to achieve the best-possible forecasting of solar activity on times scales ranging up to decades, and an understanding of the impact of stellar magnetic activity on astrobiology and life in the Universe. The road to that goal will revolutionize our understanding of stars and stellar systems, the building blocks of the Universe. SISP will zoom in on what today - with few exceptions - we only know as point sources, revealing processes never before seen, thus providing a tool to astrophysics as fundamental as the microscope is to the study of life on Earth. SISP is an ultraviolet aperture-synthesis imager with 8-10 telescopes with meter-class apertures, and a central hub with focal-plane instrumentation that allows spectrophotometry in passbands as narrow as a few Angstroms up to hundreds of Angstroms. SISP will image stars and binaries with one hundred to one thousand resolution elements on their surface, and sound their interiors through asteroseismology to image internal structure, differential rotation, and large-scale circulations; this will provide accurate knowledge of stellar structure and evolution and complex transport processes, and will impact numerous branches of (astro)physics ranging from the Big Bang to the future of the Universe. Fitting naturally within the NASA long-term time line, SISP complements defined missions, and with them will show us entire other solar systems, from the central star to their orbiting planets.
Author
Seismographs; Measuring Instruments; Spectrophotometry; Imaging Spectrometers; Imaging Techniques

20000110358 WNS GeoScience, Eltham, Australia
Earth, Venus, and Mars: A Trinity Reunited
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A review of the temperature history of the atmospheres of the Terrestrial Planets demonstrates that a single simple model of coexisting CO2 and H2O on cold-surfaced planets can explain the present state and evolution of all the Terrestrial planets with a minimum of additional constraints. Additional information is contained in the original extended abstract.
Author
Temperature Measurement; Planetary Atmospheres; Carbon Dioxide

20000110399 Lamont-Doherty Geological Observatory, Palisades, NY USA
SNC Meteorites and the Bulk Composition of Mars
Longhi, John, Lamont-Doherty Geological Observatory, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Although igneous rocks such as the SNC (shergottite-nahklite-chassignite) meteorites - the meteorites from Mars - do not provide direct information about their parent body's bulk composition, their compositions do hold important clues that can be employed to estimate bulk composition. For example, because K and La are highly incompatible in igneous processes, their ratio changes little during igneous differentiation; yet K/La may vary during nebular processes because K is moderately volatile, whereas La is relatively involatile. So the Earth, its moon, and the various groups of igneous meteorites have distinct K/La ratios. The average K/La of the SNCs is about 600 as compared to the terrestrial value (about 350) - both of which are much higher than K/La in lunar rocks and eucrites, but lower than chondritic K/La (about 2400). Therefore, numerous authors have concluded that the SNC parent body (Mars) has higher abundances of other moderately volatile elements (alkalis, sulfur) than the earth, and possibly higher abundances of carbon and water. Similarly, Mn/Mg is nearly constant in ordinary and C1 chondrites, and Fe/Mn varies little during igneous processes; so if the silicate portion of a planet has chondritic proportions of refractory elements (Ca, Al, Ti, Mg, REE), then Fe/Mn in basalts can yield Fe/Mg in the bulk silicate. Dreibus and Wanke derived a value of 0.75 for

MgO/(MgO+FeO) in this way for the martian crust and mantle. These authors also found that the SNCs were systematically lower in Co, Ni, and Cu than their terrestrial counterparts with similar FeO and MgO concentrations; they surmised that FeS liquids scavanged chalcophile elements out of the early martian mantle and into the core. They derived the bulk sulfur content of Mars and its coupled iron from K/La (above) and other volatile element systematics. Finally, they assumed a Fe/Si ratio for Mars equivalent to that in C1 chondrites (1.71) and apportioned the balance of the Fe not bound with sulfur or mantle silicate to the core. Additional information is contained in the original extended abstract.
Author
Chondrites; Mars (Planet); Mars Surface; Planetary Geology; SNC Meteorites; Chemical Composition; Meteoritic Composition; Planetary Composition

20000110400 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
Microtektites on Mars
Lorenz, R. D., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Energetic impact events produce a fireball large enough to punch through the atmosphere and distribute ejecta on ballistic trajectories, leading to large fields of microspheres. These particles, often called microtektites, are formed by condensation of rock vapor in the expanding fireball, and by melting of material on reentry. Mars' thin atmosphere means that this process can occur for smaller, and therefore more frequent, impact events. Such materials should therefore be widespread on Mars. Furthermore, the thermal history of such particles is very different from the steady sprinkling of micrometeorites entering the atmosphere on hyperbolic orbits. This will make deposits of microtektites easy to recognize with in-situ instrumentation, especially in the polar deposits. Additional information is contained in the original extended abstract.
Author
Micrometeorites; Tektites; Micrometeoroids; Hypervelocity Projectiles; Mars (Planet); Mars Surface

20000110471 NASA Johnson Space Center, Houston, TX USA
Biogenic Magnetite in Martian Meteorite ALH84001
Thomas-Keprta, K. L., Lockheed Martin Corp., USA; Bazylinski, Dennis, Iowa State Univ. of Science and Technology, USA; Wentworth, Susan J., Lockheed Martin Corp., USA; McKay, David S., NASA Johnson Space Center, USA; Kirschvink, Joseph L., California Inst. of Tech., USA; Clemett, SImon J., MVA, Inc., USA; Bell, Mary Sue, Lockheed Martin Corp., USA; Golden, D. C., Dual, Inc., USA; Gibson, Everett K., Jr., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Fine-grained magnetite (Fe3O4) in martian meteorite ALH84001, generally less than 200 nm in size, is located primarily in the rims that surround the carbonate globules. There are two populations of ALH84001 magnetites, which are likely formed at low temperature by inorganic and biogenic processes. Nearly 27% of ALH84001 magnetite particles, also called elongated prisms, have characteristics which make them uniquely identifiable as biological precipitates. Additional information is contained in the original extended abstract.
Author
Magnetite; SNC Meteorites; Biological Evolution

20000110486 California Inst. of Tech., Div. of Geological and Planetary Sciences, Pasadena, CA USA
Thermal and Magnetic History of the Martian Meteorite ALH84001: Implications for Past Martian Life and Panspermia
Weiss, Benjamin P., California Inst. of Tech., USA; Kirschvink, Joseph L., California Inst. of Tech., USA; Maine, Altair T., California Inst. of Tech., USA; Macdonald, Francis, California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The thermal and magnetic history of the Martian meteorite ALH84001 has critical implications for interpreting potential biological markers in the meteorite, the capability of meteorites to transfer life from Mars to Earth, and the degree to which the ancient Martian surface and atmosphere were shielded from high-energy particles. If the meteorite were found to have not been heated significantly since its last brecciation event, this would mean that the carbonate globules - which mostly postdate this major brecciation and which may contain evidence for past Martian life - formed at temperatures amenable to life. This would also mean that the meteorite was not heat-sterilized either by the event that blasted it off Martian surface nor from its passage through the Earth's atmosphere and landing on Antarctica. A strong magnetic field could have prevented the solar wind from bathing the Martian

surface with harmful radiation and from stripping the atmosphere of green-house gases. Records of both the maximum temperature experienced by the Martian meteorite in the past approx. four billion years and the strength of the ancient Martian magnetic field may be preserved by the meteorite's ferromagnetic minerals. Two groups have previously studied the magnetic properties of these minerals in the meteorite.
Author
Magnetic Properties; Mars (Planet); Mars Surface; Meteorites; Panspermia; Ferromagnetic Materials; Paleomagnetism; SNC Meteorites; Exobiology

20000110492 Manchester Univ., Earth Sciences Dept., UK
Trapping of Ancient Martian Atmosphere in Meteorite ALH84001
Whitby, J. A., Manchester Univ., UK; Gilmour, J. D., Manchester Univ., UK; Turner, G., Manchester Univ., UK; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The fourteen known Martian meteorites have been used to place many constraints on the nature and evolution of Martian volatiles, particularly by means of study of the noble gases. Noble gas contents of Martian meteorites have generally been interpreted as mixtures of terrestrial air, modern Martian atmosphere and the Martian mantle, which contributions from spallation and in situ radioactive decay. ALH84001 has relatively high concentrations of trapped noble gases, despite a lower abundance of shock glasses than the shergottites. Various suggestions have been made for the location and trapping mechanism of the various gas components, including Xe-129, within ALH84001. to further investigate the location of Martian atmospheric xenon in ALH84001, we prepared a mineral separate for acid-etching. Initial results are presented here.
Derived from text
Atmospheric Composition; Mars Atmosphere; Xenon Isotopes; SNC Meteorites; Mars (Planet)

20000110945 Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA
Timing and Spectral Study of 4U 1538-52 ***Final Report***
Clark, George W., Massachusetts Inst. of Tech., USA; Oct. 19, 2000; 4p; In English
Contract(s)/Grant(s): NAG5-4485; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Improved orbital parameters of the high-mass binary X-ray pulsar 4U 1538-52 have been derived from high count rate data obtained from the Rossi X-Ray Timing Explorer. Pulse-timing analysis yields an eccentricity of 0.174 +/- 0.015, a periastron at 64 deg +/- 9 deg, and evidence of orbital decay with prime-P(sub orb)/P(sub orb) = (-2.9 +/- 2.1) x 10(exp -6)/yr.
Author
Pulsars; X Ray Binaries

20000111071 NASA Goddard Space Flight Center, Greenbelt, MD USA
Massive Star Formation in NGC4038/4039: HII Regions and Supernova Remnants in "The Antennae"
Neff, S. G., NASA Goddard Space Flight Center, USA; Ulvestad, J. S., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Gas and Galaxy Evolution, 21-24 May 2000, Socorro,, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The nearest merger, NGC4038/4039 ("The Antennae, Arp244), is undergoing a starburst apparently triggered and driven by the ongoing interaction. The system provides an excellent laboratory to study star formation processes because well-studied and nearby (21 Mpc assumed here). Models of the interaction suggest that the interaction's first periapse occurred 200 Myr ago, and that final coalescence will occur in another 100 Myr. Blue and H alpha images show a continuous loop of bright knots around the NGC4038 (northern) nucleus, continuing down through the NGC4039 (southern) nucleus. Recent HST V and I images resolve the star-forming knots into several thousand blue compact clusters, with ages 5Myr for the youngest clusters. Far Ultraviolet (lambda 1500A) observations directly detect O and B stars in regions of low extinction; the total mass of young stars so observed is approximately 8 x 10 (exp 5) solar mass. FIR observations imply a star formation rate of approximately 5 M (sub 0) dot yr (sup -1) or greater. We used the VLA at 6 and 4 cm to obtain high resolution radio images of the star-formation regions in NGC4038/4038. We used high resolution imaging to identify compact radio emitting regions and spectral indices of the compact regions to differentiate between thermal sources such as HII regions (flat spectra) and supernova, remnants (steep spectra). We found that compact radio sources produce approximately 12% and/sim 25 strongest radio emission occurs between the galaxies, at an optically unremarkable location near but not coincident with an extremely red cluster. The radio peak is at a location of intense star formation (as detected in the mid-IR, reference?) and of dense molecular gas. We identify 115 individual compact 6cm radio sources and 63 individual 4 cm sources in the system, to a limiting luminosity of approximately 2 x 10 (exp 1) 8 W Hz (sup -1) (or /sim4x the luminosity of Cas A). of the strongest sources, for which the h flux densities are large enough to measure spectral indices with reasonable errors, we find that one third have nominally flat radio spectra (presumeable dominated by thermal emis-

sion from HII regions) and two thirds have nominally steep spectra (presumeably dominated by synchrotron emission from supernova, remnants). For the thermal sources, we derive typical masses of 10 (exp 4) to 10 (exp 5) solar mass in massive young stars and ionized gas masses of 10 (exp 3) - 10 (exp 4) solar mass. From the steep-spectrum sources, we derive a total system supernova rate of 0.2-0.3 yr (sup -1), about an order of magnitude larger than that expected from the currently observed O-star population. Taken together, these suggest that that a large number of O stars may have formed in the system in a short-lived burst, less than 10 (exp 6) yr in duration and about 3-4 Myr ago.
Author
H II Regions; Massive Stars; Star Formation; Supernova Remnants; Starburst Galaxies

20000111085 NASA Johnson Space Center, Houston, TX USA
Noble Gases in the Monahans Chondrite and Halite: Ar-39 - Ar-40 Age, Space Exposure Age, Trapped Solar Gases, and Neutron Fluence ***Final Report***
Bogard, Donald D., NASA Johnson Space Center, USA; Garrison, Daniel H., NASA Johnson Space Center, USA; [2000]; 3p; In English; 31st; Lunar and Planetary Science, 13-17 Mar. 2000, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA
Contract(s)/Grant(s): RTOP 344-31-00; No Copyright; Avail: Issuing Activity; Abstract Only

In the Monahans H5 chondrite, Zolensky et al. report the first occurrence of grains of halite (NaCl), which contain minor sylvite (KCl) and tiny inclusions of liquid water. Here we report Ar-39 - Ar-40 ages of Monahans light (4.53 Ga) and dark phases and of the halite (>4.33 Ga). We report the presence of trapped solar gases in the dark phase, demonstrating that it represents a prior regolith on the Monahans parent body, We also report the cosmic-ray exposure age of Monahans and the neutron fluence experienced by the regolith component. Because the halite grains are apparently located only in the regolith phase, they may have formed by early hydrous activity within the Monahans parent body regolith, or they may have been introduced from outside.
Derived from text
Rare Gases; Chondrites; Halites; Sodium Chlorides; Potassium Chlorides

20000112919 NASA Ames Research Center, Moffett Field, CA USA
Formation of Prebiotic Molecules in Interstellar and Cometary Ices
Bernstein, Max P., NASA Ames Research Center, USA; Sandford, Scott A., NASA Ames Research Center, USA; Allamandola, Louis J., NASA Ames Research Center, USA; Dworkin, Jason, NASA Ames Research Center, USA; Gilette, J. Seb, Stanford Univ., USA; Zare, Richard N., Stanford Univ., USA; [2000]; 9p; In English; Bioastronomy Conference 1999: A New Era in the Search for Life in the Universe, 2-6 Aug. 1999, Kohala Coast, HI, USA
Contract(s)/Grant(s): NAG5-4936; NAG5-7208; RTOP 344-50-92-02; RTOP 344-37-44-01; RTOP 344-38-12-04; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We report here on our lab studies of ice photochemistry of large organic molecules under cometary conditions. We focus on polycyclic aromatic hydrocarbons (PAHs), their photoproducts, and their similarities to molecules seen in living systems today. We note that these kinds of compounds are seen in meteorites and we propose an explanation for both their formation and their observed deuterium enrichments.
Author
Ice; Photochemical Reactions; Laboratories; Polycyclic Aromatic Hydrocarbons

20000113832 California Univ., Dept. of Earth and Space Sciences, Los Angeles, CA USA
High-Resolution Multiple Sulfur Isotope Studies of Martian Meteorites
Mojzsis, S. J., California Univ., USA; [2000]; 1p; In English
Contract(s)/Grant(s): NCC2-5232; No Copyright; Avail: Issuing Activity; Abstract Only

Sensitive, high resolution measurements of S-32, S-31, and S-34 in individual pyrite grains in martian meteorite ALH84001 by an in situ ion microprobe multi-collection technique reveal mass-independent anomalies in Delta.S-33 (Delta.S-33 = delta.S-33 - 0.516delta.S-34) in addition to the lowest 634S found in an extraterrestrial material. Low delta.S-34 values in two pyrite grains intimately associated with carbonate in ALH84001 can be explained by the sensitivity of sulfur to fractionations in the geologic environment. Anomalies in Delta.S-33 recorded in ALH84001 pyrites probably formed by gas-phase reactions in the early martian atmosphere (>4 Ga). The discovery of clearly resolvable Delta-S33 anomalies in 2 of 12 ALH84001 pyrites analyzed in their petrographic context in thin section, is considered strong evidence for crust-atmosphere exchange and the global cycling of volatile sulfur species on early Mars. These results corroborate previous measurements by Farquhar and co-workers who used a differ-

ent technique that measures that bulk Delta.S-33 values of martian meteorites. These independent techniques, and their results, suggest that sulfur affected by mass-independent fractionation is common on Mars.
Author
High Resolution; Sulfur Isotopes; Pyrites; SNC Meteorites; Mars Surface

20000113833 California Univ., Dept. of Earth and Space Sciences, Los Angeles, CA USA
Isotope Geochemistry of Possible Terrestrial Analogue for Martian Meteorite ALH84001
Mojzsis, Stephen J., California Univ., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We have studied the microdomain oxygen and carbon isotopic compositions by SIMS of complex carbonate rosettes from spinel therzolite xenoliths, hosted by nepheline basanite, from the island of Spitsbergen (Norway). The Quaternary volcanic rocks containing the xenoliths erupted into a high Arctic environment and through relatively thick continental crust containing carbonate rocks. We have attempted to constrain the sources of the carbonates in these rocks by combined O-18/O-16 and C-13/C-12 ratio measurements in 25 micron diameter spots of the carbonate and compare them to previous work based primarily on trace-element distributions. The origin of these carbonates can be interpreted in terms of either contamination by carbonate country rock during ascent of the xenoliths in the host basalt, or more probably by hydrothermal processes after emplacement. The isotopic composition of these carbonates from a combined delta.18O(sub SMOW) and delta.13C(sub PDB) standpoint precludes a primary origin of these minerals from the mantle. Here a description is given of the analysis procedure, standardization of the carbonates, major element compositions of the carbonates measured by electron microprobe, and their correlated C and O isotope compositions as measured by ion microprobe. Since these carbonate rosettes may represent a terrestrial analogue to the carbonate ”globules” found in the martian meteorite ALH84001 interpretations for the origin of the features found in the Spitsbergen may be of interest in constraining the origin of these carbonate minerals on Mars.
Author
Geochemistry; SNC Meteorites; Mars Surface

20000114107 Florida State Univ., Dept. of Oceanography, Tallahassee, FL USA
Low Frequency Oscillation in Turbulent Convection
Krishnamurti, Ruby, Florida State Univ., USA; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 007-8923; Volume 898, pp. 122-126; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA
Contract(s)/Grant(s): N00089-J-1662; NSF OCE-98-09805; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

Large fluid systems such as the atmosphere of the Earth or the convection zone of the Sun are no doubt turbulent, but contain considerable organization on many scales. Not all of these scales are directly forced; some arise as a result of internal arrangements of energy and momentum, giving rise, in the Earth’s atmosphere, to such phenomena as the atmospheric jet streams. This paper is about an investigation of large-scale organization that arises in turbulent Rayleigh-Benard convection. We report on observations of low frequency oscillations in the Rayleigh number (R) range 10(exp 7) - 10(exp 8), with Prandtl number (Pr) equal to seven. It has been known that for convecting layers with large aspect ratio A (where A is the ratio of fluid layer width to depth), a steady large-scale now sets in at R = 2 x 10(exp 6). Tilted transient plumes embedded in this now, and maintaining it through Reynolds stresses, drift in one direction along the bottom of the layer, and in the opposite direction along the top. At a fixed point near the bottom or top boundary, there is a variability associated with the passage of these plumes. We call this the high-frequency variability. A new kind of organization is observed for 10(exp 7) is less than R is less than 10(exp 8); clusters of transient tilted plumes travel in a horizontal direction as coherent units. These clusters are separated from each other by quiescent zones with almost no plumes. Now at a fixed point near the bottom boundary, there is a low-frequency variability associated with the passage of clusters, as well as the high frequency variability from the passage of plumes within the cluster. Quantitative information on this low-frequency oscillation derived from space-time portraits and from temperature-time series is described. A mathematical model of the low frequency oscillation is presented.
Author
Low Frequencies; Oscillations; Turbulence; Rayleigh-Benard Convection

20000114108 Minnesota Univ., Lab. for Computational Science and Engineering, Minneapolis, MN USA
Convection in Slab and Spheroidal Geometries
Porter, David H., Minnesota Univ., USA; Woodward, Paul R., Minnesota Univ., USA; Jacobs, Michael L., Minnesota Univ., USA; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 1-20; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA
Contract(s)/Grant(s): USRA/5555-23/NASA; NSF ASC-92-17394; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

Three-dimensional numerical simulations of compressible turbulent thermally driven convection, in both slab and spheroidal geometries, are reviewed and analyzed in terms of velocity spectra and mixing-length theory. The same ideal gas model is used in both geometries, and resulting flows are compared. The piecewise-parabolic method (PPM), with either thermal conductivity or photospheric boundary conditions, is used to solve the fluid equations of motion. Fluid motions in both geometries exhibit a Kolmogorov-like k(sup -5/3) range in their velocity spectra. The longest wavelength modes are energetically dominant in both geometries, typically leading to one convection cell dominating the flow. In spheroidal geometry, a dipolar flow dominates the largest scale convective motions. Downflows are intensely turbulent and up drafts are relatively laminar in both geometries. In slab geometry, correlations between temperature and velocity fluctuations, which lead to the enthalpy flux, are fairly independent of depth. In spheroidal geometry this same correlation increases linearly with radius over the inner 70 percent by radius, in which the local pressure scale heights are a sizable fraction of the radius. The effects from the impenetrable boundary conditions in the slab geometry models are confused with the effects from non-local convection. In spheroidal geometry nonlocal effects, due to coherent plumes, are seen as far as several pressure scale heights from the lower boundary and are clearly distinguishable from boundary effects.
Author
Convection; Convection Cells; Slabs; Spheroids

20000114110 Florida Univ., Physics Dept., Gainesville, FL USA
Turbulent Convection in the Classical Variable Stars
Buchler, J. Robert, Florida Univ., USA; Kollath, Zoltan, Konkoly Observatory, Hungary; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 39-58; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA
Contract(s)/Grant(s): OTKA-T-026031; NSF AST-95-28338; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

We give a status report of convective Cepheid and RR Lyrae model pulsations. Some striking successes can be reported, despite the use of a rather simple treatment of turbulent convection with a 1D time-dependent diffusion equation for the turbulent energy. It is now possible to obtain stable double-mode (beat) pulsations in both Cepheid and RR Lyrae models with astrophysical parameters, i.e. periods and amplitude ratios, that are in agreement with observations. The turbulent convective models, however, have difficulties giving global agreement with the observations. In particular, the Magellanic Cloud Cepheids which have been observed in connection with the microlensing projects have imposed novel observational constraints because of the low metallicity of the MCs.
Author
Turbulence; Convection; Time Dependence; Diffusion

20000114111 Florida Univ., Physics Dept., Gainesville, FL USA
Time-Dependent Turbulent Convection in 1D Radiation Hydrodynamics of Pulsating Stars
Feuchtinger, Michael, Florida Univ., USA; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 59-76; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA
Contract(s)/Grant(s): NSF AST-95-28338; FWF Proj. S-7305-AST; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

Due to the lack or a self-consistent convection theory, each model or turbulent convection has to pass through several tests based on detailed comparisons with observations of real astrophysical objects. In this context nonlinear investigations of radially pulsating stars play an important role. They provide a unique opportunity to confront results of model calculations with a huge, detailed and accurate material of observational data. Using a state-of-the-art numerical technique we investigate the nonlinear behavior of radially pulsating stars by solving the full time-dependent system of radiation hydrodynamics including a time-dependent turbulent convection model. As a first example we discuss nonlinear models of RR Lyrae stars. We present fundamental as well as first overtone lightcurves for two sets of stellar parameters. A standard Fourier decomposition is used to confront the resulting light and radial velocity variations with recent observations and we show that well-known problems like the phase discrepancy problem or the problem of stable nonlinear double mode models can be treated.
Author
Time Dependence; Turbulence; Convection

20000114112 Arizona Univ., Steward Observatory, Tucson, AZ USA

Mixing and Burning in Stars

Arnett, David, Arizona Univ., USA; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISBN 0077-8923; Volume 898, pp. 77-89; In English; 14th; Nonlinear Astronomyand Physics, 18-20 Feb. 1999, Gainesville, FL, USA; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

The role of hydrodynamic mixing in astrophysics is reviewed, emphasizing connections with simulations by computer and with laser physics experiments. Computer technology now allows two-dimensional (2D) simulations, with complex microphysics, of stellar hydrodynamics and evolutionary sequences, and holds the promise for 3D. Careful validation of astrophysical methods, by laboratory experiment, by critical comparison of numerical and analytical methods. and by observation are necessary for the development of simulation methods with reliable predictive capability. Recent and surprising results from isotopic patterns in presolar grains, 2D hydrodynamic simulations of stellar evolution, and laser tests and computer simulations of Richtmeyer-Meshkov and Rayleigh-Taylor instabilities are discussed and related to stellar evolution and supernovae.

Author

Hydrodynamics; Mixing; Combustion; Astrophysics; Stellar Evolution

20000114114 Los Alamos National Lab., NM USA

Coherent Transport of Angular Momemtum: The Ranque-Hilsch Tube as a Paradigm

Colgate, Stirling A., Los Alamos National Lab., USA; Buchler, J. Robert, Florida Univ., USA; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 105-112; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA

Contract(s)/Grant(s): W-7405-eng-36; NSF AST-95-28338; NSF AST-98-19608; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

The mechanism for efficient and coherent angular momentum transport remains one of the unsolved puzzles in astrophysics despite the enormous efforts that have been made. We suggest that important new insight could be gained in this problem through an experimental and theoretical study of a laboratory device (Ranque-Hilsch tube) that displays a similar enhanced angular momentum transfer which cannot be explained by a simple turbulent model. There is already good experimental evidence to suggest that the cause of this enhancement is the formation of aligned vortices that swirl around the symmetry axes very much like virtual paddle blades.

Author

Angular Momentum; Momentum Transfer; Astrophysics; Solar Corona

20000114116 Paris VI Univ., Lab. de Modelisation en Mecanique, France

Two-Phase Shear Instability: Waves, Fingers, and Drops

Yecko, Philip, Paris VI Univ., France; Zaleski, Stephane, Paris VI Univ., France; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 127-143; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

We examine the development of instability for a shear now made up of two distinct immiscible fluids, taking into account their disparate densities, viscosities, and the possibility of tension acting on the interface that separates them. Linear theory leads to a pair of coupled Orr-Sommerfeld equations supplemented by the required matching conditions at the interface. The most unstable mode found here is believed to explain the nature of the instability essential to breakup at its onset. In addition, we find a second mode, which can be most unstable in certain situations of interest. Direct numerical simulations are performed for a range of parameter values. At early times, the simulations reveal the linear and nonlinear amplitude growth, verifying the applicability and accuracy of the numerical method over a range of density and viscosity ratios. At later times, the simulations show the development of elongated structures and the subsequent breakup of the heavier fluid into drops.

Author

Two Phase Flow; Turbulent Flow; Direct Numerical Simulation; Shear Flow; Flow Stability

20000114117 Woods Hole Oceanographic Inst., Physical Oceanography Dept., MA USA

Fingering Convection: The Interplay of Small and Large Scales

Paparella, Francesco, Woods Hole Oceanographic Inst., USA; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 144-158; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

Direct numerical simulations of two-dimensional fingering convection are presented. They show the growth of a finger-zone from a region of high gradients of temperature and salinity set in the initial conditions and the appearance of large-scale convective

cells in the homogeneous layers above and below it. The interaction between the finger-zone and the convection is described and the vertical fluxes are compared with a theoretical scaling law.
Author
Convection; Turbulence; Direct Numerical Simulation; Turbulent Flow

20000114830 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Corongraphic Observations and Analyses of The Ultraviolet Solar Corona ***Final Report, 1 Oct. 1982 - 31 May 2000***
Kohl, John L., Smithsonian Astrophysical Observatory, USA; October 2000; 32p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-613; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The activities supported under NASA Grant NAG5-613 included the following: 1) reduction and scientific analysis of data from three sounding rocket flights of the Rocket Ultraviolet Coronagraph Spectrometer, 2) development of ultraviolet spectroscopic diagnostic techniques to provide a detailed empirical description of the extended solar corona, 3) extensive upgrade of the rocket instrument to become the Ultraviolet Coronal Spectrometer (UVCS) for Spartan 201,4) instrument scientific calibration and characterization, 5) observation planning and mission support for a series of five Spartan 201 missions (fully successful except for STS 87 where the Spartan spacecraft was not successfully deployed and the instruments were not activated), and 6) reduction and scientific analysis of the UVCS/Spartan 201 observational data. The Ultraviolet Coronal Spectrometer for Spartan 201 was one unit of a joint payload and the other unit was a White Light Coronagraph (WLC) provided by the High Altitude Observatory and the Goddard Space Flight Center. The two instruments were used in concert to determine plasma parameters describing structures in the extended solar corona. They provided data that could be used individually or jointly in scientific analyses. The WLC provided electron column densities in high spatial resolution and high time resolution. UVCS/Spartan provided hydrogen velocity distributions, and line of sight hydrogen velocities. The hydrogen intensities from UVCS together with the electron densities from WLC were used to determine hydrogen outflow velocities. The UVCS also provided O VI intensities which were used to develop diagnostics for velocity distributions and outflow velocities of minor ions.
Derived from text
Solar Corona; Ultraviolet Spectrometers; Spectroscopy; Plasmas (Physics); Observatories; Line of Sight; Diagnosis; Coronagraphs

20000114834 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
Characteristics of Fe Ablation Trials Observed During the 1998 Leonid Meteor Shower
Chu, Xin-Zhao, Illinois Univ. at Urbana-Champaign, USA; Pan, Wei-Lin, Illinois Univ. at Urbana-Champaign, USA; Papen, George, Illinois Univ. at Urbana-Champaign, USA; Swenson, Gary, Illinois Univ. at Urbana-Champaign, USA; Gardner, Chester S., Illinois Univ. at Urbana-Champaign, USA; Jenniskens, Peter, Search for Extraterrestrial Intelligence Inst., USA; [2000]; 11p; In English; Leonid Multi-Instrument Aircraft Campaign, 16-19 Apr. 2000, Tel Aviv, Israel
Contract(s)/Grant(s): NSF ATM-97-09921; RTOP 344-50-92; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Eighteen Fe ablation trails were observed during the 17/18 Nov 1998 Leonid meteor shower with an airborne Fe lidar aboard the National Simulation Facility/National Center for Atmospheric Research (NSF/NCAR) Electra aircraft over Okinawa. The average altitude of the 18 trails from the high velocity (72 km/s) Leonid meteors, 95.67 +/- 0.93 km, is approximately 6.7 km higher than previously observed for slower (approx. 30 km/s) sporadic meteors. This height difference is consistent with the assumption that meteors ablate when the kinetic energy imparted to the atmosphere reaches a critical threshold. The average age of the Fe trails, determined by a diffusion model, is 10.1 min. The youngest ages were observed below 92 km and above 98 km where chemistry and diffusion dominate, respectively. The average abundance of the trails is ten percent of the abundance of the background Fe layer. Observations suggest that the 1998 Leonid shower did not have a significant impact on the abundance of the background Fe layer.
Author
Ablation; Iron; Iron Meteorites; Diffusion; Meteoroid Showers; Leonid Meteoroids; Meteor Trails

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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.

20000110069 NASA Johnson Space Center, Houston, TX USA
Human Exploration of the Moon
Mendell, Wendell W., NASA Johnson Space Center, USA; [1999]; 2p; In English; 2nd; New View of the Moon, 22-24 Sep. 1999, Flagstaff, AZ, USA
Contract(s)/Grant(s): RTOP 344-31-00-05; No Copyright; Avail: Issuing Activity; Abstract Only

Human exploration of the Moon tilde-n or, more generally, human exploration of the solar system tilde-n began with the landing of Apollo 11 Lunar Module on the lunar surface. Human exploration continued with growing capability until the departure of the Apollo 17 lunar module from the lunar surface in 1972. Human exploration is currently experiencing what can be called euphemistically a hiatus.
Derived from text
Lunar Exploration; Moon; Solar System

20000110270 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Examining Mars with SPICE
Acton, Charles H., Jet Propulsion Lab., California Inst. of Tech., USA; Bachman, Nathaniel J., Jet Propulsion Lab., California Inst. of Tech., USA; Bytof, Jeff A., Jet Propulsion Lab., California Inst. of Tech., USA; Semenov, Boris V., Jet Propulsion Lab., California Inst. of Tech., USA; Taber, William, Jet Propulsion Lab., California Inst. of Tech., USA; Turner, F. Scott, Jet Propulsion Lab., California Inst. of Tech., USA; Wright, Edward D., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The International Mars Conference highlights the wealth of scientific data now and soon to be acquired from an international armada of Mars-bound robotic spacecraft. Underlying the planning and interpretation of these scientific observations around and upon Mars are ancillary data and associated software needed to deal with trajectories or locations, instrument pointing, timing and Mars cartographic models. The NASA planetary community has adopted the SPICE system of ancillary data standards and allied tools to fill the need for consistent, reliable access to these basic data and a near limitless range of derived parameters. After substantial rapid growth in its formative years, the SPICE system continues to evolve today to meet new needs and improve ease of use. Adaptations to handle landers and rovers were prototyped on the Mars pathfinder mission and will next be used on Mars '01-'05. Incorporation of new methods to readily handle non-inertial reference frames has vastly extended the capability and simplified many computations. A translation of the SPICE Toolkit software suite to the C language has just been announced. to further support cartographic calculations associated with Mars exploration the SPICE developers at JPL have recently been asked by NASA to work with cartographers to develop standards and allied software for storing and accessing control net and shape model data sets; these will be highly integrated with existing SPICE components. NASA specifically supports the widest possible utilization of SPICE capabilities throughout the international space science community. With NASA backing the Russian Space Agency and Russian Academy of Science adopted the SPICE standards for the Mars 96 mission. The SPICE ephemeris component will shortly become the international standard for agencies using the Deep Space Network. U.S. and European scientists hope that ESA will employ SPICE standards on the Mars Express mission. SPICE is an open set of standards, and all related specifications and software are freely distributed around the world. This poster describes the current state of SPICE system development, with special emphasis on current and planned support for Mars exploration missions.
Author
Mars Exploration; Mars Missions; Systems Engineering; Aerospace Systems; Standardization

20000110271 NASA Goddard Space Flight Center, Greenbelt, MD USA
Implications of MOLA Global Roughness, Statistics, and Topography
Aharonson, O., Massachusetts Inst. of Tech., USA; Zuber, M. T., NASA Goddard Space Flight Center, USA; Neumann, G. A., NASA Goddard Space Flight Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

New insights are emerging as the ongoing high-quality measurements of the Martian surface topography by Mars Orbiter Laser Altimeter (MOLA) on board the Mars Global Surveyor (MGS) spacecraft increase in coverage, resolution, and diversity.

For the first time, a global characterization of the statistical properties of topography is possible. The data were collected during the aerobreaking hiatus, science phasing, and mapping orbits of MGS, and have a resolution of 300-400 m along track, a range resolution of 37.5 cm, a range precision of 1-10 m for surface slopes up to 30 deg., and an absolute accuracy of topography of 13 m. The spacecraft's orbit inclination dictates that nadir observations have latitude coverage of about 87.1S to 87.1N; the addition of observations obtained during a period of off-nadir pointing over the north pole extended coverage to 90N. Additional information is contained in the original extended abstract.
Author
Mars Surface; Surface Roughness; Topography; Mars (Planet); Statistical Analysis

20000110279 NASA Goddard Space Flight Center, Greenbelt, MD USA
Thermal Tides and Stationary Waves Revealed by MGS TES
Banfield, D., Cornell Univ., USA; Conrath, B. J., Cornell Univ., USA; Pearl, J. C., NASA Goddard Space Flight Center, USA; Smith, M. D., Cornell Univ., USA; Gierasch, P. J., Cornell Univ., USA; P. R. Christensen; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Atmospheric temperature retrievals from TES observed radiances make possible the most complete separation of the constituent wave modes evident in Mars atmosphere to date. We use all of the data from the pre-mapping mission phase, which affords good sampling of the diurnal tides and stationary waves. TES retrievals of atmospheric temperature on a grid of pressure levels are the fundamental data set in this study. We then fit this data to selected fourier modes in longitude and time for latitude and L(sub s) bins. From this we have identified the amplitudes and phases of the diurnal and semi-diurnal tides, the first few (gravest) stationary waves and standing waves, as well as an estimate of the zonal and time mean temperature meridional cross sections. These results will be compared with existing models and theory. A possible critical layer for the sun-synchronous diurnal tide may indicate 40 m/s surface zonal wind near 50S for L(sub s) =255-285. Additional information is contained in the original extended abstract.
Author
Mars Atmosphere; Standing Waves; Mars (Planet); Planetary Meteorology

20000110281 University of Central Florida, Dept. of Physics, Orlando, FL USA
Subsurface Volatile Reservoirs: Clues from Martian Impact Crater Morphologies
Barlow, N. G., University of Central Florida, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The existence of the fluidized ejecta morphologies surrounding most fresh impact craters on Mars was suggested in Mariner 9 imagery but their prevalence across the planet was not recognized until Viking Orbiter. The two major theories to explain the formation of these fluidized morphologies (also called lobate or rampart morphologies) are (1) impact into and vaporization of subsurface volatiles and (2) atmospheric entrainment and emplacement. In the 9.5 years since the 4th International Conference on Mars, substantial progress has been made in understanding the environmental conditions which produce the different types of fluidized morphologies. Both the subsurface volatile and atmospheric entrainment mechanisms appear to play a role in the formation of these morphologies. However the latitude-diameter dependence found for single lobe and multiple lobe morphologies and the regional variation in the distribution of double lobe and multiple lobe morphologies indicate that impact into subsurface volatile reservoirs is the dominant mechanism for formation. As a consequence of these results, several studies have been conducted to determine the areal and vertical distribution of subsurface volatiles (probably H2O, either pure or in brines) on Mars. Until seismic and/or electrical conductivity experiments are performed in situ, impact crater morphologies will be the dominant means by which we determine the distribution of sub-surface water and ice on Mars. Additional information is contained in the original extended abstract.
Author
Mars (Planet); Reservoirs; Ground Water

20000110285 Academy of Sciences (USSR), Vernadsky Inst., Moscow, USSR
Landscape and Surface Material Characteristics for the Mars Polar Lander Landing Site: Analysis and Predictions
Basilevsky, A. T., Academy of Sciences (USSR), USSR; Keller, H. U., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W. J., Max-Planck-Inst. fuer Aeronomie, Germany; Thomas, N., Max-Planck-Inst. fuer Aeronomie, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Mars Polar Lander (MPL) should land on the south polar layered deposits consisting of mixtures of water ice and dust. This paper considers the landscape and surface material characteristics which will be a target for studies by Robotic Arm Camera and Stereo Surface Imager. We analyze the available images of southern and northern polar deposits taken by Mars Observer Camera (MOC) and published results on the surface material properties. Additional information is contained in the original extended abstract.
Author
Mars Polar Lander; Topography; Mars Surface; Mars (Planet); Polar Caps; Landing Sites

20000110286 Southwest Research Inst., Instrumentation and Space Research Div., San Antonio, TX USA
Evidence for the Possible Accumulation of Ice at the North Pole of Mars
Bass, Deborah S., Southwest Research Inst., USA; Paige, D. A., California Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We have examined Viking Orbiter albedo, thermal, and atmospheric water vapor data acquired during Mars' northern summer season and compared these results with the imaging data from Mariner 9 and Viking Orbiters. Our results suggest that active seasonal processes have macroscopic effects that are observable from orbit. Albedo and imaging data suggest that the cap center has somewhat different characteristics than the cap edges. The maximum observed brightness of the peripheral regions examined was significantly lower than albedos measured at the center of the residual cap. Because we find that the cap center always remains brighter than the cap edges, we believe the cap center is a region of active water ice accumulation due to cold trapping. Although there is no definitive evidence regarding ice flow in the northern hemisphere of Mars, Mars Orbiter Laser Altimeter data indicate that the cap center is the highest portion of the cap. Therefore, if any regions are accumulating annual layers, the cap center is the most likely location. We also point out that the cap center has a favorable energy balance with respect to accumulation due to the increased brightness. The apparent thermal inertia and albedo of the north polar region of Mars was mapped. In the thermal inertia maps, the cap center at 90N, 250-270W has a lower thermal inertia than the surrounding portions of the cap. A lower thermal inertia indicates smaller or less annealed ice grains, which is consistent with the interpretation of younger, accumulating ice at the cap center. We have assessed the amount of bright water ice that could account for the brightening in the late summer of the residual north polar cap. We used observed albedo data in conjunction with calculations using Mie theory for single scattering and a delta-Eddington approximation of radiative transfer for multiple scattering. For an optically-thick deposit, the minimum possible thickness can be determined from its albedo using radiative transfer theory if the particle sizes of the ice and dust are known. The brightened regions most likely consist of young ice deposited late in the summer. This indicates that the ice must be relatively fine-grained, but to produce the observed cap albedo, it must also be relatively dust-rich. to produce such an albedo change, the cap surface must be relatively smooth; highly varying topography would produce patchy ice coverage on observable length scales. We suggest that the late summer cap albedo increase could have been produced by a minimum of 10's of precipitable microns of ice and dust deposited on the surface. MAWD water data indicate that the martian atmosphere held an average of 10 pr mm. Therefore, it is plausible that the water vapor observed in the atmosphere in the MAWD data condensed as surface temperatures decreased in the summer season. Additional information is contained in the original extended abstract.
Author
Atmospheric Moisture; Ice; Mars Atmosphere; Mars Surface; Polar Caps; Polar Regions; Water; Mars (Planet)

20000110293 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Where is the Geochemical Evidence for a Warm Wet Mars?
Blaney, D. L., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Groundbased and spacecraft data continue to tell contradictory stories of how the surface of Mars evolved. On one hand, there is clear evidence for the important role water has had shaping the geomorphology of the Martian surface. On the other hand, the geochemical signature of extended liquid water - rock interactions has not been detected. Recon-ciling these data is critical to understanding the biological potential of Mars and to developing an effective approach to search for evidence of life on Mars. Additional information is contained in the original extended abstract.
Author
Geomorphology; Mars (Planet); Mars Surface; Water

20000110296 NASA Ames Research Center, Moffett Field, CA USA

Simulations of the Surface Pressure Tides on Mars Incorporating New MOLA Topography Data

Bridger, A. F. C., San Jose State Univ., USA; Haberle, R. M., NASA Ames Research Center, USA; Schaeffer, J., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Simulations of surface pressure tides on Mars have been conducted previously with the NASA Ames Mars General Circulation Model (MGCM), as well as by Wilson and Hamilton. In the case of the MGCM, annual simulations with realistic (Viking-derived) dust loading have been reasonably successful at reproducing observed tides at the Viking Lander sites. One obvious discrepancy between observed and simulated tides is the amplification found in the model's diurnal tidal amplitude around L(sub s) 90. The observations show no such amplification. We report here on recent simulations of the surface pressure tide on Mars conducted with the MGCM and with the newly acquired MOLA topography data. The data is provided at 1deg x 1deg resolution, and is used by the MGCM at 7.5deg x 9deg resolution. The vertical domain of the MGCM extends to around 80 km. In the simulations reported in, the vertical domain extended to around 50 km, and the Consortium topography dataset was used. Additional information is contained in the original extended abstract.

