National Aeronautics and Space Administration
Langley Research Center

Scientific and Technical Information Program Office

# Scientific and Technical Aerospace Reports

# STAR

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# NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program plays a key part in helping NASA maintain this important role.

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- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

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# Introduction

*Scientific and Technical Aerospace Reports* (*STAR*) is an online information resource listing citations and abstracts of NASA and world wide aerospace-related STI. Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related Research & Development (R&D) results.

*STAR* subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

*STAR* includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

## The NASA STI Program

The NASA Scientific and Technical Information (STI) Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

Through the NASA Center for AeroSpace Information (CASI), the NASA STI Program acquires, processes, archives, announces and disseminates both NASA's internal STI and world-wide STI. The results of 20th and 21st century aeronautics and aerospace research and development, a worldwide investment totaling billions of dollars, have been captured, organized, and stored in the NASA Aeronautics and Space Database. New information is continually announced and made available as it is acquired, making this a dynamic and historical collection of value to business, industry, academia, federal institutions, and the general public.

The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

For more information on the most up to date NASA STI, visit the STI Program's website at http://www.sti.nasa.gov.

# NASA STI Availability Information

## NASA Center for AeroSpace Information (CASI)

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Each citation in *STAR* indicates a 'Source of Availability'. When CASI is indicated, the user can order this information directly from CASI using the STI Online Order Form or contact help@sti.nasa.gov or telephone the CASI Help Desk at 301-621-0390. Before ordering you may access price code tables for STI documents and videos. When information is not available from CASI, the source of the information is indicated when known.

NASA STI is also available to the public through Federal information organizations. NASA CASI disseminates publicly available NASA STI to the National Technical Information Service (NTIS) and to the Federal Depository Library Program (FDLP) through the Government Printing Office (GPO). In addition, NASA patents are available online from the U.S. Patent and Trademark Office.

## National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at http://www.ntis.gov.

## The Federal Depository Library Program (FDLP)

The U.S. Congress established the **Federal Depository Library Program** (FDLP) to ensure access by the American public to U.S. Government information. The program acquires and disseminates information products from all three branches of the U.S. Government to nearly 1,300 Federal depository libraries nationwide. The libraries maintain these information products as part of their existing collections and are responsible for assuring that the public has free access to the information. Locate the Federal Depository Libraries http://www.access.gpo.gov/su_docs.

## The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at http://www.uspto.gov/patft/.

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**Subject Term Index**
**Personal Author Index**

# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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

VOLUME 43, JUNE 17, 2005

## 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 Thermodynamics*.

**20050175872** NASA Lewis Research Center, Cleveland, OH, USA

**Transient Wave Rotor Performance Investigated**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center is investigating the wave rotor for use as a core gas generator in future gas turbine engines. The device, which uses gas-dynamic waves to transfer energy directly to and from the working fluid through which the waves travel, consists of a series of constant-area passages that rotate about an axis. Through rotation, the ends of the passages are periodically exposed to various circumferentially arranged ports that initiate the traveling waves within the passages.

Derived from text

*Gas Turbine Engines; Traveling Waves; Wave Rotors; Aircraft Engines*

**20050175875** NASA Glenn Research Center, Cleveland, OH, USA

**Fan Noise Source Diagnostic Test: Rotor Alone Aerodynamic Performance Results**

Hughes, Christopher E.; Jeracki, Robert J.; Woodward, Richard P.; Miller, Christopher J.; April 2005; 30 pp.; In English; Eighth Aeroacoustics Conference, 17-19 Jun. 2002, Breckenridge, CO, USA

Contract(s)/Grant(s): NAS3-26617; NAS3-98004; WBS 22-781-30-74

Report No.(s): NASA/TM-2005-211681; AIAA Paper 2002-2426; E-13384; No Copyright; Avail: CASI; A03, Hardcopy