Author

Atmospheric General Circulation Models; Mars Atmosphere; Viking Lander Spacecraft; Atmospheric Pressure; Simulation; Mars (Planet)

20000110297 NASA Ames Research Center, Moffett Field, CA USA

Stationary Wave Activity Simulated by the NASA Ames MGCM Incorporating New MOLA Topography Data

Bridger, A. F. C., San Jose State Univ., USA; Hollingsworth, J. L., NASA Ames Research Center, USA; Haberle, R. M., NASA Ames Research Center, USA; Schaeffer, J., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Annual simulations of Mars' atmosphere have been conducted with the NASA Ames Mars General Circulation Model (MGCM) using the newly-acquired MOLA topography data. The data is provided at 1 x 1 deg resolution, and is used by the MGCM at 7.5 x 9 deg resolution. The vertical domain in the simulations reported here extends to around 80 km. Simulated stationary wave activity is examined in each hemisphere as a function of season (at every 30 deg of Ls), dust loading (dust visible opacities of 0.3, 1, and 3), and topography (comparing results with MOLA vs. Smith-Zuber topography). Additional information is contained in the original extended abstract.

Author

Atmospheric General Circulation Models; Mars Atmosphere; Annual Variations; Simulation; Dust; Data Simulation

20000110298 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Ventifacts on Mars

Bridges, N. T., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Prior to the Pathfinder mission, rocks on the Martian surface appeared relatively unaffected by physical weathering processes. A major discovery of Pathfinder was the finding that numerous rocks exhibit features characteristic of ventifacts, rocks that have been abraded by windborne particles. Initial studies have shown that: 1) at least half the rocks at the landing site are abraded, 2) ventifacts are more abundant at the Pathfinder site than at the Viking sites, and 3) most of the rock erosion appears to have occurred in a climatic regime different from that of today. Additional information is contained in the original extended abstract.

Author

Erosion; Mars Surface; Rocks; Weathering

20000110302 NASA Ames Research Center, Moffett Field, CA USA

Results of the First Astronaut-Rover (ASRO) Field Experiment: Lessons and Directions for the Human Exploration of Mars

Cabrol, N. A., NASA Ames Research Center, USA; Kosmo, J. J., NASA Johnson Space Center, USA; Trevino, R. C., NASA Johnson Space Center, USA; Thomas, H., NASA Ames Research Center, USA; Eppler, D., NASA Johnson Space Center, USA; Bualat, M. G., NASA Ames Research Center, USA; Baker, K., NASA Johnson Space Center, USA; Huber, E., NASA Johnson Space Center, USA; Sierhuis, M., NASA Ames Research Center, USA; Grin, E. A., NASA Ames Research Center, USA; The

Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The first Astronaut-Rover Interaction field experiment (hereafter designated as the ASRO project) took place Feb. 22-27, 1999, in Silver Lake, Mojave Desert, CA. The ASRO project is the result of a joint project between NASA Ames Research Center and Johnson Space Center. In the perspective of the Human Exploration and Development of Space (HEDS) of the Solar System, this interaction - the astronaut and the rover as a complementary and interactive team - in the field is critical to assess but had never been tested before the Silver Lake experiment. Additional information is contained in the original extended abstract.
Author

Solar System; Roving Vehicles; Mars Surface

20000110306 NASA Ames Research Center, Moffett Field, CA USA

Ultraviolet Radiation on the Surface of Mars

Catling, D. C., NASA Ames Research Center, USA; Cockell, C. S., NASA Ames Research Center, USA; McKay, C. P., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An evaluation of the ultraviolet (UV) flux incident on the Martian surface is important for a number of issues. UV-induced photolysis of water changes the chemistry of the soil and atmosphere, inducing its oxidizing nature. Alternatively, UV may directly affect surface chemistry by generating silicate defects. UV also rapidly degrades organic material delivered by meteoritic infall. Consequently, UV affects the overall chemistry of the Martian surface and atmosphere. The extent of UV breakdown of organic molecules is also relevant to concerns regarding contaminants on lander or rover surfaces that could interfere with life-detection experiments causing ”false positives”. The radiation flux at a point on the surface of Mars depends on factors such as cloud cover, atmospheric dust loading, season, local time, and latitude. Previously, the UV spectrum incident on the surface of Mars has been calculated from a simple radiative transfer model. Limitations of this earlier model include no accounting for the effect of dust, which may be a perennial constituent of the atmosphere, and also the use of gas absorption data measured at room temperature that overestimate absorption for lower Martian temperatures. We present an updated model for UV radiation (200-400 nm) that incorporates dust and more recent data for the solar spectrum, gas absorption, and UV surface albedo. Additional information is contained in the original extended abstract.
Author

Ultraviolet Radiation; Mars Surface; Surface Reactions; Solar Spectra; Radiative Transfer; Organic Materials; Mars Atmosphere; Dust

20000110308 Paris VI Univ., Orsay, France

The Dynamo Micro-Orbiter Project: Investigation of Mars Gravity/Magnetic Fields and Atmospheric Interactions

Chassefiere, E., Paris VI Univ., France; Forget, F.; Smrekar, S.; Reme, H.; Mazelle, C.; Acuna, M.; Connerney, J.; Purucker, M.; Lin, R.; Luhmann, J.; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dynamo is a small Mars orbiter planned to be launched as an auxiliary passenger on the european Ariane V launcher. It is aimed at improving gravity and magnetic field resolution, in order to better understand the magnetic, geologic and thermal history of Mars, and characterizing current atmospheric escape, which is still poorly constrained. These objectives are achieved by using a low periapsis orbit, similar to the one used by the Mars Global Surveyor spacecraft during the aerobraking phase. The proposed periapsis altitude for Dynamo of 120-130 km, coupled with the global distribution of periapses to be obtained during one Martian year of operation, through about 5000 low passes, will produce a magnetic field data set with approximately five times the spatial resolution of MGS. Although some gravity data were acquired at low altitude in the northern hemisphere, most of the gravity field data will be obtained from much higher altitudes (360-400 km) during the nominal observing phase of MGS. Low periapsis provides a unique opportunity to investigate the chemical and dynamical properties of the deep ionosphere, thermosphere, and the interaction between the atmosphere and the solar wind, which is sup-posed to give rise to significant atmospheric escape, in the absence of an intrinsic magnetic field withholding the solar wind from upper atmospheric layers. There is much room for debate on the importance of current atmosphere escape processes in the evolution of the Martian atmosphere, as early ”exotic” processes including hydrodynamic escape and impact erosion are traditionally invoked to explain the apparent sparse inventory of present-day volatiles. Yet, the combination of low surface gravity and the absence of a substantial internally generated magnetic field have undeniable effects on what we observe today. In addition to the current losses in the forms of Jeans and photochemical escape

of neutrals, there are solar wind interaction-related erosion mechanisms because the upper atmosphere is directly exposed to the solar wind. The solar wind related loss rates, while now comparable to those of a modest comet, nonetheless occur continuously, with the intriguing possibility of important cumulative and/or enhanced effects over the several billion years of the solar system's life. If the detailed history of the Martian internal field could be traced back, and the current escape processes could be understood well enough to model the expected stronger losses under early Sun conditions, one could go a long way toward constraining this part of the mysterious history of Mars' atmosphere. Note that MGS measurements of crustal magnetization suggest that the cessation of the internal magnetic dynamo occurred during the few first hundred million years of Mars' history, but such a preliminary result needs further confirmation and refinement. Additional information is contained in the original extended abstract.
Author
Atmospheric Stratification; Erosion; Gravitational Fields; Magnetic Fields; Mars Atmosphere; Microgravity; Paleontology; Photochemical Reactions

20000110313 Lockheed Martin Aerospace, Denver, CO USA
On the Non-Observability of Carbonates on Mars
Clark, Benton C., Lockheed Martin Aerospace, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In spite of the view, widely held over a long period of time, that large deposits of carbonate should be present on Mars, conclusive evidence has not been forthcoming. Spectral remote sensing data is either negative or controversial. In situ measurements by the Sojourner rover's APX reported no detection, with a current upper limit on C of 0.7% . Yet, the so-called "missing carbonates" issue has been singled out as one of the major conundrums of martian science. Additional information is contained in the original extended abstract.
Author
Carbonates; Deposits; Mars (Planet)

20000110315 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Evolution of the Martian Hydrosphere and Its Implications for the Fate of a Primordial Ocean
Clifford, S. M., Lunar and Planetary Inst., USA; Parker, T. J., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The existence of a primordial ocean in the northern plains of Mars appears to have been an inevitable consequence of the hydraulic and thermal conditions that existed during the Early Noachian. In this abstract we demonstrate that the progressive crustal assimilation of this early surface reservoir of H2O (punctuated by possible episodes of less extensive flooding) was a natural consequence of the planet's subsequent climatic and geothermal evolution. Additional information is contained in the original extended abstract.
Author
Mars Surface; Climatology; Hydrology; Thermal Conductors

20000110317 Centre National de la Recherche Scientifique, Lyon, France
Need for SAM on Mars!!! a.k.a. In Situ Inorganic and Organic Analysis of the Martian Soil, on Mars Sample Return Mission
Coll, P., Centre National de la Recherche Scientifique, France; Cabane, M., Centre National de la Recherche Scientifique, France; Israel, G., Centre National de la Recherche Scientifique, France; Rannou, P., Centre National de la Recherche Scientifique, France; Raulin, F., Laboratoire Interuniversitaire des Systemes Atmospheriques, France; Sternberg, R., Laboratoire Interuniversitaire des Systemes Atmospheriques, France; Jambon, A., Laboratoire de Petrologie, France; Niemann, H.; Mahaffy, P.; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In order to know if life is or has been present at the surface of Mars, the Mars Sample Return mission, in 2005, will include the sampling of sub-surface, at depths where the effects of UV radiations and oxidizing agents are negligible. The last C.N.E.S. symposium (Paris, February 1999) had clearly shown questions from the community concerning the Sample Return, in the frame of the 2005 Mars mission (conservation, possible sterilization during the fly back to Earth...). These interrogations have clearly demonstrated the risk of informations loss during the Sample Return, and also the need of informations about Mars surface and sub-surface before 2008, date of the Sample Return on Earth. For this purpose we propose to perform a preliminary in-situ analysis of Martian samples. to analyze inorganics and organics sampled at various depths, we propose to use the Pyrolysis/Chemical reac-

tor-Gas Chromatography-Mass-Spectrometry technique. This experiment (SAM: Sample Analysis on Mars) may be performed using techniques already developed in the frame of other planetary (ACP/HUYGENS) or cometary (COSAC/ROSETTA) missions, which can easily be adapted to the proposed mission objective, and which will reach 3 goals : - organics research, inorganics research, and isotopic analysis. This paper will present why it is necessary to have a tool like SAM on Mars, what are the main scientific objectives and will provide a brief description of the measurement strategy.
Author
Gas Chromatography; Mars Sample Return Missions; Mars Surface Samples; Pyrolysis; Soils

20000110319 National Air and Space Museum, Center for Earth and Planetary Studies, Washington, DC USA
The UCL IUS-Tithonium Chasma Digital Elevation Model
Cook, A. C., National Air and Space Museum, USA; Muller, J.-P., University Coll., UK; Day, T.; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format
Contract(s)/Grant(s): GR/F-84-294; GR/F-82-894; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We re-examine a previously unpublished digital elevation model (DEM) of a approx. 105,000 sq km area of Tithonium and Ius Chasma area, produced by the EXODUS (Extra-terrestrial Orbital DEMs for Understanding Surfaces) project at University College London (1990-1993) using an almost fully automated digital stereo matcher from the UCL 3D image maker software package. Other results of the Exodus project have included a study of Ma'adim Vallis, and the grooves on Phobos. Additional information is contained in the original extended abstract.
Author
Applications Programs (Computers); Mars Surface; Examination

20000110321 Centre National de la Recherche Scientifique, Laboratoire de Geologie Dynamique de la Terre et des Planetes, Orsay, France
New Evidences for Ice Rich Sediments on the Northern Plains from MGS Data
Costard, F., Centre National de la Recherche Scientifique, France; Kargel, J., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Recent studies indicate a quite good correlation between the hypothetical oceanic shorelines (contact 2 of Parker et al., 1989) and an equipotential surface parallel to the present geoid, corresponding to an ancient north polar ocean. A quite good correlation was discussed by Head et al. between the limit of the contact 2 and some periglacial features. Polygonally fractured terrains and pseudocraters also occur at low elevations near the mouths of outflow channels supporting the hypothesis of volatile-rich layers of sediments. These small cratered cones interpreted as pseudocraters are usually found north of fractured ground in Acidalia Planitia between 80 deg and 330 deg W and 45 deg to 67 deg N and in Utopia Planitia between 170 deg to 260 deg W and 53 deg to 67 deg N. In these two areas, large concentrations of rampart craters are found. In order to quantify the spatial distribution of martian ground ice, a global study of rampart craters was undertaken to determine their temporal and spatial relations with the surrounding morphostructural units. Rampart craters all over planet Mars have been systematically measured and mapped using a GIS database of geologic and topographic information. We used the MOLA data to correlate the profiles with our data from rampart craters. In addition, we used some MOC images to define the structure of the Martian ground ice. Additional information is contained in the original extended abstract.
Author
Ice; Topography; Terrain; Mars Surface; Mars Craters; Geology; Data Bases

20000110324 RAND Corp., Santa Monica, CA USA
Status of the RAND-USGS Control Network of Mars
Davies, Merton, RAND Corp., USA; Colvin, Tim, RAND Corp., USA; Kirk, Randolph, Geological Survey, USA; Lee, Ella, Geological Survey, USA; Sucharski, Robert, Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The RAND-USGS control network of Mars is a combination of the RAND control network and the USGS network. The original data sets were: RAND Control Network 2958 Viking and Mariner 9 images 9918 Points 33380 Measurements USGS Control Network 4577 Viking Images (full coverage at about 250 m/pixel) 26702 Points 55429 Measurements 1215 images are common to both networks. Combined RAND-USGS Control Network 6320 Images 36620 Points 88809 Measurements Standard Error of

Measurement is 10.01 um This solution solves for latitude and longitude of each point and the three C angles of each image. The overdetermination is 1.93. The Pathfinder longitude was 33.2604 deg. (Malin's location of lander on a Viking frame and Folkner's latitude and radius.) The Viking 1 longitude was 47.9600 deg. (Parker's location of lander on a Viking frame and Folkner's latitude and radius.) The W equation is approximately W = 176.6384 + 350.89198226 d. This work is in progress. All numbers are subject to change.
Author
Geological Surveys; Mars Photographs; Radii; Networks; Data Bases

20000110329 Arizona State Univ., Dept. of Geology, Tempe, AZ USA
Environmental and Mineralogical Controls on Fossilization: Key Elements in a Strategy for Mars Exopaleontology
Farmer, Jack D., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One cannot expect to land just any-where on Mars and discover a fossil record. What are the important factors that should guide the search? While the potential range of fossil information preserved in rocks of all ages is quite broad, including actual cellular remains (1), various classes of chemofossils (2), biominerals, biofabrics, and stromatolites (3), studies of fossilization processes in modern environments on Earth, as well as the terrestrial fossil record, indicate that the preservation of biosignatures is strongly influenced by the physical, chemical and biological factors of the environment (4). Acting together, these factors determine the types of deposits and range of information preserved. Additional information is contained in the original extended abstract.
Author
Environmental Control; Mineralogy; Mars Environment

20000110331 Brown Univ., Providence, RI USA
The Geometry of Chasma Boreale, Mars Using Mars Orbiter Laser Altimeter(MOLA) Data: A Test of the Catastrophic Outflow Hypothesis of Formation
Fishbaugh, Kathryn E., Brown Univ., USA; Head, James W., III, Brown Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Chasma Boreale is a large reentrant in the northern polar layered deposits of Mars. The Chasma transects the spiraling troughs which characterize the polar layered terrain. The origin of Chasma Boreale remains a subject of controversy. Clifford proposed that the Chasma was carved as a result of a jokulhlaup triggered by either breach of a crater containing basal melt water or by basal melting due to a hot spot beneath the cap. Benito et al. suggest an origin in which catastrophic outflow is triggered by sapping caused by a tectono-thermal event. A similar origin is proposed for Chasma Australe in the Martian southern polar cap. Until accurate topographic data became available with the use of the Mars Orbiter Laser Altimeter (MOLA), the topographic geometry of the Chasma and its distal deposit regions had been poorly understood. This study utilizes MOLA data to describe the topography of the Chasma and distal deposits and uses these observations to better constrain the viability of a catastrophic outflow method of formation as well as to compare with terrestrial jokulhlaup features. Further study will include using the topographic data to better understand the specific features predicted to result from the trigger mechanisms proposed by Clifford and Benito et al. If Clifford's model applies, topographic data should provide evidence for an initially small Chasma enlarged by frictional melting and eventually reaching the surface of the cap. In addition, ice chunks resulting from the catastrophic flow would be later sublimed, leaving behind sediment to be modified by eolian erosion which should be evident in the topography. If Benito et al.'s model applies, the largest of the described flood features should be evident in the topography such as giant current ripples and inner channels as well as evidence for tectonic control such as orthogonal cliffs and straight walls. Benito et al. suggest that evidence of sapping would be later destroyed by outflow. Additional information is contained in the original extended abstract.
Author
Laser Altimeters; Deposits; Surface Layers; Mars Surface; Water; Topography; Planetary Geology; Friction Factor; Erosion

20000110333 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Young Impact Craters as Potential Sites for the Exploration of the Martian Subsurface
Gaidos, E. J., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Orbiter and lander data indicate that a global, oxidizing regolith may blanket the surface of Mars. New sub-km crater counts by Hartmann indicate that an impact-gardened regolith may exist to a depth of at least 15 m (assuming a mean surface age of 2 Gyr), although the original meter-scale geology may still persist at certain locations such as the outflow channel of the Pathfinder landing site. The pervasive regolith appears to have an aeolian-mobilized component which may frustrate attempts to find key minerals such as carbonates or nitrates. It may also stymie searches for physical and chemical signs of past or present life. Various mechanical (penetrators, drills) means of obtaining access to the subsurface have been proposed: Here I propose to let Nature do the work by using a young impact crater. Both the nearby ejecta blanket and the crater rim may provide freshly exposed subsurface material. The crater must be large enough to penetrate the regolith but still young enough that chemical and physical weathering of exposed material is minor. A high latitude site may be preferable since organics may oxidize much more slowly at low temperatures. The tradeoffs in crater and site selection are presented, and possible crater exploration strategies are suggested.
Author
Craters; Geology; Mars Surface; Minerals; Nitrates; Oxidation; Penetration; Weathering

20000110334 NASA Goddard Space Flight Center, Greenbelt, MD USA
Global Geometric Properties of Martian Impact Craters: A Preliminary Assessment Using Mars Orbiter Laser Altimeter (MOLA)
Garvin, J. B., NASA Goddard Space Flight Center, USA; Sakimoto, S. E. H., Universities Space Research Association, USA; Schnetzler, C., Science Systems and Applications, Inc., USA; Frawley, J. J., Hughes STX, Inc., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Impact craters on Mars have been used to provide fundamental insights into the properties of the martian crust, the role of volatiles, the relative age of the surface, and on the physics of impact cratering in the Solar System. Before the three-dimensional information provided by the Mars Orbiter Laser Altimeter (MOLA) instrument which is currently operating in Mars orbit aboard the Mars Global Surveyor (MGS), impact features were characterized morphologically using orbital images from Mariner 9 and Viking. Fresh-appearing craters were identified and measurements of their geometric properties were derived from various image-based methods. MOLA measurements can now provide a global sample of topographic cross-sections of martian impact features as small as approx. 2 km in diameter, to basin-scale features. We have previously examined MOLA cross-sections of Northern Hemisphere and North Polar Region impact features, but were unable to consider the global characteristics of these ubiquitous landforms. Here we present our preliminary assessment of the geometric properties of a globally-distributed sample of martian impact craters, most of which were sampled during the initial stages of the MGS mapping mission (i.e., the first 600 orbits). Our aim is to develop a framework for reconsidering theories concerning impact cratering in the martian environment. This first global analysis is focused upon topographically-fresh impact craters, defined here on the basis of MOLA topographic profiles that cross the central cavities of craters that can be observed in Viking-based MDIM global image mosaics. We have considered crater depths, rim heights, ejecta topologies, cross-sectional ”shapes”, and simple physical models for ejecta emplacement. To date (May, 1999), we have measured the geometric properties of over 1300 impact craters in the 2 to 350 km diameter size interval. A large fraction of these measured craters were sampled with cavity-center cross-sections during the first two months of MGS mapping. Many of these craters are included in Nadine Barlow’s Catalogue of Martian Impact Craters, although we have treated simple craters smaller than about 7 km in greater detail than all previous investigations. Additional information is contained in the original extended abstract.
Author
Cavities; Cratering; Image Analysis; Landforms; Mars Craters; Mars Global Surveyor; Mars Surface; Planetary Geology; Topography

20000110337 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Craters as an Indicator of Martian Regolith Thickness
Gilmore, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Two craters (D approx.900 m) found in MOC images of Xanthe Terra have concentric terraced morphologies, where one crater lies within a second, larger crater. This type of morphology has been documented on the Moon and attributed to an impact into fragmental material overlying a more competent substrate. These craters offer a mechanism by which to estimate thickness of unconsolidated surface material over large areas on Mars. Such measurements may constrain deflation rates and volume estimates

of hydrologic reservoirs on Mars and yield information on the strength of the local bedrock. Additional information is contained in the original extended abstract.
Author
Craters; Mars Surface; Morphology; Regolith

20000110338 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Magnetometer Data Tests Models for the Origin of the Martian Crustal Dichotomy; Dichotomy Models Constrain Timing of Martian Magnetic Field
Gilmore, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Measurements recently supplied by the MGS Magnetometer/Electron Reflectometer (MAG/ER) on MGS can be applied to test theories of the origin of the martian crustal dichotomy. Strong (+/- 1500 nT) magnetic anomalies are observed in the Martian crust. The observations can be summarized as follows: 1) strong crustal magnetic sources are generally confined to the southern highlands, although weaker (approx. 40 nT) anomalies were observed during close periapsis; 2) strong magnetic anomalies are absent in the vicinity of Hellas and Argyre; 3) the anomalies in the region 0 deg to 90 deg S, 120 deg to 240 deg west have a linear geometry, strike generally east west for 1000s km, and show several reversals. This latter point has led to the suggestion that some form of lateral plate tectonics may have been operative in the southern highlands of Mars. These observations have led previous workers to hypothesize that the magnetic anomalies were present prior to and were destroyed by the formation of Hellas and Argyre. As such large impacts are confined to the era of heavy bombardment, this places the time of formation of large magnetic anomalies prior to approx. 3.9 Ga. One obvious extension of this is that the northern lowlands lack significant anomalies because they were erased by impacts and/or the northern lowlands represent crust completely reheated above the Curie temperature. Preliminary observations of the distributions of the large crustal magnetic anomalies show that many of them extend continuously over the highland lowland boundary. This occurs particularly north of the boundary between 30 deg W and 270 deg W, corresponding to northern Arabia, but also occurs in southern Elysium (approx. 10 deg S, 200 deg) and the SW portion of Tharsis (approx. 15 deg S, 140 deg). This suggests that, in these areas, Noachian crust containing the greater than 3.9 Ga magnetic signature, lies beneath the northern highlands. This geometry can be used to test models for the formation of the martian crustal dichotomy. Additional information is contained in the original extended abstract.
Author
Magnetometers; Boundaries; Dichotomies; Magnetic Anomalies; Magnetic Signatures; Mars Surface; Planetary Crusts; Planetary Magnetic Fields

20000110341 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Constraints, Approach, and Status of Mars Surveyor 2001 Landing Site Selection
Golombek, M., Jet Propulsion Lab., California Inst. of Tech., USA; Bridges, N., Jet Propulsion Lab., California Inst. of Tech., USA; Briggs, G., NASA Ames Research Center, USA; Gilmore, M., Jet Propulsion Lab., California Inst. of Tech., USA; Haldemann, A., Jet Propulsion Lab., California Inst. of Tech., USA; Parker, T., Jet Propulsion Lab., California Inst. of Tech., USA; Saunders, R., Jet Propulsion Lab., California Inst. of Tech., USA; Spencer, D., Jet Propulsion Lab., California Inst. of Tech., USA; Smith, J., Jet Propulsion Lab., California Inst. of Tech., USA; Soderblom, L., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

There are many similarities between the Mars Surveyor '01 (MS '01) landing site selection process and that of Mars Pathfinder. The selection process includes two parallel activities in which engineers define and refine the capabilities of the spacecraft through design, testing and modeling and scientists define a set of landing site constraints based on the spacecraft design and landing scenario. As for Pathfinder, the safety of the site is without question the single most important factor, for the simple reason that failure to land safely yields no science and exposes the mission and program to considerable risk. The selection process must be thorough and defensible and capable of surviving multiple withering reviews similar to the Pathfinder decision. On Pathfinder, this was accomplished by attempting to understand the surface properties of sites using available remote sensing data sets and models based on them. Science objectives are factored into the selection process only after the safety of the site is validated. Finally, as for Pathfinder, the selection process is being done in an open environment with multiple opportunities for community involvement including open workshops, with education and outreach opportunities. Additional information is contained in the original extended abstract.
Author
Landing Sites; Surface Properties; Site Selection; Safety; Risk; Analogies

20000110342 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Mars Environmental Compatibility Assessment (MECA) Wet Chemistry Experiment on the Mars 2001 Lander

Grannan, S. M., Jet Propulsion Lab., California Inst. of Tech., USA; Meloy, T. P., West Virginia Univ., USA; Hecht, H., Jet Propulsion Lab., California Inst. of Tech., USA; Anderson, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Buehler, M., Jet Propulsion Lab., California Inst. of Tech., USA; Frant, M., Orion Research, Inc., USA; Kounaves, S. P., Tufts Univ., USA; Manatt, K. S., Jet Propulsion Lab., California Inst. of Tech., USA; Pike, W. T., Jet Propulsion Lab., California Inst. of Tech., USA; Schubert, W., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Environmental Compatibility Assessment (MECA) is an instrument suite that will fly on the Mars Surveyor 2001 Lander Spacecraft. MECA is sponsored by the Human Exploration and Development of Space (HEDS) program and will evaluate potential hazards that the dust and soil of Mars might present to astronauts and their equipment on a future human mission to Mars. Four elements constitute the integrated MECA payload: a microscopy station, patch plates, an electrometer, and the wet chemistry experiment (WCE). The WCE is the first application of electrochemical sensors to study soil chemistry on another planetary body, in addition to being the first measurement of soil/water solution properties on Mars. The chemical composition and properties of the watersoluble materials present in the Martian soil are of considerable interest to the planetary science community because characteristic salts are formed by the water-based weathering of rocks, the action of volcanic gases, and biological activity. Thus the characterization of water-soluble soil materials on Mars can provide information on the geochemical history of the planet surface. Additional information is contained in the original extended abstract.

Author

Volcanoes; Soil Science; Rocks; Mars Surface; Geochemistry; Electrometers; Dust; Compatibility

20000110343 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Mars Pathfinder Landing Site: Evidence for a Change in Wind Regime and Climate from Lander and Orbiter Data

Greeley, R., Arizona State Univ., USA; Kraft, M. D., Arizona State Univ., USA; Kuzmin, R. O., Academy of Sciences (USSR), USSR; Bridges, N. T., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Surface features related to the wind are observed in data from the Mars Pathfinder lander and from orbit by the Viking Orbiter and Mars Global Surveyor missions. Features seen from the surface include wind tails associated with small rocks, barchanoid duneforms, ripplelike patterns, and ventifact flutes cut into some rocks. Features seen from orbit include wind tails associated with impact craters, ridges inferred to be duneforms, and modified crater rims interpreted to have been eroded and mantled by windblown material. The orientations of these features show two prevailing directions, one inferred to represent winds from the northeast which is consistent with strongest winds predicted by a general circulation model to occur during the Martian northern winter under current conditions, and a second wind pattern oriented approx. 90 degrees to the first. This latter wind could be from the W-NW or from the E-SE and was responsible for cutting the ventifacts and modifying the crater rims. The two wind regimes could reflect a change in climate related to Mars' obliquity or some other, unknown factor. Regardless of the cause, the MPF area has been subjected to a complex pattern of winds and supply of small particles, in which the original surface formed by sedimentary processes from Tiu and Ares Vallis events has been modified by repeated burial and exhumation.

Author

Atmospheric General Circulation Models; Climate; Mars Surface; Wind Effects

20000110345 Arizona State Univ., Tempe, AZ USA

Particle Size Effects in Particulate Rock Samples: Implications for Thermal Emission Spectrometer (TES) Data Analysis in High Albedo Regions on Mars

Hamilton, V. E., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We are evaluating the spectral characteristics of particulate bulk rock samples as potential analogues for surface materials in the high-albedo and border regions on Mars. If distinguishing characteristics as functions of particle size, composition, mixing, texture, and packing can be found, these results will aid in the interpretation of Thermal Emission Spectrometer data. Spectral absorptions in TES data are attributable to atmospheric CO2 and dust, waterice clouds, and surface materials. The surface spectrum that remains after atmospheric removal is indicative of several properties of the surface materials including bulk composition, relative abundances of minerals, and particle size. The easiest surface spectra to interpret are those obtained in the low-albedo,

high thermal inertia regions that are dominated by coarse (10Os D 100Os of mm) sands, regolith, and/or bedrock with little dust. However, the fundamental spectral signatures of most coarse materials and bedrock are likely obscured in higher albedo regions, which contain higher percentages of fine (10Os of mm) particles and have low spectral contrast. Because regions of geologic interest include both dark (rocky) and bright (dusty) regions, this study will examine the midinfrared (5 D 50 mm) spectral characteristics of crushed and powdered whole rock samples with the objective of qualitatively establishing the spectral behavior of particulate mixtures at decreasing particle sizes as a function of composition. Additional information is contained in the original extended abstract.
Author
Albedo; Analogs; Bedrock; Carbon Dioxide Concentration; Dust; Emission Spectra; Mars Surface; Minerals; Thermal Emission; Spectrometers

20000110350 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Extension Across Tempe Terra, Mars from MOLA Topographic Measurements
Harrington, B. W., Washington Univ., USA; Phillips, R. J., Washington Univ., USA; Golombek, M. P., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Previously, methods of estimating the extension across grabens and rifts on Mars by necessity relied on photogeologic methods such as shadow measurement, crater ellipticity, or photoclinometry. With the new data being returned by the Mars Global Surveyor, specifically from the Mars Orbital Laser Altimeter (MOLA), it is now possible to directly measure the depths of these structures and therefore to estimate more accurately the amount of extension. Here we provide an example of this new approach in the Tempe Terra region. Additional information is contained in the original extended abstract.
Author
Craters; Ellipticity; Estimating; Mars Surface; Photogeology; Topography

20000110351 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
An Analysis of Evidence from MOLA for Northern Seas and Oceans in the Past History of Mars
Head, J. W., Brown Univ., USA; Kreslavsky, M., Brown Univ., USA; Hiesinger, H., Brown Univ., USA; Thomson, B., Brown Univ., USA; Pratt, S., Brown Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Abundant evidence exists for the presence of water on the surface and in the subsurface in the past history of Mars. Among the most distinctive pieces of evidence are the outflow channels that begin full-size at discrete sources and flow hundreds to thousands of km downslope into the northern lowlands displaying a wide variety of bedforms on their floors. An unusual characteristic of outflow channels is that channel cutting does not continue far into the northern lowlands even though downslope topographic gradients appear to continue. Where did the water go? Did it spread out over the broad smooth lowlands and sink into the substrate, or could it have ponded, creating lakes, seas or oceans? Some investigators have hypothesized that outflow channels had enough volume and occurred with sufficient simultaneity and repetitiveness to produce large standing bodies of water in the northern lowlands (Oceanus Borealis) at several times in the history of Mars. Specifically, Parker et al. mapped two contacts near and generally parallel to the highland boundary of the northern lowlands and interpreted these contacts to be shorelines, representing two separate highstands of a north polar ocean. Contact 1 is older and corresponds approximately to the highland-lowland dichotomy boundary. Contact 2 is younger, lies northward of Contact 1, and is more well-expressed by a sharply defined smooth, lobate, or arcuate contact and associated features interpreted to be related to shorelines and basinward deposition and evolution. The new MOLA data permit us to test this hypothesis in several ways. Additional information is contained in the original extended abstract.
Author
Cutting; Deposition; Water; Topography; Seas; Highlands; Oceans; Mars Surface

20000110354 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Surface Ages and Resurfacing Rates of the Polar Layered Deposits on Mars
Herkenhoff, K. E., Geological Survey, USA; Plaut, J. J., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The martian polar layered deposits (PLD) are probably the best source of information about the recent climate history of Mars, but their origin and the mechanisms of accumulation are still a mystery. The polar layers are sedimentary deposits that most plane-

tary scientists believe are composed of water ice and varying amounts of wind-blown dust, but their composition is poorly constrained. Interpretation of the observed polar stratigraphy in terms of global climate changes is complicated by the significant difference in surface ages between the north and south PLD inferred from crater statistics. While no craters have been found in the north PLD, the surface of the south PLD appears to have been stable for many of the orbital/axial cycles that are thought to have induced global climate changes on Mars. Using medium-resolution Viking imagery, Plaut et al. found at least 15 impact craters in the southern layered deposits and concluded that their surface is 120 +/- 40 million years old. In contrast, Cutts et al. found no fresh impact craters larger than about 300 meters in summertime images of the north polar layered deposits. Additional information is contained in the original extended abstract.
Author
Deposits; Folds (Geology); Climate Change; Craters; Cycles; Mars Photographs; Mars Surface; Planetary Geology

20000110355 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
Polygons in Southern Utopia Planitia: Initial Results from the Mars Orbiter Laser Altimeter (MOLA)
Hiesinger, Harald, Brown Univ., USA; Head, James W., III, Brown Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

New data obtained by the Mars Orbiter Laser Altimeter (MOLA) allow us to analyse the topography and morphology of the polygonal terrain in southern Utopia Planitia. MOLA data show that: 1) polygonal terrain in Utopia Planitia is located at the slopes of the Utopia basin; 2) the onset of polygonal terrain in Utopia occurs nearly at the same elevation in several profiles and lies at about the same elevation as a terrace, which is interpreted as a shoreline of an ancient body of standing water within the Utopia basin; 3) polygonal terrain occurs over a wide range of elevations below the terrace, i.e. on regional slopes of approx. 0.1” and this is consistent with observations on Earth for the formation of polygons in a permafrost environment; 4) the depth of the troughs is on the order of 30 m and tends to be greater towards the center of the Utopia basin; 5) the widths of polygonal troughs are on the order of 2 km and are considerably larger than previously published; 6) the morphology of the troughs was modified by eolian and/or mass wasting processes; 7) the formation of polygonal terrain is likely due to a combination of desiccation, thermal contraction, and bending of a wet sediment layer over preexisting topography. These observations are consistent with the formation of polygonal terrain in the area of a former standing body of water. Additional information is contained in the original extended abstract.
Author
Polygons; Data Acquisition; Topography; Morphology; Mars Surface; Shorelines

20000110361 WNS GeoScience, Eltham, Australia
Ice and Layering on Early and Modern Mars
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The ubiquitous layering of the equatorial regions of Mars is an enigma requiring explanation. How have such thick deposits of layered material accumulated, and what is their composition? Both sedimentary and volcanic explanations have been proposed, but there seems to be little evidence for the global volumes of liquid required for such extensive sedimentation, nor for the many volcanic vents or fissures. Layering is clearly penecontemporaneous with the entire Noachian and early Hesperian cratering record, since craters both large and small cut into layering and are themselves filled by layered deposits as revealed by smaller later-stage craters and by cross-cutting erosive canyons and tectonic zones. Curiously, the layering also exists inside closed craters and there is little evidence for erosive degradation of the crater rims. It is as if the layered material fell out of the sky. Indeed, an ignimbrite origin is one possibility, except that source vents and calderas of sufficient magnitude are absent. Additional information is contained in the original extended abstract.
Author
Accumulations; Deposits; Ice; Mars Surface; Tectonics; Earth (Planet); Sediments

20000110362 WNS GeoScience, Eltham, Australia
Pressure and Temperature Evolution of Mars’ Surface
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A model is presented for the evolution of the Martian surface and atmosphere based on a cold icy origin interacting with impact cratering. Mars' surface is understood as a thick layered regolith of dirty ice and icy rock with water ice as a solid refractory phase. CO2-bearing phases dominate the atmospheric pressure equilibrium and greenhouse effect which results in pressure and temperature conditions broadly around the triple point of carbon dioxide. Additional information is contained in the original extended abstract.
Author
Atmospheric Pressure; Temperature Effects; Mars Surface; Planetary Temperature; Ice

20000110363 WNS GeoScience, Eltham, Australia
Volatiles and Ices on Mars
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Models of the vertical structure of volatiles in the regolith of Mars are typically simplified in terms of a single volatile species - water. The presence of Carbon Dioxide as a significant additional volatile leads to a much more interesting analysis. A number of Authors have explored the distribution and evolution of volatiles in the porous regolith of Mars e.g. [1]. Generally, an equilibrium is found with liquid water at modest depths and a thick cap of water ice sealing the volatile reservoir from the surface. A thin dry layer composes the uppermost layers of Regolith. Inferences from these models have been drawn to suggest the evolution and distribution of volatiles on Mars at the present day. Additional information is contained in the original extended abstract.
Author
Atmospheric Composition; Carbon Dioxide; Ice; Mars Atmosphere; Mars Surface; Planetary Geology

20000110364 WNS GeoScience, Eltham, Australia
White Mars: A Global Evolution Model for Mars' Surface Based on CO2
Hoffman, N., WNS GeoScience, Australia; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A model is presented for the evolution of the Martian surface and atmosphere located in pressure and temperature conditions broadly around the triple point of carbon dioxide. Mars' surface features and evolution are shown to fit better than any model based on liquid water. The Amazonian outburst "floods" are reinterpreted as a new class of cold, gas-supported density flow analogous to Terrestrial pyroclastic surges and submarine turbidites, here termed Cryoclastic flows. Studies of the present day surface of Mars demonstrate recurrent processes best explained by the presence of liquids at various times in its evolution. However, atmospheric models of Mars have great difficulty in achieving the stability criteria for liquid water. This paradox is resolved here by modelling Mars' evolution with CO2 as the active fluid, and demonstrating that many otherwise obscure features of the Planet can be explained by interactions of CO2 around its solid / liquid / vapour triple point, rather than that of water. In particular, the early Noachian and Hesperian erosive valley features are shown to be due to local liquid CO2 cycling driven by precipitation of CO2 snow and rain within a moderately dense (~5 Bar) early atmosphere, locally warmed by impact heating and volcanism, whilst later Amazonian catastrophic outburst features are explained by largely solid subsurface deposits of CO2 being released in self-sustaining collapse/flow events at the solid/vapour phase boundary with long-distance transport of the "flood" deposits sustained by internal release of CO2 vapour. The closest terrestrial analogues to this process are Pyroclastic volcanic flows, submarine turbidity currents, or air-supported long-runout landslides and snow avalanches. Additional information is contained in the original extended abstract.
Author
Carbon Dioxide; Evolution (Development); Atmospheric Models; Cold Gas; Deposits

20000110367 NASA Ames Research Center, Moffett Field, CA USA
Southern Hemisphere Storm Zones on Mars: Implications of MOLA Topography
Hollingsworth, J. L., NASA Ames Research Center, USA; Haberle, R. M., NASA Ames Research Center, USA; Schaeffer, J., Raytheon STX Corp., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Using the NASA Ames Mars general circulation model and recent Mars orbiter laser altimeter (MOLA) global topography, annual-cycle simulations have been performed corresponding to a lowglobally-averaged atmospheric dust loading (tau= 0 - 3). Comparisons of key global circulation fields as simulated utilizing previous topography datasets and those using the new Mars

global topography have been carried out. Values of globally and/or hemispheric averaged kinetic energy associated with the longitudinally averaged (i.e., zonal) circulation and longitudinal departures (i.e., eddy components) as a function of season for simulations using the different topography datasets are provided contributions arising frommeteorological variability associated with thermal tides, stationary circulation components and recurrent weather systems (transient baroclinc and/or barotropic eddies). It can be noted that eddy activity in the northern hemisphere (NH) is substantially diminished using the new topographic data, and that at some seasons, the southern hemisphere (SH) activity is moderately increased. Additional information is contained in the original extended abstract.
Derived from text
Storms; Southern Hemisphere; Mars Atmosphere; Topography; Atmospheric General Circulation Models; Laser Altimeters; Zonal Flow (Meteorology)

20000110368 NASA Ames Research Center, Moffett Field, CA USA
The Martian Water Cycle Based on 3-D Modeling
Houben, H., Space Physics Research Inst., USA; Haberle, R. M., NASA Ames Research Center, USA; Joshi, M. M., Search for Extraterrestrial Intelligence Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Understanding the distribution of Martian water is a major goal of the Mars Surveyor program. However, until the bulk of the data from the nominal missions of TES, PMIRR, GRS, MVACS, and the DS2 probes are available, we are bound to be in a state where much of our knowledge of the seasonal behavior of water is based on theoretical modeling. We therefore summarize the results of this modeling at the present time. The most complete calculations come from a somewhat simplified treatment of the Martian climate system which is capable of simulating many decades of weather. More elaborate meteorological models are now being applied to study of the problem. The results show a high degree of consistency with observations of aspects of the Martian water cycle made by Viking MAWD, a large number of ground-based measurements of atmospheric column water vapor, studies of Martian frosts, and the widespread occurrence of water ice clouds. Additional information is contained in the original extended abstract.
Author
Atmospheric Moisture; Hydrological Cycle; Ice Clouds; Mars Environment; Mars Surface; Mathematical Models; Simulation

20000110369 Kobe Univ., Japan
Colors of Martian Fog: Observation Plan by MIC
Inada, A., Kobe Univ., Japan; Nakamura, A. M., Kobe Univ., Japan; Mukai, T., Kobe Univ., Japan; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Viking Orbiter 1 observed the channel region in the west of the scarp in Memnonia (centered at 15S, 145W) at 45 min and 75 min after sunrise. The later image shows the higher brightness in the most craters seen there, as well as on the floor of the channels in that region. Such brightening is not found in the preceding im-age. As a result, it is thought that a frost on the surface of Mars evaporated after sunrise, and then the resulting water re-condensed in the atmosphere as a fog. It is known from Mars Pathfinder data that the temperature on the surface in the mid latitude changes from 196 K to 265 K in a spring day. It is natural to assume that the temperature in the low latitudes is higher in the same season. In addition, the temperature of the atmosphere, where the fog is generated, is close to that of the surface, because of its low altitude (less than 100 meters). Therefore, we can expect that the main component of the fog is water, because carbon oxide is saturated under 150 K. The study for the formation of fog is important to examine the water balance between the regolith and the atmosphere in Mars. Savijarvi suggested the expansion of fog up to 60-80 m altitude during the night and their dispersion in two hours after sunrise, based on a simulation of fog formation performed in the case that topsoil was dry, which was detected at the Viking Lander 1 site in summer. Kahn has shown that the particle size of a discrete ice haze in the upper atmosphere can grow up large enough to fall to the surface. Referring to these results, we can propose alternative mechanisms for the formation of morning fog, i.e. (1) re-condensation from a frost on the surface, and (2) remaining of night fog. Evening fog may occur as (1) a precursor of night fog or as (2) a grown haze. The size of fog particle plays a key role to study the mechanism of its formation. When the water vapor saturates in the atmosphere, the size of resulting ice particles are small at the beginning time. As the vapor cools down slowly, the particle size increases. Therefore, the morning fog which was generated during night (as night fog), in general, consists of larger particles. On the other hand, the re-condensed particles in the morning fog coming from the evaporation of frost should be smaller. We will present the angular and wavelength dependence of the scattered light by the surface fog to study the size, shape and material components of its individual particles,

using the color images taken by Mars Imaging Camera (MIC). Additional information is contained in the original extended abstract.
Author
Brightness; Carbon; Color; Evaporation; Fog; Ice; Mars Surface; Tropical Regions

20000110370 California Inst. of Tech., Pasadena, CA USA
Observations of Polar Night Clouds with the Mars Orbiter Laser Altimeter (MOLA)
Ivanov, A.nton B., California Inst. of Tech., USA; Muhleman, Duane O., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Condensation of CO2 is an important process for the formation of the perennial ice caps on Mars. CO2 ice may form on cold surface when temperatures are low enough (approx 146 K) or condense in the atmosphere and fall down on the surface as snow. This paper will focus on observations of CO2 clouds during the polar night by the Mars Orbiter Laser Altimeter (MOLA). We will interpret MOLA measured height, reflected energy and returned pulse width in terms of microphysical cloud properties. Additional information is contained in the original extended abstract.
Author
Polar Regions; Night; Cloud Physics; Carbon Dioxide

20000110371 California Inst. of Tech., Pasadena, CA USA
Topography of the North and South Polar Ice Caps on Mars
Ivanov, Anton B., California Inst. of Tech., USA; Muhleman, Duane O., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Recent observations by Mars Orbiter Laser Altimeter have provided high resolution view of the Northern Ice cap, compiled on the basis of data returned during Science Phasing Orbit. Starting in March 1999, Mars Global Surveyor was transferred into its mapping configuration and began systematic observations of Mars. Data returned during the mapping orbit allowed compilation of high resolution topography grid for the southern ice cap. This paper will concentrate on description of observations of the southern ice cap topography and comparison with the northern ice cap. We will compare topography across the ice caps and apply a sublimation model, which was developed to explain the shape of the Northern Ice Cap, to the Southern Ice Cap. Additional information is contained in the original extended abstract.
Author
Topography; Ice; Laser Altimeters; Polar Caps; Sublimation

20000110372 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
Chryse Planitia, Mars: Topographic Configuration from MOLA Data and Tests for Hypothesized Lakes and Shorelines
Ivanov, M. A., Brown Univ., USA; Head, J. W., Brown Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Many of the main outflow channels on Mars debouch into the Chryse Basin and pre-Mars Global Surveyor topographic data show it to be a closed depression almost 2000 km in diameter. New MOLA laser altimeter data show: 1) that Chryse is not a locally closed basin but opens into the North Polar basin; 2) that the distinctive channel morphology of the six largest channels disappears into the northern lowlands at elevations that all occur within 350 m of each other over a lateral distance of 2200 km. Parker et al mapped Contact 2 in this area, a boundary interpreted by them to represent an ancient shoreline, and shown by Head et al. to lie at -3700 m. MOLA data show that the elevations where these channels disappear all fall within approx. 180 m of Contact 2. These observations are consistent with the hypothesis of a large standing body of water in the northern lowlands in Late Hesperian-Early Amazonian times. Additional information is contained in the original extended abstract.
Author
Topography; Mars Surface; Structural Basins; Morphology; Landforms

20000110374 Toledo Univ., Dept. of Physics and Astronomy, OH USA
The Dust Cycle: Sinks and Sources, Cause and Effect
James, Philip B., Toledo Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dust is ubiquitous on Mars; large portions of the Martian surface are covered with a veneer of the material, and the atmosphere contains significant amounts of dust as a dispersed aerosol. Dust participates in significant atmospheric phenomena that span an extremely wide range of spatial scales: dust devils, dust plumes, local dust storms, regional dust storms, and planet-encircling and global events. Both atmospheric and surface phenomena are highly variable on both seasonal and interannual time scales. In fact the term ”dust cycle” is misleading because dust phenomena are certainly not periodic on an annual scale; and it is not even obvious that they are periodic at all, because of limitations on the continuity and resolution of observations. A review of Martian dust phenomena based mainly upon Viking studies was published following the Fourth Mars Conference by the University of Arizona Press. This review will concentrate on developments since that article was written. Additional information is contained in the original extended abstract.
Author
Dust Storms; Sinks; Plumes; Mars Surface

20000110375 NASA Glenn Research Center, Cleveland, OH USA
Status of the Dust Accumulation and Removal Technology Experiment for the Mars 2001 Surveyor Lander
Jenkins, P. P., Ohio Aerospace Inst., USA; Landis, G. L., NASA Glenn Research Center, USA; Krasowski, M. J., NASA Glenn Research Center, USA; Greer, L. C. , III, NASA Glenn Research Center, USA; Lekki, J., NASA Glenn Research Center, USA; Baraona, C. R., NASA Glenn Research Center, USA; Scheiman, D. A., Ohio Aerospace Inst., USA; Wilt, D. M.; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Dust Accumulation and Removal Technology (DART) experiment is designed to quantify the nature of dust settling out of the Martian atmosphere. DART is part of the Mars in-situ propellant precursor (MIP) experiment which is a payload on the Mars 2001 Surveyor Lander. At the time of this writing, high fidelity development hardware has been integrated in to the MIP experiment and completed Mars environment testing. Additional information is contained in the original extended abstract.
Author
Mars Atmosphere; Dust; Accumulations; Removal; Technology Assessment

20000110376 Geological Survey, Flagstaff, AZ USA
Exploring the Effects of Dust Coatings and Shock Pressures on Thermal Infrared Spectra
Johnson, J. R., Geological Survey, USA; Lucey, P. G., Hawaii Univ., USA; Christensen, P. R., Arizona State Univ., USA; Hoerz, F., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dust coatings on rocks obscured the underlying rock surfaces at the Mars Pathfinder landing site and made it difficult to obtain pristine visible/near-infrared reflectance spectra and chemical measurements. Such dust coatings also affect the ability of thermal infrared (TIR) spectra (such as that provided by TES and future lander (mini-TES) and orbiter multispectral imaging systems (THEMIS) to reveal accurately the mineralogy of rocks and soils. Similarly, high shock pressures from impact events cause crystalline disorder in important minerals such as pyroxene and feldspar that also affects their TIR spectra and complicates spectral interpretation of shocked impact materials. Additional information is contained in the original extended abstract.
Author
Dust; Coating; Infrared Spectra; Thermal Analysis; Rocks; Imaging Techniques

20000110378 Lunar and Planetary Inst., Houston, TX USA
Time-dependent Mantle Convection on Mars: Implications for Episodic Tectonism and Volcanism in Tharsis
Kiefer, Walter S., Lunar and Planetary Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Tharsis province on Mars is roughly 5000 km across, at least 8 km higher than the mean radius of Mars, and has a long-wavelength geoid anomaly exceeding 1 km. Volcanic activity has occurred in Tharsis for most of the history of the Mars, including relatively recent times - the last 40 to 100 million years at Arsia Mons and possibly the last 25 million years at Olympus Mons. Extensional tectonism is widespread in the Tharsis region. The Elysium province may be a small-scale version of Tharsis. Additional information is contained in the original extended abstract.
Author
Convection; Mars Volcanoes; Volcanology; Tectonics; Mars (Planet); Planetary Mantles

20000110382 Lunar and Planetary Inst., Houston, TX USA

Workshop Report: "Spectroscopy of the Martian Surface: What Next?"

Kirkland, L. E., Lunar and Planetary Inst., USA; Treiman, A., Lunar and Planetary Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

There is much current debate in the Mars community about which types of instruments should be flown on future missions, and what visible/infrared spectroscopy can add to knowledge about the surface of Mars. In light of that, we would will to convene a focused workshop for the spectroscopy community to address the following: Given the current priorities of the Mars Program, what are the most important questions that spectroscopy should address, and what is the best approach to address them? The workshop is scheduled to occur at the Lunar and Planetary Institute, Houston, TX on 10-11 June. At the 5th Mars Conference we will present a summary of the workshop conclusions. Additional information is contained in the original extended abstract.
Author

Mars (Planet); Mars Surface; Spectroscopy; Mission Planning; Mars Missions; Mars Environment

20000110384 Lunar and Planetary Inst., Houston, TX USA

Utilizing Night Spectra of Mars for Mineralogy

Kirkland, L. E., Lunar and Planetary Inst., USA; Herr, K. C., Aerospace Corp., USA; McAfee, J. M., Los Alamos National Lab., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Thermal infrared spectra measured of the night side of Mars have advantages over day measurements for examining the aerosol dust mineralogy because they contain fewer atmospheric gas and surface features. Despite the advantages night spectra offer, they have rarely been utilized because the methodology to convert them to transmission was poorly understood. Here we present a method for converting night and day spectra to apparent transmission. We also discuss the advantage for mineralogical studies of apparent transmission vs. apparent emissivity. Additional information is contained in the original extended abstract.
Author

Infrared Spectra; Mars Surface; Mineralogy; Night; Planetary Geology; Mars (Planet); Mars Exploration

20000110386 Academy of Sciences (USSR), IGEM, Moscow, USSR

On a Successful Prediction of Martian Crust Fractionation Based on Comparative Wave Planetology

Kochemasov, G. G., Academy of Sciences (USSR), USSR; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A significant compositional difference between martian lowlands and highlands was predicted two years before "Pathfinder" landing /1/ and then two months before this event /2/. At that time the majority of planetologists considering spectral evidences believed that martian crust is mainly basaltic or "basic" as so-called "martian meteorites". Our confidence was based on regularities of wave planetology /3 and others/ indicating that with increasing solar distance (orbital periods) planetary bodies become tectonically "coarser grained", less spherical and more disrupted (relief range increases) and hence must acquire higher density (compositional) differences between highland and lowland rocks. All these regularities are consequences of elongated elliptical orbits of celestial bodies (much more pronounced in the geological past when much of body shaping occurred). They imply periodically changing orbital curvatures and body accelerations leading to arising in them standing inertia-gravity waves warping rotating bodies in four ortho- and diagonal directions. Interference of these waves leads to formation of uplifting /+/, subsiding /-/ and neutral /0, alternation of + and -/ segments, sectors and other polygonal blocks constructing surfaces and deeper spheres of any cosmic body. The following theorems of planetary tectonics proved by laws of wave interference are formulated: 1) Celestial bodies are dichotomic. 2) Celestial bodies are sectoral. 3) Celestial bodies are granular. 4) Angular momenta of different level blocks tend to be equal. Additional information is contained in the original extended abstract.
Author

Celestial Bodies; Elliptical Orbits; Mars (Planet); Planetary Crusts; Planetary Geology; Planetary Evolution; Planetary Structure

20000110387 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Deflation History of the Mars Pathfinder Landing Site

Kraft, M. D., Arizona State Univ., USA; Greeley, R., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Image data from the Mars Pathfinder landing site show a suite of geomorphic features that indicate the post-flood soils at the site have been deflated. The orientations of aeolian features-ventifact flutes versus wind tails and duneforms-indicate the dominant wind direction may have changed over time. Sedimentary deposits appear to have been deflated under both wind directions to an established base level. The site may have been blanketed by several centimeters of dust, which has been removed by saltating particles under the current wind regime. Additional information is contained in the original extended abstract.

Author

Geomorphology; Landing Sites; Wind Effects; Mars (Planet); Mars Surface; Geodynamics

20000110389 Technische Univ., Institut fuer Geologie und Palaeontologie, Clausthal-Zellerfeld, Germany

Extensional Tectonics and New Crater Statistics of the Northern Tharsis Province, Mars

Kronberg, P., Technische Univ., Germany; Hauber, E., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Geologic mapping of Mars has led to a global stratigraphic framework and a rather comprehensive synthesis of the tectonic history of Mars. Up to now, special attention has been paid to the key area of martian tectonics, the Tharsis province, and its radially oriented extensive graben systems. Individual tectonic events in particular areas of the Tharsis province have been identified by a detailed structural analysis and have been assigned to 5 stages through time. Our recent studies refer to the Northern Tharsis province where three regional extensional units, the Mareotis Fossae, Tempe Fossae, and Alba Patera region reveal major differences in upper crustal behaviour under changing extensional stress fields in space and time. Detailed photogeologic structural mapping of Viking orbiter photomosaics has been used for an inventory of different fault patterns and their spatial occurrence. of special interest are differences in geometry and kinematics of extensional faulting. to establish the ages of tectonic events, we use new crater counts on high-resolution digital photomosaics of selected areas. Additional information is contained in the original extended abstract.

Author

Mars Surface; Mars Volcanoes; Planetary Geology; Tectonics; Mars (Planet); Planetary Craters

20000110390 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Mars Environmental Compatibility Assessment (MECA) Abrasion Tool

Kuhlman, K. R., California Inst. of Tech., USA; Anderson, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Hinde, B. D., Jet Propulsion Lab., California Inst. of Tech., USA; Hecht, M. H., Jet Propulsion Lab., California Inst. of Tech., USA; Pike, W. T., Jet Propulsion Lab., California Inst. of Tech., USA; Marshall, J. R., NASA Ames Research Center, USA; Meloy, T. P., West Virginia Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Environmental Compatibility Assessment (MECA) experiment, an instrument suite to be flown on Mars Surveyor 2001, will include a tool for doing simple mineralogical scratch and streak tests on particles from the Martian regolith. The Abrasion Tool will be applied to particles that adhere themselves to highly polished substrates of various hardnesses. Granular soil components will be subjected to a compressive force of about 3 N using a leaf spring. The spring will be applied with a paraffin actuator capable of a 0.76 mm throw to achieve a maximum displacement of about 7.5 mm at the tip of the tool. The pressure per grain will be dependent on the grain size, the number of grains that adhere to the substrate and the number of grains in compression. The pressure per particle is expected to be on the order of 100 MPa - 1 GPa. The MECA sample wheel containing the substrates will be rotated after the particles are placed in compression to produce scratches or pits. A primary goal of the Abrasion Tool is to identify quartz (Mohs' hardness = 7) using substrates of varying hardnesses. Quartz is considered hazardous to future human explorers of Mars because it can cause silicosis of the lungs if it is of respirable size. It is also hazardous to machinery, structures, and space suits because of its ability to abrade and scratch surfaces. Since large quantities of minerals harder than quartz are not expected, any scratches produced on polished quartz substrates might be reasonably attributed to quartz particles, although there may be minerals such as impact metamorphic diamond in the soils. Careful calibration of the tool will be necessary to ensure that grains are not overloaded; for example, a steel ball pressed into glass will produce a Hertzian fracture, even though it is softer than

glass. Other minerals, such as magnetite (Mohs' hardness = 6.5) have been shown to scratch glass ceramics such as Zerodur (Mohs' hardness = 6.5). Thus, minerals can be differentiated: note that regardless of the mineral species, if any particle is harder than 6.5 it will certainly be an interesting discovery for both planetary geology and human exploration concerns. The scratches will be identified using the 6X optical microscope and profiled with the atomic force microscope included in the MECA instrument suite. Analysis of the scratch morphology will yield evidence concerning the shape of the particle responsible for producing each scratch. For example, angular grains should leave vertical cracks with microconchoidal lateral chipping, while rounded grains might leave chatter marks, or nested partial Hertzian cracks. Particle shape can thus be inferred from these indentation modes, as well as material hardness. In addition, particle size information may also be available if pits caused by rolling particles can be identified. Converse to scratching, the minerals may be crushed at their contact points, and be smeared onto the target substrates to leave what geologists refer to as "streaks". These are cold-welded trails of mineral material that have structure and color indicative of mineral composition. The AFM will determine the morphology of these streaks, while the microscope will ascertain the color. On the harder substrates, we might expect streaking to dominate; on the softer substrates, scratching may dominate. Progressions of material interactions across the substrate selection will be a valuable source of data for mineral discrimination. It should also be noted that many minerals have coatings (such as iron oxides), and these will have to be differentiated from the host mineral grains; laboratory tests will establish the effects of such coatings on the scratch results. Finally, we note that the microscope will provide corroborative data regarding likely mineral species by grain shapes, fracture patterns, surface textures, color, and UV fluorescence reactions. Additional information is contained in the original extended abstract.
Author
Abrasion; Hardness; Mars Surface; Mars Surveyor 2001 Mission; Mars (Planet); Mission Planning; Experiment Design

20000110393 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Inst. of Space Sensor Technology and Planetary Exploration, Berlin, Germany
Rheological Investigations of Lava Flows on Arsia Mons, Mars
Lanz, J. K., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The rheological investigation of lava flows on Mars is restricted to remote sensing methods as in situ data are obviously not available. Several models have been developed and applied to martian lava flows. As, even on Earth, we are still far from understanding fully all the relationships between lava composition, temperature, shear rate, viscosity and crystallinity, and how these parameters control the final shape of a lava flow, these models are bound to suffer from severe insufficiencies. Currently, though, they represent the only way to assess the rheology of planetary lava flows. Arsia Mons, the southernmost of the three Tharsis Volcanos in the Tharsis Region of Mars, was examined to determine the yield strengths and effusion rates of 30 lava flows in the summit region of the volcano. Additional information is contained in the original extended abstract.
Author
Fluid Flow; Lava; Mars (Planet); Mars Volcanoes; Rheology; Dynamic Models; Volcanology

20000110394 NASA Ames Research Center, Moffett Field, CA USA
Small Valleys Networks on Mars: The Glacial Meltwater Channel Networks of Devon Island, Nunavut Territory, Arctic Canada, as Possible Analogs
Lee, Pascal, NASA Ames Research Center, USA; Rice, James W., Jr., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; Sponsored in part by the Nunavut Research Institute and the Polar Continental Shelf Project of Canada; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Small valley networks are perhaps the clearest evidence for episodes of sustained fluid erosion by water on Mars. While small valley formation has occurred even in Amazonian times, notably on the flanks of some volcanoes, most small valley networks on Mars are associated with the heavily cratered Noachian terrains and are thought to be as old as these terrains. We discuss here the recent identification of glacial meltwater channel networks on Devon Island, Nunavut Territory, Arctic Canada, as possible analogs for many small valley networks seen on Mars. A meltwater channel network interpretation for the martian networks may help solve critical problems plaguing more classical interpretations of their origin such as surface runoff following precipitation or groundwater release, including the need for warm climatic conditions. Additional information is contained in the original extended abstract.
Author
Arctic Regions; Ground Water; Mars Surface; Terrain; Valleys; Water Erosion; Mars (Planet); Terraforming

20000110395 Colorado Univ., Lab. of Atmospheric Space Physics, Boulder, CO USA

HST Observations of North Polar Dust Storms in Late Summer on Mars

Lee, S. W., Colorado Univ., USA; James, P. B., Toledo Univ., USA; Wolff, M. J., Space Science Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format

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The Martian polar regions play an integral role in the current climate of the planet. Polar processes also play important roles in the dust cycle; enhanced deposition of atmospheric dust is thought to take place as dust grains act as nucleation sites for CO2 and H2O condensation, perhaps leading to significant sedimentary deposits. The presence of dust will alter the albedo of surface condensates, and greatly impacts the polar radiation budget and the rate of sublimation once spring returns; subsequent transport of dust out of the region contributes significantly to the atmospheric dust loading and therefore to the atmospheric temperatures. It is clear that understanding the seasonal behavior of dust in the polar regions is essential to understanding the current climate on Mars. In late-1990, the Hubble Space Telescope (HST) began a long-term program of Mars observations; by late-1997, HST had accumulated observations over portions of four consecutive Martian years. During that time, HST has provided unique observations of the seasonal behavior of both polar caps, and has given clear evidence of a surprising level of dust activity in the north polar region. In fact, over the course of roughly monthly HST observations between September 1996 and October 1997 (covering an L(sub s) range of about 10 deg. to 190 deg.), dust activity was detected over the north polar cap in the majority of the observations. James, P. B. et al. has reported on north polar dust storms seen by HST during early northern spring, the time during which the north polar hood (a blanket of clouds which obscures the polar region through much of the autumn and winter) dissipates and the seasonal polar cap recedes. This presentation will discuss observations during the period between late northern summer and early autumn, the time during which the north polar hood reforms and the seasonal cap begins condensing onto the surface. A figure shows a polar map constructed from HST WFPC2 images obtained during early northern summer (L(sub s) about 98 deg); this shows the extent of the residual north polar cap at this time. A second figure shows a series of polar maps obtained between L(sub s) 163 deg and 186 deg. (late summer through early autumn). The obscuration of the residual polar cap by the polar hood is evident, as is the presence of large dust storms in most of the maps. Dust is particularly obvious in the L(sub s) 172 deg, 183 deg, and 186 deg maps. In this last view, the dust cloud appears to obscure most of the polar region northward of about 60 deg latitude. Details of the polar dust activity during this time period will be discussed in this presentation. These 1997 HST observations will form the basis for ongoing observations of the polar regions by Mars Global Surveyor and the upcoming Mars Climate Orbiter missions. The combined data should provide a detailed look at the behavior of dust in the north polar region over at least three consecutive Martian years, allowing the extent and interannual variability of this dust activity to be investigated. Additional information is contained in the original extended abstract.

Author

Dust Storms; Mars (Planet); Mars Environment; Mars Surface; Polar Caps; Polar Regions

20000110401 NASA Ames Research Center, Moffett Field, CA USA

Latest Results from the Mars Pathfinder Atmospheric Structure Investigation

Magalhaes, J. A., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Pathfinder Atmospheric Structure Investigation (ASI) obtained information on Martian atmospheric structure from three science accelerometers, which measured the deceleration of the probe at all levels in the atmosphere. Entry, descent, and landing occurred within 850 km of the Viking 1 landing site and somewhat later in northern summer. Pathfinder entered at 3 AME Local Mars Time (LMT), which provided the first opportunity to study Mars' nighttime atmospheric structure, and Viking 1 entered at 4:15 PME LMT. Magalhaes et al and Schofield et al have previously reported on the analysis of accelerometer measurements from the entry phase, which ended at about 8.5 km. The derived temperature profile extends from 140 km altitude down to 8.9 km, with a vertical resolution ranging from 250 meters to 50 meters, respectively. Here we report on a refined analysis of the Pathfinder entry phase ASIE data in which the effects of the small angular motions of the entry vehicle have been removed, thus enabling a search for small amplitude and small vertical wavelength structures. In addition, we will report on the atmospheric structure at altitudes below 8 km which is being derived from the accelerometer data acquired during the parachute descent phase. Additional information is contained in the original extended abstract.

Author

Atmospheric Chemistry; Atmospheric Physics; Mars Atmosphere; Mars (Planet)

20000110402 Malin Space Science Systems, San Diego, CA USA

An Emergent, New Paradigm for Mars Geology

Malin, M. C., Malin Space Science Systems, USA; Edgett, K. S., Malin Space Science Systems, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The planet Mars revealed by the Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) is not the Mars we all thought we knew from the Viking and Mariner missions. One of the most fundamental (and usually unstated) assumptions about martian geology is the notion that the planet's heavily cratered terrain is like that of the Moon, a megabreccia of primordial crust, perhaps consisting of the same lithology throughout (e.g., lunar anorthosite). The additional unstated assumption is that "heavily cratered terrain" formed on the surface of Mars, and then "stuff happened" to this terrain-such as mantling, volcanic plains formation, and processes involving running water, to provide the configuration of landforms that we see today. Nearly all pre-MGS efforts to classify, quantify, map, and date these surfaces on the basis of apparent stratigraphic relationships and crater counts have made this basic, though simplifying, assumption. MOC images reveal that the upper crust, everywhere that it is exposed in outcrop form, is layered. In retrospect, the Mariner 9 and Viking Orbiter images also demonstrate this fact, often in dramatic ways that did not make sense until now. Additionally, the surface properties of Mars, such as the regional albedo patterns and the distribution of dunes, yardangs, rocks, and dust, are all manifestations of this layered upper crust and subsequent weathering and redistribution of its materials. MOC images show that there are different types of layers, some with different albedo and some with different resistance to erosion. They also hint that some of the layers must be of sedimentary origin, and might have a regional extent that implies that processes occurred on ancient Mars that are completely unlike the processes that occur there today. Layered rocks (especially sedimentary rocks) on Earth tell tales of entire seas and mountain ranges that have formed, evolved, and vanished. The presence of a layered crust suggests that planet Mars was once unlike anything that anyone has ever described. This Mars existed at a time when impact crater formation was still frequent, and probably existed at a time that predates all of the major volcanic and tectonic features of the Tharsis/Syria rise. This is an early Mars that pre-dates all of the landforms previously attributed to "early Mars",for example, valley networks, and the surface that has been described prior to MGS is simply that found within the final few chapters in a diverse and previously unrecognized martian history. This Mars is just barely accessible to spacecraft, and will likely require careful exploration by human geologists operating in the field for many decades to fully reveal and appreciate the complex and rich history of this terrestrial planet. Additional information is contained in the original extended abstract. Author

Landforms; Lithology; Mars (Planet); Mars Surface; Planetary Geology; Planetary Evolution; Planetology

20000110403 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Atmospheric Results from the MGS Horizon Science Experiment

Martin, T. Z., Jet Propulsion Lab., California Inst. of Tech., USA; Murphy, J. R., New Mexico State Univ., USA; Hollingsworth, J. L., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Horizon Science Experiment (HORSE) utilizes the Mars Horizon Sensor Assembly (MHSA) on the Mars Global Surveyor (MGS) orbiter to measure 15-micron band thermal emission from the Martian atmosphere. During the first two phases of aerobraking, from September 1997 to May 1998, and from September 1998 to March 1999, one of the four MGS quadrants was pointed well onto the planet consistently during the near-periapsis aerobraking passes, allowing the device to obtain data on the latitudinal variation of middle atmospheric temperature (0.2 - 2.0 mbar). of particular interest during the first phase (L(sub s) = 182 - 300 deg) were the effects of a prominent dust storm at L(sub s) =224 deg, and wavelike behavior in the strong temperature gradient near the north polar cap. Additional information is contained in the original extended abstract. Author

Mars Atmosphere; Mars (Planet); Atmospheric Temperature; Planetary Temperature

20000110404 California Univ., San Diego, Dept. of Chemistry, La Jolla, CA USA

Evolution of the Martian Atmosphere: Clues from Nitrogen and Noble Gas Isotopic Signatures in SNC Meteorites

Mathew, K. J., California Univ., San Diego, USA; Marti, K., California Univ., San Diego, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Nitrogen, argon, and xenon isotopic signatures in separated shock-melted glass of the shergottite Zagami were shown to match those observed earlier in the glassy lithology of the Antarctic shergottite EETA79001, demonstrating that the observed signatures are characteristic to all shergottites and represent the trapped gases in these shock-melted glass. The close resemblance

of the measured 282% larger than terrestrial N-15/N-14 ratio, of the Xe-129/Xe-132 = 2.40 and of the nitrogen/argon/xenon elemental ratios in glassy lithologies of shergottites to the Viking spacecraft data for the Martian atmosphere provided the strongest evidence for a Martian origin of these meteorites. Additional information is contained in the original extended abstract.
Author
Mars (Planet); Mars Atmosphere; Meteoritic Composition; Shergottites; SNC Meteorites

20000110406 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mars Climate Orbiter's Investigation of the Atmosphere and Polar Caps
McCleese, D. J., Jet Propulsion Lab., California Inst. of Tech., USA; Moroz, V., Jet Propulsion Lab., California Inst. of Tech., USA; Schofield, T., Jet Propulsion Lab., California Inst. of Tech., USA; Taylor, F., Jet Propulsion Lab., California Inst. of Tech., USA; Zurek, R., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Climate Orbiter (MCO) is now on its way to Mars. It carries an atmospheric sounder whose observations will provide a continuous, global data set on weather and climate for a full Martian year. This paper describes the observation strategy and anticipated results from the Pressure Modulator Infrared Radiometer (PMIRR). PMIRR will measure vertical profiles of atmospheric infrared radiance in the 7 to 50 micron wavelength region extending from the surface of Mars to 80-km altitude. The observations have a vertical resolution of 5 km, or one-half the atmospheric scale height. From these radiance profiles we will retrieve profiles of atmospheric temperature, pressure, and the amounts of dust, condensates and water vapor. In addition, PMIRR will measure the radiative balance of the polar regions of Mars in an effort to better understand the short-term climate variability of the planet. The information obtained with PMIRR on MCO will be complementary to data obtained by the Thermal Emission Spectrometer (TES) and Radio Science (RS) experiments on the Mars Global Surveyor. A major emphasis of our research will be the assimilation of PMIRR data into numerical models of the Martian atmosphere. Assimilation schemes, of which several are currently in development, will permit the extension of measurements to spatial and temporal scales and to phenomena (e.g. winds) not observed directly by PMIRR.
Author
Atmospheric Temperature; Climate; Condensates; Dust; Mars Atmosphere; Mars Environment; Mathematical Models; Polar Caps; Temperature Profiles

20000110407 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Alkaline Hypersaline Lakes as Analogs for Ancient Microbial Habitats on Mars
McDonald, G. D., Jet Propulsion Lab., California Inst. of Tech., USA; Tsapin, A. I., Jet Propulsion Lab., California Inst. of Tech., USA; Storrie-Lombardi, M. C., Jet Propulsion Lab., California Inst. of Tech., USA; Nealson, K. H., Jet Propulsion Lab., California Inst. of Tech., USA; Brinton, K. L. F., Jet Propulsion Lab., California Inst. of Tech., USA; Sun, H., Jet Propulsion Lab., California Inst. of Tech., USA; Venkateswaren, K., Jet Propulsion Lab., California Inst. of Tech., USA; Tsapin, I., Moscow State Univ., Russia; Melack, J., California Univ., USA; Jellison, R., California Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

As the climate of ancient Mars became colder and drier with time, open bodies of water would have entered a regime in which evaporation exceeded input from precipitation or runoff. This would have resulted in increases in salinity and perhaps pH. The last open water on Mars was most likely found in alkaline hypersaline lakes, and these lakes would have been the last surface aquatic habitats for life on Mars. It follows, then, that the biomarkers most likely to be found in ancient sedimentary basins on Mars are those left by organisms adapted to high salt and high pH environments. We have begun to investigate the nature of biological diversity and adaptation to these environments, and the potential for biomarker preservation in them, using Mono Lake as a terrestrial analog environment. Additional information is contained in the original extended abstract.
Author
Biological Diversity; Climate; Evaporation; Extraterrestrial Life; Marine Biology; Mars Environment; Mars Surface; Microorganisms; pH

20000110408 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
Stratigraphy of the Upper Crust of Mars
McEwen, A. S., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The stratigraphy of the upper crust of Mars is a record of the geologic history over the past approx. 4 Gyr. MGS has just begun to provide a deluge of new information on the stratigraphy from high-resolution MOC images. An attempt at this time to synthesize and review the new data in terms of the geologic history of Mars is premature and very likely to be rendered obsolete within the next few months. Such an attempt follows anyhow, but take it with a grain of evaporite. The main purpose of the talk will be to show a set of spectacular new images of the crustal stratigraphy. Additional information is contained in the original extended abstract.
Author
Stratigraphy; Crusts; Mars Surface; Mineral Deposits; Paleontology; Planetary Geology; Sedimentary Rocks

20000110411 State Univ. of New York, Dept. of Geosciences, Stony Brook, NY USA
Geochemical Constraints on the Surface (Sedimentary) Mineralogy of Mars
McLennan, Scott M., State Univ. of New York, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Any insight into Martian surface mineralogy is of interest because it helps to constrain surficial chemical processes. Among the approaches to the problem are imaging, spectroscopy, magnetics, and chemical analyses. Geochemical constraints, considered here, come from analyses of soils and rocks at the Viking and Pathfinder sites, gamma-ray spectroscopy, and analyses of SNC meteorites. There have been several attempts to constrain Martian soil mineralogy by a combination of thermodynamic considerations and chemical mass balance. However, thermodynamic insight into mineralogy requires a variety of assumptions about surficial conditions (e.g., pH, pO2, pCO2, etc.) and multi-component mixing models are typically non-unique. An alternative approach (also see is to use geochemical variations among soils and rocks to constrain possible involvement of various minerals during sedimentary processes. Additional information is contained in the original extended abstract.
Author
Balance; Chemical Analysis; Chemical Reactions; Geochemistry; Imaging Techniques; Mineralogy; Thermodynamics

20000110412 European Space Agency, Departement de Geotectonique, Paris, France
Dikes on Mars: (1) What to Look For? (2) A First Survey of Possible Dikes During the Mars Global Surveyor Aerobreaking and Science Phasing Orbits
Mege, D., European Space Agency, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The tectonic importance of dikes on terrestrial planets in mantle plume contexts has been increasingly recognized, for the Earth as well as for Mars, Venus, and the Moon. Evidence of dikes on other planets is generally indirect and rest on geomorphologic observations at grabens. The resolution of the MGS/MOC images will allow direct observation of dikes and their relation-ships to structural patterns and distribution of volcanism. This paper discusses clues of dike outcrops that may be observed on MOC images, and gives examples of possible dikes observed during the aerobreaking and science phasing orbits. It must be pointed out, however, that because of the absence of a regional context at a similar resolution, these interpretations are by no means definitive. Additional information is contained in the original extended abstract.
Author
Mars Surface; Volcanology; Tectonics; Surveys; Rock Intrusions; Geological Faults

20000110413 European Space Agency, Departement de Geotectonique, Paris, France
Graben Morphology, Dike Emplacement, and Tension Fracturing in the Tharsis Igneous Province of Mars
Mege, D., European Space Agency, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The formation of many grabens on Mars is associated to geomorphologic processes resulting in graben deepening and widening. Material removal requires mode I opening in addition to normal faulting. Two mechanisms for material removal have been suggested to date, involving subsurface collapse in tension cracks underlying grabens at depth, and dike emplacement and interaction with sub-surface volatiles. In this paper, I review some of the geomorphologic, structural, and geodynamic arguments in favor of these mechanisms and some of the problems they pose. Additional information is contained in the original extended abstract.
Author
Morphology; Rock Intrusions; Fracturing; Geodynamics; Mars Surface

20000110415 West Virginia Univ., Morgantown, WV USA

Quartz May be a Hazard to Human Exploration of Mars

Meloy, T. P., West Virginia Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Environmental Compatibility Assessment (MECA) payload on the MSP '01 Lander has been selected to evaluate hazards to future astronauts associated with Martian soil and dust. of the possible hazards, cumulative inhalation of fine quartz particles stands out as the most threatening. This paper evaluates the implications of as little as 0.1% of the soil consisting of such particles. The high filtration rates required to remove respirable quartz dust from the martian habitat could call into question the very feasibility of human exploration of Mars.

Author

Dust; Exposure; Extravehicular Activity; Filtration; Hazards; Mars Surface; Quartz; Respiration

20000110417 Nevada Univ., Dept. of Geological Sciences, Reno, NV USA

Feeding the Mars Dust Cycle; Surface Dust Storage and Dust Devil Entrainment

Metzger, S. M., Nevada Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The wind-blown transport of fine-grained particulate material is the dominant geomorphic process currently producing erosion, transport and deposition on Mars. This is evidenced by the pervasive occurrence of globally-distributed seasonal wind streaks and regional albedo changes as well as close-up examination of dust drape changes on rocks at the Viking Lander sites. Further-more, dust and the mechanisms that loft it from the surface link the surficial geology and its interaction with the atmosphere. Additional information is contained in the original extended abstract.

Author

Dust Storms; Cycles; Mars Atmosphere; Carbon Dioxide; Convection; Deposition; Geomorphology

20000110418 California State Univ., Dept. of Physics and Geology, Bakersfield, CA USA

Rampart Craters: Mechanism for Excavation of a Martian Biota of Halothermophilic Archaea-Bacteria

Mitchell, Steven W., California State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Investigations of bacterial phylogeny using nucleic acid sequencing suggest that the first life forms to evolve on Earth were hyperthermophilic archaea and bacteria. This biota probably persued microbial chemosynthesis based on the an-aerobic metabolization of sulfur and/or the aerobic oxidation of hydrogen sulphide, hydrogen, methane or Fe(II) to Fe(III). Such a biota would have evolved and spread rapidly, perhaps within 30 Myr beginning near the end of the early bombardment (approx. 3.8 Bya) . Additional information is contained in the original extended abstract.