The aerodynamic performance of an isolated fan or rotor alone model was measured in the NASA Glenn Research Center 9- by 15- Foot Low Speed Wind Tunnel as part of the Fan Broadband Source Diagnostic Test conducted at NASA Glenn. The Source Diagnostic Test was conducted to identify the noise sources within a wind tunnel scale model of a turbofan engine and quantify their contribution to the overall system noise level. The fan was part of a 1/5th scale model representation of the bypass stage of a current technology turbofan engine. For the rotor alone testing, the fan and nacelle, including the inlet, external cowl, and fixed area fan exit nozzle, were modeled in the test hardware; the internal outlet guide vanes located behind the fan were removed. Without the outlet guide vanes, the velocity at the nozzle exit changes significantly, thereby affecting the fan performance. As part of the investigation, variations in the fan nozzle area were tested in order to match as closely as possible the rotor alone performance with the fan performance obtained with the outlet guide vanes installed. The fan operating performance was determined using fixed pressure/temperature combination rakes and the corrected weight flow. The performance results indicate that a suitable nozzle exit was achieved to be able to closely match the rotor alone and fan/outlet guide vane configuration performance on the sea level operating line. A small shift in the slope of the sea level operating line was measured, which resulted in a slightly higher rotor alone fan pressure ratio at take-off conditions, matched fan performance at cutback conditions, and a slightly lower rotor alone fan pressure ratio at approach conditions. However, the small differences in fan performance at all fan conditions were considered too small to affect the fan acoustic performance. Author

*Aerodynamic Characteristics; Aerodynamic Noise; Rotors; Turbofan Engines; Wind Tunnel Tests; Turbofans*

**20050176064** NASA Lewis Research Center, Cleveland, OH, USA

**New Method Developed for Aeroelastic Stability Analysis**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The development of advanced-design ultrahigh bypass ratio engines has led to renewed interest in the study of the flutter of bladed disks. Previously, two fundamental approaches were used in flutter calculations: frequency domain analysis and time-domain analysis. With the development of time-marching computational fluid dynamics (CFD) flow solvers, both approaches have been used with equal ease. In the present work at the NASA Lewis Research Center, substantial computational savings have been achieved by applying a numerical eigensolver to a nonlinear, time-marching fluid-structure interaction system solver for flutter prediction.
Author
*Aeroelasticity; Flutter Analysis*

**20050176391** NASA Lewis Research Center, Cleveland, OH, USA, NASA Lewis Research Center, Cleveland, OH, USA, McDonnell-Douglas Corp., USA
**Prediction Capability for Transonic Nozzle Afterbodies Improved**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Under the High Speed Research (HSR) Program, the NASA Lewis Research Center, the NASA Langley Research Center, and the aerospace industry have been developing exhaust nozzle concepts for a future High Speed Civil Transport (HSCT). For such an aircraft to be both economically viable and environmentally acceptable, the exhaust nozzles must combine highly efficient operation throughout the flight envelope with low noise levels at takeoff. A team composed of researchers from Lewis, Langley, and McDonnell Douglas created a two-dimensional data base using computational fluid dynamics. First, each group validated their computational fluid dynamics code against existing experimental data to gain confidence in the code's results. Next, the organizations analyzed several configurations, and the results were used to create the new data base. Then, the analysis methods were updated to account for the effects of two-dimensional nozzles. This will result in a more accurate analysis of the propulsion system for the High Speed Civil Transport.
Derived from text
*Afterbodies; Computational Fluid Dynamics; Data Bases; Exhaust Nozzles; Transonic Nozzles*

**20050177090** National Transportation Safety Board, Washington, DC
**Annual Review of Aviation Accident Data: U.S. General Aviation, Calendar Year 2000**
Jun. 17, 2004; 66 pp.; In English
Report No.(s): PB2004-105928; NTSB/ARG-04/01; NOTATION-7534B; No Copyright; Avail: CASI; A04, Hardcopy