Author

Microorganisms; Mars (Planet); Life Sciences; Hydrogen; Bacteria; Aerobes

20000110419 NASA Ames Research Center, Moffett Field, CA USA

Experimental Studies of Brines and Evaporites as Applied to Mars: Initial Results from 1998-1999 Runs

Moore, J. M., NASA Ames Research Center, USA; Bullock, M. A., Southwest Research Inst., USA; Mellon, M. T., Colorado Univ., USA; Woosley, C. R., NASA Ames Research Center, USA; Zent, A. P., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We are performing laboratory experiments to determine the concentrations and rates of dissolution of ions that could occur in closed, juvenile groundwater systems on Mars. Our approach is to incubate unaltered Mars-analog minerals in initially pure liquid water in contact with a Mars gas mixture for one year. At exponentially increasing time intervals, aliquots of the solutions at three different temperatures are extracted and analyzed using standard terrestrial laboratory geochemical techniques. Ultimately, our experiments will produce Mars analog brines which will be freeze dried to create evaporites. The physical and chemical properties of these evaporites will be compared with spacecraft remote sensing and in situ compositional and physical data. Additional information is contained in the original extended abstract.
Author
Anions; Atmospheric Composition; Composition (Property); Deposits; Dissolving; Experimentation; Brines; Mars Environment; Geochemistry

20000110420 NASA Ames Research Center, Moffett Field, CA USA
The Topography and Basin Deposits of the Equatorial Highlands: A MGS-Viking Synergistic Study
Moore, J. M., NASA Ames Research Center, USA; Schenk, P. M., Lunar and Planetary Inst., USA; Howard, A. D., Virginia Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the greatest unresolved issues concerns the evolution of Mars early in its history; during the time period that accretion was winding down but the frequency of impacting debris was still heavy. Ancient cratered terrain that has only been moderately modified since the period of heavy bombardment covers about a quarter of the planet's surface but the environment during its formation is still uncertain. This terrain was dominantly formed by cratering. But unlike on the airless Moon, the impacting craters were strongly modified by other contemporary surface processes that have produced distinctive features such as: 1) dendritic channel networks, 2) rimless, flatfloored craters, 3) obliteration of most craters smaller than a few kilometers in diameter (except for post heavy-bombardment impacts), and 4) smooth intercrater plains. The involvement of water in these modification processes seems unavoidable, but interpretations of the surface conditions on early Mars range from the extremes of: 1) the "cold" model which envisions a thin atmosphere and surface temperatures below freezing except for local hydrothermal springs; and 2) the "warm" model, which invokes a thick atmosphere, seasonal temperatures above freezing in temperate and equatorial regions, and at least occasional precipitation as part of an active hydrological cycle. The nature of hydrologic cycles, if they occurred on Mars, would have been critically dependent on the environment. The resolution of where along this spectrum the actual environment of early Mars occurred is clearly a major issue, particularly because the alternate scenarios have much different implications about the possibility that life might have evolved on Mars. Additional information is contained in the original extended abstract.
Author
Topography; Deposits; Mars Environment; Evolution (Development); Surface Properties; Planetary Craters; Hydrological Cycle; Structural Basins

20000110421 Institut d'Aeronomie Spatiale de Belgique, Brussels, Belgium
Two-Dimensional Numerical Study of the Atmospheric and Surface Oxidant on Mars
Moreau, D., Institut d'Aeronomie Spatiale de Belgique, Belgium; Fonteyn, D., Institut d'Aeronomie Spatiale de Belgique, Belgium; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An important step for improving our knowledge of the martian photochemistry should be the validation of the currently admited scheme of stability, originally proposed by Parkinson and Hunten (1972) and McElroy and Donahue (1972). Over twenty years ago the Viking Mission's life detection experiments proved that the Martian soil is extraordinarly oxidizing. The evolution of CO2 from Labelled Release experiment is consistent with the presence of a thermally labile oxidant. Detection and characterisation of the chemical and physical nature of this powerful oxidant is therefore of great interest not only in the exobiology point of view but also to understand exchanges between the atmosphere and the regolith on Mars. In the thin cold Martian atmosphere, photochemical reactions occurring between traces of water and the ultraviolet radiation from the Sun probably lead to the production of H2O2 which in turn can condense onto soil grain and airborne dust. This molecule, in fact, may be the key constituant for the chemical regulation of H2, O2 and CO in the Martian atmosphere as well as for the photochemical stabilisation of the atmosphere. Today, hydrogen peroxide has not yet been detected in the Martian atmosphere. Tentative detection has been carried out few years ago using IRAM radiotelescope. These observations only allow to determine a global upper limit for this molecule a factor of three below any one dimensional and two-dimensional model calculations. This new upper limit seem however to confirm the assumption that, due to the low thermal conditions prevailing on Mars these last years, H2O2 probably condensed out

of the atmosphere. The purpose of this paper is to presents results of our model showing the regulation of H2, O2 and CO in the current Martian atmosphere due to hydrogen peroxide photochemistry. From our simulations, H2O2 appears as an interesting tracer for chemical reactions related to water vapor and possess an absorption continuum between 150 and 200 nm. Its presence in the atmosphere should conduct to a small decrease of the transmission in this spectral region and allow to estimate the total column of this constituant using the UV chanel of Spicam-Light experiment programmed to fly during Mars Express mission.
Author
Two Dimensional Models; Numerical Analysis; Dust; Exobiology; Hydrogen Peroxide; Mars Atmosphere; Mars Environment; Oxidation

20000110422 NASA Johnson Space Center, Houston, TX USA
Titanomagnetite-bearing Palagonitic Dust as an Analogue for Magnetic Aeolian Dust on Mars
Morris, Richard V., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Pathfinder magnetic properties experiment included two Magnet Arrays (MAs) which consist of five permanent magnets that have different strengths. Each magnet is a cylindrical and ring magnet arranged in a "bulls-eye" pattern beneath a thin surface layer. The design of the MA permits estimation of magnetic properties (saturation magnetization and magnetic susceptibility) of adhering material, principally by the number of magnets that have adhering material and the extent each magnet is saturated. The two MAs passively sample aeolian dust. Additional information is contained in the original extended abstract.
Author
Titanium; Analogs; Dissolving; Iron Oxides; Magnetic Permeability; Magnetic Properties; Mars Pathfinder

20000110423 Hawaii Univ., Inst. Geophysics and Planetology, Honolulu, HI USA
New Styles of Martian Volcanic Activity Revealed by Mars Orbiter Camera Images
Mouginis-Mark, P. J., Hawaii Univ., USA; Wilson, L., Hawaii Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Images from the Mars Orbiter Camera (MOC) are revealing more diversity in the styles of volcanism on Mars compared to observations made using Viking data. Here we illustrate three new types of activity to aid further geomorphic mapping and the development of numerical models for Martian volcanic eruptions. Additional information is contained in the original extended abstract.
Author
Volcanology; Mars Volcanoes; Models; Geomorphology

20000110424 Institut d'Aeronomie Spatiale de Belgique, Brussels, Belgium
Simulations of Mars Nadir UV and Infrared Observations for the SPICAM-Light Instrument on Mars-Express
Muller, C, Institut d'Aeronomie Spatiale de Belgique, Belgium; Moreau, D., Institut d'Aeronomie Spatiale de Belgique, Belgium; Fonteyn, D., Institut d'Aeronomie Spatiale de Belgique, Belgium; Korablev, O., Academy of Sciences (USSR), USSR; Bertaux, J. L., Centre National de la Recherche Scientifique, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars-Express mission due to be launched in 2003 will carry the SPICAM-light instrument for the study of the climatology of water vapor and ozone in the Mars atmosphere. The UV channel extends from 180 to 340 nm and the IR channel, aiming at the 1.38 microns band extends from 1 to 1.7 micrometer. Simulations of the signal are given as for different seasons and latitudes for the expected performances of the instrument. A comparison is made with the previous ozone and water vapor sensors flown on Mariner 9 and Viking will be made and the reinterpretation of the data with the new tools to be developed for SPICAM-light will be discussed. This process could cover two purposes: the validation of the new techniques and the acquisition of two coherent series obtained at a thirty years interval.
Author
Water Vapor; Simulation; Ozone; Mars Atmosphere; Gas Detectors; Climatology; Atmospheric Composition

20000110425 New Mexico State Univ., Dept. of Astronomy, Las Cruces, NM USA
The Martian Atmospheric Dust Cycle: Insights from Numerical Model Simulations
Murphy, J. R., New Mexico State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also

20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Suspended dust (or lack thereof) in the martian atmosphere is the most important determining factor regarding the thermal, and thus dynamical, state of the martian atmosphere. The observational history of martian atmospheric dust, including direct measurements at visible and infrared wavelengths and indirect inferences from microwave observations of atmospheric temperatures, indicate substantial variations in dust load during a given year and from year to year. The dust cycle is a manifestation of the interaction between near-surface atmospheric stability and dust available for lifting upon the martian surface. In this presentation, we address the role the large-scale atmospheric circulation can play in the dust cycle. Additional information is contained in the original extended abstract.

Author

Dust; Cycles; Mars Atmosphere; Simulation; Numerical Analysis; Mathematical Models

20000110426 Brown Univ., Dept. of Geological Science, Providence, RI USA

Layering Due to Pedogenic Processes in the Martian Soil

Mustard, John F., Brown Univ., USA; Cooper, Christopher D., Brown Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Malin and Edgett note that Mars is layered on a variety of scales, indicating that mechanisms that deposit and indurate have played a significant role in the evolution of at least the near surface (1-5 km) of the planet. We have been investigating processes that have may occur in the regolith of Mars (which we refer to as soil), and have focused on those processes likely to have resulted in induration and layering. In this abstract we outline the basic classes of pedogenic processes that would lead to induration and layering, and discuss implications of the processes for testable observations from existing and planned spacecraft. The very presence of a layer indicates a material whose strength is distinct from the surrounding materials. In soils, this contrast in strength is due to the presence of a cementing agent or from a textural difference (e.g. compacted vs. loose dust). In general, pedogenic processes leading to induration and layering can be divided into top-down, bottom-up, and cyclic. Top-down processes are those where the mechanism leading to induration is driven by a surface-atmosphere interaction. In bottom-up processes, the mechanism is driven by subsurface transport. Cyclic processes are those where materials are eroded and deposited on long time scales leading to sorting or burial. Additional information is contained in the original extended abstract.

Author

Dust; Deposits; Mars Surface; Surface Reactions; Soils

20000110427 Kyoto Univ., Faculty of Science, Sakyoku, Japan

The Blue Clearing at Syrtis Major and Its Relation to Equatorial Clouds: 1997 and 1999 Observations

Nakakushi. T., Kyoto Univ., Japan; Akabane, T., Kyoto Univ., Japan; Iwasaki, K., Kyoto Gakuen Univ., Japan; Larson, S. M., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We observed Mars with a CCD camera attached to the 65 cm refractor at Hida Observatory in the 1997 apparition, and the 60 inch reflector at Steward Observatory in the 1999 apparition. In both of the observational periods it was summer in the northern hemisphere of Mars. Many clouds appeared in the equatorial region and mid latitudes of the northern hemisphere. Those clouds are classified into morning, afternoon, and evening clouds. The morning and evening clouds have a large dimension extending from mid latitudes in the southern hemisphere to mid latitudes in the northern hemisphere. The afternoon clouds tend to appear near local noon at large volcanoes in Tharsis and Elysium. They are visible through the local afternoon. Their dimension is considerably smaller than morning and evening clouds. Clouds of those three types are the most active in late spring to mid summer in the northern hemisphere. In this period low latitudes are overspread with clouds, and the equatorial cloud belt is formed. The cloud belt extends from 10 deg S to 30 deg N. Additional information is contained in the original extended abstract.

Author

Equatorial Regions; Mars Atmosphere; Mars Surface; Northern Hemisphere; Southern Hemisphere; Volcanoes

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Initiation of Sandstorms Due to Impacts of the 1-10-Meter-Diameter Meteoroids onto the Surface of Mars

Nemtchinov, I. V., Academy of Sciences (USSR), USSR; Popova. O. P., Academy of Sciences (USSR), USSR; Rybakov, V. A., Academy of Sciences (USSR), USSR; Shuvalov, V. V., Academy of Sciences (USSR), USSR; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The least understood aspect of Martian aeolian cycles is the mechanism for setting particles into suspension. Because of the low-density atmosphere, extremely high winds are required to raise loose dust of the size inferred for Martian dust (approximately a few micrometers). The size of the small dust clouds being registered on Mars roughly coincides with the size of the clouds after the impact of bodies of approximately a few meters in size. The cloud of debris and dust being formed after the impact may be a trigger-mechanism for famous Martian sandstorms (local, regional, or even global, under favorable conditions). Additional information is contained in the original extended abstract.

Author

Dust Storms; Mars Environment; Mars Surface; Impact; Meteorites; Clouds (Meteorology)

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The Effects of Magnetic Anomalies Discovered at Mars on the Structure of the Martian Ionosphere and the Solar Wind Interaction as Follows from Radio Occultation Experiments

Ness, N. F., Bartol Research Inst., USA; Acuna, M. H., NASA Goddard Space Flight Center, USA; Connerney, J. E. P., NASA Goddard Space Flight Center, USA; Cloutier, P., Rice Univ., USA; Kliore, A. J., Jet Propulsion Lab., California Inst. of Tech., USA; Breus, T. K., Academy of Sciences (USSR), USSR; Krymskii, A. M., Academy of Sciences (USSR), USSR; Bauer, S. J., Graz Univ., Austria; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The electron density distribution in the ionosphere of nonmagnetic (or weakly magnetized) planet depends not only on the solar ultraviolet intensity, but also on the nature of the SW interaction with this planet. Two scenarios previously have been developed based on the observations of the bow shock crossings and on the electron density distribution within the ionosphere. According to one of them Mars has an intrinsic magnetosphere produced by a dipole magnetic field and the Martian ionosphere is protected from the SW flow except during ”overpressure conditions, when the planetary magnetic field can not balance the SW dynamic pressure. In the second scenario the Martian intrinsic magnetic dipole field is so weak that Mars has mainly an induced magnetosphere and a Venus-like SW/ionosphere interaction. Today the possible existence of a sufficiently strong global magnetic field that participates in the SW/Mars interaction can no longer be supported. The results obtained by the Mars-Global-Surveyor (MGS) space-craft show the existence of highly variable, but also very localized magnetic fields of crustal origin at Mars as high as 400-1500 nT. The absence of the large-scale global magnetic field at Mars makes it similar to Venus, except for possible effects of the magnetic anomalies associated with the remnant crustal magnetization. However the previous results on the Martian ionosphere obtained mainly by the radio occultation methods show that there appears to be a permanent existence of a global horizontal magnetic field in the Martian ionosphere. Moreover the global induced magnetic field in the Venus ionosphere is not typical at the solar zenith angles explored by the radio occultation methods. Additional information is contained in the original extended abstract.

Derived from text

Magnetic Anomalies; Mars Atmosphere; Solar Wind; Radio Occultation; Plasma Interactions; Planetary Magnetic Fields; Planetary Ionospheres; Magnetization

20000110430 Oxford Univ., Oxford, UK

A Dust Transport Model for Mars: From Injection to Deposition

Newman, C. E., Oxford Univ., UK; Lewis, S. R., Oxford Univ., UK; Read, P. L., Oxford Univ., UK; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

For many years now it has been recognized that the correct simulation of the atmosphere of Mars requires the inclusion of radiative effects due to dust in the atmosphere. The dust distribution, however, is highly variable in space and time, so it is insufficient for a model which claims to simulate the atmosphere completely to ignore this variation. Currently, the Mars General Circulation Model (MGCM), which has been developed jointly at Oxford and at Laboratoire de Meteorologie Dynamique du CNRS in Paris, attempts to capture some of this variability by using a dust distribution which may be varied with areocentric longitude (Ls), with latitude, and in total optical depth. An improvement on this method is to try to simulate the dust distribution, and this requires

a dust transport scheme. The scheme discussed here consists of a tracer advection model, which uses winds from the MGCM to advect dust mixing ratios, as well as several parameterizations of small-scale dust processes. Additional information is contained in the original extended abstract.
Author
Dust; Transport Properties; Atmospheric General Circulation Models; Simulation; Mars Atmosphere; Deposition

20000110434 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mars Electromagnetic Sounding Experiment: MARSES
Ozorovich, Y. R., Academy of Sciences (USSR), USSR; Linkin, V. M., Academy of Sciences (USSR), USSR; Smythe, W. D., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The MARSES is the sounding instrument developed of searching for water, water-ice or permafrost layers existing in some depth under the visible surface of Mars. There are many evidences that water once was abundant on Mars. There are stream lined islands formed by flowing water, flow patterns reminiscent of wadis in Earth deserts, and outflow channels thought to have been formed by sudden outrush of subterranean water. The secondary task is to measure the soil properties of the subsurface of Mars, which include porosity, electrical resistance of the liquid phase, thermal conductivity, temperature dependence. A main task of the MARSES system is to examine changes in subsurface properties of local areas regolith on the martian surface, and to relate them to optical images and other remote sensing data in order to understand the nature of different terrain forms. The dryed up regions of Martian frozen rocks is considered to have been developing during more than 3.5 bln years, so the upper layer boundary of permafrost can serve as an indicator reflecting the course of martian paleoclimate evolution. Additional information is contained in the original extended abstract.
Author
Flow Distribution; Ice; Images; Liquid Phases; Mars Surface; Regolith; Remote Sensing; Water

20000110435 Observatoire de Bordeaux, Astronomical Observatory, Floirac, France
On Performances of Ground Penetrating Radars for Mars Subsurface Exploration
Paillou, P., Observatoire de Bordeaux, France; Grandjean, G., Bureau de Recherches Geologiques et Minieres, France; Heggy, E., Observatoire de Bordeaux, France; Malezieux, J.-M., Bordeaux Univ., France; Achache, ., Centre National d'Etudes Spatiales, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Among the future missions for Mars exploration, two will operate ground penetrating radars. The first one is the Netlander mission (CNES) that proposes four landers, each carrying a 2 MHz fixed GPR. The second one is the Mars Express mission (ESA) that will fly an orbital sounding radar. Both instruments aim at exploring the first layers of the martian subsurface for water and ice detection down to a depth of approx. 3 km. This radar penetration depth was estimated for the Netlander instrument using an electromagnetic numerical simulation; these computations were first made with a simple model of the martian megaregolith under the form of successive layers of sediments, fresh basalt, ice and water. An attempt was also made to take into account the effect of iron oxides in the upper 30 meters of the soil but the possible effect of salts and clays that could be also present in the martian soil has not yet been looked at. We present here the results of recent experiments in the Republic of Djibouti, a region that looks very similar to Mars, which show that these elements could dramatically decrease the radar penetration because of strong conduction and relaxation losses. Additional information is contained in the original extended abstract.
Author
Basalt; Clays; Detection; Ground Water; Ice; Mars Exploration; Mars Surface; Penetration; Regolith

20000110436 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Observational Tests of the Mars Ocean Hypothesis: Selected MOC and MOLA Results
Parker, T. J., Jet Propulsion Lab., California Inst. of Tech., USA; Banerdt, W. B., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We have begun a detailed analysis of the evidence for and topography of features identified as potential shorelines that have been im-aged by the Mars Orbiter Camera (MOC) during the Aerobraking Hiatus and Science Phasing Orbit periods of the Mars Global Surveyor (MGS) mission. MOC images, comparable in resolution to high-altitude terrestrial aerial photographs, are partic-

ularly well suited to address the morphological expressions of these features at scales comparable to known shore morphologies on Earth. Particularly useful are examples of detailed relationships between potential shore features, such as erosional (and depositional) terraces have been cut into ”familiar” pre-existing structures and topography in a fashion that points to a shoreline interpretation as the most likely mechanism for their formation. Additional information is contained in the original extended abstract. Author

Aerial Photography; Erosion; Morphology; Terraces (Landforms); Topography

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Location and Geologic Setting for the Three U.S. Mars Landers

Parker, T. J., Jet Propulsion Lab., California Inst. of Tech., USA; Kirk, R. L., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Super resolution of the horizon at both Viking landing sites has revealed ”new” features we use for triangulation, similar to the approach used during the Mars Pathfinder Mission. We propose alternative landing site locations for both landers for which we believe the confidence is very high. Super resolution of VL-1 images also reveals some of the drift material at the site to consist of gravel-size deposits. Since our proposed location for VL-2 is NOT on the Mie ejecta blanket, the blocky surface around the lander may represent the meter-scale texture of ”smooth palins” in the region. The Viking Lander panchromatic images typically offer more repeat coverage than does the IMP on Mars Pathfinder, due to the longer duration of these landed missions. Sub-pixel offsets, necessary for super resolution to work, appear to be attributable to thermal effects on the lander and settling of the lander over time. Due to the greater repeat coverage (particularly in the near and mid-fields) and all-panchromatic images, the gain in resolution by super resolution processing is better for Viking than it is with most IMP image sequences. This enhances the study of textural details near the lander and enables the identification rock and surface textures at greater distances from the lander. Discernment of stereo in super resolution im-ages is possible to great distances from the lander, but is limited by the non-rotating baseline between the two cameras and the shorter height of the cameras above the ground compared to IMP. With super resolution, details of horizon features, such as blockiness and crater rim shapes, may be better correlated with Orbiter images. A number of horizon features - craters and ridges - were identified at VL-1 during the misison, and a few hils and subtle ridges were identified at VL-2. We have added a few ”new” horizon features for triangulation at the VL-2 landing site in Utopia Planitia. These features were used for independent triangulation with features visible in Viking Orbiter and MGS MOC images, though the actual location of VL-1 lies in a data dropout in the MOC image of the area. Additional information is contained in the original extended abstract. Author

Dropouts; Ejecta; Landing Sites; Mars Pathfinder; Mars Photographs; Mars Surface

20000110441 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Mystery of the Mars North Polar Gravity-Topography Correlation(Or Lack Thereof)

Phillips, R. J., Washington Univ., USA; Sjogren, W. L., Jet Propulsion Lab., California Inst. of Tech., USA; Johnson, C. L., Carnegie Institution of Washington, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Maps of moderately high resolution gravity data obtained from the Mars Global Surveyor (MGS) gravity calibration orbit campaign and high precision topography obtained from the Mars Orbiter Laser Altimeter (MOLA) experiment reveal relationships between gravity and topography in high northern latitudes of Mars. Figure 1 shows the results of a JPL spherical harmonic gravity model bandpass filtered between degrees 6 and 50 contoured over a MOLA topographic image. A positive gravity anomaly exists over the main North Polar cap, but there are at least six additional positive gravity anomalies, as well as a number of smaller negative anomalies, with no obvious correlation to topography. Additional information is contained in the original extended abstract.

Author

Anomalies; Gravity Anomalies; Laser Altimeters; Mars Surface; Polar Caps; Topography

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MOLA-derived Roughness Data Used to Predict Surface Scattering for Mars Subsurface Radar Sounding

Plaut, J. J., Jet Propulsion Lab., California Inst. of Tech., USA; Garneau, S., International Space Univ., Inc., Japan; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Express orbiter, to be launched by the European Space Agency in 2003, will carry a low-frequency radar sounding instrument, MARSIS (Mars Advanced Radar for Subsurface and Ionospheric Sounding). The primary goal of MARSIS is to map the distribution of water, both solid and (if present) liquid, in the upper several km of the martian crust. Detecting discontinuities in the crust, such as an ice-water transition, presents many challenges for a Mars orbital radar sounder. One challenge that must be overcome is the presence of radar scattering (echoes) from the surface of Mars, expected to be detected by the sounder antennas at the same time as any echoes aris-ing from subsurface interfaces. As the transmitted spherical wavefront spreads within the crust of Mars,. it also interacts with surface topography at off-nadir positions, creating a ”clutter” signal that can mask the subsurface echoes. The MARSIS instrument will utilize Doppler filtering to limit the off-nadir clutter in the along-track direction, and a nadir-null secondary antenna to identify strong off-nadir clutter from the cross-track direction. to evaluate the effects of off-nadir surface clutter and the capability of these schemes to reduce the clutter, it is necessary to predict the range of scattering behavior that may be expected from martian surface topography. In this paper, we utilize Mars Orbital Laser Altimeter (MOLA) data from the current Mars Global Surveyor mission to characterize the topographic roughness of a variety of martian terrain types, at scales relevant to the MARSIS clutter problem. Segments of MOLA altimetry profiles are reduced to the topographic parameters rms slope and fractal dimension, which then are used as inputs to a near-nadir radar scattering model to predict the strength of the clutter signal. Additional information is contained in the original extended abstract.

Author

Detection; Echoes; Ice; Ionospheric Sounding; Laser Altimeters; Mars Surface; Planetary Crusts; Radar Scattering; Surface Roughness; Terrain; Topography

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The Effect of Bulk Density on the Thermal Conductivity of Particulate Materials Under Martian Atmospheric Pressures

Presley-Holloway, M. A., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

On December 3, 1999, the DS-2 Mars Microprobes will impact into the surface of Mars. The friction of those impacts will heat the surface materials surrounding the probes. Over a period of several hours, and hopefully days, two thermistors on each probe will measure the temperature, and hence the rate of cooling of the surrounding surface materials. From these measurements and previously derived thermal models, we will be able to deduce the thermal conductivity of the materials that the probes penetrate. Previous laboratory measurements have shown that under martian atmospheric pressures, the thermal conductivity of particulate materials depends on the particle size, and in particular, may be empirically related to particle size and atmospheric pressure. At a minimum, then, we should be able to estimate the particle size of the materials that the probes penetrate. However, particle size and atmospheric pressure are not the only parameters that can determine the thermal conductivity of martian surficial deposits. As previously discussed, the transfer of thermal energy due to collisions of gas molecules that exist between the particles is the predominant mechanism of thermal conduction in porous sediments not under vacuum. The mean free path of gas molecules at the martian surface will vary between 3 and 42 microns, and is approximately the same order of magnitude as the effective distance over which conduction takes place between the particles. Conduction occurs primarily near the points of contact between the particles, and the effective conduction distance is approximately one-sixth the particle diameter or less. Gas molecules are thus as likely to collide with the solid particles as they are with each other, and the average heat transfer distance between particles, which is related to pore size and shape, will determine how fast heat will flow through a particulate material. Particle shape, bulk density of the material, and particle size sorting, as well as particle size, will affect the average heat transfer distance between particles and, therefore, the thermal conductivity of the deposit. In particular, the impact from the probes is expected to increase the bulk density of the impacted materials by approximately 20%. The dependence of thermal conductivity on bulk density, there-fore, must be known in order to properly characterize the deposits. In a previous paper, this relationship was briefly examined. On the basis of three different densities of samples consisting of the same particle size, the thermal conductivity appeared to increase linearly with an increase in bulk density. However, in order to reach a reasonable conclusion about the physical properties of the materials at the DS-2 impact site, this relationship needs to be determined more thoroughly. Additional information is contained in the original extended abstract.

Author

Thermal Conductivity; Mars Atmosphere; Pressure Effects; Surface Properties; Planetary Geology; Particle Density (Concentration); Conductive Heat Transfer

20000110448 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

Sedimentary Geomorphology of the Mars Pathfinder Landing Site

Rice, J. W., Jr., Arizona Univ., USA; Lemmon, M. T., Arizona Univ., USA; Smit, P. H., Arizona Univ., USA; Yingst, R. A., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The successful landing of Mars Pathfinder near the confluence of Ares and Tiu Valles on July 4, 1997, has prompted new interest in understanding the nature of the geomorphology of the outflow channels around the margins of the Chryse Basin. However, investigators still do not agree upon which mechanisms (catastrophic flood, debris flow, glacial flow) created the landscape. Additional information is contained in the original extended abstract.

Author

Geomorphology; Glaciers; Landing Sites; Mars Surface; Terrain; Topography

20000110451 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Thermal-Infrared Spectral Characteristics of Martian Albedo Features: Clues to Composition

Ruff, S. W., Arizona State Univ., USA; Christensen, P. R., Arizona State Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Thermal-infrared spectra of Mars are dominated by features attributable to atmospheric constituents. Dust, CO2, water vapor, and water ice all have strong absorptions in the thermal-infrared region that tend to obscure the spectral character of the surface and frustrate attempts to identify surface mineralogy. Any effort to examine Mars' surface spectral character must account for the atmosphere in some way. In the case of spectra measured by the Thermal Emission Spectrometer (TES), efforts are underway to account for atmospheric components using both radiative transfer analysis and a linear deconvolution strategy. Both techniques are computationally intensive and are not readily available to users of TES data. However, empirical analysis of existing TES data has demonstrated that the bright and dark albedo features of Mars have unique spectral characteristics that are not obscured by the atmosphere. These characteristics persist across a range of atmospheric conditions and are mapable down to the smallest spatial resolution of TES data. Using carefully applied ratios of bright and dark region spectra, it is possible to cancel atmospheric spectral contributions to a degree that allows for compositional analysis of both bright and dark material on Mars' surface. Additional information is contained in the original extended abstract.

Author

Atmospheric Composition; Carbon Dioxide; Dust; Albedo; Thermal Emission; Infrared Spectra; Water Vapor; Ice; Mars Surface

20000110452 NASA Goddard Space Flight Center, Greenbelt, MD USA

Martian Polar Impact Craters: A Preliminary Assessment Using Mars Orbiter Laser Altimeter (MOLA)

Sakimoto, S. E. H., Universities Space Research Association, USA; Garvin, J. B., NASA Goddard Space Flight Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Our knowledge of the age of the layered polar deposits and their activity in the volatile cycling and climate history of Mars is based to a large extent on their apparent ages as determined from crater counts. Interpretation of the polar stratigraphy (in terms of climate change) is complicated by reported differences in the ages of the northern and southern layered deposits. The north polar residual ice deposits are thought to be relatively young, based on the reported lack of any fresh impact craters in Viking Orbiter Images. Herkenhoff et al., report no craters at all on the North polar layered deposits or ice cap, and placed an upper bound on the surface age (or, alternatively, the vertical resurfacing rate) of 100 thousand years to 10 million years, suggesting that the north polar region is an active resurfacing site. In contrast, the southern polar region was found to have at least 15 impact craters in the layered deposits and cap. Plaut et al, concluded that the surface was less than or = 120 million years old. This reported age difference factor of 100 to 1000 increases complexity in climate and volatile modeling. Recent MOLA results for the topography of the northern polar cap document a handful or more of possible craters, which could result in revised age or resurfacing estimates for the northern cap. This study is a preliminary look at putative craters in both polar caps. Additional information is contained in the original extended abstract.

Author

Craters; Impact; Age Factor; Climate Change; Deposits; Mars Environment; Mars Photographs; Polar Caps

20000110453 Tokyo Univ., Planetary Sciences Group, Japan

Concentration of Phobos-derived Particles on the Equatorial Region of Martian Surface

Sasaki, Sho, Tokyo Univ., Japan; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Like other planets, Martian surface receives flux of interplanetary dust particles (micrometeorites) continuously. Michelangeli et al. included this flux to investigate the formation of Martian water clouds. However, continuous supply of satellite-derived solid particles on planets has not been discussed, although contamination of Neptune's atmosphere by atomic or ionic nitrogen from Triton was proposed. On the Earth, there found lunar meteorites but dust particles of lunar origin have not been detected precisely. Because of chemical similarity between the Earth and the moon, it is difficult to identify them. Phobos and Deimos are possibly trapped asteroids and of different chemical composition from Mars. Although interpretation of Phobos' reflectance spectrum is still in debate, there is an opinion that Phobos is in C-type category. Phobos-derived particles, if existed, could be identified in Martian surface samples. In the present study, from theoretical investigation of a dust ring around Mars, possible concentration of Phobos- derived particles on the Martian equatorial region is proposed. Additional information is contained in the original extended abstract.

Author

Chemical Composition; Contamination; Interplanetary Dust; Mars Surface; Meteorites; Phobos; Water

20000110455 NASA Ames Research Center, Moffett Field, CA USA

South Polar Region of Mars: Topography and Geology

Schenk, P. M., Lunar and Planetary Inst., USA; Moore, J. M., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The polar layered deposits of Mars represent potentially important volatile reservoirs and tracers for the planet's geologically recent climate history. Unlike the north polar cap, the uppermost surface of the bright residual south polar deposit is probably composed of carbon dioxide ice. It is unknown whether this ice extends through the entire thickness of the deposit. The Mars Polar Lander (MPL), launched in January 1999, is due to arrive in December 1999 to search for water and carbon dioxide on layered deposits near the south pole (SP) of Mars. Additional information is contained in the original extended abstract.

Author

Topography; Mars Surface; Planetary Geology; Deposits

20000110458 Nevada Univ., Geomechanics-Rock Fracture Group, Reno, NV USA

A New Look at Martian Extensional Structures: Are the Faults More than Only Skin Deep?

Schultz, Richard A., Nevada Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Considerable progress has been made on Martian extensional tectonics since the 4th Mars Colloquium in 1989. The intervening decade has seen significant advances in the understanding of how extensional structures in general work-both terrestrial and planetary-along with a remarkable convergence of opinion on the polygenetic history of the Valles Marineris. The new imaging and topographic data currently streaming back from Mars will provide more detailed observations of many Martian structures. Improvements in the analysis and interpretation of terrestrial extensional systems over the past decade will, in concert with the new data, permit a wider range of physically based tectonic interpretations to be made. In this abstract I touch on some aspects of the three-dimensional nature of extensional deformation on Mars based on surface exposures. Many ideas concerning how normal fault and graben systems work have changed greatly since 1989, resulting in a wealth of new tools that can be applied to planetary structural problems. A few of these tools and concepts are noted here. In particular, the key role that the classic grabens found in Canyonlands National Park, Utah, have played in the development and pedigree of ideas on Martian extensional tectonics will be summarized. While these grabens continue to provide insight into planetary fault systems, they are no longer the universal template that they once may have been. As a result, the "thin-skinned" interpretation of Martian grabens, based on the original Canyonlands analogy, does not appear to be supportable by well-documented examples of terrestrial graben systems for comparable stratigraphic and tectonic settings. Additional information is contained in the original extended abstract.

Author

Tectonics; Convergence; Exposure; Geological Faults; Imaging Techniques; Mars Surface; Planetary Geology; Stratigraphy

20000110460 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

Analysis of Mars HST Observations

Smith, P. H., Arizona Univ., USA; Bos, B. J., Arizona Univ., USA; Lemmon, M., Arizona Univ., USA; McStroul, G. P., Arizona Univ., USA; Reid, R. J., Arizona Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format

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During the 1997 Mars opposition, several observations of Mars were obtained with the Wide Field/Planetary Camera 2 (WFPC2) of the Hubble Space Telescope (HST). We have analyzed two sets of those observations obtained on March 30 and March 31 of 1997 as part of HST GO Programs 6741 and 6793. Our analysis has included a search for evidence of the coarse-grained hematite deposit reported by the Mars Global Surveyor Thermal Emission Spectrometer (TES) as well as other materials. Although no compelling evidence has verified the TES discovery, spectral signatures have been identified at other locations on the Martian disk that may be consistent with coarse-grained hematite. Additional information is contained in the original extended abstract.

Author

Thermal Emission; Spectral Signatures; Mars Global Surveyor; Grain Size; Deposits

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Constraints on the Martian Plate Tectonic Hypothesis from Gravity and Topography Data

Smrekar, S., Jet Propulsion Lab., California Inst. of Tech., USA; Raymond, C., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Mars Global Surveyor Magnetic Fields Experiment/ Electron Reflectometer (MGS MAG/ER) experiment serendipitously discovered unanticipated and unprecedented regions of high amplitude crustal magnetic anomalies, indicating strong sources of remanent crustal magnetism. In one area of the southern hemisphere, the anomalies appear lineated and alternate in direction, resembling the stripes formed at terrestrial oceanic spread-ing regions. However, many significant differences exist. The inferred magnetization are easily an order of magnitude greater in strength than terrestrial counterparts. The width of the anomalies appears to be approximately 200 km, in comparison to a variable width of order 10-1000 km at terrestrial spreading centers. However, the spacecraft altitude of 100-200 km may be such that narrower anomalies are simply unresolved. Although the majority of strong anomalies are found in the southern highlands, there is no clear correlation with landforms at the surface. The lack of a correlation between magnetism and topography hinders the confident interpretation of magnetic sources. Additional information is contained in the original extended abstract.

Author

Anomalies; Correlation; Crusts; Gravitation; Tectonics; Hypotheses; Mars Surface; Magnetic Properties

20000110462 Carnegie Institution of Washington, Dept. of Terrestrial Magnetism, Washington, DC USA

New Insights into the Thermal History and Crustal Evolution of Mars from Mars Global Surveyor

Solomon, Sean C., Carnegie Institution of Washington, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The subject of the thermal history of Mars ties together the evolution of the crust, mantle, core, and atmosphere as well as the history of magmatic and tectonic activity on the planet. Recent results from the Mars Global Surveyor (MGS) mission constitute important new information pertinent to planetary evolution. These results include the detection of substantial magnetization anomalies in the martian crust, new high-resolution topography both on a global scale and for features sensitive to the properties of the underlying lithosphere, and new information from imaging on martian magmatic processes. Additional information is contained in the original extended abstract.

Author

Anomalies; Mars Surface; Planetary Crusts; Planetary Evolution; Imaging Techniques

20000110463 Nantes Univ., Laboratoire de Planetologie et Geodynamique, France

Revisited Models of Mars Internal Structure and Thermal Evolution

Sotin, C., Nantes Univ., France; Lognonne, Ph., Institut de Physique du Globe, France; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper describes models of the internal structure and dynamics of Mars based on recent models describing thermal convection of an infinite Prandtl number fluid with strongly temperature dependent viscosity. Main differences compared to previous models include the definition of the lithosphere, an early thermal history which cannot be described by stationary scaling laws, high mantle temperature, and some predictions concerning the formation of hot plumes at the core-mantle boundary. The role of the Netlander mission to Mars to constrain the present internal structure and the thermal evolution of the planet is then described. Additional information is contained in the original extended abstract.

Author

Temperature Dependence; Plumes; Core-Mantle Boundary; Models; Mars Surface; Planetary Evolution

20000110466 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Manganese, Metallogenium, and Martian Microfossils

Stein, L. Y., Jet Propulsion Lab., California Inst. of Tech., USA; Nealson, K. H., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Manganese could easily be considered an abundant element in the Martian regolith, assuming that the composition of martian meteorites reflects the composition of the planet. Mineralogical analyses of 5 SNC meteorites have revealed an average manganese oxide concentration of 0.48%, relative to the 0.1% concentration of manganese found in the Earth's crust. On the Earth, the accumulation of manganese oxides in oceans, soils, rocks, sedimentary ores, fresh water systems, and hydrothermal vents can be largely attributed to microbial activity. Manganese is also a required trace nutrient for most life forms and participates in many critical enzymatic reactions such as photosynthesis. The wide-spread process of bacterial manganese cycling on Earth suggests that manganese is an important element to both geology and biology. Furthermore, there is evidence that bacteria can be fossilized within manganese ores, implying that manganese beds may be good repositories for preserved biomarkers. A particular genus of bacteria, known historically as Metallogenium, can form star-shaped manganese oxide minerals (called metallogenium) through the action of manganese oxide precipitation along its surface. Fossilized structures that resemble metallogenium have been found in Precambrian sedimentary formations and in Cretaceous-Paleogene cherts. The Cretaceous-Paleogene formations are highly enriched in manganese and have concentrations of trace elements (Fe, Zn, Cu, and Co) similar to modern-day manganese oxide deposits in marine environments. The appearance of metallogenium-like fossils associated with manganese deposits suggests that bacteria may be preserved within the minerals that they form. Additional information is contained in the original extended abstract.