The National Transportation Safety Board's 2000 Annual Review of Aircraft Accident Data for U.S. General Aviation is a statistical compilation and review of general aviation accidents that occurred in 2000 involving U.S.-registered aircraft. As a summary of all U.S. general aviation accidents for 2000, the review is designed to inform general aviation pilots and their passengers and to provide detailed information to support future government, industry, and private research efforts and safety improvement initiatives. The Safety Board drew on several resources in compiling data for this review. Accident data, for example, were extracted from the Safety Board's Aviation Accident/Incident Database. Activity data were extracted from the General Aviation and Air Taxi Activity Survey (GAATA Survey) and from U.S. Civil Airmen Statistics, both of which are published by the Federal Aviation Administration (FAA), Statistics and Forecast Branch, Planning and Analysis Division, Office of Aviation Policy and Plans. Additional information was extracted from the General Aviation Statistical Databook, published by the General Aviation Manufacturers Association (GAMA). A total of 1,837 accidents occurred during calendar year 2000, involving 1,861 aircraft. The total number of general aviation accidents in 2000 was higher than in 1999, with a 4% increase of 69 accidents. Of the total number of accidents, 345 were fatal, resulting in a total of 596 fatalities. The number of fatal general aviation accidents in 2000 increased 1.5% over calendar year 1999, but the total number of fatalities that resulted decreased by 4%. The circumstances of these accidents and details related to the aircraft, pilots, and locations are presented throughout this review.
NTIS
*General Aviation Aircraft; Aircraft Accidents; Data Bases*

**20050177128** NASA Langley Research Center, Hampton, VA USA
**Free-to-Roll Investigation of the Pre-Production F/A-18E Powered Approach Wing Drop**
Owens, D. Bruce; Bryant, Elaine M.; Barlow, Jewel B.; April 11, 2005; 9 pp.; In English
Report No.(s): AD-A432636; AFIT-CI04-1033; No Copyright; Avail: CASI; A02, Hardcopy

A free-to-roll study of the low-speed lateral characteristics of the pre-production F/A-18E was conducted in the NASA Langley 12-Foot Low-Speed Tunnel. In developmental flight tests the F/A-18E unexpectedly experienced uncommanded

lateral motions in the power approach configuration. The objective of this study was to determine the feasibility of using the free-to-roll technique for the detection of uncommanded lateral motions for the pre-production F/A-18E in the power approach configuration. The data revealed that this technique in conjunction with static data revealed insight into the cause of the lateral motions. The free-to-roll technique identified uncommanded lateral motions at the same angle-of-attack range as experienced in flight tests. The cause of the uncommanded lateral motions was unsteady asymmetric wing stall. The paper also shows that free-to-roll data or static force and moment data alone are not enough to accurately capture the potential for an aircraft to experience uncommanded lateral motion.
DTIC
*Angle of Attack; Fighter Aircraft; Flight Tests; Roll; Wings; Wind Tunnel Tests; Stalling*

**20050177166** NASA Lewis Research Center, Cleveland, OH, USA
**Scale Model Icing Research Tunnel**
Canacci, Victor A.; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

NASA Lewis Research Center's Icing Research Tunnel (IRT) is the world's largest refrigerated wind tunnel and one of only three icing wind tunnel facilities in the USA. The IRT was constructed in the 1940's and has been operated continually since it was built. In this facility, natural icing conditions are duplicated to test the effects of inflight icing on actual aircraft components as well as on models of airplanes and helicopters. IRT tests have been used successfully to reduce flight test hours for the certification of ice-detection instrumentation and ice protection systems. To ensure that the IRT will remain the world's premier icing facility well into the next century, Lewis is making some renovations and is planning others. These improvements include modernizing the control room, replacing the fan blades with new ones to increase the test section maximum velocity to 430 mph, installing new spray bars to increase the size and uniformity of the artificial icing cloud, and replacing the facility heat exchanger. Most of the improvements will have a first-order effect on the IRT's airflow quality. To help us understand these effects and evaluate potential improvements to the flow characteristics of the IRT, we built a modular 1/10th-scale aerodynamic model of the facility. This closed-loop scale-model pilot tunnel was fabricated onsite in the various shops of Lewis' Fabrication Support Division. The tunnel's rectangular sections are composed of acrylic walls supported by an aluminum angle framework. Its turning vanes are made of tubing machined to the contour of the IRT turning vanes. The fan leg of the tunnel, which transitions from rectangular to circular and back to rectangular cross sections, is fabricated of fiberglass sections. The contraction section of the tunnel is constructed from sheet aluminum. A 12-bladed aluminum fan is coupled to a turbine powered by high-pressure air capable of driving the maximum test section velocity to 550 ft/sec (Mach 0.45). The air turbine and instrumentation are housed inside a fiberglass nacelle. Total and static pressure measurements can be taken around the loop, and velocity and flow angularity measurements can be taken with hot-wire and five-hole probes at specific locations. The Scale Model Icing Research Tunnel (SMIRT) is undergoing checkout tests to determine how its airflow characteristics compare with the IRT. Near-term uses for this scale-model tunnel include determining the aerodynamic effects of replacing the 52-yearold W-shaped heat exchanger with a flat-faced heat exchanger. SMIRT is an integral part of the improvements planned for the IRT because testing the proposed IRT improvements in a scale-model tunnel will lower costs and improve productivity.
Derived from text
*Ice Formation; Scale Models; Wind Tunnel Tests; Fabrication*

## 03
## AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport 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*.

**20050173881** Air Command and Staff Coll., Maxwell AFB, AL USA
**CADRE Quick-Look: Sky Cops**
Meyer, Mike; Conway, John L.; Wathen, Alexander M.; Feb. 2005; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432511; No Copyright; Avail: Defense Technical Information Center (DTIC)

Problem: 1. What role does the USAF have in Phase IV? 2. After the success of Air Power during recent wars, will the Air Force have a hard time justifying, maintaining, and/or increasing it's current major force programing levels? 3. What can

the Air Force do to help bring the current Iraqi situation to a positive resolution sooner rather than later? 4. Can the Air Force better assist in border patrol and countering the flow of terrorists from one country to another and also aid in the war on drugs? Discussion. We used to call the proud Airmen guarding our flight lines and their precious air assets, our bases and the front doors to the Air Force 'Sky Cops.' It is time for the Air Force to start developing a new 'Sky Cops' capability. We have all heard the saying that goes something like, 'When the Spectre flies, all the bad guys stay home, or go home in a box.' The gun ship (AC-130, nicknamed 'Spectre') provides the ultimate night surveillance platform with the added capability of massive and pinpoint kinetic weapons fire. Now think back to all the cop shows you use to watch. Remember two cops sitting in an unmarked car staking out the bad guys and eating doughnuts? In effect, that is what the Spectre can do, and when the bad guys know they are in the sky, they tend to stay home. Part of the problem in Fallujah and other trouble spots in Iraq is the bad guys can operate with virtual impunity, unless the Spectre is in their area. There simply are not enough Spectres to cover all the hot spots in Iraq. The Air Force must take the capability of the gunship, flatten it out to provide greater coverage, and add monitoring and recording capability. Communications gear capable of working with the entire spectrum of operators on the ground and various command and control entities is a must. The goal should be a smaller, less expensive airframe(s) and more of them.
DTIC
*Warfare; Ships*

**20050173886** Air Univ., Maxwell AFB, AL USA
**CADRE Quick-Look: Tapping the Operational Art Portfolio**
Feb. 2005; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432515; No Copyright; Avail: Defense Technical Information Center (DTIC)