Author

Manganese Oxides; Deposits; Fossils; Marine Environments; Mars Surface; Meteoritic Composition; Microorganisms; Planetary Geology

20000110472 Brown Univ., Providence, RI USA

The Role of Water/Ice in the Resurfacing History of Hellas Basin

Thomson, B. J., Brown Univ., USA; Head, J. W., Brown Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Hellas impact basin is one of the most prominent topographic features in the southern hemisphere of Mars. It is comparable in magnitude to the South Pole-Aitken basin on the Moon. The total relief of Hellas basin is over 9 km, and the floor of the basin is the lowest topographic point on the planet. The MOLA global topographic data has allowed the first accurate assessment of the area drained by the Hellas Basin. The main basin rim is approx. 2300 km in diameter. MOLA has revealed a previously unmapped annulus of high-standing topography that surrounds the basin rim. This annulus has a significant topographic signature that is evident in the surrounding terrain more than one basin diameter distant from the main rim. An analysis of the drainage divide of the basin has revealed that it is the among the largest topographic sinks on Mars, being second only to the northern lowlands in terms of areal extent and volume. There are a wide variety of processes that have been interpreted to have modified the basin,

including volcanic, eolian, fluvial, lacustrine, glacial, and periglacial processes. Here we examine the role that water/ ice may have played in the modification history of the basin. Additional information is contained in the original extended abstract.
Author
Glaciers; Ice; Mars Surface; Signatures; Structural Basins; Terrain; Water

20000110478 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Removal of Periodic Gravitational Perturbations from Mars Global Surveyor's Science Phasing Orbits Applied to the Study of the Martian Exosphere
Tracadas, P. W., Massachusetts Inst. of Tech., USA; Zuber, M. T., Massachusetts Inst. of Tech., USA; Lemoine, F. G., NASA Goddard Space Flight Center, USA; Smith, D. E., NASA Goddard Space Flight Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The martian exosphere and upper atmosphere exert measurable drag on the Mars Global Surveyor (MGS) spacecraft. Using the Goddard Space Flight Center's GEODYN orbit determination software, the science phasing orbits (SPO) were analyzed to determine the atmospheric drag and hence, measure the average density near the orbits' perifocus (170-180 km altitude above high northern latitudes). Future work will include the gravity calibration and mapping periods as well. Additional information is contained in the original extended abstract.
Author
Calibrating; Computer Programs; Gravitation; Mars Atmosphere; Perturbation

20000110480 Lunar and Planetary Inst., Houston, TX USA
Near-Surface Stratigraphy Beneath Xanthe Terra
Treiman, Allan H., Lunar and Planetary Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Four lithologic units are exposed in the uppermost half-kilometer of Vallis and Chasma walls on Xanthe Terra. Where the walls transect impact craters, these units pass uninterrupted beneath crater rims and floors. This relationship seems unlikely if the units are lava flows or sediments. An unexpected result from Mars Orbiter Camera (MOC) high-resolution images is the near-ubiquity of horizontal layering exposed on Martian chasm and valley walls. These kilometer-deep horizontal layers do not fit the conventional view of Martian highlands crust as mega-regolith, and suggest that a "new paradigm" is needed in Martian geology. Horizontal layers are also visible at the tops of chasm and valley walls, in the uppermost portion of the Martian crust, and are of interest for under-standing surface and near-surface geology. Here, I describe lithologic layers exposed in the uppermost kilometer of the Martian crust in Xanthe Terra, an area of Noachian cratered terrain that is cut by portions of the Valles Marineris system and by several outflow channels including Nanedi Vallis. Additional information is contained in the original extended abstract.
Author
Canyons; Craters; Lava; Lithology; Mars Surface; Planetary Crusts; Regolith

20000110483 California Univ., Dept. of Earth and Space Sciences, Los Angeles, CA USA
Surface Properties of Mars' Polar Layered Deposits and Polar Landing Sites
Vasavada, A. R., California Univ., USA; Herkenhoff, K. E., Geological Survey, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The landed component of the Mars Surveyor 1998 missions, the Mars Polar Lander (MPL), will reach the planet's south polar region along with the Mars Microprobes on Dec. 3, 1999. The spacecraft will land on the south polar layered deposits, which partially cover the region poleward of 70S latitude, and will conduct the first in situ observations of the polar subsurface, surface, and atmosphere. Like on Earth, the polar regions of Mars are strongly influenced by seasonal and climatic cycles, and are ideal sites for landed experiments. The location of MPL's landing site is limited by atmospheric entry constraints to a latitude of 75 +/- 2 degrees. This latitude range overlaps a contiguous, dissected plateau of layered deposits known as Ultimi Lobe between 170W and 230W longitude. West of 205W, Ultimi Lobe forms a broad plateau with elevations up to approx. 2 km above the surrounding cratered terrain. Elevations gradually decrease east of 205W. Because the area is unexplored at the lander's scale, properties and processes at that scale can be inferred only from remote sensing or theoretical results. In anticipation of the landed mission, here

we review the derived surface properties of the southern layered deposits, and present new determinations of surface thermal inertia. Additional information is contained in the original extended abstract.
Author
Atmospheric Entry; Deposits; Landing Sites; Mars Surface; Surface Properties

20000110493 Space Science Inst., Boulder, CO USA
Monte Carlo Radiation Transfer Models for Mars
Whitney, B. A., Space Science Inst., USA; Wolff, M. J., Space Science Inst., USA; Clancy, R. T., Space Science Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We have developed a 3-D Monte Carlo radiation transfer code to aid in the analysis of several currently available datasets for Mars. Our code uses algorithms developed previously for other applications. The code accurately computes scattering and thermal emission in the Martian atmosphere and surface. Any number of opacity sources may be specified for the atmosphere. The Monte Carlo algorithms calculate complicated dust scattering functions with the same ease as isotropic. The surface scattering properties currently use the Minneart law for phase function. In contrast to a plane-parallel radiation transfer model, this code calculates the radiation transfer of the planet as a whole with incident solar radiation. The surface and atmospheric properties can be specified in a 3-D grid, allowing for surface features and clouds to be represented in model images. The solar angle and the viewing angle are arbitrarily specified. The code allows viewing of the planet from several vantage points, to allow for more direct comparison to datasets produced by the Hubble Space Telescope, the Mars Global Surveyor, and the Mars Pathfinder.
Author
Monte Carlo Method; Thermal Emission; Mars Atmosphere; Radiative Transfer; Mars (Planet); Solar Radiation; Three Dimensional Models

20000110494 Washington Univ., Dept.of Earth and Planetary Science, Saint Louis, MO USA
Morphometry of Circum-Chryse Outflow Channels: Preliminary Results and Implications
Williams, R. M., Washington Univ., USA; Phillips, R. J., Washington Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

High-resolution Mars Orbiter Laser Altimeter (MOLA) elevation data affords an opportunity to study the morphometry of the circum-Chryse outflow channels. Channel depth and gradient can be quantitatively determined with this topographic data set. Bedform channel morphologies, such as teardrop-shaped islands, rounded knobs and longitudinal grooves, indicate the channels terminated in Chryse Planitia. The shape of the channel and bedforms may help distinguish between competing hypotheses for channel formation mechanism (glacial vs. catastrophic flooding vs. debris flows).
Author
Gradients; Topography; Mars Surface; Grooves; Mars (Planet); Planetary Geology

20000110496 Hawaii Univ., Inst. of Geophysics and Planetology, Honolulu, HI USA
Widespread Occurrence of Dikes Within the Olympus Mons Aureole Materials
Wilson, L., Hawaii Univ., USA; Mouginis-Mark, P. J., Hawaii Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since their discovery by Mariner 9, the basal escarpment and aureole materials of Olympus Mons volcano have been recognized as enigmatic features on Mars. Various origins have been proposed for the aureole materials, including gravity sliding and tectonic uplift. We present here a new interpretation for the aureole, based on our analysis of images from the Mars Orbiter Camera (MOC).
Derived from text
Mars Surface; Mars Volcanoes; Planetary Geology; Mars (Planet); Mars Climate Orbiter

20000110500 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Ultraviolet Radiation-induced Alteration of Martian Surface Materials
Yen, A. S., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The nature and origin of martian surface materials cannot be fully characterized without addressing the unusual reactivity of the soil and the effects of exposure to the unique martian environment. Our laboratory experiments show that ultraviolet radiation at the martian surface can result in the oxidation of metal atoms and the creation of reactive oxygen species on grain surfaces. This process is important in understanding the nature and evolution of martian soils. It can explain the reactivity discovered by the Viking Landers and possibly the origin of the ferric component of the soil.
Author
Mars Environment; Mars Surface; Reactivity; Ultraviolet Radiation; Ultraviolet Astronomy

20000110502 Alaska Univ., Water and Environmental Research Center, Fairbanks, AK USA
Rock Textures and the Coating Analogues at the Pathfinder Landing Site and Thiel Mountains, Inland Antarctica
Yoshikawa, K., Alaska Univ., USA; Ishimaru, S., Geological Survey of Japan, Japan; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This study compared the rock surface weathering processes of the site of the Mars Pathfinder (MPF) and Nolan Pillar, one of the most inland nunataks (rock outcropping surrounded by ice) in the Thiel Mountains, Antarctica. Nolan Pillar is one of the Earth's coldest and most arid snow-free places. The small pits on the surface of the rocks are important common features of both places. The surface coating is uneven and faces away from direct solar radiation at both sites. The coating materials of MPF site have been investigated by comparing the Alpha Proton X-ray Spectrometer (APXS) and the Imager Mars Pathfinder (IMP) multispectral data. However, the processes associated with the texture and coating of the rock surface is still unclear. Similar phenomena exist on the Antarctic rocks. Nolan Pillar is a small nunatak in the southeastern-most part of the Thiel Mountains (85 deg 26 min S, 86 deg 46 min W and ca. 1600 m). Granodiorite porphyry samples were taken from the lowest part of the southeast-facing perpendicular rock wall of the pillar and moraine. The rock surfaces of the Thiel mountain samples were analyzed by Energy Dispersion Spectrometry (EDS) and X-ray Diffractogram (XRD) of the surface and interior of the rock. The pit holes were observed by the Scanning Electron Microscope (SEM).
Author
Rocks; Mars Surface; Mars (Planet); Planetary Geology; Weathering

20000111089 NASA Johnson Space Center, Houston, TX USA
Thermal and Evolved Gas Analysis of Hydromagnesite and Nesquehonite: Implications for Remote Thermal Analysis on Mars *Final Report*
Lauer, H. V., Jr., Lockheed Martin Space Mission Systems and Services, USA; Ming, D. W., NASA Johnson Space Center, USA; Golden, D. C., Hernandez Engineering, Inc., USA; Lin, I.-C., NASA Johnson Space Center, USA; Boynton, W. V., Arizona Univ., USA; [2000]; 2p; In English; Lunar and Planetary Science, 13-17 Mar. 2000, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA
Contract(s)/Grant(s): RTOP 898-10-01; No Copyright; Avail: Issuing Activity; Abstract Only

Volatile-bearing minerals (e.g., Fe-oxyhydroxides, phyllosilicates, carbonates, and sulfates) may be important phases on the surface of Mars. In order to characterize these potential phases the Thermal Evolved-Gas Analyzer (TEGA), which was onboard the Mars Polar Lander, was to have performed differential scanning calorimetry (DSC) and evolved-gas analysis of soil samples collected from the surface. The sample chamber in TEGA operates at about 100 mbar (approximately 76 torr) with a N2, carrier gas flow of 0.4 seem. Essentially, no information exists on the effects of reduced pressure on the thermal properties of volatile-bearing minerals. In support of TEGA, we have constructed a laboratory analog for TEGA from commercial instrumentation. We connected together a commercial differential scanning calorimeter, a quadruple mass spectrometer, a vacuum pump, digital pressure gauge, electronic mass flow meter, gas "K" bottles, gas dryers, and high and low pressure regulators using a collection of shut off and needle valves. Our arrangement allows us to vary and control the pressure and carrier gas flow rate inside the calorimeter oven chamber.
Derived from text
Gas Analysis; Thermal Analysis; Heat Measurement; Soil Sampling; Mars Surface Samples; Mars Surface; Mars Polar Lander

20000112933 National Academy of Sciences - National Research Council, Task Group on the Forward Contamination of Europa, Washington, DC USA
Preventing the Forward Contamination of Europa
[2000]; 68p; In English
Contract(s)/Grant(s): NASW-96013; Copyright; Avail: Issuing Activity

At its meeting March 29-31, 2000, the Space Studies Board's Committee on Planetary and Lunar Exploration (COMPLEX) began work on an assessment of options for the orderly disposal for the Galileo spacecraft at the end of its mission. This assessment was made at the specific verbal and, subsequent, written request of John D. Rummel, NASA's Planetary Protection Officer. COMPLEX was asked to provide 'findings, conclusions, and recommendations' about the various end-of-mission options currently being considered by the Galileo Project. In addition, the committee was asked to comment of four subsidiary issues relating to the possibility of impacting Io and Europa and the biological contamination of Jupiter and Io.
Author
Biological Effects; Galileo Project; Galileo Spacecraft; Mission Planning; Contamination; Europa

20000112957 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Plasma Densities in the Vicinity of Callisto from Galileo Plasma Wave Observations
Gurnett, D. A., Iowa Univ., USA; Persoon, A. M., Iowa Univ., USA; Kurth, W. S., Iowa Univ., USA; Roux, A., Centre des Etudes Terrestraire et Planetaire, France; Bolton, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; Geophysical Research Letters; Jul. 01, 2000; ISSN 0094-8276; Volume 27, No. 13, pp. 1867-1870; In English; Original contains color illustrations
Contract(s)/Grant(s): JPL-958779
Report No.(s): Paper 2000GL003751; Copyright; Avail: Issuing Activity

The Galileo spacecraft has made seven close flybys of Jupiter's moon Callisto. During the closest of these (C22), which approached to within 535 km of the surface, the plasma wave instrument detected a very clear upper hybrid emission as the spacecraft passed near the moon. The peak electron density indicated by the upper hybrid resonance emission was 400/cc, almost one-thousand times the, electron density in the magnetosphere of Jupiter at the orbit of Callisto. These observations indicate that Callisto is probably surrounded by a dense ionospheric-like plasma.
Author
Plasma Density; Callisto; Jupiter (Planet)

20000112986 NASA Ames Research Center, Moffett Field, CA USA
Mars Surveyor 2001 Landing Site Workshop
Gulick, Virginia C., Editor, NASA Ames Research Center, USA; [1998]; 110p; In English, 26-27 Jan. 1998, Moffett Field, CA, USA; See also 20000112987 through 20000113026; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This document is composed of abstracts of presentations from a conference convened to discuss the scientific value of various landing sites for the Mars Surveyor 2001 Mission. Issues of interest to science included discovering more information about possible life either past or present, and the existence of water on Mars. Other interests included the geology, and mineralogy of Mars
CASI
Landing Sites; Mars Surface; Mars Surveyor 2001 Mission; Conferences

20000112987 NASA Ames Research Center, Moffett Field, CA USA
The Athena Mars Rover Science Payload
Squyes, S. W., Cornell Univ., USA; Arvidson, R., Washington Univ., USA; Bell, J. F., III, Cornell Univ., USA; Carr, M., Geological Survey, USA; Christensen, P., Arizona State Univ., USA; DesMarais, D., NASA Ames Research Center, USA; Economou, T., Chicago Univ., USA; Gorevan, S., Honeybee Robotics Ltd., USA; Klingelhoefer, G., Technische Hochschule, Germany; Haskin, L., Washington Univ., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Mars Surveyor missions that will be launched in April of 2001 will include a highly capable rover that is a successor to the Mars Pathfinder mission's Sojourner rover. The design goals for this rover are a total traverse distance of at least 10 km and a total lifetime of at least one Earth year. The rover's job will be to explore a site in Mars' ancient terrain, searching for materials likely to preserve a record of ancient martian water, climate, and possibly biology. The rover will collect rock and soil samples, and will store them for return to Earth by a subsequent Mars Surveyor mission in 2005. The Athena Mars rover science payload is the suite of scientific instruments and sample collection tools that will be used to perform this job. The specific science objectives that NASA has identified for the '01 rover payload are to: (1) Provide color stereo imaging of martian surface environments, and remotely-sensed point discrimination of mineralogical composition. (2) Determine the elemental and mineralogical composition of martian surface materials. (3) Determine the fine-scale textural properties of these materials. (4) Collect and store samples. The Athena payload has been designed to meet these objectives. The focus of the design is on field operations: making sure the rover can locate, characterize, and collect scientifically important samples in a dusty, dirty, real-world environment. The topography, morphology, and mineralogy of the scene around the rover will be revealed by Pancam/Mini-TES, an integrated imager and IR spectrometer. Pancam views the surface around the rover in stereo and color. It uses two high-resolution cameras that are identical

in most respects to the rover's navigation cameras. The detectors are low-power, low-mass active pixel sensors with on-chip 12-bit analog-to-digital conversion. Filters provide 8-12 color spectral bandpasses over the spectral region from 0.4 to 1.1 micron Narrow-angle optics provide an angular resolution of 0.28 mrad/pixel, nearly a factor of four higher than that of the Mars Pathfinder and Mars Surveyor '98 cameras. Image compression will be performed using a wavelet compression algorithm. The Mini-Thermal Emission Spectrometer (Mini-TES) is a point spectrometer operating in -the thermal IR. It produces high spectral resolution (5 /cm) image cubes with a wavelength range of 5-40 gm, a nominal signal/noise ratio of 500:1, and a maximum angular resolution of 7 mrad (7 cm at a distance of 10 in). The wavelength region over which it operates samples the diagnostic fundamental absorption features of rockforming minerals, and also provides some capability to see through dust coatings that could tend to obscure spectral features. The mineralogical information that Mini-TES provides will be used to select from a distance the rocks and soils that will be investigated in more detail and ultimately sampled. Mini-TES is derived from the MO/MGS TES instrument, but is significantly smaller and simpler. The instrument uses an 8-cm Cassegrain telescope, a Michelson interferometer, and uncooled pyroelectric detectors. Along with its mineralogical capabilities, Mini-TES can provide information on the thermophysical properties of rocks and soils. Viewing upward, it can also provide temperature profiles through the martian atmospheric boundary layer. Elemental and Mineralogical Composition: Once promising samples have been identified from a distance using Pancam/Mini-TES, they will be studied in detail using up to three compositional sensors that can be placed directly against them by an Instrument Arm. The two compositional sensors, presently on the payload are an Alpha-Proton-X-Ray Spectrometer (APXS), and a Mossbauer Spectrometer. The APXS is derived closely from the instrument that flew on Mars Pathfinder. Radioactive alpha sources and three detection modes (alpha, proton, and x-ray) provide elemental abundances of rocks and soils to complement and constrain mineralogical data. The Athena APXS will have a revised mechanical design that will cut down significantly on backscattering of alpha particles from martian atmospheric carbon. It will also include a target of known elemental composition that will be used for calibration purposes. The Athena Mossbauer Spectrometer is a diagnostic instrument for the mineralogy and oxidation state of Fe-bearing phases, which are particularly important on Mars. The instrument measures the resonant absorption of gamma rays produced by a Co-57 source to determine splitting of nuclear energy levels in Fe atoms that is related to the electronic environment surrounding them. It has been under development for space flight for many years at the Technical University of Darmstadt. The Mossbauer Spectrometer (and the other arm instruments) will be able to view a small permanent magnet array that will attract magnetic particles in the martian soil. The payload may also include a Raman Spectrometer. If included, the Raman Spectrometer will provide precise identification of major and minor mineral phases. It requires no sample preparation, and is also sensitive to organics. Fine-Scale Texture: The Instrument Arm a also carries a Microscopic Imager that will obtain high-resolution monochromatic images of the same materials for which compositional data will be obtained. Its spatial resolution is 20 micron/pixel over a 1 cm depth of field, and 40 micron/pixel over a 1-cm depth of field. Like Pancam, it uses the same active pixel sensor detectors and electronics as the rover's navigation cameras. The Instrument Arm is a three degree-of-freedom arm that uses designs and components from the Mars Pathfinder and Mars Surveyor '98 projects. Its primary function is instrument positioning. Along with the instruments noted above, it also carries a brush that can be used to remove dust and other loose coatings from rocks. Sample Collection and Storage: Martian rock and soil samples will be collected using a low-power rotary coring drill called the Mini-Corer. An important characteristic of this device is that it can obtain intact samples of rock from up to 5 cm within strong boulders and bedrock, Nominal core dimensions are 8xl7 mm. The Mini-Corer drills a core to the commanded depth in a rock, shears it off, retains it, and extracts it. It can also acquire samples of loose soil, using soil sample cups that are pressed downward into loose material. The Mini-Corer can drill at angles from vertical to 45' off vertical. It has six interchangeable bits for long life. Mechanical damage to the sample during drilling is minimal, and heating is negligible. After acquisition, the sample may be viewed by the arm instruments, and/or placed in one of 104 compartments in the Sample Container. A subset of the acquired samples may be replaced with other samples obtained later if desired. The Sample Container has no moving parts, and is mounted external to the rover for easy removal by the Mars Surveyor 2005 flight system. Operation of the rover will make extensive use of automated onboard navigation and hazard avoidance capabilities. Otherwise, use of onboard autonomy is minimal. Data downlink capability is about 40 Mbit/sol, and the use of the Mars Surveyor '01 orbiter for data relay imposes a limit of at most two command cycles per sol. Because of the significant amount of time available between command cycles, all payload elements will be operated sequentially, rather than in parallel.; this approach also significantly simplifies operations and minimizes peak power usage. The landing site for the '01 rover has not been selected yet. Site selection will make as full use as possible of Mars Global Surveyor data, and will involve substantial input from the broad Mars science community. Summary: The following table describes the mass, power, providers, and key scientific objectives of all the major elements of the Athena payload. Additional Athena payload information may be found at: http://astrosun.tn.cornell.edu/athena/index.html. Additional information contained in the original. Author

Mars (Planet); Mars Surface; Mars Surface Samples; Mineralogy; Onboard Equipment; Planetary Geology; Roving Vehicles; Soils; Planetology; Mars Missions

20000112988 Washington Univ., Dept. of earth and Planetary Sciences, Saint Louis, MO USA

A Mission Model for the 2001 Mars Rover/Athena Payload

Arvidson, R. E., Washington Univ., USA; Niebur, C. S., Washington Univ., USA; Bowman, J., Washington Univ., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Over the span of approximately an Earth year, the Athena Payload on the Mars Surveyor Program 2001 Rover will conduct remote sensing (multispectral imaging and emission spectroscopy) and in-situ (microscope imaging; Alpha-proton-xray, Moessbauer, and perhaps Raman Spectroscopy) observations, and collect samples (rock drill cores and soils) for possible return to Earth. The rover will communicate with Earth twice per day for a daily data return of approximately 40 Mbits. A total traverse distance of up to approximately 10 km is possible. Careful planning and tradeoffs are needed to accomplish science objectives (search for evidence of paleoclimatic conditions, prebiotic compounds, and life) within power, data rate, and mobility restrictions placed upon the mission. The purpose of this abstract is to introduce a rover mission model that shows in a quantitative fashion what science and traversing can be accomplished within the envelop of environmental and engineering constraints placed on operations. The mission model is a daily plan, using standard spreadsheet software, of rover activities that charts various aspects of rover operations for a given site. For each Sol of the year-long mission a series of tasks are specified, including remote sensing, in-situ analyses, sampling, traversing, and engineering activities. The power required to perform the tasks, the total power available, the amount of data acquired during the tasks, the amount of data stored, and data transmitted to Earth are tabulated each Sol. Power availability is a strong constraint on mission operations and is highly dependent on the landing site latitude. Landing occurs during the northern winter season. We have opted in our initial model to land in the southern hemisphere at approximately 6.5 deg S, 358 deg W, on a valley network in Terra Meridiani. This site exhibits a meandering channel system with evidence for modification by sapping processes. The site thus provides access to Noachian terrain and a channel system that may have produced spring-derived aqueous sedimentary rocks. At this latitude, power is highest during the initial phase of the mission and decreases with time as the southern winter is approached. With the landing site chosen, the total power availability curve for that latitude can be used to determine power available for mission operations. The total power predicted to be available at 6 degrees south latitude was reduced by 4% relative to project-supplied data in order to account for the presence of the Athena mast, which will cast shadows on the solar panel. The power available was further reduced by another 10% in order to provide a safety margin for operations. With the power available calculated, the power required for each scientific instrument in the Athena Payload and for rover traverses of different lengths was estimated. The time needed to complete scientific measurements, sampling, and rover traverses was also estimated. Using the daily power available values and the required power and time estimates, a daily plan for rover activities was generated. Three mission phases were created, each approximately one and a half Earth months long, focusing on intensive science activities at three separate sites. The first is located at the landing site and the assumption is that measurements and sample collection would be done in the immediate vicinity of the lander before long traverses were attempted. The two other science-intensive sites were assumed to be far from the landing site and could represent, for example, good exposures of Noachian rocks at one site and aqueous sediments at the other site. At each of these three sites in situ analyses are done (microscope imaging, APXS, Moessbauer and Raman Spectroscopy for each rock target, with each analysis requiring 1 Sol) and samples are acquired and cached. The other two mission phases consist of traverses totaling 10 km, requiring a period of 8 months to accomplish. The traverse phases focus on remote sensing science and mobility. At the end of each sol during a traverse phase, the Athena stereo cameras acquire a panorama for immediate transmission to Earth. These data are used for traverse planning for the next Sol. The cameras only reveal the 30 to 50 m of terrain in detail, limiting the distance traveled on any given so[is limited to that these values. It requires approximately one hour to traverse these distances for reasonable terrain. The model also contains a plan for daily data management. The daily data generated are estimated and added to the log of data stored onboard the rover. For each of the two daily communication sessions, the data transmitted to Earth are prioritized based on data needed to plan tasks for the next Sol. Under the assumption that 10 km distance is needed to get to relevant sites, traverses will consume the greatest amount of time, thus limiting the number of science-intensive sites that can be visited and studied. The duration of the traverse phases is controlled fundamentally by the distance the rover can travel in a given Sol. For the three science-intensive sites, at total of only 17 rocks are analyzed by each instrument and 17 cores are obtained, along with a half dozen soil samples. A total of 13 Gbits of data are returned. Clearly, the mission model shows that a landing site must be chosen that minimizes traverse distances in order to maximize time spent at science-intensive sites. Further mission modeling will assume that not all in-situ instruments will be used for each rock or soil target. Even so, there will need to be continuing trade studies between traversing and science-intensive studies, particularly since results of solar panel degradation due to dust accumulation have not yet been factored into the mission model. Additional information contained in the original.

Author

Landing Sites; Mars Surface; Mars Surveyor 2001 Mission; Payloads; Roving Vehicles; Mission Planning; Onboard Equipment

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Selection and Assessment of Predictions of the Mars Pathfinder Landing Site

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The successful landing of the Mars Pathfinder spacecraft on Mars allows the review of the process of selecting the landing site and assessing predictions made for the site based on Viking and Earth-based data. Selection of the landing site for Mars Pathfinder was a two-phase process. The first phase took place from October 1993 to June 1994 and involved: initial identification of engineering constraints, definition of environmental conditions at the site for spacecraft design, and evaluation of the scientific potential of different landing sites. This phase culminated with the first "Mars Pathfinder Landing Site Workshop", held at the Lunar and Planetary Institute in Houston, Texas on April 18-19, 1994, in which suggested approaches and landing sites were solicited from the entire scientific community. A preliminary site was selected by the project for design purposes in June 1994. The second phase took place from July 1994 to March 1996 and involved: developing criteria for evaluating site safety using images and remote sensing data, testing of the spacecraft and landing subsystems (with design improvements) to establish quantitative engineering constraints on landing site characteristics, evaluating all potential landing sites on Mars, and certification of the site by the project. This phase included a second open workshop, "Mars Pathfinder Landing Site Workshop II: Characteristics of the Ares Vallis Region and Field Trips in the Channeled Scabland, Washington" held in Spokane and Moses Lake September 24-30, 1995 and formal acceptance of the site by NASA Headquarters. Engineering constraints on Pathfinder landing sites were developed from the initial design of the spacecraft and the entry, descent and landing scenario. The site must be within 5 degrees of the subsolar latitude at the time of landing (15N for maximum solar power and flexible communications with Earth. It also must be below 0 km elevation to enable enough time for the parachute to bring the lander to the proper terminal velocity for landing. The entire landing ellipse, which is 70 km by 200 km due to navigational, ephemeris and atmospheric uncertainties, must be free of steep slopes, scarps and obvious hazards in Viking orbiter images, have acceptable radar reflectivity, moderate rock abundances and have little or no dust. Scientific considerations of the Mars Pathfinder payload and mission indicate that analyses of "grab bag" samples at the mouths of outflow channels can offer a first order assessment of a variety of rock types on Mars. Highland sites offer the advantage of in situ analysis of ancient rocks on Mars that record crustal differentiation and the nature of the early environment. Dark gray sites offer the potential of analyzing unweathered and unoxidized materials. Following a general assessment of the safety of different sites, a preliminary selection of a "grab bag" site was made. This site, Ares Vallis, is near the mouth of an outflow channel that may contain ancient Noachian terrain, Hesperian ridged plains, and reworked channel materials. All potential landing sites on Mars that met basic safety criteria were analyzed in detail. Sites (100 by 200 km target ellipses) were considered safe if they were below 0 km elevation, were free of obvious hazards (high relief surface features) in high-resolution (is less than 50 m/pixel) Viking orbiter images and had acceptable reflectivity and roughness at radar wavelengths, high thermal inertia, moderate rock abundance, low red to violet ratio, and low albedo. Only 4 sites on Mars met all the above criteria, which included 1995 opposition 3.5 cm delay-Doppler radar data. Complete data were evaluated for 7 sites and the Viking landing sites for comparison for all the above criteria as well as crater abundance, hill and mesa abundance, slopes over meter to kilometer scales, low altitude winds (from global circulation models and slopes), the size-frequency distribution of large rocks, as well as rover trafficability and science potential. Discussion of potential hazards at Ares Vallis using a variety of data sets (including radar) at a second open workshop, indicated this site cannot be shown to be any more hazardous than the Viking landing sites. Field trips to the Channeled Scabland and the Ephrata Fan, analogs for Ares Vallis and the landing site, respectively, provided valuable insight into possible geologic processes and potential surface characteristics. Three sites met all the data requirements and safety criteria for landing Pathfinder. Ares Vallis was selected by the project because it appeared acceptably safe (although it appeared to have greater rock abundances than other sites, its elevation was likely the best known) and offered the prospect of analyzing a variety of rock types expected to be deposited by catastrophic floods, which would enable addressing first-order scientific questions such as differentiation of the crust, the development of weathering products, and the nature of the early martian environment and its subsequent evolution. The selection was reviewed by an external board at a number of meetings and accepted, and the site was approved by NASA Headquarters. Data gathered by the Pathfinder lander' and rover provides the opportunity to test the predictions made for the site in the selection process based on remote observations from Earth, orbit, and the surface. The discussion below is taken from Golombek et al. to which the reader is referred for a more complete discussion and a complete list of references, which are omitted here for brevity. Many characteristics of the landing site are consistent with its being shaped and deposited by the Ares and Tiu catastrophic floods. The rocky surface is consistent a depositional plain comprising semi-rounded pebbles, cobbles and tabular boulders (some of which appear imbricated and/or inclined in the direction of flow) that appear similar to depositional plains in terrestrial catastrophic floods. The Twin Peaks appear to be streamlined hills in lander images, which is

consistent with interpretations of larger hills in Viking orbiter images of the region that suggest the lander is on the flank of a broad, gentle ridge trending northeast from Twin Peaks. This ridge, which is the rise to the north of the lander, is aligned in the downstream direction from the Ares and Tiu Valles floods, and may be a debris tail deposited in the wake of the Twin Peaks. Channels visible throughout the scene may be a result of late stage drainage. As predicted by delay-Doppler radar measurements and tracking results, the average elevation of the center of the site was about the same as Viking Lander I relative to the 6.1 mbar geoid. The Doppler tracking and two-way ranging estimate for the elevation of the spacecraft is only 45 in lower than the Viking I Lander and within 100 in of that expected, which is within the uncertainties of the measurements. After landing, surface pressures and winds (5-10 m/s) were found to be similar to expectations based on Viking data, although temperatures were about 10 K warmer. The temperature profile below 50 km was also roughly 20 K warmer. As a result, predicted densities were 5% higher near the surface and up to 40% lower at 50 km but within the entry, descent and landing design margins. The populations of craters and small hills and the slopes of the hills measured in high-resolution (38 m/pixel) Viking orbiter images and the radar derived slopes of the landing site are all consistent with observations of these properties in the lander images. A rocky surface was expected from Viking Infra-Red Thermal Mapper (IRTM) observations and comparisons with the Viking landing sites. The observed cumulative fraction of area covered by rocks with diameters greater than 3 cm and heights greater than 0.5 in (potentially hazardous to landing) at Ares is similar to that predicted by IRTM observations and models of Viking lander and Earth analog rock size-frequency distributions. The IRTM prediction postulated an effective thermal inertia of 30 (10(exp -3) cgs units - cal/cubic cm/s(exp 0.5)/K) for the rock population, but we obtain a slightly different effective thermal inertia for the actual rock population. The validity of interpretations of radar echoes prior to landing are supported by a simple radar echo model, an estimate of the reflectivity of the soil from its bulk density, and the fraction of area covered by rocks. In the calculations, the soil produces the quasi-specular echo and the rocks produce the diffuse echo. The derived quasispecular cross section is comparable to the cross-sections and reflectivities reported for 3.5-cm wavelength observations. The model yields a diffuse echo that is modestly larger than the polarized diffuse echo reported for 3.5-cm wavelength observations. At 12.5-cm wavelength, similar rock populations at Ares and the Viking I site were expected because the diffuse echoes are comparable, but the large normal reflectivities suggests that bulk densities of the soils at depth are greater than those at the surface. We also obtain a fine-component inertia near 8.4 which agrees with the fine-component inertia of 8.7 (in 10(exp -3) cgs units) estimated from thermal observations from orbit by the IRTM; for this estimate, we used a bulk thermal inertia of 10.4 for the landing site, an effective thermal inertia near 40 (10(exp -3) cgs units) for the rock population, and a graphical representation of Kieffer's model. Color and albedo data for Ares suggested surfaces of materials at Ares Vallis would be relatively dust free or unweathered prior to landing compared with the materials at the Viking landing sites. This suggestion is supported by the abundance of relatively dark-gray rocks at Ares and their relative rarity at the Viking landing sites, where rocks are commonly coated with bright red dust. Finally, the 40 km long Ephrata Fan of the Channeled Scabland in Washington state, which was deposited where channelized water flowing down the Grand Coulee filled the Quincy Basin, was suggested as an analog for the landing site because the overall geology and geornorphology of the landing site, as interpreted from orbital images prior to landing, are compatible with such a depositional plain. The geology and geomorphology of the landing site (discussed earlier) is similar to such a depositional plain and the abundance and size of pebbles, cobbles and boulders are consistent with the expected general decrease in clast size from the mouth of the channel. The prediction of the important characteristics of the site for safe landing and roving indicates that remote sensing data at scales of kilometers to tens of kilometers can be used to infer surface properties at a scale of meters. The prediction that the site would be a plain deposited by a catastrophic flood is consistent with that found at the surface and implies that some geologic processes observed in orbiter data can be used to infer surface characteristics where those processes dominate over other processes affecting the martian surface layer. Analyses of rock chemistry and close up rover images suggest that a variety of rock types are present, consistent with it being a "grab bag" of materials deposited by the flood.

Author

Landing Sites; Mars Environment; Mars Landing; Mars Pathfinder; Mars Surface; Mars Missions; Mars (Planet); Site Selection

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Useful Radar Data for Mars 2001 Landing Site Selection

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Radar data, of both Doppler-only and delay-Doppler varieties, played a useful role in the landing site certification process for Mars Pathfinder. Radar provides information on the elevation of the planetary surface, on its radar reflectivity and on the surface roughness. The elevation is important for proper entry, descent and landing, as is the reflectivity if a radar altimeter is to be used on the lander. Both the reflectivity and the surface roughness can measure the rockiness of the surface, important for a safe landing, as well as for rover trafficability. The spatial resolution of this Earth-based remote sensing technique is around 10 km

in longitude by some 150 km in latitude. In the case of Pathfinder the regionally averaged properties were confirmed by ground truth at the landing site in Ares Vallis. The landing site assessment for Pathfinder relied principally on data from the 1995 Mars opposition when sub-Earth latitudes on Mars ranged from 16 to 22 degrees north. Data from earlier oppositions (1992-93, 1990, 1988-89) are available and cover latitudes from 25 south to 25 north at various longitudes. The available data will be presented at the symposium. The data are of varying quality, although ranging data is available for about 20 radar tracks per opposition, reflectivity and roughness analyses may not always be possible. Some older data are also available (1982, 1980) with range-only information.
Author
Landing Sites; Mars Landing; Radar Data; Site Selection; Mars (Planet); Mars Surveyor 2001 Mission; Mars Surface

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Landing Site Mission Impacts
Spencer, D., Jet Propulsion Lab., California Inst. of Tech., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 14p; In English; See also 20000112986; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

This document is intended to provide the Mars Surveyor 2001 Project Science Group (PSG) with an overview of all the significant impacts of landing site location on the flight system, mission design, and science return. In order to facilitate the design of the Rover and Lander systems, the Project has requested that the PSG select a 15 latitude band within the 15S to 30N region, at the site selection workshop to be held at NASA Ames Research Center on January 26-27, 1998.
Author
Landing Sites; Mars Surveyor 2001 Mission; Site Selection; Mars Surface; Mission Planning; Mars (Planet)

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Exobiological Considerations for Mars 2001 Landing Sites
Jakosky, Bruce M., Colorado Univ., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

With the overarching scientific goal of the Mars Surveyor mission being the search for evidence of past or present life, it makes sense to consider the relevance to exobiology in choosing landing sites. The major considerations are well known and involve looking for locations that at one time would have had the necessary environmental conditions to allow the sustenance of biological activity or prebiological chemistry. The relevant conditions are thought to include (i) the presence of liquid water, (ii) access to the biogenic elements, and (iii) a source of energy that can drive chemical disequilibrium. so that the ”slide” back toward equilibrium can provide energy for life: Liquid water. Liquid water is thought to have been more stable at the martian surface during its earliest history than it is today, based on the geological considerations. Although there is no real agreement as to what this means, it does not necessarily mean that there were standing bodies of water or an Earth-like environment. Also based on the geological evidence, it is clear that there has been liquid water present in the martian subsurface throughout geologic time. It is not obvious that there have been episodic events that provided longstanding periods in which liquid water was present at the surface subsequent to the apparent change in the climate some 3.5 b.y.a. Thus, at the minimum it, is clear that liquid water was present at the surface to some degree between about 4.0 and 3.5 b.y.a., and beneath the surface both during this period and throughout subsequent eras. Although not demonstrated, it is likely that there is abundant subsurface liquid water at the present. Biogenic elements. Access to elements such as C, H, 0, N, S, P, Ca, Fe, and so on, is required in order to have the building blocks for prebiotic chemistry or for biological activity. All of these are present in seemingly appropriate amounts, based on the direct measurements from Viking, Pathfinder, and the martian meteorites. In particular, carbon is present in substantial abundance 8 CO2 and is likely to be present within the crust as carbonate minerals. This is the case whether or not all of the carbon from a putative thick, early, greenhouse atmosphere still is present on or within Mars, rather than having been lost to space. Given the abundant geological activity on Mars, it is likely that the required elements are available throughout the crust. Certainly, the weathered materials present at the surface are probably widely distributed. Energy. Available and accessible energy represents the biggest uncertainty in supporting possible life. The most plausible source of energy would be geochemical energy, involving either chemical weathering of minerals within the crust or conversion of geothermal energy to chemical energy within hydrothermal systems driven by volcanic activity. (Alternatives which probably, but not certainly, are less relevant include oxidation of organic molecules brought in from space and a primitive form of photosynthesis involving uv-stimulated emission of electrons from elements in minerals.) We have done an inventory of the geochemical energy available on the martian surface and within the crust, over the entire 4 billion years of observeable martian history; this allows us to obtain an upper limit as to how much life could have existed on Mars. The answer is--not much. The available energy will support the construction of only -20 a biota/cm2 over 4 billion years. This is 4 million times less life than is present on Earth (with the large difference primarily being due to terrestrial photosynthesis), and is the amount of life that could have been created on the early Earth by the same geochemical processes in only -100 million years.

Discussion. It is clear that the limiting factors -on the presence of life are likely to be the geographical and temporal distributions of access to liquid water and to usable energy. In particular, the energy may be extremely limiting: (1) It is likely that there was insufficient access to energy to allow much life to be created, even though all of the necessary environmental conditions were met widely over the planet. (2)It is unlikely that evidence for life will be found in samples of the martian surface collected from random locations. Rather, it is essential that they be collected from places that are the most likely ”reservoirs” for life, present or past. (3) These best places include volcanic sites where there may have been liquid water in hydrothermal systems driven by the heat from the volcanism, the ancient terrain where liquid water would have been more available during the early history of the planet, places where the deep crust can be sampled and where liquid water might have been present for long periods of time, and probably many (if not most) of the sites to be discussed at the meeting. (4) The worst sites would include everything else, including safe landing sites not selected specifically for their exobiological potential.
Author
Exobiology; Landing Sites; Mars (Planet); Mars Landing; Mars Surface; Mars Surveyor 2001 Mission; Extraterrestrial Life; Site Selection; Abiogenesis

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Site Selection for Mars Exopaleontology in 2001
Farmer, Jack, NASA Ames Research Center, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The microbial fossil record encompasses a wide range of information, including cellular remains, stromatolites, biofabrics, trace fossils, biominerals and chemofossils. The preservation of fossils is strongly influenced by the physical, chemical and biological factors of the environment which, acting together, ultimately determine the types of information that will be captured and retained in the rock record. The critical factor in assessing the suitability of a site for a microbial fossil record is the paleoenvironment. The reconstruction of ancient sedimentary environments usually requires the integration of a wide variety of geological information, including the shape, geometry and internal structure of sedimentary deposits, their mineralogy, and geochemistry. For Mars, much of our knowledge about past environments is based on orbital imaging of geomorphic features. This evidence provides an important context and starting point for site selection. However, our knowledge of the martian surface is quite limited, and a major goal of the upcoming exploration effort is to reconstruct the history of Martian volatiles, climate, and hydrology as a context for the exploration for past or present life. Mineralogical mapping from orbit will be an important key in this effort. In exploring for evidence of past life, terrestrial experience suggests that the long-term preservation of biological information as fossils occurs under a fairly narrow range of geological conditions that are well known to paleontologists (1). In detrital sedimentary systems, microbial fossilization is favored by rapid burial in fine-grained, clay-rich sediments. In chemical sedimentary systems, preservation is enhanced by rapid entombment in fine-grained chemical precipitates. For long term preservation, host rocks must be composed of stable minerals that resist chemical weathering, and which form an impermeable matrix and closed chemical system that can protect biosignatures from alteration during subsequent diagenetic change or metamorphism. In this context, host rocks composed of highly ordered, chemically-stable mineral phases, like silica (forming cherts) or phosphate (forming phosphorites), are especially favored. Such lithologies tend to have very long crustal residence times and (along with carbonates and shales), are the most common host rocks for the Precambrian microfossil record on Earth. If we assume that a subsurface hydrosphere has been present throughout martian history, then life could have originated there at any time, perhaps emerging at the surface periodically when climate changes, induced by external forcing or endogenous processes (e.g. volcanism), allowed liquid water to exist at the surface. The recent discovery of subsurface chemolithoautotrophic organisms which are capable of synthesizing organic substrates from C02 and H2 liberated from the aqueous weathering of basalt, is especially. relevant as a model for martian life. While a subsurface habitable zone may yet exist on Mars, access to such environments will likely require drilling to depths of several kilometers. Given the technological challenge of deep drilling, this is unlikely to occur prior to human missions. So, even if there is extant life on Mars today in subsurface habitats, it may be much easier to find its fossil counterparts in ancient deposits exposed at the surface. In exploring for a fossil record in subsurface environments on Mars there are several geological situations that may provide access to the appropriate materials. These include 1) ejecta from impact craters, 2) talus slopes, debris flows or alluvial fans developed below the walls of deep canyons, and 3) the deposits of outflood channels. Examples of aqueous mineral deposits of formed in subsurface environments that could harbor a microbial fossil record include such things as cements in detrital sedimentary rocks, low temperature diagenetic minerals deposited in veins, or filling vesicles in volcanic rocks, and hydrothermal deposits formed below the upper temperature limit for life (about 160 degrees C). There are many sites within the present latitudinal constraints for the 2001 mission (15 deg S to 30 deg N) that meet these requirements. But the practical problem with these kinds of deposits is that they tend to be disseminated, making up only a small percentage of a host rock. Even with mineralogical information provided by the Thermal Emission Spectrometer (TES) presently in orbit around Mars, predicting their occurrence ahead of time may be quite difficult. The deposits of surficial aqueous sedimentary systems are likely to provide

the largest targets for site selection in 2001. of these, the deposits of hydrothermal systems (subaerial and subaqueous thermal springs) have been discussed previously. It is likely that hydrothermal systems were widespread on Mars early in its history and a number of common geo-tectonic settings on Mars are likely to have hosted hydrothermal activity. Most of these are represented within the latitudinal constraints presently identified for 2001. However, the deposits of surface spring systems are likely to be difficult to find as well. On Earth, exposure areas for hydrothermal spring mounds are typically a few square kms, less than a single TES pixel. But such deposits may be quite abundant within some volcanic terrains, It is estimated, for example, that between 15-20% of the floor of Yellowstone caldera is covered by thermal spring deposits. In such abundances, subaerial sinters could well be detected by TES. Where exposed, the shallow subsurface portions of these systems may be quite a lot larger (perhaps tens of square kms), although (as noted above) mineralization may be finely disseminated in the basement rock, making remote detection more difficult. Paleolake Basins. There are a large number of potential paleolake basins on Mars (inclusive of impact craters and volcanic calderas) that have been previously identified using Viking images. Most of these lie in the southern highlands beyond the l5 deg S constraint for 2001. However, deposits of paleolakes may offer the largest and most easily identified exopaleontological targets from orbit. Based on a variety of arguments, some workers have suggested that there was once an ancient ocean on the northern plains, and some sites of interest (potential shoreline terraces) fall within the 30 deg N constraint. From a paleontological standpoint the most interesting places of this type are terminal paleolake basins which are likely to have been both saline and alkaline. Models by Schaefer suggest such environments could be widespread on Mars. The conditions in terminal lake basin settings favor widespread chemical sedimentation, an important condition for microbial fossilization. Important lithological targets for a microbial fossil record in terminal lake basins include spring-deposited carbonates, shoreline cements, a wide variety of evaporite minerals and fine-grained detrital sediments including shales, marls, and water-lain volcanic ash deposits. In developing a strategy to explore for ancient hydrothermal deposits on Mars, we can learn from the methods that have been developed by explorationists to explore for economic mineral deposits on Earth. Due to their simple mineralogy, hydrothermal deposits can often be detected using remote sensing methods. Common thermal spring mineral assemblages include silica, carbonate, and various metallic oxides and sulfides. But there are also a number of diagnostic silicate minerals, including clays, formed by the hydrothermal alteration of country rocks. These hydrothermal minerals have characteristic spectral signatures that could be detected from Mars orbit using high resolution infrared remote sensing methods. In playa lake settings, evaporite deposits often form a predictable ”bull’s eye” pattern with carbonates being deposited in marginal basin areas, and sulfates and halides occurring progressively more basinward. The floors of some impact craters on Mars, such as ”White Rock” and Bequeral Crater (see Oxia Palus NE, Site 148), have floor deposits that could be evaporites, inclusive of carbonates. Evaporite minerals possess characteristic spectral signatures in the infrared and could similarly be identified from Mars orbit using high resolution remote sensing methods. Clearly, utilization of TES data will be important for optimizing site selection for Exopaleontology, and every effort should be made to benefit from that data before a final decision is made.

Author

Extraterrestrial Life; Fossils; Mars (Planet); Mars Atmosphere; Mars Surface; Microorganisms; Paleontology; Planetary Geology; Rocks; Site Selection; Landing Sites

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Potential Mars Surveyor 2001 Landing Sites: Low-Elevation Cratered ”Highlands” in Central and Eastern Sinus Meridiani and Near Amenthes Fossae

Edgett, K. S., Arizona State Univ., USA; Parker, T. J., Jet Propulsion Lab., California Inst. of Tech., USA; Huntwork, S. N., North High School, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986

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The main scientific goal for the Mars Surveyor Program 2001 (MSP 01) landed mission is to collect and characterize 91 rock and 13 soil core samples using an integrated instrument suite onboard the Athena Rover. If possible, these samples will be retrieved and returned to Earth via a MSP 05 or MSP 07 mission. Preliminary engineering constraints for the MSP 01 landing site call for a location that lies between 15 S and 30 N, and below about 2 km elevation (based on Viking-era topography). Desirable landing sites for MSP 01 are to be located ”in the ancient highlands where the environmental conditions may have been favorable to the preservation of evidence of possible prebiotic or biotic processes including the emergence (and, potentially, the persistence) of life”. We interpret this to mean that the desirable sites include those that have evidence of aqueous sediments that might have been deposited during the Noachian and/or Hesperian Epochs of Mars’ history. In addition to the search for subaqueous sedimentary deposits, we took into consideration the fact that the rover, Athena, will need to be able to access these materials. Thus, a site where aeolian deflation has occurred might be desirable because it might expose, in situ, layered sedimentary deposits. Deflated areas, of course, might include potential landing hazards in the form of meterscale buttes and mesas (e.g., Christmas Lake Valley, OR), thus careful study of such sites with high resolution images will be required before a decision is made to land. We have been examining three regions that have potential to be considered for MSP 01 landing sites. This work is based on Viking (VIS, IRTM)

and Phobos 2 (Termoskan) observations and should be regarded as preliminary because we believe that the final site selection should also be based upon analysis of Mars Global Surveyor observations that help constrain mineralogy (TES) and local geomorphology (MOC, MOLA). (1) Eastern Sinus Meridiani Region (proposed by K. S. Edgett) Sinus Meridiani is a persistent low-albedo (is less than 0. 16) region on the martian equator that has been recognized for about 400 years. All of Sinus Meridiani is below the 2 km elevation constraint for MSP 01. The region includes cratered highlands, valley networks, aeolian dunes, and possible aqueous sedimentary deposits. The landing site study region is located in the eastern portion of Sinus Meridiani. It is bounded by latitudes 10 S to 2 N, longitudes 355 W to 345 W, and the elevations are mostly 1-2 km. The center of this area contains a medium-albedo (0.19-0.21), relatively smooth-surfaced deposit that was suggested by Rice to be a lacustrine deposit. Several potential landing areas can be suggested within this region. Based on Viking and Phobos 2 data, the favored sites so far are centered at 7.6 S, 346.9 W and 0.8 S, 349 W. Thermal inertias are 3.2-7.0 x 10(exp -3) cal /sq cm s(exp -0.5)/K; and rock abundances are around 2-6%. The site at 7.6 S, 346.9 W is at the southern end of the smooth, medium-albedo unit that might have a lacustrine origin. At this location, numerous channels appear to have drained toward the smooth unit. Viking images from orbit 747A show this area at about 15 m/pixel ground resolution. The images reveal that aeolian deflation has occurred along the deposit's margins. Bright (i.e., albedo is greater than = 0.21) aeolian dunes are present on the channel floors and in some of the depressions on the smooth unit. The bright, apparently active dunes might consist of material (perhaps lakedeposited sands) that has been eroded from the smooth unit. The site at approximately 0.8 S, 349 W is selected because it offers an opportunity to solve a long-standing puzzle about Mars remote sensing. There are three main "color" units on Mars: "dark red, dark gray, and bright red". This landing site would allow the Athena rover an opportunity to investigate all three materials within close proximity (the best place on Mars to do so). There are no high resolution (better than 100 m/pixel) Viking or Mariner images of this site. (2) Central Sinus Meridiani Region (proposed by K. S. Edgett and T. J. Parker) Central Sinus Meridiani is characterized by two types of surfaces [4]. One is like typical martian cratered highlands elsewhere- there are old valley networks and old impact craters. The other is relatively smooth and flat. These two units are in contact around 3.1 S between 5 W and 4 E longitudes. Valley networks- including one at 6'S, 358 W that rivals the Grand Canyon of Arizona- once drained toward the smooth unit. Edgett and Parker [4] proposed that the smooth unit might consist of sediments laid down in a large Noachian-aged sea/ocean that would have covered much of the northern hemisphere. Schultz and Lutz [I I I suggested that it is a paleopolar layered deposit. Regardless, the smooth unit where it contacts the cratered terrain would make an excellent site for Athena rover to investigate. The site is best seen in Viking high resolution images from orbits 408B (about 30 m/pixel) and 746A (about 12 m/pixel). These images suggest that aeolian deflation has occurred along the margin of the smooth unit, and this deflation has exposed horizontal larrs of material. The elevation is about 0.5 km; thermal inertias are 6.5-8.0 x 10(exp -3) cal /sq cm s(exp -0.5) / K; rock abundances are 2-4%; and the surface is probably sandy with dark drifts and ripples but almost no actual dunes. We suggest a landing around 3.2 S, 3.0 W would test the aqueous sediment hypothesis and provide a potentially smooth surface on which to land. (3) Amenthes Fossae Region (proposed by S. N. Huntwork and K. S. Edgett) The Amenthes Fossae are a series of graben/fissures that are circumferential to the southeast side of Isidis Planitia. These fissures cross a variety of ancient, heavily cratered Noachian terrain and younger, Hesperian and Amazonian terrain. We focused our search on a region 0-15 N, 250 - 270 W. Elevations are -0.5 to 2 km. Depending upon whether Isidis Planitia was ever a water-rich environment, this region might have been influenced by aqueous sedimentation. Valley networks are common, and they drained toward the north and northwest. We focused our work on a set of Viking orbiter high-resolution images, 719A 1-48. These have resolutions 16-24 rri/pixel. We examined images 20-23, centered at 2 N, 258 W. This site, on the plains just southwest of a 42 km-diameter crater, includes a valley network channel, a relatively young crater ejecta deposit, a few buttes composed of presumably ancient, Noachian bedrock, and a "plains" unit. The plains might make an ideal landing surface, except for the presence of some fine-scale ridges (oriented approximately N-S). The ridges are probably yardangs, thus this site offers a place where aeolian deflation has probably exposed some of the layered rock units that comprise the "plains". Thermal inertias are 7.9-8.3 x 10(exp -3) cal/sq cm s(exp -0.5) /K and rock abundances are 10-15%. A rover traverse might include the opportunity to go down to the floor (and sample along the walls) of the valley network channel at 2 N 258.1 W.
Author
Geomorphology; Landing Sites; Mars (Planet); Mars Surface; Mars Surveyor 2001 Mission; Site Selection; Mars Environment; Planetary Geology

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Proposed Mars Surveyor Landing Sites in Northern Meridiani Sinus, Southern Elysium Planitia, and Argyre Planitia
Parker, T. J., Jet Propulsion Lab., California Inst. of Tech., USA; Edgett, K. S., Jet Propulsion Lab., California Inst. of Tech., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Our objective is to propose two landing sites that the Mars Surveyor 2001 Lander and Athena Rover could go to on Mars that should meet the safety requirements of the spacecraft landing system and optimize surface operations (chiefly driven by power

and communications requirements). An additional site within Argyre Planitia, initially proposed by Parker to the Mars Surveyor Landing Site program, is also proposed for potential consideration for post-2001 missions to Mars, as it is well outside the current latitude limits for the Athena Rover. All three sites are designed to be situated as close to a diversity of geologic units within a few kilometers of the landing site so that diversity can be placed in a geologic context. This objective is very different from the Mars Pathfinder requirement to land at a site with a maximum chance for containing a diversity of rocks within a few tens of meters of the lander. That requirement was driven by the Sojourner mobility limit of a few tens of meters. It can be argued that the Athena project, with its much larger mobility capability, might actually want to avoid such a site, because placing collected samples in geologic context would be difficult. While it has been argued, both before and after the Mars Pathfinder landing, that the provenance for local blocks may be determined by orbiter spectra, primarily from the MGS TES instrument, our ability to do so has yet to be demonstrated. Indeed, several months after conclusion of the Pathfinder mission, we have yet to reach a consensus on the composition of local materials. Our primary data set for selecting a landing site within the latitude and elevation constraints of the 2001 mission is the Viking Orbiter image archive. The site must be selected to place the landing ellipse so as to avoid obvious hazards, such as steep slopes, large or numerous craters, or abundant large knobs. For this purpose, we chose a resolution limit of better than 50 m/pixel. This necessarily excludes from the present study images from current and future orbiter spacecraft, until such data does become readily available. Within each proposed region, it may be possible to identify additional sites once these data become available. Second, the fine-component thermal inertia data, should be greater than about 5 or 6 cgs Units (10(exp -3) cal/sq cm s(exp -0.5)/K). Low thermal inertias imply dusty environments, which could pose a mobility hazard. Similarly, the albedo of the site should not be particularly high, which would also suggest dusty surfaces. Low albedos are preferred, as they often coincide with low Viking red:violet ratios and indicate less dusty surfaces. Next, the Modeled Block Abundance should also not be too high or too low. Based on the Viking Lander and Mars Pathfinder experiences, percentages of blocks should be on the order of 5-25%. Too many blocks could pose a hazard to the landing and mobility. Too few blocks could also indicate a dusty surface. Primary Landing Site: Northern Meridiani Sinus (Proposed by T. J. Parker and K., S. Edgett) Vital Statistics: (1) Latitude, Longitude: 0-3 N, 350-2 W. *Elevation (Viking): about0.5-1.5 Ian. (2) Viking Orbiter Image coverage: Excellent coverage by 15 - 25 m/pixel images (orbits 709A and 410B). Possible stereo coverage in region where two orbits overlap (probably small parallax angle, as these orbits are not listed in NASA Contractor Report 3501) (3) Albedo: about .18 -.26 (4) Block Abundance: 5-26% (5)Fine-Component Thermal Inertia: 5-9 cgs units This region consists of bright deposits similar to those described by Edgett et al, that also lie within a prominent dark albedo region. These deposits are flat-lying, to such a degree that they ramp against topography rather than draping over it. This led Edgett and Parker to suggest that they may be subaqueous sediments, possibly lacustrine or marine evaporites, laid down sometime from the late Noachian to middle Hesperian (age determination pending crater counts). A contact between this material and elevated, dissected highlands to the south was identified , and is described by Edgett et al. Our desire in proposing this landing site is to sample the edge of this deposit where it has been exposed through etching, presumably eolian deflation (the deposit, though in the highlands, is itself only lightly to moderately cratered). This should enable access to in situ stratigraphy. The actual landing site will be selected where slopes are not expected to be steep, such that the rover itself should be able to traverse them and sample layered materials on the way, either up or down the slope. Perhaps due to uncertainties at this time as to the friability or meter-scale roughness of the deposit, it might make sense to place the landing ellipse on the exhumed highland surface adjacent to the deflated margin of the deposit and plan on driving to the deposit rather than landing on it and driving downslope. This should also enable imaging the margin for evidence of layering should it prove too difficult to climb. A target ellipse on the highland surface should also allow Athena access to ancient Noachian highland materials, particularly if placed near crater ejecta or an inlier of knobby material. Secondary Landing Site: Southern Elysium Planitia (Proposed by T. J. Parker) Vital Statistics: (1) Latitude, Longitude: 1.5-3.5 S, 195-198 W. (2) Elevation (Viking): -1.0 km. (3) Viking Orbiter Image coverage: Excellent coverage by 15 - 25 m/pixel images (orbit 725). Possible stereo coverage between images from beginning and end of orbit that overlap (probably small parallax angle) (4) Albedo: about .27-.28 (5) Block Abundance: 4-7% (6) Fine-Component Thermal Inertia: about 3 cgs units This region consists of eroded knobby material, probably of Noachian age, though much of the crater population has been destroyed, that is onlapped at a sharp contact by an extensive plains unit in southern Elysium Planitia that is Amazonian in age. The plains materials have been attributed to unusually low-viscosity flood lavas from fissures south of the Elysium volcanic rise, or to lacustrine materials associated with a large, Amazonian lake at the source of Marte Vallis. Parker and Schenk presented evidence in support of the latter interpretation, though they attributed the putative shore morphology to an embayment of a northern plains ocean into the southern Elysium region. Detailed examination of the margin of the deposit, showing erosion, not simply burial, of small crater rims and fluidized ejecta blankets, also points to lacustrine or marine sedimentation rather than volcanic plains burial. The plains surface exhibits a ”crusty” appearance that many researchers have attributed to pressure ridges in lava flows. In a lacustrine context, they also resemble pressure ridges in desiccated evaporite deposits and salt-rimmed pools (now dry) similar in scale and morphology to spectacular, hundred meter-scale pool rims in alkaline Lake Natron, East African Rift. The eroded highland margin surface adjacent to these plains appears to be fairly smooth, even at 15 m/pixel. Isolated knob inliers are scattered from a few kilometers to several tens of ”kilometers apart. Heights of the knobs have

not been measured yet but, based on experience with similar features in the Pathfinder landing ellipse, are probably typically on the order of several tens of meters high and smaller, though some of the largest knobs in the region are probably up to a few hundred meters high. Two craters larger than a kilometer in diameter, with fluidized deposits, lie nearby the proposed landing site. Very high-resolution images from MOC should help to determine whether a landing site navigable by the Athena rover could be placed in this region. The space between knobs and craters is large enough to enable placement of a target landing ellipse between them but still provide access to one or more of them and to the margin of the Elysium plains material. Post-2001 Mars Surveyor Landing Site: Argyre Planitia (Proposed by T. J. Parker) Vital Statistics: (1) Latitude, Longitude: 55-56 S, 41-43 W. (2) Elevation (Viking): 1.0 km. (3) Viking Orbiter Image coverage: Excellent coverage by 40 m/pixel images (orbits 567B, 568B, and 569B). Excellent stereo coverage with large parallax angles over the entire landing site region, and much of central and southern Argyre. (4) Albedo: about .23-.24 (5) Block Abundance: No data (6) Fine-Component Thermal Inertia: No data The floors of both the Argyre and Hellas basins contain etched layered materials that are probably thick accumulations of channel or lacustrine sediments. The deposits in Hellas are much more eroded than those in Argyre, and Hellas lacks a channel outlet. Argyre is unique in that Uzboi Vallis flowed out of the basin, requiring overflow of a standing body of water within Argyre. This makes it the largest impact basin on Mars with channels both draining into it and flowing out from it. Hellas' channels may be catastrophic flood channels, whereas Argyre was fed by modest-scale valley networks, though the outlet at Uzboi Vallis was a catastrophic flood Highland craters and basins of this kind should be high-priority landing targets for missions intended to focus on the search for either prebiotic organic materials or even simple fossil microorganisms. Basins with internally-draining valley networks should be preferred over flood channels, as they could have provided the long-term influx of water favorable to the origin of life. (Catastrophic floods are not conducive to fossil preservation, due to their very short durations and high transportation energies). They also afford an opportunity to study the evolution of the planet's climate and volatiles during the period of time between the late Noachian and early Hesperian, when a drastic change from a proposed early warm, wet climate to one more closely resembling the modern environment is thought to have occurred. Large basins of this type are better targets than smaller ones, because the local environment would be less susceptible to freezing or drying caused by large swings in climate.

Author

Landing Sites; Mars Missions; Mars Surface; Mars Surveyor 2001 Mission; Planetary Geology; Site Selection; Mars (Planet); Mars Environment

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The Schiaparelli Basin as a Mars Surveyor 2001 Landing Site

Barlow, N. G., University of Central Florida, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Three spacecraft have now successfully landed on the surface of Mars (Viking 1, Viking 2, and Mars Pathfinder), all within the geologically young northern plains, The next lander, the Mars Surveyor 1998, will land in polar layered deposits near the south pole, another geologically young terrain. The time has come for a spacecraft to sample an area representative of the ancient terrain of Mars, which covers about 60% of the martian surface. The Mars Surveyor 2001 Lander is designed to investigate such an area. However, the constraint that the landing site must be at an elevation less than 2.5 km eliminates much of the ancient highlands. The floor of an old impact basin in the ancient highlands can overcome the elevation problem and still permit analysis of old material, The Schiaparelli impact basin is one such location which provides an excellent site for the Mars 2001 lander to investigate questions relating to the evolution of the martian ancient terrain. Geologic Setting Schiaparelli is an approximately 470-km-diameter impact basin centered at 2.5 S 343.3 W. USGS topographic maps place the 2-km contour along the rim and the southern exposed portion of a 230-km-diameter central ring. The rim of the crater is highly eroded and dissected by small channels, indicating a relatively old age for the crater. The crater is superposed on Noachian-aged terrain, including Noachian aged ridged plateau (Nplr) to the north and Noachian-aged dissected plateau (Npld) to the south, east, and northwest. to the west is the Hesperian-aged smooth unit of the plateau sequence (Hpl-3) and within the basin are Hesperian-aged ridged plains (Hr). The rim is listed as Noachian-aged hilly material (Nplh). Based on the stratigraphic information, Schiaparelli probably formed during the late Noachian, which crater density estimates suggest occurred between 3.5 Gyr to perhaps as early as 4.3 Gyr. The Noachian-aged dissected plateau (Npld) unit to the east, south, and northwest is highly eroded by small valley networks, including Evros Vallis about 400 km south of the southern rim of Schiaparelli. Although no fully-formed valley networks transect the rim of Schiaparelli, small gullies are predominant around the entire circumference of the rim. High resolution imagery from the Mars Global Surveyor mission of one of these gullies on the south side of the basin (MOC 215B and MOC 2-15C) reveal small depressions with faint dark lines crossing lighter floors. These regions have been likened to dry lake beds, with the light material being salts or other minerals deposited when an earlier lake evaporated. The dark lines are interpreted as mud cracks or freeze-thaw-produced cracks. These initial results suggest that evidence of water (either surface or subsurface) is retained in the Schiaparelli area. Since one of the scientific objectives of the Mars Surveyor 2001 mission is to obtain "rocks and soil likely to preserve evidence of ancient martian

environmental conditions and possible life", such material from the nearby highlands likely will have been deposited along the inner rim of the Schiaparelli basin. We thus propose a landing site near the rim of Schiaparelli to allow sampling of such material. In the southeastern portion of the basin is a streak of dark material about 150 km long and up to 20 km across. This dark deposit is superposed on the Hesperian-aged ridged plains that fill most of the basin floor and envelopes many of the small craters in this region, indicating the deposit is young (i.e., probably of Amazonian age). The northern end of this deposit appears to emanate from one of the gullies along the rim, although no obvious source of this material can be discerned in the Viking imagery. A Mars Global Surveyor image (MOC 2-18C) lies just to the north of this region and sheds no light on the source of the dark material. Similar dark deposits (although smaller in areal extent) are found within the floors of many other old craters throughout the region suggesting that the source may be a widespread buried layer which can only be tapped through a combination of impact excavation and eolian and/or fluvial dispersion. The southeastern portion of the floor of the Schiaparelli impact basin provides an area of smooth Hesperian-aged plains and, based on Mars Global Surveyor data, surface dust deposits. The smoothness of the region compared to other locations in the heavily cratered martian terrain increases the odds of a successful landing. Since a major objective of the Mars Surveyor 2001 landing site is to sample material from the ancient martian highlands, we propose a landing site within the Schiaparelli basin just below its rim. The location of the dark material deposit near the southeast rim provides an opportunity for the Mars 2001 rover to sample not only material from the rim but also material from the dark deposit. A landing site that would allow access to both types of materials within the rover's proposed 10 to 20 km traverse range occurs at 3.9 S 340.0 W. This site is located along the eastern edge of the dark deposit and near the mouth of one of the rim gullies. The Viking data covering this region is not sufficient to determine slopes, but it may be possible for the rover to traverse at least partway up the gully for further soil and rock analysis and collection. A small impact crater (approximately 4-km-diameter) with a fresh fluidized ejecta blanket is located about 10 km north of the landing site and could be an alternate target of exploration by the rover. The Mars Surveyor 2001 lander site proposed above will be able to address several of the science objectives of the lander mission. It provides access to rocks and soil deposited from the ancient highlands into the bottom of the basin while still providing a smooth landing site within the latitude and topographic constraints of the mission. The dark deposit can be sampled and its mineralogy constrained--since this dark material is apparently widespread throughout the region, this analysis will help provide a possible origin for this material and clues to the geologic evolution of the region. Water has likely affected the surrounding highlands material, as indicated by the abundance of valley networks and the possible "evaporite deposits" identified in Mars Global Surveyor imagery of an area to the south of the proposed landing site. The abundant evidence of water in the region makes the area a good location to look for evidence of ancient martian life. In fact, one of the proposed source craters for the martian meteorite ALH84001, which has been interpreted as possibly containing biogenic material, is located approximately 500 km southwest of the proposed landing site. Mars Global Surveyor imagery suggests the floor of Schiaparelli is blanketed by dust, which could be aeolian or perhaps lacustrine in origin. The origin of these dust deposits is another question which the Mars Surveyor 2001 lander can help address. Thus, a landing within the Schiaparelli impact basin near 3.9 S 340.0 W will provide an opportunity to address many questions regarding the early environment of Mars.

Author

Craters; Landing Sites; Mars (Planet); Mars Surface; Mars Surveyor 2001 Mission; Planetary Geology; Terrain; Topography; Site Selection; Southern Hemisphere

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Kayne Crater: A Potential Landing Site on Mars

Greeley, Ronald, Arizona State Univ., USA; Kuzmin, Rusian, Academy of Sciences (USSR), USSR; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Kayne Crater is a 33-kilometer impact structure located in the ancient highlands west of Gusev Crater and centered at 15.6 degrees south, 186.4 degrees west at an elevation of about 1 km above Mars mean datum. The general region was mapped geologically by Kuzmin et al. and shown to have a geologically complex and interesting history. Key features of the region include the Noachian-age basement complex (including some of the oldest recognizable units on Mars and high-standing massifs, some of which could be volcanic constructs), complex valley networks, Hesperian to Amazonian age outflow channels which appear to have experienced repeated episodes of channel formation, and ejecta-flow craters ranging in diameter from 6 to 14 km, suggesting the presence of a subsurface water zone at the time of their formation. Kayne Crater represents a young (Amazonian) impact and its ejecta has the potential to contain all of the materials outlined here. Crater counts of the major units in the vicinity of Kayne Crater suggest that nearly the entire geological column of Mars is represented. Thus, there is the possibility to sample the full range of uses within the ejecta deposits of Kayne. The scientific potential of these materials includes determining the age and composition of the ancient highland crust, assessment of Noachian, Hesperian, and Amazonian paleoenviroments in which liquid water appears to have been present, study of aqueous alteration products for comparisons with the Alan Hills meteorite ALH84001, and the opportunity to date a large, recent crater to aide in calibrating the impact cratering flux for Mars. The specific landing site is

proposed on the boundary of the continuous and discontinuous ejecta deposits from Kayne Crater at 187 degrees west, 16 degrees south, although other localities can also be identified in the area. Some specific issues of concern include the complexities that would be posed by working with ejecta deposits which might have been severely shocked and the uncertainties in placing samples into their original geologic context. However, the ability to rove to multiple sites and to select samples for their diversity, coupled with their subsequent analysis, could provide a rich harvest of information. Anticipated remote sensing information, as from the Mars Observer Thermal Emission Spectrometer, will enable a better assessment of the potential diversity of the Kayne site. Other concerns, such as elevation, surface roughness, and trafficability of the site will also be addressed by data from the laser altimeter and imaging system on Mars Observer. Additional information contained in the original.
Author
Landing Sites; Mars Craters; Mars Surface; Meteorite Craters; Mars (Planet); Mars Surveyor 2001 Mission

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Western Arabia Terra: Highland Materials at Low Elevation
DeHon, R. A., University of Northeast Louisiana, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A landing site near 5deg N lat. and 5deg W long. is proposed as a low-elevation site with potential for sampling and characterizing in situ Noachian highland material, the most widespread materials on the surface of Mars. An alternate site near 1deg S lat. and 8.5deg W long. would allow sampling of Noachian highland material and Hesperian ridged plains material.
Author
Highlands; Landing Sites; Mars (Planet); Mars Surface; Mars Surveyor 2001 Mission; Mars Craters; Site Selection

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Hot Rocks, Wet Rocks, and Deep Rocks: Eroded Impact Crater and Channel Deposits in Tiu Vallis
Newsom, H. E., New Mexico Univ., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Many scientific problems will contribute to deciding on a landing site for the 2001 Mars rover mission. Foremost of these questions are the characterization of environments favorable for the evolution or flourishing of pre-biotic organic chemistry or primitive life, and the characterization and sampling of mantle and crustal samples that will constrain the origin and geochemical evolution of Mars. In this work, I will focus on the exploration of large dissected impact craters to address the scientific problems, and use the Tiu Vallis area as an example.
Author
Hydrothermal Systems; Landing Sites; Mars Surface; Rocks; Mars Craters; Mars (Planet); Mars Surveyor 2001 Mission; Site Selection

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Potential Landing Site for the Mars 2001 Mission: Double Crater Near Ares Vallis
Nelson, D. M., Arizona State Univ., USA; Greeley, R., Arizona State Univ., USA; Klein, H. P., Search for Extraterrestrial Intelligence Inst., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A potential landing site, considered for both geology and exobiology, is proposed for the Mars 2001 mission. A pair of unnamed craters, about 50 km (east-west) by about 80 km (north-south) diameter, are located on the northeast margin of Ares Vallis, at 12 N, 26 W; the floor is -1 km planetary datum. The smooth crater floor, fluvial scour and drainage features to the south and west of the crater, and proximity to Ares Vallis suggest that this crater was subject to one or more floods. As a site presumed to have contained liquid water, possibly recharged repeatedly from Ares Vallis floods, it is also considered a potential exobiology site. This crater pair is located along the edge of Ares Vallis on the southern margin of Arabia Terra. The craters formed on Noachian highland plateau in subdued cratered material (Npl2), interpreted to be brecciated lava flows. The floor of the crater is a smooth deposit. The southern crater rim has been eroded in places to the level of the surrounding terrain, and a small zone of chaotic terrain formed between the craters and the channel. Because the crater is situated near the widening of Ares Vallis, where the flow energy might have decreased, it could have been far enough away from the channel that water overflowing the banks of Ares would have filled the craters with water and fluvial materials. The source of water to the craters include Iani and Aram Chaos from the southeast and Hydaspis from the south, thus sediment within the crater was derived from two sources. The site was also assessed for potential exobiology by criteria outlined by Farmer et al.. If standing water endured, being replenished from possible multiple floods, potential biotic communities, or at least the environment and/or materials required to sustain life, could have developed. However, because the water source is distant (Aram, Iani, and Hydaspis Chaos are all is greater than 500 km

away), there is potentially no local heat source. Materials from these craters could provide useful information regarding standing water bodies and potential exobiology sites on Mars. Rocks could include materials reworked and potentially hydrated by Ares Vallis flooding, the water sources of which are Aram, Iani, and Hydaspis Chaos. In addition, indicators for exobiology, fossil-bearing sediments and/or organic materials could also be present for examination. Additional information contained in the original. Author

Landing Sites; Mars Craters; Mars Surface; Planetary Geology; Mars Surveyor 2001 Mission; Mars (Planet)

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The Confluence of Gangis, Capri and EOS Chasmas: A Topographic Trap for Water and Debris at the East End of Valles Marineris

Clifford, S. M., Lunar and Planetary Inst., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Given its complex geologic evolution, and the 4-10 km-deep exposures of Martian stratigraphy visible in its canyon walls, Valles Marineris has been the focus of intense scientific interest. At its west end, it is dominated by the tectonic complex of Noctis Labyrinthus; while about 3,500 km to the east, it grades into an extensive region of chaos, with evidence of enormous catastrophic fluvial discharge into the northern plains. In the central portion of the system, debris derived from the interior layered deposits of Candor and Ophir Chasmas (which may have originated from the accumulation of lucustrine sediments) spills out into the central trough. Massive landslides, possible volcanics on the canyon floor, ejecta from interior craters, and aeolian sediments, also contribute to the canyon's considerable geologic and environmental diversity. But beyond its geologic significance, Valles Marineris is also a target of interest in the search for evidence of past life. As previously noted, the interior layered deposits of Candor, Ophir, and Hebes Chasmas, may represent sediments that were laid down in a long-standing aqueous environments, like an ice-covered lake . The potential survival and growth of native organisms in such an environment, or in the aquifers whose disruption led to the formation of the chaotic terrains, raises the possibility that fossil indicators of life may be present in the local sediment and rock. Because of the enormous distances over which these conditions occur, identifying a single landing site that maximizes the opportunity to retrieve samples of these diverse environments is not a simple task. However, the strategic location of a major topographic depression, at the eastern end of Valles Marineris, may provide an opportunity that is unequaled anywhere else within the system. This depression, which lies at the confluence of the Aureum Chaos and Gangis, Capri and EOS Chasmas (5-12 S, 31-41W), has the lowest elevation of any location accessible to the 2001 lander, with a maximum depth that lies below the about 3 km contour of the Mars Digital Terrrain Model (no MGS MOLA observations of this region are yet available). The depth of this feature, and its location between Valles Marineris and the outflow channel that served as the canyon's sole outlet to the northern plains, should have made it an efficient topographic trap for the debris carried by any flood waters that originated from deeper within the canyon. As a result, samples of ancient rock, originating from any depth within the stratigraphic sequence revealed in the canyon walls, may have been brought to the canyon floor by local landslides. Subsequent flooding, perhaps associated with the collapse of the thin partition between Melas and Candor Chasmas, may have then carried samples of this material (mixed with sediments derived from Candor's interior deposits) to the end of the canyon and into the northern plains. In the process, the flood waters may also have entrained samples of more recent volcanics and ejecta from the canyon floor. Given the numerous areas of chaos, and the extensive evidence of fluvial erosion, this scenario may have been repeated many times -- leading to the deposition of material representing a wide range of physical environments, ages, geographic locations, and depths within the stratigraphic column. The location of this depression at the canyon's sole exit to the northern plains, also implies that it has likely been one of the most frequently, and persistently, wet regions on the planet. That is, with every discharge of water to the northern plains, the confluence of the Gangis, Capri and EOS Chasmas would have been flooded to a depth of about 1 km, creating a large (about 2x 10(exp 4) sq km) ice-covered lake that may have survived for a considerable length of time. If the aquifers from which this water was derived were already sustaining an active subsurface ecosystem, then it is likely that a geologic record of this life is preserved in the sediments and rocks that were deposited on the lake floor. The repeated occurrence of such discharges, and their inevitable formation of a standing body of water at the terminus of the canyon, may have left a rich stratigraphy of biological and geochemical markers that could provide invaluable insights as to how the planetary subsurface ecosystem evolved with time. From a purely scientific perspective, the arguments in favor of this potential landing site are persuasive - but it is a site that also entails some significant risk. The measured thermal inertia and inferred rock abundance for this region are among the highest on the planet. Examination of moderate resolution Viking images (about 200 m/pixel) reveals intermingled expanses of smooth floor, chasma channel, and chasma chaotic material, demonstrating significant heterogeneity in the nature of the local terrain. Observations by the MGS MOC, MOLA, and TES instruments would greatly assist in evaluating whether the considerable scientific potential of this landing site is outweighed by the technical risk to the spacecraft. Additional information contained in the original. Author

Canyons; Landing Sites; Mars Surface; Planetary Geology; Topography; Water; Mars Surveyor 2001 Mission; Mars (Planet)

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Mars Surveyor Landing Sites in Valles Marineris: Highland Samples from the Basement

Schultz, Richard A., Nevada Univ., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Two landing sites in Melas Chasma, central Valles Marineris, can address key questions in Martian geology. Site A (Melas Labes) would permit sampling of Hesperian ridged plains material (caprock) and two exposures of different Noachian basement rocks. Site B (Melas Chasma) allows collection of material from ridged plains caprock, Noachian basement, and layered basin beds. Analysis of these samples could pin the relative Martian chronology, improve understanding of early Martian processes, and decide the origin (fluvial or volcanic) of sedimentary sequences in the troughs.

Author

Landing Sites; Mars (Planet); Mars Environment; Mars Surface; Mars Surveyor 2001 Mission; Site Selection

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A Proposed Mars Surveyor 2001 Landing Site West of Candor Mensa, Valles Marineris

Lucchitta, B. K., Geological Survey, USA; Rosanova, C. E., Geological Survey, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The purpose of the Mars Surveyor 2001 lander and rover mission is to investigate a diversity of rocks in an area that may have harbored life in the past. The Athena instrument package on the rover is designed to identify minerals, elemental compositions, water, and ironbearing phases and oxidation states. The central Valles Marineris provide a- unique opportunity to visit a variety of rock types from different ages, including rocks from possible ancient lakebeds. The proposed site is at lat 5.4E S to 5.8E S, long 74.4E to 74.9E, elevation +1 km, in quadrangle MTM !05072. It is located on the valley floor west of Candor Mensa. The site falls within the range of constraints of the mission (lat 30E N to 15E S and elevation 2.5 km). Safe landing could be achieved within a 30-km (east-west) landing ellipse. From the optimum landing spot (lat 5.5 S, long 74.6') a rover traverse of 15-20 km could reach wall rock, older interior layered deposits, a landslide containing wall rock, younger interior deposits, and a dark knob. The Candor Mensa site is ideal in that it is in close proximity to rocks having a range of ages and compositions. The lack of extensive surfaces that can be dated by crater statistics, however, is a detriment. Thus collected samples, returned to earth during a later mission, cannot be tied to datable surfaces that may fix the martian time scale. On the other hand, the variety of rock types expected to be found at the site may outweigh this disadvantage. From the landing site, the rover may traverse to the lower trough wall to the north, where ancient rocks of Noachian age are exposed. The most commonly accepted hypothesis is that these rocks are lunar highland-type breccia. However, recent images of Ius Chasma, returned by the Mars Global Surveyor, show layered units exposed in trough walls several thousand meters below the plateau surface. The nature of the rocks in the layers is currently unknown, but several considerations apply. The rocks may be faulted down; evidence for possible faulting is seen in the walls in that area. Thus they may be part of the layered sequence commonly recognized below the plateau surface. On the other hand, the rocks resemble layered mafic intrusives, and may reflect magmatic activity, including perhaps the intrusion of very thick sills. Wilhelms and Baldwin postulated the presence of sills; local outcrops of very dark layers within or at the base of trough walls support this contention. Inspecting the trough walls near the proposed landing site may shed light on these possibilities, and collecting samples at the base of the trough wall will give insights into the composition of the martian crust. West of the landing site is a large landslide deposit originating from the wall. A variety of wall rocks should also be contained in the slide and would yield informative samples. The landslide may also incorporate plateau rocks of early Hesperian age. If basalts from near the surface were sampled, future dating of these rocks may even give ages for the nearby plateau. Older interior layered deposits (Hesperian-Amazonian age) occur east of the landing site in Candor Mensa. Their origin is uncertain. Sampling these rocks may shed light not only on the composition of these materials but also on the processes of emplacement. It is widely assumed that interior layered deposits were emplaced in lakes, even though a volcanic origin cannot be ruled out for some of them . If they are lakebeds, perhaps even incorporating carbonates, their investigation and possible later return to earth offers us the best chance yet to discover fossil life. Recent studies have revealed that some interior beds are tilted. This deformation may be due to collapse in response to loss of incorporated volatiles rather than due to tectonism. If correct, this observation would support deposition of interior layered materials as lakebed sediments. Some light-colored rocks also crop out on the trough floor in the vicinity of the landing site. They are surrounded by darker, smooth mantling material. Examining the outcrops will answer questions pertaining to the origin of the subfloor in the landing area. The outcrops could represent down-faulted older interior deposits, younger interior deposits, or late eolian fill. A dark rugged hill is within reach of the proposed site to the east. It could be a volcanic neck, a vent, a breccia pipe, or a knob of otherwise resistant material. Exploration may possibly give insights into the characteristics of volcanic rocks in the troughs and their emplacement mechanisms. Rocks of late Hesperian to Amazonian age form the younger interior deposits. A thin layer of this enigmatic unit can be reached to the west of the landing site. It thinly covers part of the landslide. The origin of this post-landslide material is also unknown. The unit has light-colored flow lobes in west Candor Chasma on top of high mesas, and it fills

low areas in this chasma possibly with several thousand feet of material. The unit could be volcanic, perhaps of felsic or palagonitic composition. However, other relations in the area suggest that the unit may be mass-wasted material, reworked from older interior deposits. In this case, the incorporation of volatiles may have facilitated flow. Sampling this material would not only solve the origin of a mysterious units on Mars, but may also potentially yield rocks that were exposed to water and may have harbored life. Observations and sampling at the proposed landing site would also give insights into martian processes. by studying the landslide deposit and its matrix, one might answer the question whether the slides were wet debris flows or dry rock avalanches. If wet, the discovery would confirm the suspicion that the equatorial area contained water in the subsurface. Wind deposits are abundant on the trough floors. Sampling them would shed further light on the nature of the martian wind regime and global dust. The landing site is very smooth and reddish dark, suggesting a thick layer of drift. The material may well be equivalent to the very smooth material recently seen on the floor of Gangis Chasma by Mars Surveyor. If so, the landing and rover traverses would be easy. Overall, the proposed landing site offers a wealth of information pertaining to Mars' magmatic, volcanic, and climatic history. It also provides a good chance at obtaining evidence for former life. A bonus is that the images would be spectacular.
Author
Landing Sites; Mars (Planet); Mars Surface; Mars Surveyor 2001 Mission; Planetary Geology; Rocks

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Kasei Valles Landing Site
Costard, F., Paris-Sud Univ., France; Peulvast, J. P., Paris-Sud Univ., France; Masson, P., Paris-Sud Univ., France; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Geologic Setting An exploration site located to the East of Tharsis in Kasei Valles, (landing site: 21N / 77.5W) has been selected for the definition of a small range rover mission. During its traverse, the rover will cross several geological and geomorphological units and perform geochemical and mineralogical analysis of soil samples at various selected points along the traverse.
Author
Craters; Ejecta; Landing Sites; Mars Surface; Mars Volcanoes; Roving Vehicles; Site Selection; Surface Roughness; Topography; Geology

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Geology of the Tempe-Mareotis Region, Mars
Moore, H. J., Geological Survey, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Tempe-Mareotis region is of interest because (1) the rock units and landforms are the results of a variety of geologic processes that began billions of years ago and continue to the present day, (2) the volcanism contrasts with volcanism elsewhere on Mars, and (3) the volcanism is related to volcanism in Tharsis in space and time. Processes include: (1) fluvial resurfacing of Noachian rocks in the Hesperian (or possibly Late Noachian), (2) northeast-trending graben with zigzag segments produced by extensional stresses after the fluvial erosion, (3) plains volcanism that began in the Late Hesperian and continued into Amazonian time, and (4) deposition of dusts and ongoing surface changes due to winds. The basaltic plains volcanism in Tempe-Mareotis is quite different than volcanic styles of the flood basalts of the plana and shields of the montes. Intense fracturing of the rocks in Tempe Fossae preceded the plains volcanism; this zone of fracturing lies along the northeastward extension of the Tharsis bulge and a great circle defined by the volcanoes atop the bulge (Arsia, Pavonis, and Ascraeus Montes and Uranius Patera). Volcanism in Tempe-Mareotis occurred in the Late Hesperian and Early Amazonian when many of the Tharsis volcanoes were forming, but eruptions from most of the great Tharsis shield volcanoes continued into more recent times. Among the oldest rocks are those interpreted to be eroded layered deposits of Noachian age; they probably include some combination of impact crater and basin ejecta, volcanics, and fluvial and eolian sediments. The oldest in-place crustal materials in the region may be present at the lowest elevations in Tanais Fossae where the relief of the layered deposits is near 1.6 km, but ejecta near the rims of large craters such as Reykholt must have come from depths near ten km. Subsequent to the deposition of the layered deposits, the valleys of Tanais Fossae began to form -- possibly because of magmatic heating of ice-rich deposits within the layered deposits. Perhaps, water released during this heating resulted in a fluvial resurfacing event in the Hesperian (or possibly Late Noachian) Period. The flow of water etched terraces in the layered deposits, eroded impact craters, and left residual deposits in incised channels. The regional extent of this fluvial resurfacing event is unclear, but it could have been extensive. Enipeus Vallis, in the western part of the region and some 480 km long, may have formed during this fluvial resurfacing event. Extensional stresses at fight angles to the projected axis of the Tharsis bulge resulted in the formation of northeast-trending graben with zigzag segments after the fluvial erosion event. Graben formation almost ceased and was followed by basaltic plains volcanism in the Late Hesperian. This volcanism pro-

duced low shields and lava fields. The magmas reached the surface along vents and fissures with a wide range of azimuths, but they were oriented chiefly in northeasterly directions; modal azimuths were near N. 47 E. and N. 62 E. Lavas continued to issue from local vents and fissures aligned in northeasterly directions from the Late Hesperian into the Early Amazonian. Eolian processes, represented by windstreaks, bright-red surface materials with high albedos and low thermal inertias, and dune forms in graben, produced the most recent deposits and landforms. Eolian processes have been observed by spacecraft and are active today. The volcanic landforms of the region are similar to landforms produced by basaltic plains volcanism on Earth. Exemplified by the Snake River Plain in Idaho, basaltic plains volcanism is intermediate between flood or plateau basalt and Hawaiian volcanism. Like plains and flood basalt volcanism on Earth, low shields and lava fields with flow fronts distinguish Tempe-Mareotis volcanism from Lunae Planum and Hesperia Planum volcanism on Mars. Like plains and Hawaiian volcanism on Earth, small shields distinguish Tempe-Mareotis volcanism from the great shields produced by Tharsis volcanism on Mars. Volcanic styles in Ceraunius Fossae and at high elevations in Syria Planum resemble the style of volcanism in Tempe-Mareotis. In general, the appearances and dimensions of the shields in Tempe-Mareotis are similar to those of the Snake River Plain and suggest basaltic volcanism. The shields are typically near 5 km across, but one is near 60 km across. There are four types of volcanic edifices in Tempe-Mareotis: (1) low shields with summit depressions and smooth flanks, (2) low shields with summit depressions and radially textured or hummocky flanks, (3) low shields with summit knobs and hummocky flanks, and (4) domes. Reasons for the differences between the different kinds of shields are unclear, but radially textured flanks are probably the result of lava tube ridges, flows, and channels. Tumuli may give rise to hummocky flanks. Smooth flanks may result from pyroclastic eruptions, but lavas cannot be excluded. Height and flank-width ratios, which range from 0.011 to 0.097, are like those of low shields on Earth, which range from 0.010 to 0.067. Summit crater-diameter and flank-width ratios, which range from 0.211 to 0.931, are relatively large compared with those of low shields on Earth, which range from 0.032 to 0.54. Average yield strengths of lava flows in Tempe-Mareotis are near 1 -2 kPa and consistent with basaltic lavas. Volcanism in Tempe-Mareotis is chiefly Late Hesperian, about the same age as the paterae and tholi in Tharsis, but volcanism continued into the early Amazonian. Eruptions from the Tharsis montes continued well-beyond those in Tempe-Mareotis. Although the summit elevations of the large shields tend to increase with decreasing age, eruptions producing edifices with small relief at low elevations persisted in Ceraunius Fossae, Cerberus, and at the base of Olympus Mons over the same interval of time as the large shields.
Author
Mars Surface; Mars Volcanoes; Planetary Geology; Volcanology; Mars (Planet); Mars Environment; Planetary Craters; Petrology