In today's environment of contingency operations and AEFs where training and continuity are some of the first operational casualties, the Air Force is not adequately using one of its strongest resources: the experience, operational expertise and corporate memory operational art, if you will of its military, GS and contractor professionals. Over the past 14 years the USAF has devoted much time and energy into refining its planning procedures. We've written and refined our basic service doctrine, made strong inputs into joint doctrine for air and space power use, developed PCE courses to educate our airmen and we've shared this knowledge with our allies and coalition partners. Joint Publication (JP) 3-30 Command and Control For Joint Air Operation, does an excellent job of identifying staff and functional requirements for planning, and executing the air and space portion joint force commander's (JFC) campaign. It even identifies some of the skill sets desired for personnel serving on the joint air and space commander's (JFACC) staff. How the JFACC gets people with the knowledge required on his staff is not addressed. Today's operational environment demonstrates US military forces routinely face adversaries who understand US doctrine and actively use asymmetric methods to combat us. By allowing untapped operational art expertise to languish, our planning is not as effective or as efficient as it should be. This leads to operations that may cost more in terms of treasure, time opportunities and even lives.
DTIC
*Warfare; Functional Design Specifications; Command and Control*

**20050173887** Army War Coll., Carlisle Barracks, PA USA
**The Transatlantic Defense Industrial Base: Restructuring Scenarios and Their Implications**
Guay, Terrence R.; Apr. 2005; 40 pp.; In English
Report No.(s): AD-A432542; No Copyright; Avail: Defense Technical Information Center (DTIC)

This monograph compares the post-Cold War restructuring of the defense industries in the USA and Europe with the aim of understanding the implications for the transatlantic industrial base. We argue that different processes of industrial restructuring and consolidation present obstacles to transatlantic initiatives, and that government policies and conflicting political visions exacerbate the opportunities for collaboration between the USA and Europe. We assess the extent to which the restructuring of the U.S. and European defense industrial bases has uprooted national champions and, assisted by global competition, provided an industrial foundation for more extensive transatlantic cooperation. We conclude by suggesting factors that will shape further restructuring and consolidation in the short- and medium term and making recommendations for assisting the development of a transatlantic, rather than bipolar, defense industrial base.
DTIC
*International Relations; Defense Program*

**20050175843** NASA Glenn Research Center, Cleveland, OH, USA

**The NASA Icing Remote Sensing System**

Reehorst, Andrew L.; Brinker, David J.; Ratvasky, Thomas P.; Ryerson, Charles C.; Koenig, George G.; April 2005; 18 pp.; In English; 11th Conference on Aviation, Range, and Aerospace Meteorology, 4-8 Oct. 2004, Hyannis, MA, USA

Contract(s)/Grant(s): WBS 22-728-41-05

Report No.(s): NASA/TM-2005-213591; Paper -80776; E-15059; No Copyright; Avail: CASI; A03, Hardcopy

NASA and the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) have an on-going activity to develop remote sensing technologies for the detection and measurement of icing conditions aloft. A multiple instrument approach is the current emphasis of this activity. Utilizing radar, radiometry, and lidar, a region of supercooled liquid is identified. If the liquid water content (LWC) is sufficiently high, then the region of supercooled liquid cloud is flagged as being an aviation hazard. The instruments utilized for the current effort are an X-band vertical staring radar, a radiometer that measures twelve frequencies between 22 and 59 GHz, and a lidar ceilometer. The radar data determine cloud boundaries, the radiometer determines the sub-freezing temperature heights and total liquid water content, and the ceilometer refines the lower cloud boundary. Data are post-processed with a LabVIEW program with a resultant supercooled LWC profile and aircraft hazard identification. Remotely sensed measurements gathered during the 2003-2004 Alliance Icing Research Study (AIRS II) were compared to aircraft in-situ measurements. Although the comparison data set is quite small, the cases examined indicate that the remote sensing technique appears to be an acceptable approach.

Author

*Low Temperature Environments; Remote Sensing; Aircraft Icing; Aviation Meteorology; Multisensor Fusion*

**20050175844** NASA Glenn Research Center, Cleveland, OH, USA

**NASA Icing Remote Sensing System Comparisons From AIRS II**

Reehorst, Andrew L.; Brinker, David J.; Ratvasky, Thomas P.; April 2005; 17 pp.; In English; 43rd Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Contract(s)/Grant(s): WBS 22-728-41-05

Report No.(s): NASA/TM-2005-213592; AIAA Paper 2005-0253; E-15060; No Copyright; Avail: CASI; A03, Hardcopy

NASA has an on-going activity to develop remote sensing technologies for the detection and measurement of icing conditions aloft. A multiple instrument approach is the current emphasis of this activity. Utilizing radar, radiometry, and lidar, a region of supercooled liquid is identified. If the liquid water content (LWC) is sufficiently high, then the region of supercooled liquid cloud is flagged as being an aviation hazard. The instruments utilized for the current effort are an X-band vertical staring radar, a radiometer that measures twelve frequencies between 22 and 59 GHz, and a lidar ceilometer. The radar data determine cloud boundaries, the radiometer determines the sub-freezing temperature heights and total liquid water content, and the ceilometer refines the lower cloud boundary. Data is post-processed with a LabVIEW program with a resultant supercooled LWC profile and aircraft hazard identification. Individual remotely sensed measurements gathered during the 2003-2004 Alliance Icing Research Study (AIRS II) were compared to aircraft in-situ measurements. Comparisons between the remote sensing system s fused icing product and in-situ measurements from the research aircraft are reviewed here. While there are areas where improvement can be made, the cases examined indicate that the fused sensor remote sensing technique appears to be a valid approach.

Author

*Remote Sensing; Aircraft Icing; Aviation Meteorology; Multisensor Fusion*

**20050176488** Federal Aviation Administration, Washington, DC

**Federal Aviation Administration Fiscal Year 2005 Business Plan: Human Resources**

2005; 24 pp.; In English

Report No.(s): PB2005-106626; No Copyright; Avail: CASI; A03, Hardcopy

People are the foundation for FAA's mission accomplishment. The Office of Human Resource Management (AHR) advises on and supports the management of FAA's people. FAA's corporate vision and goals aim for true organizational excellence as we continue our global aviation leadership role far into the 21st century. The FAA's strategic plan, called the Flight Plan, stresses that success will ultimately depend on the capabilities, effectiveness and efficiency of the men and women - the human capital - of the FAA, to bring the Flight Plan to life.

NTIS

*Commerce; Human Resources; Civil Aviation*

**20050176490** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Office of the Chief Counsel**
2005; 22 pp.; In English
Report No.(s): PB2005-106624; No Copyright; Avail: CASI; A03, Hardcopy

The Federal Aviation Administration (FAA) is responsible for providing a safe and efficient aviation system that meets the needs of a wide range of customers and stakeholders. Within the FAA, the Office of the Chief Counsel (AGC) has primary responsibility for furnishing legal services to the FAA Administrator and all Agency organizations worldwide. The principal areas of AGC's legal practice include: legislation, international affairs, enforcement, regulations, procurement, airports and environmental law, personnel and labor law, litigation, and general law applicable to the executive branch (such as Freedom of Information Act (FOIA) and Privacy Act compliance).

NTIS
*Commerce; Civil Aviation*

**20050176491** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Government and Industry Affairs**
2005; 10 pp.; In English
Report No.(s): PB2005-106625; No Copyright; Avail: CASI; A02, Hardcopy

The first impression, and indeed, in some cases, the only contact Members of Congress and their staff have with the Federal Aviation Administration is with the Office of Government and Industry Affairs. This customer-oriented office, small by comparison to most every other organization in the FAA, works directly for the Administrator, and is the principal linkage between the agency and the legislative branch of government. AGI works with other staff organizations to coordinate and present the FAA's legislative message. It is AGI that must work with other organizations within the FAA to facilitate their relations with Congress. And it is AGI that must consistently monitor and gage the interest and needs of the members and leadership on Capitol Hill.