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Rationale for In-Situ Exploration of the Olympus Mons Aureole Deposits from a New Structural Model
McGovern, P. J., Carnegie Institution of Washington, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A new structural model of the large Martian shield volcano Olympus Mons suggests a strong rationale for robotic exploration of the aureole deposits. This model for aureole and scarp formation at Olympus Mons involves repeated catastrophic flank failure along a pore-fluid-pressurized detachment between the volcano and the underlying terrain, analogous to detachment structures beneath Hawaiian volcanoes. In this view, the aureole material consists of a series of highly fragmented landslides which fill a flexural moat surrounding Olympus Mons; the basal scarp is then the coalesced headwalls of these landslides. Material from a range of depths (ages) is thus potentially exposed in the aureole. Analysis of such samples would yield insight into volcanic processes, crustal formation, and planetary differentiation. Conditions in a basal detachment may provide favorable habitats for autotrophic organisms, perhaps up to the present day. Data from the Mars Global Surveyor (MGS) mission will help (and are already helping) to evaluate the basal detachment hypothesis and to identify candidate sites on the Olympus Mons aureole for a mobile lander or sample return mission. The Olympus Mons edifice is more than 600 km in diameter. A scarp defines the edifice base, which is surrounded by an aureole of disrupted terrain extending for hundreds of kilometers. The origin of the aureole deposits has been a matter of controversy; they have been attributed to mass movements of Olympus Mons flanks or to various types of volcanic deposits emplaced in-situ. Much of this work, however, preceded a radical re-assessment of volcano structure triggered by the discovery of large mass wasting events off the flanks of large ocean island volcanoes. Exploiting this new information, McGovern and Solomon proposed that a basal detachment, analogous to those beneath Hawaiian volcanoes, enabled the generation of large slumps and landslides that constitute the aureole deposits. In this view, these deposits partially fill a flexural moat around Olympus Mons in a manner analogous to mass wasting events in the Hawaiian and Marquesas island chains on Earth. A basal detachment model for Olympus Mons has important mechanical implications. Tanaka 1985 proposed a basal detachment rooted in a weak ice-saturated layer. However, the formation of a basal detachment sufficient to cause volcano flank failure requires the generation of high pore fluid pressure in a low-permeability basal layer. For example, the detachment beneath Hawaiian volcanoes is rooted in the layer of abyssal clay sediment emplaced before volcano formation. A basal detachment model

for Olympus Mons, therefore, implies the existence of an areally extensive layer of clay or other low-permeability material, as well as abundant subsurface water (as liquid, not ice) to act as the pressurized pore fluid. The presence of clay minerals on Mars has been inferred from chemical analysis and spectroscopic studies of the surface. Heat flux from the interior of Mars allows the presence of liquid water at depths of a few kilometers. Thus, the conditions required for a Hawaiian-style basal detachment may exist beneath Olympus Mons. The load of the Olympus Mons edifice is sufficient to cause depression of the lithosphere, resulting in an annular moat surrounding the volcano. Again by analogy with Hawaiian volcanoes, McGovern and Solomon proposed that a flexural moat around Olympus Mons was filled with landslide material that constitutes the aureole deposits. A preliminary MGS/MOLA altimetry profile suggests partial filling of a moat, as is the case at Hawaii and in contrast to the overfilling observed at volcanoes of the Marquesas chain. The volume of material required to fill flexural moats around large volcanoes can be an order of magnitude greater than the volume of the topographically-defined edifice alone. A similar corrective factor can thus be applied to estimates of the time required to build Olympus Mons based on edifice volume. This correction implies a longer history for the volcano than currently appreciated, a finding consistent with interpretation of possible flexural topography in Noachian terrain north of Olympus Mons. The downward deflection of the volcano-lithosphere interface is deep enough to allow melting of water beneath the edifice and most of the aureole, thus favoring the formation of a detachment at that interface. Conditions required for the existence of a basal detachment are, also conducive to the existence of subsurface life. The discovery of possible remnants of Martian lifeforms in meteorite ALH84001 has driven speculation about sites where life may continue to exist on Mars. The basal detachment model for Olympus Mons requires the presence of liquid water deep within the volcano, where temperatures will be elevated due to the above-average thermal gradient and magmatic heat. Olympus Mons, and more generally the Tharsis region, have likely been a source of thermal and chemical energy for a large fraction of the planet's history. The deep flanks of Olympus Mons are shielded from exposure to ultraviolet radiation, extreme cold, and other surface conditions harmful to life. The flanks of Olympus Mons thus constitute a site favorable to the long-term maintenance of life on Mars, perhaps in the form of lithoautotrophic organisms such as those discovered in Columbia River basalts. The proposed landslide structure of the distal flanks implies that evidence of this potential deep refuge for life may be found at or near the surface of the Olympus Mons aureole. Site selection in the Olympus Mons aureole will depend on complying with mission constraints and maximizing scientific return. Elevation and latitude constraints for the Mars 2001 mission rule out sites in the far north and distal southeast portions of the aureole. Allowable landing ellipses likely rule out sites within 100 km or so of the Olympus Mons main shield. The topographic roughness of many aureole lobes rule out a large fraction of aureole area. However, a preliminary MOLA altimetry profile indicates that relief in the outermost aureole lobe is much smaller than that of a younger inner lobe. Thus, mission requirements favor a landing site near the edge of one of the outermost (oldest) aureole lobes. Maximization of scientific return also favors a site near the edge of an outer aureole lobe. A site with access to multiple aureole lobes and aureole-covering flow units from the main shield could yield samples with a variety of ages and compositions. A site near an impact crater would allow access to deeper exhumed material of the chosen aureole lobe (or perhaps of an older lobe). The most distal aureole deposits are most likely to contain evidence for a basal detachment, which might include signs of hydrothermal alteration, shear deformation, and clay minerals. As argued above, such a site would also be a favorable place to look for evidence of autotrophic organisms. Further data (topographic, image, and spectroscopic) from the MGS mission will allow a much more refined study of potential exploration sites in the Olympus Mons aureole.

Author

Deposits; Landing Sites; Mars (Planet); Mars Surface; Mars Volcanoes; Topography; Volcanology

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Multiple Mangala Valles Landing Sites

Chapman, Mary G., Geological Survey, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Mangala Valles is an outflow channel system about 850 km long and as much as 300 km wide that cuts the Martian highlands (lat 18.5 S. to 2.5 N. and long 149 deg to 157 deg). Mangala Valles originates at one of the northeast-trending Memnonia Fossae graben at lat 18.5 S., long 149.5 deg and ends at the highland-lowland boundary scarp (lat 4 S., long 152 deg). The debouchment area on Amazonis Planitia extends from lat 4 S. to at least lat 2.5 N. Mangala Valles channel floor deposits offer grab-bag collection areas as do most of the outflow channels. The channel has ponded areas where floods have accumulated over long periods of time similar to Ma'adim Vallis/Gusev Crater. The three unique characteristics of Mangala Valles are that it (1) heads at likely source of thermal water, (2) contains likely lava flow material (resistant material, see below) interbedded between Hesperian and Amazonian flood deposits, and (3) is mostly covered by recent detailed 1:500,000 scale geologic maps. The length of Mangala Valles channel system and numerous sites of high scientific interest along it argue for a networked mission configuration with considerable mobility built in, such as a lander with a rover and balloon. However, there are at least 3 locations on or near the channel that have elevations less than 2.5 km above Martian datum and have relatively smooth 100-km-wide landing ellipses, providing access

to potentially widely variable rock compositions within the traverse capabilities of the 2001 rover. Within the channel and its debouchment area, there are at least 2 areas to land having very smooth surfaced landing ellipses (centered at lat 14. 1' S., long 149' and lat 2.0 N., long 152.5 deg). An additional highland landing site is located directly west of the channel (lat 9.0 S., long 156.5 deg). The highland site does not provide as smooth a landing ellipse as the channeled areas, but because the area may have been subject to broad sheetwash erosion during the earliest phase of Mangala Valles flooding, it is much smoother than the average highland locale.
Author
Ellipses; Highlands; Landing Sites; Mars (Planet); Mars Surface; Plateaus; Terrain; Mars Volcanoes

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Mangala Valles as a Potential Landing Site for the Mars Surveyor 2001 Lander
Anderson, R., Jet Propulsion Lab., California Inst. of Tech., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Mangala Valles is an outflow channel in the Memnonia region of Mars. Although its origin is still under debate, most researchers believe they represent some form of catastrophic flood system which occurred early in the evolutionary history of Mars. The scientific objective of the Mars Surveyor Program 2001 (MSP 01) landed mission is to examine the ancient climatic and geologic history of Mars; to characterized surface materials with respect to elemental and mineral composition of rock and soils; to identify the role water may have played with respect to evolutionary history of the surface; to look for samples which may contain possible evidence of ancient life; and to collect and store unaltered samples which may be eventually returned to Earth during a later mission (MSP 05 - 2005). As with the Mars Pathfinder lander, the landing site will depend on several engineering constraints. Preliminary engineering constraints for MSP 01 landing site is that the landing site lies with 30 N and -15 S of the equator (due to solar power limitations) and below 2 km elevation. Both the scientific objectives and the engineering constraints can be accommodated with a Mangala Valles landing site.
Author
Landing Sites; Mars (Planet); Mars Surface; Mars Surveyor 2001 Mission; Planetary Geology; Volcanology; Site Selection

20000113009 NASA Ames Research Center, Moffett Field, CA USA
Potential Mars Surveyor 2001 Landing Sites Near Apollinaris Patera
Gulick, Virginia C., NASA Ames Research Center, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Landing sites near Apollinaris Patera are proposed for the Mars Surveyor 2001 lander/rover mission. Regions near the base of Apollinaris Patera provide a unique opportunity within the proposed -15 deg to 30deg latitude belt to sample outcrop lithologies ranging from highland Noachian basement rocks, to Hesperian aged lava flows, channel and flood plain materials, to Amazonian volcanic, ash flow, and channel deposits. Pristine impact craters exhibiting lobate ejecta blankets are found both on the volcano itself and on the surrounding terrain implying a ground water rich environment well into the Amazonian. Therefore its formation likely induced long-lived volcanic-hydrothermal systems, a high priority target for the mission.
Author
Geology; Landing Sites; Mars Surface; Mars Surveyor 2001 Mission; Mars Volcanoes; Water; Mars Craters; Volcanology

20000113010 Geological Survey, Flagstaff, AZ USA
SE Elysium Basin, Mars: A Mars 2001 Candidate Site of Local Geologic and Exobiologic Investigations
Dohm, J. M., Geological Survey, USA; Tanaka, K. L., Geological Survey, USA; Lias, J. H., Geological Survey, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Elysium basin region of Mars, which extends for more than 2,500 km along the equatorial lowland plains between the cratered terrain of the southern highlands and volcanic rise that includes Elysium Mons, has been the site of numerous geologic investigations; these investigations unanimously indicate that the basin served as a catchment basin for Amazonian channel and floodplain deposits. Additionally, the basin may show the strongest evidence of a former lake on Mars. With possible exception of the Chryse Basin, Elysium is the only depositional basin of regional extent that has been found on Mars from which an outflow of water can be established by direct evidence. However, there is less agreement on the rock-stratigraphic, erosional, and depositional/emplacement histories of the Elysium basin-channel floor materials. Although Plescia agrees that there was an episode of fluvial modification and deposition, he proposes that the emplacement of lava flow materials (Cerberus Plains Volcanic Plains) postdate any episode of fluvial erosion or deposition including lava flows that may have exploited pre-existing fluvial valleys. On the other hand, Scott and Chapman suggest that the basin contains both lava flows and sedimentary deposits (lacustrine and

fluvial) and that the emplacement of lava flows predates the fluvial episode. Radar data obtained by Harmon et al. show radar-bright areas on the basin floor and along the large outflow channel (proposed eastern drainage of Elysium paleolake into Utopia basin). These bright areas may be relatively fresh or eroded lava flows or boulder and cobble fields along the channel bed; thus the radar data are inconclusive as to the relative ages of the proposed lake and basin-floor materials. The basin-channel floor materials are marked by a large diversity of landforms. These include: (1) mesas, (2) relict channels, and (3) meander patterns. In addition to a volcanic and(or) fluvial and lacustrine origin for the basin deposits, colluvial and eolian deposits and debris flow materials may have also partly infilled the basin. Additionally, some of the mesas could be erosional remnants of cratered highland materials. Materials of the Medussae Fossae Formation (interpreted to be pyroclastic material) occur within the region along part of the southern margin of the basin. Here, a putative former water level of about -1000 m can be recognized in places where possible shorelines and terraces have been eroded in relatively soft rocks of the Medussae Fossae Formation. Thus, the SE-Elysium-basin deserves attention as a Mars 2001 site of geologic and exobiologic investigations. Scientific rationale for site selection is summarized below. The SE-Elysium-basin region is of special geologic interest for a rover investigation because of diversity in: (1) rock type (volcanic, sedimentary, and possible ancient crustal materials), (2) material ages (possible Noachian highland material and Amazonian lava flows and sedimentary deposits), and (3) landforms (indicative of erosional, sedimentary, and possibly other processes). By viewing the various landforms and sampling the rock materials that form the basin floor and high- standing outcrops and materials of the Medussae Fossae Formation, we might better constrain (1) whether or not a lake occupied the basin, (2) whether the basin floor materials are lacustrine or volcanic, and (3) whether or not the Medussae Fossae materials are pyroclastic or sedimentary. Additionally, the paleolake possibility, which may have existed intermittently, possibly for sufficiently long periods to promote and sustain life, may make this region suitable for future exobiologic investigations. Proposed traverses of the SE-Elysium-basin region. We propose four traverses within the region that fall well within the mission constraints defined by the Athena investigation team. The proposed traverses, which occur within an elevation range of -2,000 to -1000 meters, are located near lat 2.5 N., long 184.8 (site A); lat 2.2 N., long 188.7 (site B); lat 5.1 N., long 188.9 (site C); lat 6.3N., long 185.5 (site D). Relatively smooth plains appear to dominate the proposed rover traverses. However, because radar reflectivity maps show areas of strong backscatter within the Elysium basin, MGS data should be utilized to determine more accurately the trafficability of the proposed sites. Additional information contained in the original.

Author

Landforms; Mars Surface; Mars Volcanoes; Planetary Geology; Water; Landing Sites; Mars (Planet); Mars Surveyor 2001 Mission

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Gusev Crater Paleolake: Two-Billion Years of Martian Geologic, (and Biologic?) History

Cabrol, N. A., NASA Ames Research Center, USA; Grin, E. A., NASA Ames Research Center, USA; Landheim, R., NASA Ames Research Center, USA; Greeley, R., Arizona State Univ., USA; Kuzmin, R., Academy of Sciences (USSR), USSR; McKay, C. P., NASA Ames Research Center, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Ancient Martian lakes are sites where the climatological, chemical, and possibly biological history of the planet has been recorded. Their potential to keep this global information in their sedimentary deposits, potential only shared with the polar layered-deposits, designates them as the most promising targets for the ongoing exploration of Mars in terms of science return and global knowledge about Mars evolution. Many of the science priority objectives of the Surveyor Program can be met by exploring ancient Martian lake beds. Among martian paleolakes, lakes in impact craters represent probably the most favorable sites to explore. Though highly destructive events when they occur, impacts may have provided in time a significant energy source for life, by generating heat, and at the contact of water and/or ice, deep hydrothermal systems, which are considered as favorable environments for life. In addition, impact crater lakes are changing environments, from thermally driven systems at the very first stage of their formation, to cold ice-protected potential oases in the more recent Martian geological times. Thus, they are plausible sites to study the progression of diverse microbiologic communities.

Author

Lakes; Landing Sites; Mars (Planet); Mars Surface; Planetary Geology; Water; Planetary Craters; Mars Surveyor 2001 Mission

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Southern Utopia Planitia: Geology and Proposed 2001 Rover Traverse Near the Lowland/Highland Boundary

Kargel, J. S., Geological Survey, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A 2001 landing site in southern Utopia Planitia is proposed near N Lat 28 deg 52 min, Long. 270 deg 29min, at an elevation of -400 m, in an area where thermal inertia data suggests a moderate rock abundance. The landing site is an area of so-called

”thumbprint terrain.” The primary geologic objectives of this mission would be to investigate (a) the nature of the lowland/highland boundary, (b) the physical processes responsible for modifying this boundary, and (c) the petrology and origin of deposits that fill much of the northern plains. We would address hitherto intractable questions as to the possible roles of eolian, volcanic, marine/lacustrine, mud/debris flows, and glacial processes operating regionally and mass wasting, mud volcanism, and periglacial processes acting locally. Widely suspected of being an area where water or ice once was abundant, this could be a possible exobiological site. The Martian lowland/highland boundary includes, in close proximity, rock units of diverse origin and wide ranging ages. This globe-circling geologic boundary probably is the most striking first-order geologic contact on the planet. Although not as visually stunning as the equatorial canyons, major shield volcanoes, or polar caps, the boundary zone nevertheless includes some dramatic and enigmatic landforms--naturally sculpted knobs towering hundreds of meters (e.g., the so-called ”face”), fretted canyons bearing glacier-like and lobate mass flow units, and variety of plains deposits. Interpretations vary, but any origin must have involved processes that acted on a globe-girdling scale, because the stratigraphic contacts along the boundary circumscribe virtually the entire northern plains, except where younger volcanic deposits overlap. This important set of stratigraphic contacts and the rock units involved may hold a key to the nature of depositional processes in the northern plains. According to Mars Observer Laser Altimeter measurements, these processes appear to have filled and leveled huge expanses of the northern plains basin. Much of the sedimentary component was derived by widespread erosion of the highlands and the lowland/highland boundary zone. The highland/lowland boundary zone evidently contains a rock record of processes whose collective reach was truly global. Parker et al. the boundary zone encompassing their Units A and B, Contact 2 between these units, and the fretted or gradational boundary itself. Contact 2 and Units A and B occur within the landing site area. Parker et al. showed and described an image of the very site proposed here for the 2001 mission. This type of contact occurs along perhaps 50% of the periphery of the northern plains but inward from (downward in elevation, generally north of) the boundary feature described as being either fretted or gradational. Contact 2 at the landing site occurs between the two basinal units, where Unit B overlies and onlaps Unit A, which in turn extends to the very edge of the northern plains at a somewhat fretted, somewhat gradational boundary with the Noachian cratered plains. Unit B is dominated by hummocks and whorled or subparallel ridges constituting thumbprint terrain; in the immediate landing site thumbprint terrain degenerates into its hummocky form. Parker’s Contact 2 coincides with what Jons mapped and interpreted as the edge of a northern plains ”mud ocean,” an interpretation that lately has drawn new support in terms of a debris-flow model. In the vicinity of the proposed landing site, Contact 2 also coincides with what Scott et al. mapped as the western shore of a long, narrow lake west of Elysium. Thumbprint terrain and associated plains deposits making up Unit B have been variously interpreted as debris flows perhaps with aligned mud volcanoes , lava flows perhaps covered with eolian deposits, ancient shorelines or nearshore marine deposits, or glacial moraines. There is no consensus on the interpretation of these features, but there is agreement that this Contact 2 circumscribes much of the northern plains and represents a dramatic geologic event central to an understanding of deposition in the northern plains. This contact generally occurs between 0 and -2 km. MOLA data suggest that in this area Contact 2 occurs at or near a profound change in the gentle slopes of the northern plains (Unit A is relatively steeply sloping, Unit B is almost horizontal), although this requires confirmation. The Syrtis Major quadrangle, containing the landing site and the boundary zone, has been mapped geologically at 1:5 million by Meyer and Grolier, and the area was mapped as part of a global geologic map at 1:25 million by Scott and Carr. The landing site occurs on a terrain mapped alternatively as (a) ”plains material” of unclear origin, perhaps involving eolian, volcanic, sedimentary, impact, and/or ground-ice processes, and an unspecified though relatively young age, or (b) ”cratered plains material” consisting of possible lava flows blanketed by eolian deposits of Amazonian age. The landing site nominally occurs on Parker’s Unit B and is within roving distance of Contact 2, west of which, lies Unit A. The landing site is expressed locally as a fairly smooth landscape grading into a somewhat rougher area to the east comprising scattered hummocks and whorled to parallel ridges -- somewhat subdued and disordered thumbprint terrain. North of the landing site, thumbprint terrain occurs in spectacular form, so there is little question that Unit B at the landing site is closely related to thumbprint terrain. Contact 2 occurs as a discrete, lobate contact of Unit B onlapping Unit A along a lobate scarp-like contact, convex toward Unit A; the scarp is of order 50 m high. The surface of Unit A dips to the northeast, and so it appears that Unit B thickens in the same direction. A visit by Athena to Contact A stands a good chance of settling the argument over the depositional origin of Unit B and whether there were oceans/big lakes, glaciers, mud seas, sand seas, or lava seas in this part of the northern plains. Reaching Contact 2 is the primary geologic objective. For the following proposed traverse, which is merely illustrative of the possibilities in this area, I assume a precise landing at the coordinates specified above. Less precise landing accuracy would entail changes to the specific travserse, but the same type of geologic features occur over a much wider area, so landing accuracy of +/- 30 or 40 km would allow the basic objectives to be achieved. (1) Rover investigations start with morphologic, sedimentologic, and petrologic investigations of Unit B in the immediate vicinity of the lander (N Lat 28 52, Long. 270’ 29). (2) The rover would then drive 4 km west to Contact 2 (N Lat 28’ 52, Long. 270’ 33), the overarching goal of the mission. (3) Drive 3 km northeast to a nearby knob that locally diverted deposition of Unit B (N Lat 28’ 54, Long. 270 31). Drive around east side of the knob where Unit B was deposited onto the knob. Study knob’s lithology and indications of possible mud volcanism, wave or current activity, and mass wasting due to ice processes or arid-climate mesaland processes (ground-water sapping, avalanches, and eolian

erosion). (4) Drive 7 km northwestward to an 8-km-long ridge and drive 2 km along its edge (N Lat 29 deg 01 min, Long. 270 deg 33). This feature is a possible tombolo, a compressional ridge in a debris flow, an esker, or some other structure- but whatever it is, such ridges are common in Unit B. (5) Drive 33 km to the edge of the ejecta blanket of a double-lobe 10-km-diameter rampart crater (N Lat 29 deg 26 min, Long. 270 deg 57min); this crater would have excavated rocks from over 1000 m deep, with complete penetration through Unit B and possible penetration through Unit A into Noachian-age basement material of the boundary zone. Examine ejecta for flow characteristics, evidence of aqueous chemical and physical weathering of rocks; investigate igneous, sedimentary, and shock metamorphic petrology. Other geologic features in this area include: (6) a butterfly ejecta crater (Lat 30 N, Long 273) this crater measures 32 x 48 km and is a possible source for some of the SNC meteorites; ejecta from this crater may be within driving distance of the nominal landing site. (7) Knobs and Contact A similar to what is present at rover stops 2 and 3. (8) Terraced knobs and flat-topped mesas. (9) Secondary crater field from the ejecta of a distant, unknown crater- a possible navigational obstacle, but an interesting geologic objective, with possible SNC meteorites, if navigation is possible. (10) Eroded ghost crater partly buried by Unit A. (11) A sharp contact between Unit A and heavily eroded Noachian-age rocks of the gradational form of the boundary zone -- a region where periglacial ice processes are believed to have been active. The knobs pose a small but significant landing hazard, since they occupy about 2-3% of the surface area in this region. Boulders are a more likely and unavoidable hazard, since thermal inertia data suggests a moderate (10-15%) rock abundance. In general, the smooth terrain and moderate rock abundance suggests that this area should be easily navigable and a relatively safe landing site. The combination of safety, geologic interest, and difference with respect to earlier landing sites makes this area worth serious consideration for the 2001 mission.

Author

Geology; Landforms; Landing Sites; Mars (Planet); Mars Surface; Terrain; Mars Surveyor 2001 Mission; Planetary Craters; Roving Vehicles

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Southwestern Isidia Planitia, Mars: Geology and Rover Traverses

Tanaka, K. L., Geological Survey, USA; Dohm, J. M., Geological Survey, USA; Lias, J. H., Geological Survey, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

We propose two traverses in southwestern Isidis Planitia, Mars, as candidate sites for the Mars 2001 Surveyor lander/rover mission. Investigation of these sites would address geoscience and exobiologic issues of current interest, including: How were highland materials degraded and northern plains materials emplaced? What is the composition of Hesperian lavas? Can fossils be found in materials formerly making up shallow aquifers? The proposed traverses occur on relatively smooth plains marked by ridges, hills, and impact craters and distant plateau and highland terrains, mostly within the range of lats 6-9N., longs 256-279W. The plains are within a topographic basin at an elevation of about -2,000 m or lower, based on the USGS elevation model, the Smith and Zuber model, and a Goldstone radar profile at lat 9.48 N.

Author

Mars Surface; Roving Vehicles; Landing Sites; Mars (Planet); Mars Surveyor 2001 Mission; Planetary Geology

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Strategies and Recommended Targets for Mars Surveyor Program Landing Sites

Rice, James W., Jr., NASA Ames Research Center, USA; Scott, David H., Geological Survey, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The two major constraints for selecting the Mars Surveyor Program (MSP) 2001 landing site at the time of this meeting are latitude (30'N to 15S) and elevation (is less than 2.5 km). The latitude belt will be narrowed down to a 15' sector after this workshop. This mission will demonstrate the capability to perform a precision landing, with the goal of achieving an accuracy of approximately 10 km, 3-sigma. There will be at least two different landing sites ('01 and '03) selected in the MSP. However, there should be an option of having the '05 sample return mission land in a different site and the '05 mission should be equipped with a rover for two reasons. The reasoning behind this follows: '05 lander/rover package should have the option of going to an independent site from either '01 or '03 because predecessor missions (orbital) may locate the "Ultimate Site"; '05 needs a rover to either: (A) explore and sample this "ultimate site" for sample return; (B) retrieve samples from '01 or '03 rovers, as a contingency, in case these rovers malfunction and cannot negotiate the trek back to the sample return vehicle.

Author

Landing Sites; Mars Surface; Mars Surveyor 2001 Mission; Planetary Geology; Roving Vehicles; Mission Planning

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SW Isidia Planitia, Mars: Valley Network Sediments, Highland Rocks, and Intermediate-Age Lavas

Crumpler, L. S., New Mexico Museum of Natural History, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Four basic themes identified repeatedly for the Mars Surveyor program of sample return are life, climate, crater count calibration, and resources. Sample themes repeatedly discussed that address these four issues are sediments, ancient highland rocks, volcanic plains, and ices. Geological settings that will enable these type of samples to be collected include lake beds (and spring deposits,) valley networks, volcanic plains, and polar deposits. This study evaluates potential Mars Surveyor lander/rover sites on the southwestern western and southwestern margins of the Isidis impact that contain these three of these geologic settings (lake beds and spring deposits, valley networks, and volcanic plains). The margins of the Isidis basin were selected for study because the Isidis basin has been a topographic sink for volatiles, runoff of an area of high drainage density, and possible subsurface flow and spring emergence. In addition, there are many sites along the margins that both fit within engineering constraints and address realistic field science objectives of a Mars Surveyor program rover. Two sites along the transition between Syrtis Major and Isidis Planitia have been discussed previously. A secondary site along the western boundary has been discussed previously on the basis of theoretical arguments for spring discharge there. In this discussion, I review direct observations in support of a third and prime site (3.4N and 277.8W) located at the terminus of a major valley network. The proposed site is of particular interest because it lies at the geologic junction between the intermediate-age lavas of Syrtis Major Planum, the valley networks of Libya Montes, and the late basin-fill materials of Isidis Planitia. Geologic opportunities at this site include a thick stratigraphic section of sediments, macroscopic exposures of sedimentary features, altered highland materials, and potential fragments of intermediate age lavas derived from Syrtis Major. The site is chosen such that these goals are attainable with a simple geotraverse between 15 and 25 km over terrain with relatively benign slopes. The areas of interest have been geologically mapped digitally at scales up to 1:300K, using specially mosaicked and digitally enhanced Viking EDRs. Spectral data were also considered. Eight units are mapped and span ages from middle Noachian to late Hesperian-early Amazonian: Nm, ancient highland massifs interpreted to be heavily eroded Isidis basin ejecta; Nf, fluvially dissected foothills and lower slopes of massifs and rolling inter-montane plains; Hi, intermontane and crater-interior plains interpreted as sediments; Hd, plains bearing high density valley networks with meandering characteristics; Hv, Syrtis Major lava flows, Hk, knobby, Isidis-marginal plains; and Hr, plains with ridges and aligned-mounds of the Isidis basin interior. The proposed site lies in the terminal fan of a large valley network. The terminal valley networks deposits here are locally cut by a small valley enabling direct access to sediments; a geotraverse from this valley to the east would move up a possible stratigraphic succession of terminal deposits over 15 km. Highland rocks, many probably weathered and altered, occur in adjacent hills and may be accessible. The nearby impact crater Syrtis Ee is the largest and youngest in the area and is located on the margins of the Syrtis lava flow. Dispersed samples of these intermediate-age lavas may randomly litter the surface and be available for sampling and analysis. Additional information contained in the original.

Author

Mars Surface; Valleys; Mars Volcanoes; Landing Sites; Mars Surveyor 2001 Mission; Mars (Planet)

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Considerations for Selecting the 2001 Mars Landing Site

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It is somewhat ironic that the site of the first sample return from Mars may be in the martian highlands. Although these materials represent over 65% of the surface area of Mars, in comparison to features such as the Tharsis volcanoes, outflow channels, or Valles Marineris relatively little research effort has been devoted to the highlands. Because the highlands are extremely old, they have been subjected to most of the geologic processes that have occurred on Mars through time, so geologically they are extremely complicated. On the other hand, they are so vast that it's difficult to identify very many traverses 10 km long that will have access to more than one geologic unit. Although the impetus for exploring the highlands comes from the putative evidence of nanofossils in the ALH 84001 meteorite, which is thought to have come from the cratered highlands, many scientists still cling to the idea that the early martian climate was cold and dry. If this hypothesis is true, then the surface of the highlands might be one of the worst places to look for evidence of life. However, there are several key geologic settings that could assure we get as diverse a sampling as possible, settle the long-standing debate about the nature of the early martian climate, and increase our chances at finding evidence of extinct or extant life. The landing should occur in an area that is (1) as dust-free as possible (i.e., high thermal inertia), (2) as low an elevation as possible, (3) within traversing distance of (Hesperian)-ridged plains materials, and (4) near both an ancient valley network and a degraded impact crater. When these criteria are taken into account along with

the engineering constraints imposed on the lander, the latitudinal bin with the most viable landing sites occurs from the 0 deg. to 15 deg. S latitude, primarily within the Mare Tyrrhenum (MC-22) and Margaritifer Sinus (MC-19) quadrangles.
Author
Highlands; Landing Sites; Mars (Planet); Mars Environment; Mars Surface; Planetary Craters; Mars Surveyor 2001 Mission

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Science Potential of Noachian Closed Drainage Basins as Mars Lander/Sample Return Mission Targets
Forsythe, R. D., North Carolina Univ., USA; Blackwelder, C. R., North Carolina Univ., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

From a scientific viewpoint there are a multitude of fundamental questions regarding the evolution of Mars which warrant serious consideration for guiding future lander and sample return missions. For brevity's sake one can group scientific objectives into three broad categories. First there are many assumptions and inferences regarding the last 20 years of geologic mapping on Mars which need to be verified at the earliest possible opportunity. Validation of lithostratigraphic work is essential for future mission planning and should be a primary component of any sample return mission. Second, the evidence for water on the Martian surface in the past is unequivocal, but has yet to be placed in its proper hydrologic setting. While hypotheses regarding the ancient Martian hydrosphere are numerous, all remain highly speculative in nature. A lander site should be chosen which has a high prospect of advancing our knowledge of the ancient Martian hydrosphere. The third issue is the possibility for life, or past life, on Mars. This issue, no matter how tenuous or speculative it is believed to be, is of such fundamental concern to humanity that it must, despite the odds, be given serious consideration.
Author
Mars (Planet); Mars Surface; Mineralogy; Mars Surveyor 2001 Mission; Landing Sites; Planetary Geology

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A Reason to Land in the Dark
Calvin, W. M., Geological Survey, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In spite of many years of both remote and in-situ observations, we still know very little about the actual surface mineralogy of Mars. The current presumption from the spectroscopic community is that bright regions represent altered (i.e. oxidized) materials and that dark regions must be relatively unaltered volcanic material such as pyroxene. A number of recent observations, both of the geology and spectroscopy of dark regions suggest that the picture is not nearly so simple. Evidence which counters these previous assumptions includes the lack of pyroxene absorptions in the dark material at the Pathfinder landing site and remote observations which suggest the most hydrated regions appear to be low or moderately low albedo areas. Here I examine the potential for ferrous clays, a spectrally distinct class of minerals, to be consistent with the visible, near-infrared and thermal infrared spectra of Mars, the geology and past presence of water, and their tantalizing association with organic materials and biotic precursors which suggest that some dark regions may be the best sites for exobiological exploration. Within the landing constraints for the 2001 mission, the best exobiological sites consistent with the ferrous clay model are in Margaritifer and Meridiani Terra.
Author
Clays; Exobiology; Iron; Landing Sites; Mars (Planet); Mars Surface; Planetary Geology; Mars Surveyor 2001 Mission; Mineralogy

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Studies of Potential Mars Surveyor 1998 Landing Sites
Herkenhoff, K. E., Jet Propulsion Lab., California Inst. of Tech., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The 1998 lander payload consists of a descent imager, the Mars Volatiles and Climate Surveyor (MVACS) instruments (lander stereo camera, arm-mounted close-up imager, meteorology package, thermal and evolved gas analyzer), and a LIDAR instrument. The mission focuses on assessment of near-surface water ice in the south polar region, and the volatile and climate history of Mars. In order to achieve these objectives, the landing site must allow access to polar layered deposits by the robotic arm, which may be able to dig as much as 0.5 m below the surface. Hence, the presence of recent aeolian debris at the landing site may adversely affect the ability of the MVACS instruments to gather the samples and acquire data needed to properly address the science objectives. The studies described here include mapping surface units in the landing region (73S - 77S, 140W - 230W) to infer the distribution of aeolian debris and to identify potential landing sites where mantling is minimal. Because the '98 lander will not be able to survive very low temperature conditions, this study also includes mapping of south polar seasonal frost retreat based on

Viking Orbiter images. The results of this work, in conjunction with complementary studies by other investigators, will facilitate the selection of the Mars Surveyor 1998 landing site (and backup) by the summer of 1998.
Author
Landing Sites; Mars (Planet); Mars Atmosphere; Mars Environment; Mars Polar Lander; Meteorology; Wind (Meteorology); Planetary Meteorology

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Volcanic Intrusions on Mars: Heat Sources to Maintain Viable Ecosystems?
Head, James W., III, Brown Univ., USA; Wilson, Lionel, Lancaster Univ., UK; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

We analyze long-term heat input into the martian crust from volcanic sources and use this as a basis for developing criteria for potential landing sites that might have maintained thermally viable ecosystems in the past history of Mars. Candidate sites that meet these criteria are described.
Author
Heat Flux; Heat Sources; Hydrothermal Systems; Magma; Mars (Planet); Mars Surface; Mars Volcanoes; Planetary Geology; Volcanology; Water

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Da Vinci Crater: Potential Landing Site for the Mars 2001 Mission
Nelson, D. M., Arizona State Univ., USA; Greeley, R., Arizona State Univ., USA; Klein, H. P., Search for Extraterrestrial Intelligence Inst., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Da Vinci, a large crater in Xanthe Terra which indicates fluvial modification and is a potential exobiology site, is proposed as a possible landing site for the Mars 2001 mission. Da Vinci is about 90 km diameter and located on the west margin of Hydraotes Chaos, at 2N, 39W; the floor is +1 km planetary datum. Associated fluvial features in conjunction with its proximity to Hydraotes Chaos suggest that this crater was subject to one or more high energy floods. Being an enclosed system, and having the potential for containing standing water, Da Vinci could have sustained an environment capable of supporting life. Additionally, if biotic communities were present in the aquifer below Hydraotes, and, with its disruption the organisms were brought to the surface, exobiology indicators from this source could be located in Da Vinci.
Author
Exobiology; Landing Sites; Mars Surface; Water; Mars Surveyor 2001 Mission; Mars Craters; Mars (Planet)

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Galilaei Crater as a Possible Landing Site for the Mars 2001 Mission
Nelson, D. M., Arizona State Univ., USA; Greeley, R., Arizona State Univ., USA; Klein, H. P., Search for Extraterrestrial Intelligence Inst., USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Galilaei is an approximately 130 km diameter crater, located at 6N, 27W, and about 0 km planetary datum, between two outflow channels extending from Hydaspis Chaos. This crater is proposed as a potential landing site for the investigation of both geology and exobiology. The smooth crater floor, fluvial scour features, and drainage valley suggest that this crater was subject to multiple floods. As a site presumed to have contained liquid water, possibly for significant periods of time, it is considered as a potential exobiology site. Galilaei crater lies within the cratered highland region of Xanthe Terra consisting of smooth plateau material (Hpls), interpreted to be volcanic flows which had been modified during the Hesperian by broad sheetwash from Valles Marineris. Along its southeast margin is an undeveloped channel, which leads to Ares Vallis. Hydaspis Chaos lies to the south of the crater and a strip of grooved terrain, trending to the northwest from the Chaos, indicates flow into Tiu Vallis. Galilaei has a smooth floor with many small hills (is less than 5 km) near the crater wall. The hills on the crater floor could be remnants of material eroded from the crater walls.
Author
Exobiology; Landing Sites; Mars Missions; Mars Surface; Mars Craters; Mars (Planet); Mars Surveyor 2001 Mission

20000113023 NASA Ames Research Center, Moffett Field, CA USA
Gale Crater: An Amazonian Impact Crater Lake at the Plateau/Plain Boundary
Cabrol, N. A., NASA Ames Research Center, USA; Grin, E. A., NASA Ames Research Center, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Gale is a 140-km diameter impact crater located at the plateau/plain boundary in the Aeolis Northeast subquadrangle of Mars (5S/223W). The crater is bordered in the northward direction by the Elysium Basin, and in eastward direction by Hesperian channels and the Aeolis Mensae 2. The crater displays a rim with two distinct erosion stages: (a) though eroded, the south rim of Gale has an apparent crest line visible from the north to the southwest (b) the west and northwest rims are characterized by a strong erosion that, in some places, partially destroyed the rampart, leaving remnant pits embayed in smooth-like deposits. The same type of deposits is observed north, outside Gale, it also borders the Aeolis Mensae, covers the bottom of the plateau scarp, and the crater floor. The central part of Gale shows a 6400 km2 subround and asymmetrical deposit: (a) the south part is composed of smooth material, (b) the north part shows spectacular terraces, streamlines, and channels. The transition between the two parts of the deposit is characterized by a scarp ranging from 200 to 2000 in high. The highest point of the scarp is at the center of the crater, and probably corresponds to a central peak. Gale crater does not show a major channel directly inflowing. However, several large fluvi systems are bordering the crater, and could be at the origin of the flooding of the crater, or have contributed to. One fluvial system is entering the crater by the southwest rim but cannot be accounted alone for the volume of sediment deposited in the crater. This channel erodes the crater floor deposit, and ends in a irregular-shaped and dark albedo feature. Gale crater shows the morphology of a crater filled during sedimentation episodes, and then eroded Part of the lower sediment deposition contained in Gale might be ancient and not only aqueous in origin. According to the regional geologic history, the sedimentary deposit could be a mixture of aeolian and pyroclastic material, and aqueous sedimentary material that can originate both from drainage of the regional subsurface aquifer, and/or from surface flood. The central deposit shows three main levels: (a) the current crater floor (north of Gale), (b) an ancient level about 200 rn higher (south of Gale), and (c) the massive terraced deposits. A crater statistics on the 15,400 kM2 area of the crater floor and deposit [3,41 gave: 259+/-112.4 craters, most of them partly embayed in the sedimentary deposit, and all inferior to 5-km diameter. For superimposed crater population only, the result is 194+/-112. The deduced relative ages ranges from Early to Middle Amazonian. The population of craters are comparable for the three levels, implying that the last sedimentation/erosion episode on Gale was recent and affected the whole crater. The streamlined morphology of the border of the deposit, the layering, the channels, and the terraces are compatible with a significant fluvio-lacustrine history of the site. Multiple levels may suggest different episodes, but the common statistical age of the three levels shows that the last episode involved the whole crater. The origin of the lake water in Gale may have varied in time. Three major contributions have been proposed: (a) the drainage of the regional underground aquifer by Gale crater over an area of 110-km radius around the crater which would have provided approximately 1,600 cubic km of water, (b), surface drainage entering Gale by the south and north rims. In the south, a 250-km long system originates in the cratered uplands in a Noachian crater material plain (Nc), and crosses Hesperian and Amazonian crater material plains (AHc) northward [1]. Several fluvial systems originate in the Aeolis Mensae, east of Gale. They may had two functions in time: to recharge, the underground aquifer in the region of Gale, and to supply surface water in the crater by overspilling the northern rim, and (c) surface floods that originated from the rising of the water level in the Elysium Basin. According to the Amazonian age of Gale's floor, and the erosion direction in the crater, a flood from Elysium Basin is the most likely event to explain the material observed in Gale, and the formation of the last lake. This last flood may have been important enough to flood the central deposit up to about 1400 m above the crater floor, leaving two islands (non stream lined features) at the center of the deposit. Terrace spacing suggests a regular drop of the lake level in time. Fractures in terraces perpendicular to the shoreline can be interpreted either as: (a) the result of the drainage systems during the waning of the lake, or (b) traces of the pressure of an ice-covered sheet associated with subglacial drainage. The presence of a lake of such volume during the Amazonian period is one more evidence that water was still active on Mars relatively recently. Gale crater offers the rare opportunity to unveil a key-period of the martian history. The Amazonian might proved not as cold and dry as previously thought. The presence of large lakes and basins (Elysium Basin is large as the Mediterranean Sea), reinforces the model of an extensive water activity during the Amazonian that has still to be understood in the context of an assumed cooling and drying planet. The sediments and rocks that were left of this period in Gale keep the record of the climatic conditions of the Amazonian and the clues that are missing to understand the climatic evolution of Mars. In addition, Gale crater presents the advantage to be located at the plateau/plain boundary, which has never been studied and contains information about the two main martian geological units. As a conclusion, we propose a table that summarizes the worthiness of a mission in Gale crater, and the expected science return relative to the objectives to be met by the Surveyor Program. Additional information contained in the original.