NTIS
*Commerce; Government/Industry Relations; Civil Aviation*

**20050177050** National Inst. for Occupational Safety and Health, Washington, DC, USA
**NIOSH Health Hazard Evaluation Report: HETA No. 2005-0091-2957, Health Hazard Evaluation Summary Report: Air Contaminant and Noise Exposures among Transportation Security Administration (TSA) Baggage Screeners at Four International Airports, April**
Apr. 2005; 36 pp.; In English
Report No.(s): PB2005-106275; HETA-2005-0091-2957; No Copyright; Avail: CASI; A03, Hardcopy

During 2004, NIOSH conducted health hazard evaluations of baggage screening areas at four airports (Palm Beach (PBI), Miami (MIA), Dulles (IAD), and Baltimore (BWI) International Airports) at the request of the Transportation Security Administration (TSA). Employees were concerned about exposure to diesel exhaust, carbon monoxide, and noise. We measured levels of air contaminants and noise in the passenger checked baggage screening areas. The NIOSH investigators determined that a hazard does not exist from exposure to EC, CO, CO2, NO2, NO, or VOCs. Some tug emissions were elevated when compared to ambient levels and could contribute to an increase in air contaminants in some baggage areas. There was little evidence of a serious noise problem. However, additional noise analyses may be useful in characterizing worker exposure in areas where the NIOSH REL was exceeded. Also, changes in the maintenance of baggage handling equipment (conveyors) and repairing cracks in the concrete floors are needed to reduce unnecessary noise. Additionally, the interim use of hearing protection devices is recommended for workers whose noise doses exceed the NIOSH REL. Other recommendations for maintaining the air quality and further reducing noise exposures are provided in the Recommendations Section of this report.

NTIS
*Airports; Contaminants; Noise Measurement*

**20050177054** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Financial Services**
2005; 14 pp.; In English
Report No.(s): PB2005-106620; No Copyright; Avail: CASI; A03, Hardcopy

The Office of the Assistant Administrator for Financial Services/CFO (ABA) co-leads (with the Assistant Administrator

for Human Resource Management) and contributes directly to the Organizational Excellence goal. We indirectly support the Safety, Capacity, and International goals. The highest priorities for the Office include improving the business processes and resolving issues relative to the new Department of Transportation (DOT) financial management system (DELPHI); continuing to obtain a 'clean audit' with a focus on managing agency assets; completing the implementation of the Cost Accounting System; and implementing a cost control program in support of the Flight Plan.
NTIS
*Financial Management; Flight Plans; Resources Management*

**20050177055** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Civil Rights**
2005; 12 pp.; In English
Report No.(s): PB2005-106622; No Copyright; Avail: CASI; A03, Hardcopy

The Office of Civil Rights supports the Greater Capacity Goal area by managing the Disadvantage Business Enterprise Program and investigating equal access complaints for the Airport Improvement Grant Program that is under the administration of the Office of Airport Planning and Programming.
NTIS
*Airport Planning; Commerce; Airports*

**20050177057** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Aviation Policy, Planning and Environment**
2005; 26 pp.; In English
Report No.(s): PB2005-106623; No Copyright; Avail: CASI; A03, Hardcopy

The Office of Aviation Policy, Planning and Environment (AEP) provides critical support to the Administrator and FAA organizations in two major program areas: (1) planning and policy development and; (2) environment and energy programs. AEP accomplishes its goals by being the agency's focal point for strategic plan development and coordination; by identifying policy issues, and by developing, recommending and coordinating national aviation policy related to FAA authority; national airport and airway system development, operation, and finance; and environmental and energy matters.
NTIS
*Project Planning; Organizations; Systems Engineering*

**20050177059** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Information Services**
2005; 16 pp.; In English
Report No.(s): PB2005-106627; No Copyright; Avail: CASI; A03, Hardcopy

The Federal Aviation Administration (FAA) is responsible for providing a safe and efficient national aviation system. Within the FAA, the Assistant Administrator for Information Services and Chief Information Officer (AIO) has the primary responsibility to formulate agency information technology (IT) policy and strategy, to protect agency IT assets from cyber-attacks, to ensure alignment between IT investment and agency business needs, and to improve agency IT processes.
NTIS
*National Aviation System; Policies; Information Systems*

**20050177060** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Public Affairs**
2005; 18 pp.; In English
Report No.(s): PB2005-106629; No Copyright; Avail: CASI; A03, Hardcopy