Author

Mars (Planet); Mars Craters; Mars Environment; Mars Surface; Water; Landing Sites; Mars Surveyor 2001 Mission

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Ma'adim Vallis Estuarine Delta in Elysium Basin and Its Relevance as a Landing Site for Exobiology Exploration on Mars

Grin, E. A., NASA Ames Research Center, USA; Cabrol, N. A., NASA Ames Research Center, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The debouche of Ma'adim Vallis in the Elysium Basin generated a transitional transported sediment structure, which planimetric shape is controlled by the enclosing topography of a deep reentrant gulf of the Basin into the highland. We defined it as an estuarine delta. The location and the importance of this estuarine delta is supported by the theoretical model of graded profile constructed for Ma'adim Vallis, and by two approaches: (i) the reconstruction of Ma'adim Vallis downstream course from Gusev to Elysium Basin, and (ii) the survey of the sediment deposit in the alleged estuary. The longitudinal graded profile of Ma'adim Vallis finds its base-level in the Elysium Basin, at a about 1000 m elevation, which is in agreement with the observed Basin shoreline. This model is supported by observational evidence of flow between the northern rim of Gusev crater, and the Elysium Basin shoreline. This downstream course of Ma'adim Vallis can be divided into three hydrogeologic regions. into three hydrogeologic regions. (a) The first region is a flooded plain (Zephiria Mensae), consisting in chaotic terrain formed by highland rocks, and disintegrated lava of the western flank of Apollinaris. Morphologic indicators of the flood process are: (1) the sediment deposit over the Gusev crater northern rim that reflects the overspilling of the crater-lake water through a 40-km wide gap provided by an ancient impact crater, (2) the tear-drop shaped feature on the northeastern flank of Apollinaris Patera, and (3) the chaotic terrain that suggest the emergence of ground water generated by the seepage of the crater lake through high-permeable broken rampart material. This underground water circulation sustained by the hydrostatic pressure of the crater-lake has likely generated a hydrothermal system in the volcanic environment of Apollinaris Patera. The stratigraphy of the flooded area is identified as Hesperian age, with occurrences of Noachian hilly individual features, and as Amazonian flooded plain and chaotic material, (b) The second region is located on the western flank of Apollinaris Patera. It is surrounded by relics of deep valleys that suggest a former downstream course of Ma'adim Vallis. The geologic setting of this region (Lucus Planum) is interpreted to be an Amazonian formation composed by the middle and lower members of the Medusae Formation., c) The third region corresponds to the convergence of the west and east branches of Ma'adirn Vallis into a deep re-entrant wide gulf that penetrates about 100 km into the highland. This topographic depression is delineated by the 1000 in elevation contour. This gulf has formed an estuarine configuration centered at 3S/190W within the Elysium Basin. This configuration has favored the formation of a estuarine sedimentary delta, because of topographically controlled lateral migration. This estuarine structure is strongly dominated by the incoming supply of Ma'adim Vallis fluvial sediment extracted from Zephiria Mensae and Lucus Planum. The obtuse-angle geometry of the estuary increases the sedimentation rate, which is higher than in the course of the channel. The sediment deposition process is governed by the estuarine water circulation. The inflowing loaded fluvial water enters the estuary as a bottom current, and mixes with the relatively less-loaded water of the receiving basin. When they mixed. the inflowing fluvial material, and the landward basin circulating water generate an accumulation of highly-diversified estuarine deposit stratification. This accumulation of material is mostly centered in the transitional zone of the delta. The sediment trapping efficiency of the estuary is function of the energy balance between the inflowing fluvial water, and the ingoing basin current. The submergence of the delta by the rising of the water-level increases the estuary water-depth, and consequently the sediment entrapment is favored. The locus of sediment accumulation moves landward in the zone of inflowing fluvial water. This results in the rising of the channel base-level, thus in the increase of the length of the longitudinal graded-profile. The sediment deposit facies of the zone A shows a generally smooth surface. The longitudinal deposit is bordered by alluvial terraces that reflect the variations of the channel level. The waning of the Elysium Basin caused the erosion of the Basin estuarine zone by small channels, this episode being characterized by dissected tear-drop shaped mesa-like morphologies in the delta. Our estuarine delta model predicts a lithostratigraphic depositional sequence associated with the water submergence and the transgression of Elysium Basin. The thickness of the estuarine sediment corresponds to the Elysium Basin levels changes relatively to the bed floor of the estuary, The depositional sequence of Ma'adim Vallis are described: (1) a pro-current filled region (A), where fluvial are longitudinally accumulated by the inflowing water, (2) inverse current from Elysium Basin (B), where fluvial and lacustrine sediments are accumulated, and (3) zone of current equilibrium (C), where the sediments are distributed as a shoreline at the boundary of the estuarine delta. The estuary sedimentology dynamics collects and keeps the record of the geologic unit material crossed by Ma'adim Vallis, and those of the lakebed deposit of Elysium Basin. The predicted mixed stratigraphic sequence from fluvial and lacustrine sediment makes this site an exceptional environment to concentrate potential multi-origin biologic records. We envision four possible strategies to explore this sedimentologic record: (1) longitudinal surface and subsurface traverses in region A to investigate outcrop levees, (2) exploration of the mesa walls in region B, (3) deep drilling hole lodging of the sequential deposits in the zones A and B, and (4) surface and subsurface exploration of the shoreline delta. The expected results for each of these strategies are: (1) in the deepest layers of region A are predicted frequent and abundant coarse material, sandy lenses lamination grading downward from sand to cobbles. Volcanic debris from the Noachian crustal Plateau unit material, hydrothermal altered rocks, carbonates, Hesperian and possibly Amazonian volcanic material, from Apollinaris Patera, altered rocks and carbonates from Zephiria Mensae are expected. As a favorable environment for inception of life, possible biological records are expected in transported rock, (2) At the surface, and subsurface (is less than =100 m), large deposits sandy to silted material from Elysium paleolake basin mixed with fine-grained sediments from Ma'adim Vallis are expected mostly in the upstream part of region B, (3) on the shoreline of the estuarine delta, abundant fine material from Elysium paleolake basin (evaporites, carbonates), mostly Amazonian in age are expected. The Ma'adini estuary is a favorable landing site for all the

above mentioned science aspects, and .for its location. The site lies near the equator, which is favorable for the rover solar power supply, and at 1000m elevation, which is a favorable configuration for the descent system braking. Another advantage is the extent of the area of high scientific interest (33,000 sq km), which provides a good ellipse, and potential long study traverses.
Author
Exobiology; Ground Water; Landing Sites; Mars Surface; Water; Mars (Planet); Mars Surveyor 2001 Mission; Planetary Craters

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Deep Basalt Aquifers in Orcus Patera, Elysium Basin Mars: Perspectives for Exobiology Exploration
Grin, E. A., NASA Ames Research Center, USA; Cabrol, N. A., NASA Ames Research Center, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Direct indicators of shorelines, spillways, and terraces allowed to determine the extent of the Elysium Paleolake between the contour-lines 1000 and 500 m below the Martian datum. The Elysium Paleolake is bordered north by Orcus Patera (14N/181W), which lies west of the Tartarus Montes and Tartarus Colles. The Orcus Patera displays an ellipse-shaped collapsed caldera of 360-km long and 100-km wide. Viking topographic data show that the bottom of the caldera is located at 2500 below the Martian datum, and surrounded by a steep-walled ram art which crest is located at about 0 m elevation. Considering the localization of Orcus Patera in the Elysium paleolake, its altimetry, and the magmatic origin of this caldera, we propose the existence of a paleolake in Orcus Patera generated (a) by juvenile water from magma during the Noachian period, and (b) by intermittent influx of the Elysium Basin from Hesperian to Amazonian. Results are encouraging to consider this site as a potential high-energy source environment for microbial communities. are circumscribed by a 50-km wide lava field mapped as Noachian material. The structure of Orcus Patera represents the record of material erupted from a magmatic reservoir. The caldera is enclosed by steep inner walls (25% measured from topographic data), values which could be in agreement with the presence of a deep magmatic reservoir, as suggested by the typology of Crumpler et.al. The depth of the caldera might be due to the collapse of the magma reservoir, and the release of gases accompanying the magma thermal evolution. Origins of water for the paleolake(s): The water that generated a paleolake in Orcus Patera may have come from two origins: (1) Juvenile water: Plescia and Crips estimated a magma H20 content by weight between 0.5% and 1.5% using for the first value a comparison with terrestrial basalt, and for the second values from a Martian meteorite. The amount of H20 can be estimated by the volume of erupted lava, and the lava content of the caldera. In this study, we adopt a water content of 1%. The total volume of magma that has been contained in the caldera, and the volume of lava contained in the observed lava field is about 110 x 10(exp 6) cubic km, that gives a total volume of 1.10 x 10(exp 6) cubic km of water. The juvenile water expelled by the overpressure within the magma chamber charged with desolved water-vapor may have moved into the crust. The decrease in overburden pressure led to bubble formation. The ascent of these bubbles generated a pressurization of the magma, which was sufficient to fracture the overlaying magma layer, (2) Water from Elysium paleolake. During the Amazonian, the rise of the Elysium paleolake level generated an overspilling that supplied the caldera with water. The southern portion of the crest shows a deep gap 12-km wide at -1500 m elevation, locating the gap between 500 to 1000 in below the assumed water of Elysium paleolake, thus facilitating the influx of Elysium paleolake water into Orcus Patera. Bathymetric calculations give a floor area of 25,500 sq km at -2000 m elevation, and a water volume of 42,000 cubic km, with a lake-level at -1500 m. A substantial amount of water may have percolated through the fractured lava, and part of the volume may have overspilled the northern crest of Orcus Patera to debouch in the Tartarus Montes region. We envision the formation of a subsurface aqueous environment in basaltic rocks at the contact of the two water-source origins, possibly the percolating surface lake water, and more likely the juvenile water. Similarly to terrestrial calderas, Orcus Patera might be surrounded by ring-fractures caused by the collapse of the magma chamber that followed the release of gases. These ring-fractures may have been covered later by sedimentation in the caldera (lacustrine, aeolian, and volcanic), and by mass wasting. The detumescence of the magma in the caldera, and the vesiculation of the juvenile water may have operated simultaneously. Comparatively to terrestrial melts, Martian iron-rich melts are denser. This greater density implies greater effusion rates (eight-times terrestrial values), and larger fissuration widths (two-times terrestrial ones). With increasing vesiculation of magma, the bubbles interact with one-another because there are of similar pressure. They make a magma froth at the contact with the caldera surface, and on the walls of the fractures. In the saturated magma, froth, where the volume ratio of gases-to-liquid is about 4:1, the bubbles form a huge surface area of interconnected spaces. Bubbles near the caldera surface disrupt the magma, and fragmentation takes place, which moves downward through the magma column. On Earth, the bubbles are likely to grow between 1 and 50 mm in diameter due to the difference between the magma surface tension, and the bubble supersaturation pressure. The Martian low-pressure at surface level is likely to accelerate the expansion of the bubbles, and increase their final diameter and number, creating more voids in the magma. The strong magma froth with enclosed juvenile water bubbles interconnected with exsolved gas bubbles constitute a potential geothermal environment for geochemical energy production from basalt and water that does not require excessive temperatures. This process can start at +20C. Similar types of environments have been shown on Earth as potential energy sources for microbial metabolism, and could have provided deep aqueous basaltic niches for possible Martian microorganisms, even geologically

recently. During the Amazonian, combination of volcanism and water activity still existed on Mars. Moreover, this type of potential niches open ways for investigation of possible oases of extinct or extant life, not only on paleolakes, and surface hydrothermalism spring areas, but also all large systems of fossae, which combine hydrologic and volcanic activities, and which provide an energy source, and an underground shelter to prevent surface UV bombardment. Additional information contained in the original. Author

Calderas; Exobiology; Lakes; Magma; Mars (Planet); Mars Surface; Volcanoes; Mars Surveyor 2001 Mission; Landing Sites

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Possible Lacustrine Deposits on Crater Floors as Targets for Mars Surveyor Sample Return Missions

Zimbelman, James R., National Air and Space Museum, USA; Mars Surveyor 2001 Landing Site Workshop; [1998]; 2p; In English; See also 20000112986; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A high priority for a sample return landing site is a location where liquid water may have flowed and/or ponded early in Martian history. Such a site could potentially provide samples that would address water chemistry and availability during Martian history, as well as provide a possible site for accumulation of any microfossils that might accompany any sedimentary deposit. There is abundant evidence that water played a crucial role throughout Martian history, but it is often difficult to find many features that unambiguously indicate a fluvial or pluvial contribution to the local geologic story. Lacustrine deposits within large craters in the highlands of Mars represent a possible target that might provide a sample return mission with access to materials from the ancient cratered terrain as well as water-borne sediments that accumulated within the crater at some time after heavy bombardment. The case has been made that the cratered highlands of Mars include numerous pluvial lakes, as evidenced either by erosional shorelines within a crater or by high albedo deposits on the crater floor. The erosional features representing possible lake shorelines are distinctive, but they lack clear evidence that the liquid involved was water (as opposed to a possible fluid lava or some other geologically reasonable liquid). A compelling case for evidence of water-borne sediments can be made for distinct high-albedo deposits within some highland craters. Viking imaging does not reveal clear layering in these deposits, although erosional patterns in some of them suggest that the material is variably indurated and may be vertically inhomogeneous. Two candidates for possible lacustrine deposits are the crater Bequerel (N22, W7) and an unnamed crater near the Schaparelli basin that includes the unusual feature called ”White Rock” (S8, W335). Both are located within the cratered highlands, which is the prime target area for the sample return missions. Bequerel is approximately 80 km in diameter, located in the Arabia Terra highlands with a rim height above the 0-km elevation contour but a floor that is mostly below the -1 km elevation contour. Assuming the landing ellipse is small enough to fit within the crater and miss the eroded (possible lacustrine) deposit, this crater deserves consideration as a possible target for a sample return mission. The White Rock crater is about 70 km in diameter, located within Terra Sabaea, but it is more problematic as a potential target since its rim corresponds to an elevation between the 4 and 5-km contours and its floor is below the 3-km contour. The flow or elevation may exceed the final engineering constraints, so this particular crater may not be a satisfactory target, even though the White Rock deposit has a strong possibility of being a sizeable lacustrine deposit. An alternative target near the White Rock crater is the 150 km diameter Schaparelli basin (S3, W343), whose floor is below the 2-km elevation contour. If Schaparelli is assumed to have experienced conditions similar to those that led to the formation of the White Rock deposit, then this basin should be considered for a sample return landing. Knowledge of the topography and elevation of features on Mars is currently rather imprecisely known. Elevations based on Viking data can be in error by up to a couple of km. Earth-based radar gives substantially better topography, but only for isolated tracks scattered within the N25 to S25 latitude band. The Mars Orbital Laser Altimeter (MOLA) experiment on the Mars Global Surveyor (MGS) spacecraft will generate the first well-constrained topographic data set for Mars during its two-year mapping mission, which should officially commence in March 1999. Preliminary MOLA data described in press releases and made available on the Internet make it abundantly clear how poorly constrained are some portions of the Viking-based elevation data set. It is anticipated that MOLA data may show that crater floors with possible lacustrine deposits currently thought to be at too high an elevation (e.g. the White Rock crater) may yet turn out to be within the engineering constraints of a lander mission. Also, high-resolution images from the Mars Orbital Camera (MOC) and compositional information from the Thermal Emission Spectrometer (TES) on the MGS spacecraft may be able to test the viability of a lacustrine interpretation for the high-albedo intra-crater deposits prior to final selection of the landing site for the 2001 mission, as well as subsequent Mars landing missions.

Author

Landing Sites; Mars (Planet); Mars Global Surveyor; Mars Surface; Planetary Geology; Mars Craters; Water

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A Virtual Collaborative Environment for Mars Surveyor Landing Site Studies

Gulick, V.C., NASA Ames Research Center, USA; Deardorff, D. G., NASA Ames Research Center, USA; Briggs, G. A., NASA Ames Research Center, USA; Hand, K. P., NASA Ames Research Center, USA; Sandstrom, T. A., NASA Ames Research Center, USA; [1999]; 2p; In English; 2nd; MSLS Workshop, 1999, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Over the past year and a half, the Center for Mars Exploration (CMEX) at NASA Ames Research Center (ARC) has been working with the Mars Surveyor Project Office at JPL to promote interactions among the planetary community and to coordinate landing site activities for the Mars Surveyor Project Office. To date, CMEX has been responsible for organizing the first two Mars Surveyor Landing Site workshops, web-archiving resulting information from these workshops, aiding in science evaluations of candidate landing sites, and serving as a liaison between the community and the Project. Most recently, CMEX has also been working with information technologists at Ames to develop a state-of-the-art collaborative web site environment to foster interaction of interested members of the planetary community with the Mars Surveyor Program and the Project Office. The web site will continue to evolve over the next several years as new tools and features are added to support the ongoing Mars Surveyor missions. Derived from text

Mars Exploration; Mars Missions; Mars Landing; Surveyor Project; Landing Sites; Lunar Landing

92
SOLAR PHYSICS

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

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Prediction of Coronal Mass Ejections from Vector Magnetograms: Results from More Active Regions

Falconer, D. A., NASA Marshall Space Flight Center, USA; Moore, R. L., NASA Marshall Space Flight Center, USA; Gary, G. A., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 15 Dec. 2000, San Francisco, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

In a previous pilot study of four predominantly bipolar active regions observed by the MSFC vector magnetograph in 1991-92, we found that two quantitative measures of the global nonpotentiality of an active region were promising predictors of whether the active region produced coronal mass ejections (CMES) during its rotation across the Sun. The two quantitative measures are 1) the length (L(sub ss)) of the segments along the active region's main neutral line on which the vector magnetic field is both strong and strongly sheared, and 2) the global net current (I(sub N) flowing up one side of the bipole and down the other. Two of the active regions had large measured global nonpotentiality (L(sub ss) approximately is greater than 10(exp 5) km and I(sub N) approximately is greater than 4x 10(exp 12) Amp) and produced three CMEs each. The other two active regions had much smaller measured global nonpotentiality and produced no CMES. We have now expanded our sample of active regions by a factor of 3 with active regions from 1991 to the present. We have calibrated the line-of-sight magnetic field by comparing it to the line-of-sight field measured by Kitt Peak and/or SOHO/MDI. We have resolved the 180 deg. ambiguity in the transverse field by using three different methods, and compared the resulting global net currents. We will compare the two measures of global nonpotentiality to each other and to the CME productivity of each active i-eolon in our expanded set. We will examine the extent to which these results from the expanded set confirm or modify the tentative rule for CME prediction that we found in our pilot study. Author

Magnetic Fields; Coronal Mass Ejection; Solar Flares; Solar Corona; Predictions

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Electrons In The Low Density Solar Wind

Ogilvie, Keith W., NASA Goddard Space Flight Center, USA; Desch, Michael, NASA Goddard Space Flight Center, USA; Fitzenreiter, Richard, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 18-21 Jul. 2000, Ann Arbor, MI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The recent occurrence of an interval (May 9th to May 12th, 1999) of abnormally low density solar wind has drawn attention to such events. The SWE instrument on the Wind spacecraft observed nine similar events between launch (November 1994) and August 1999: one in 1997, three in 1998, and five in January-August 1999. No such events were observed in 1996, the year of solar minimum. This already suggests a strong dependence upon solar activity. In this paper we discuss observations of the electron strahl, a strong anisotropy in the solar wind electrons above 60 eV directed along the magnetic field and observed continuously during the periods of low density in 1998 and 1999. When the solar wind density was less than 2/cc, the angular width of the strahl was below 3.5 degrees and the temperature deduced from the slope of the electron strahl phase density (as a function of energy

in the energy range 200 to 800 eV) was 100 to 150 eV, equivalent to a typical coronal electron temperature. Three examples of this phenomenon, observed on Feb. 20- 22, April 26-27 and May 9-12, 1999, are discussed to show their similarity to one another. These electron observations are interpreted to show that the strahl occurs as a result of the conservation of the first adiabatic invariant, combined with the lack of coulomb collisions as suggested by Fairfield and Scudder, 1985.
Author
Electrons; Solar Wind

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Momentum Transport in the Solar Wind Erosion of the Mars Ionosphere
PerezdeTejada, H., Universidad Nacional Autonoma de Mexico, Mexico; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Measurements in the Mars plasma environment indicate that a friction layer develops between the solar wind and that planet's ionosphere. The observed features include a velocity boundary layer in the solar wind that streams around the flanks of the Mars ionosphere, and enhanced planetary particle fluxes in that region. Information on the flow dynamics and ion composition in the Mars plasma environment has been obtained with measurements conducted with the Phobos spacecraft. Flow speed profiles derived from data obtained downstream from Mars show a sharp decrease of the solar wind velocity to the low values that are seen across the wake. Around that region there is also a sharp change in the composition of the particle population. In particular, solar wind protons are dominant in the outer parts of the plasma environment, where the flow speed remains high approx. 400 km/s), and strong fluxes of planetary O(+) ions are detected as the spacecraft approaches and moves through the wake where the speed of the proton population has decreased to very low approx. 40 km/s) values. An important implication of the smaller flow speeds measured within the boundary layer is that the solar wind momentum is used to accelerate planetary pickup ions and ionospheric plasma. In particular, the low speeds of the solar wind within the velocity boundary layer implies the removal of most of the incident momentum which can then be employed to produce a plasma flow in the upper ionosphere. It is suggested that a cold plasma flow is present in the tenuous Mars upper ionosphere and that its momentum is provided by the solar wind within the adjacent velocity boundary layer. Following an earlier analysis we will estimate the erosion of the present day ionosphere and the amount of material that could have been removed in the early Mars atmosphere. Additional information is contained in the original extended abstract.
Author
Boundary Layers; Plasmas (Physics); Electromagnetic Measurement; Wind Erosion; Solar Wind Velocity; Momentum Transfer; Magnetohydrodynamic Flow; Mars Atmosphere

20000113127 Colorado Univ., Center for Astrophysics and Space Astronomy, Boulder, CO USA
Coordinated ASCA Observations of Coronal Structure and Flares on the RS CVn Binary Sigma CrB ***Final Report, 1 Jul. 1997 - 30 Jun. 2000***
Brown, Alexander, Colorado Univ., USA; [2000]; 4p; In English
Contract(s)/Grant(s): NAG5-4783; No Copyright; Avail: Issuing Activity; Abstract Only

This NASA grant supported my ASCA observing and data analysis during AO 5. This research involved a multiwavelength observation of the short period (1.14 day) active binary sigma(sup 2) CrB using the ASCA and RXTE satellites and the NRAO VLA radio array. ASCA observed sigma(sup 2) CrB for 81 ksec on 1997 March 11-13. A large flare outburst, with a flare enhancement over of quiescence of a factor of 6, was seen starting on March 12.23. This flare was also observed by RXTE and the VLA. Two-temperature spectral fitting indicates the presence of a nonvarying cooler component at 8 mk and a hotter component that increased from a quiescent temperature of 22 mk to 50 mk at the peak of the flare. Continuous emission measure distributions derived from the spectra are consistent with the two-temperature fits and also indicate the presence of very hot (100 MK) plasma during the rise phase of the flare. The detailed analysis of all the spectral and radio data for sigma(sup 2) CrB is published in Osten et al. (2000).
Author
Eclipsing Binary Stars; Coronal Loops; Solar Flares; Solar X-Rays

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Realistic Solar Surface Convection Simulations

Stein, Robert F., Michigan State Univ., USA; Nordlund, Ake, Theoretical Astrophysics Center, Denmark; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 21-38; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA; Sponsored in part by Danish Research Foundation

Contract(s)/Grant(s): NAG5-4031; NSF AST-95-21785; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

We perform essentially parameter free simulations with realistic physics of convection near the solar surface. We summarize the physics that is included and compare the simulation results with observations. Excellent agreement is obtained for the depth of the convection zone, the p-mode frequencies, the p-mode excitation rate, the distribution of the emergent continuum intensity, and the profiles of weak photospheric lines. We describe how solar convection is nonlocal. It is driven from a thin surface thermal boundary layer where radiative cooling produces low entropy gas which forms the cores of the downdrafts in which most of the buoyancy work occurs. We show that turbulence and vorticity are mostly confined to the intergranular lanes and underlying downdrafts. Finally, we illustrate our current work on magneto-convection.
Author

Turbulence; Convection

20000114113 Observatoire de Paris-Meudon, Dept. d'Astrophysique Stellaire et Galactique, France

Plumes in Stellar Convection Zones

Zahn, J. P., Observatoire de Paris-Meudon, France; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 90-104; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

All numerical simulations of compressible convection reveal the presence of strong downward directed flows. Thanks to helioseismology, such plumes have now also been detected at the top of the solar convection zone, on supergranular scales. Their properties may be crudely described by adopting Taylor's turbulent entrainment hypothesis, whose validity is well established under various conditions. Using this model, one rinds that the strong density stratification does not prevent the plumes from traversing the whole convection zone, and that they carry upward a net energy flux. They penetrate to some extent in the adjacent stable region, where they establish an almost adiabatic stratification when there is little radiative diffusion. These plumes have a strong impact on the dynamics of stellar convection zones, and they probably play a key role in the dynamo mechanism.
Author

Free Convection; Stellar Convection; Stellar Interiors; Solar Interior; Plumes

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Influence of the Tachocline on solar Evolution

Brun, A. S., Observatoire de Paris-Meudon, France; Zahn, J.-P., Observatoire de Paris-Meudon, France; Annals of the New York Academy of Sciences: Astrophysical Turbulence and Convection; February 2000; ISSN 0077-8923; Volume 898, pp. 113-121; In English; 14th; Nonlinear Astronomy and Physics, 18-20 Feb. 1999, Gainesville, FL, USA; ISBN 1-57331-244-4; Copyright; Avail: Issuing Activity

Recently, helioseismic observations have revealed the presence of a shear layer at the base of the convective zone related to the transition from differential rotation in the convection zone to almost uniform rotation in the radiative interior, the tachocline. At present, this layer extends only over a few percent of the solar radius and no definitive explanations have been given for the thinness. Following Spiegel and Zahn (1992, The solar tachocline, Astron. Astrophys. 265: 106-114), who invoke anisotropic turbulence to stop the spread of the tachocline deeper in the radiative zone as the Sun evolves, we give some justifications for their hypothesis by taking into account recent results on rotating shear instability (Richard & Zahn, 1999, Astron. Astrophys.). We study the impact of the macroscopic motions present in this layer on the Sun's structure and evolution by introducing a macroscopic diffusivity DT in updated solar models. We find that a time dependent treatment of the tachocline significantly improves the agreement between computed and observed surface chemical species. such as the L-7i and modify the internal structure of the Sun (Brun, Turck-Chieze & Zahn, 1999, in Astrophys. J.).
Author

Shear Layers; Convection; Sun; Solar Diameter

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SPACE RADIATION

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

20000109849 NASA Marshall Space Flight Center, Huntsville, AL USA
Ten Years of Gamma-Ray Bursts Observations with BATSE
Fishman, Gerald J., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Gamma-Ray Bursts in the Afterglow Era Workshop, 17-20 Oct. 2000, Rome, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

The observed gamma-ray temporal, spectral, intensity and spatial distribution characteristics of GRBs from data obtained from BATSE/Compton Observatory, will be described. The talk will concentrate on recent studies of burst properties, correlations of GRB parameters and other statistical studies that have only recently come to light with the unprecedented sample of over 2700 GRBS. Recent studies of possible observational biases, un-triggered GRBs and threshold calculations for BATSE will also be described.
Author
Gamma Ray Bursts; Gamma Rays; Gamma Ray Astronomy

20000109852 NASA Marshall Space Flight Center, Huntsville, AL USA
Detection of X-ray Emission From Galaxies Inside The Bootes Void
Kim, Chulhee, Chonbuk National Univ., Korea, Republic of; Boller, Thomas, Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Ghosh, Kajal K., National Academy of Sciences - National Research Council, USA; Swartz, Douglas A., Universities Space Research Association, USA; Ramsey, Brian D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We report the x-ray properties of Bootes void galaxies detected by the ROSAT All-Sky Survey (RASS). by searching the fields of 26 radio and 27 emission-line-selected void galaxies, we have detected 9 x-ray emitting void galaxies at is greater than 2.7-sigma confidence level. Five of these 9 galaxies are in the IP,AS subsample. We expect 2 detections at the redshift of the Bootes void based on previous positional cross-correlation studies of the RASS and IRAS Point Source Catalogue sources. Three of the x-ray emitting galaxies are AGNs (IRAS~14288+5255, Mrk~845, and IRAS 15195+5050), and the remaining 6 are all likely emission line galaxies (PC~1357+4641, CG~547, CG~922, IRAS~14SOO+4804, CG~637, and IRAS~15092+3940). The far infrared flux levels of the AGN sources implies most of the observed x-ray emissivity is from starburst activity. We have carried out timing and spectral analysis for the narrow-line Seyfert 1 galaxy Mrk~845. Poor statistics prevents detailed analysis of the remaining sources. only two galaxies in our sample, BHI 1514+3819 and FSS 1515+3823, were observed during ROSAT pointed observations resulting in a nondetection at the 1-sigma level.
Author
Active Galactic Nuclei; Galaxies; Seyfert Galaxies; Starburst Galaxies; X Ray Astronomy

20000109944 NASA Marshall Space Flight Center, Huntsville, AL USA
New Data on Microfossils from Shungites
Hoover, Robert B., NASA Marshall Space Flight Center, USA; Rozanov, Alexei Yu., Academy of Sciences (USSR), USSR; [2000]; 1p; In English; Instruments Methods and Missions for Astrobiology III, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Shungites are pre-cambrian (2Gya) carbon-rich, silicate rocks known from deposits in the north-western part of lake Onega, near the city of Petrozavodsk in Karelia (North from St. Petersburg, Russia). Shungites are extremely rich in carbon, with carbon accounting for 98% in vein shungites. Shungites have been found to exhibit interesting optical, ultrasonic, thermal, mechanical, electrical properties and have recently been found to contain small amounts of C60 fullerene. Shungite rocks from Karelia have a characteristic globular structure and are chemically inert and metastable. As part of our ongoing search for biomarkers in ancient terrestrial rocks that are of potential significance to Astrobiology, we have conducted Environmental and Field Emission Scanning Electron Micrographs of freshly fractured interior surfaces of Shungites. We find them to contain indigenous miocrofossils, similar to cyanobacteria known from the phosphorites of Khubsugul, Mongolia. We describe this investigation and provide ESEM and FESEM images of biomorphic microstructures that we interpret as indigenous microfossils in Shungites.
Author
Precambrian Period; Geology; Silicates; Carbonaceous Rocks; Carbonates; Fossils

20000110578 Science Applications International Corp., San Diego, CA USA

Modeling Ultraviolet Emissions Near Io ***Final Report, 1 Jun. 1999 - 31 May 2000***

Linker, Jon A., Science Applications International Corp., USA; Oct. 17, 2000; 12p; In English; Original contains color illustrations

Contract(s)/Grant(s): NASW-99013

Report No.(s): SAIC-00/8030:APPAT-263; Rept-01-0157-04-0340-000; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this report, we describe work awarded to Science Applications International Corporation, for the period 6/l/99 to 5/31/00. During this time period, we have investigated the interaction of Io, Jupiter's innermost Galilean satellite, with the Io plasma torus, and the role this interaction plays in producing ultraviolet (UV) emissions from neutral oxygen and sulfur. Io, the innermost of Jupiter's Galilean satellites, plays a unique role in the jovian magnetosphere. Neutral material that escapes from Io is ionized to form the lo torus, a dense, heavy-ion plasma that corotates with Jupiter and interacts with Io. Io supplies not only the torus, but is a major source of plasma for the entire magnetosphere. Ionization and charge-exchange of neutrals near lo strongly influences the plasma interaction, and Io's neutral atmosphere plays an important role in the generation of currents that couple Io to Jupiter. There have been no in situ measurements of the neutral density near Io, but remote observations of neutrals near lo have been performed for many years. Recent observations from the Hubble Space Telescope (HST) have shown detailed structure in UV emissions from neutral species near Io. Electron-impact of the neutrals by the Io torus plasma is the primary mechanism responsible for exciting these emissions. Previously, we have modeled the Io plasma environment using three-dimensional magnetohydrodynamic (MHD) simulations, and we have shown that the interaction between Io and the plasma torus plays an important role in producing the morphology of the observed emissions. In the past year, we have extended these studies to use both UV observations and Galileo particle and field measurements to investigate the Io interaction.

Derived from text

Io; Magnetohydrodynamics; Ultraviolet Emission; Mathematical Models

20000111067 NASA Goddard Space Flight Center, Greenbelt, MD USA

Distorted Wave Calculations and Applications

Bhatia, A. K., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Physical properties such as temperature and electron density of solar plasma and other astrophysical objects can be inferred from EUV and X-ray emission lines observed from space. These lines are emitted when the higher states of an ion are excited by electron impact and then decay by photon emission. Excitation cross sections are required for the spectroscopic analyses of the observations and various approximations have been used to calculate the scattering functions. One of them which has been widely used is a distorted wave approximation. This approximation, along with its applications to solar observations, is discussed. The Bowen fluorescence mechanism and optical depth effects are also discussed. It is concluded that such calculations are reliable for highly charged ions and for high electron temperatures.

Author

Computation; Scattering Functions; Approximation; Electron Scattering; X Ray Astronomy

20000112956 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

The Influence of The Galilean Satellites on Radio Emissions From The Jovian System

Kurth, W. S., Iowa Univ., USA; Gurnett, D. A., Iowa Univ., USA; Menietti, J. D., Iowa Univ., USA; Radio Astronomy at Long Wavelenghts; [2000], pp. 213-225; In English; Original contains color illustrations

Contract(s)/Grant(s): JPL-959779

Report No.(s): Geophysical-Monograph-119; Copyright; Avail: Issuing Activity

The Galilean satellites influence radio emissions from the Jovian system in a variety of ways. The best and most familiar example of these is the Io control of decametric radiation discovered in 1964 by Bigg. Voyager observations of broadband kilometric radiation revealed a low-latitude shadow zone cast by the Io torus at frequencies between a few tens of kHz and about 1 MHz. Voyager also discovered narrowband kilometric radio emissions emanating from the outer edge of the torus. In this paper we will discuss expansions in the suite of satellite influences based on new observations by Galileo. These include the discovery of Ganymede's magnetosphere and evidence of radio emissions generated via mode conversion from upper hybrid waves in the frequency range of about 20 - 100 kHz. There is evidence that Ganymede may control some of the hectometric or low-frequency decametric radio emissions based on occultation measurements and statistical studies of radio emission occurrence as a function of Ganymede phase. Direction-finding measurements in the vicinity of Io suggest that a portion of the hectometric emissions may be generated near the lo L-shell. A rotationally modulated attenuation band in the hectometric emission appears to be the result of scattering

at or near the Io L-shell where the waves propagate nearly parallel to the magnetic field. There is even a tantalizing hint of a Europa connection to the source of narrowband kilometric radiation.
Author
Galilean Satellites; Galileo Spacecraft; Jupiter Satellites; Radio Emission; Ganymede; Io; Jupiter (Planet)

20000113673 NASA Marshall Space Flight Center, Huntsville, AL USA
Gamma-Ray Burst Class Properties
Hakkila, Jon, Charleston Coll., USA; Haglin, David J., Minnesota State Univ., USA; Pendleton, Geoffrey N., Alabama Univ., USA; Mallozzi, Robert S., Alabama Univ., USA; Meegan, Charles A., NASA Marshall Space Flight Center, USA; Roiger, Richard J., Minnesota State Univ., USA; Astrophysical Journal; Jul. 20, 2000; Volume 538, pp. 165-180; In English
Contract(s)/Grant(s): NRA-98-OSS-03; Copyright; Avail: Issuing Activity

Guided by the supervised pattern recognition algorithm C4.5 developed by Quinlan in 1986, we examine the three gamma-ray burst classes identified by Mukherjee et al. in 1998. C4.5 provides strong statistical support for this classification. However, with C4.5 and our knowledge of the Burst and Transient Source Experiment (BATSE) instrument, we demonstrate that class 3 (intermediate fluence, intermediate duration, soft) does not have to be a distinct source population: statistical/systematic errors in measuring burst attributes combined with the well-known hardness/intensity correlation can cause low peak flux class 1 (high fluence, long, intermediate hardness) bursts to take on class 3 characteristics naturally. Based on our hypothesis that the third class is not a distinct one, we provide rules so that future events can be placed in either class 1 or class 2 (low fluence, short, hard). We find that the two classes are relatively distinct on the basis of Band's work in 1993 on spectral parameters alpha, beta, and E (sub peak) alone. Although this does not indicate a better basis for classification, it does suggest that different physical conditions exist for class 1 and class 2 bursts. In the process of studying burst class characteristics, we identify a new bias affecting burst fluence and duration measurements. Using a simple model of how burst duration can be underestimated, we show how this fluence duration bias can affect BATSE measurements and demonstrate the type of effect it can have on the BATSE fluence versus peak flux diagram.
Author
Classifications; Gamma Ray Bursts; Cosmology

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GENERAL

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

20000110312 Lockheed Martin Aerospace, Denver, CO USA
The Myths and Magic of Mars: Science and Non-Science in the Golden Age of Exploration
Clark, Benton C., Lockheed Martin Aerospace, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The allure of Ares. The magic of Mars. of all the planets, it is the Red One that has captivated the minds of the public and scientists during this century. and as the century draws to a close, we have in place the most ambitious series of planetary exploration missions ever mounted by humanity, centering on this one object. Is it due to the persistent idea that other life in the uni-verse may be in our own solar system backyard? Is it because of accessibility and environment, Mars is the only one for which it seems practical or sensible to someday send human explorers. Does that recurring bright redness which makes it the ruby of the night sky reach into our subconscious like an old friend? Do the vivid two-page color spreads in books and magazines burn into our imaginations as the brilliance and sparkle of fire? Additional information is contained in the original extended abstract.
Author
Solar System; Planets; Mars Exploration

20000114829 NASA Ames Research Center, Moffett Field, CA USA
Research and Technology, *FY 1997*
September 1998; 192p; In English; Original contains color illustrations
Report No.(s): NASA/TM-1998-112240; A-9810764; NAS 1.15:112240; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report highlights the challenging work accomplished during fiscal year 1997 by Ames research scientists, engineers, and technologists, It discusses research and technologies that enable the Information Age, that expand the frontiers of knowledge for aeronautics and space, and that help to maintain U.S. leadership in aeronautics and space research and technology development. The accomplishments are grouped into four categories based on NASA's four Strategic Enterprises: Aeronautics and Space Transportation Technology, Space Science, Human Exploration and Development of Space, and Earth Science. The primary purpose of this report is to communicate knowledge--to inform our stakeholders, customers, and partners, and the people of the USA about the scope and diversity of Ames' mission, the nature of Ames' research and technology activities, and the stimulating challenges ahead. The accomplishments cited illustrate the contributions that Ames is making to improve the quality of life for our citizens and the economic position of the USA in the world marketplace.

Author

Earth Sciences; Engineers; Research and Development; Space Transportation; Technology Utilization; Mission Planning; Aeronautics

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