FAA Public Affairs works with the news media to provide the public with accurate, timely, useful and important information about the agency's goals, policies, activities and operations. As part of that mission, Public Affairs actively promotes FAA activities that deal with Safety, Capacity, International Leadership and Organizational Excellence.
NTIS
*Information Dissemination; News Media; Policies*

**20050177064** National Ocean Service, Rockville, MD, USA
**GPS-Assisted Phototriangulation Package (GAPP) User's Guide, Version 1.02**
Lucas, J. R.; Nov. 1989; 38 pp.; In English
Report No.(s): PB2005-106732; NOAA/TM/NOS/CGS-2; No Copyright; Avail: CASI; A03, Hardcopy

The GPS-Assisted Phototriangulation Package (GAPP) provides a means for incorporating kinematic Global Positioning System (GPS) observations of the aircraft position into an aerotriangulation adjustment. A floppy disk containing the program and a set of sample data files are provided with the user's guide which provides a description of both program and files. It also provides some guidance in the preparation of data files for a project and prepares the user to respond to decision requests made by the program during execution.
NTIS
*Aircraft; Photogrammetry; User Manuals (Computer Programs)*

**20050177066** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Flight Plan 2005-2009**
2005; 48 pp.; In English
Report No.(s): PB2005-106649; No Copyright; Avail: CASI; A03, Hardcopy

The Flight Plan is a multi-year strategic effort, setting a course for the FAA through 2009. The mission is to provide the safest and most efficient air transportation system in the world. The past year has been one of success in each of the four goal areas of the Flight Plan: Safety, Capacity, Leadership, and Excellence.
NTIS
*Flight Plans; Air Transportation*

**20050177067** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Regulation and Certification**
2005; 34 pp.; In English
Report No.(s): PB2005-106638; No Copyright; Avail: CASI; A03, Hardcopy

The Associate Administrator for Regulation and Certification and the staff have a singular mission: to promote aviation safety in the interest of the American public and the millions of people who rely on the aviation industry for business, pleasure, and commerce. To fulfill this mission, Regulation and Certification (AVR) directs and manages safety programs: o Operational Safety: AVR's most important function is to ensure that existing certificate holders continue to meet the safety requirements, standards, and regulations of their original certification. o Standards and Policy: AVR creates and amends as necessary the rules and regulations that provide the safety standards for people, organizations, and equipment operating in the U.S. civil aviation system. o Certification: AVR issues initial and renews existing certificates that allow (1) people, organizations, and equipment to operate in the U.S. civil aviation system, (2) manufacturers to build aircraft and avionics, and (3) organizations to provide maintenance services.
NTIS
*Aircraft Safety; Certification; Regulations*

**20050177068** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Air Traffic Organization**
2005; 68 pp.; In English
Report No.(s): PB2005-106637; No Copyright; Avail: CASI; A04, Hardcopy

The Air Traffic Organization's strategic activities presented in this Business Plan contribute to over half of the FAA's Flight Plan strategic initiatives. They are distributed across all four Flight Plan goal areas: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence. The majority of ATO's strategic initiatives focus on Safety and Capacity; however, the organization continues to be a major player in the International and Organizational Excellence arenas as well. ATO provides International Leadership by working globally to improve aviation safety and efficiency. Its focus on human capital management and cost reduction activities reflect ATO's commitment to Organization Excellence.
NTIS
*Aircraft Safety; Leadership; Organizations; Commerce; Air Traffic*

**20050177071** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Security and Hazardous Materials**
2005; 32 pp.; In English
Report No.(s): PB2005-106634; No Copyright; Avail: CASI; A03, Hardcopy

The Office of Security and Hazardous Materials (ASH) is the FAA's line of business that has primary responsibility for critical infrastructure protection, emergency operations, contingency planning, and the safe transportation of hazardous materials in air commerce. ASH has four major program areas and staff offices that assist in carrying out this function. The Office of Security and Hazardous Materials Strategic Plan and Business Plan are directly linked to the FAA Flight Plan. ASH has responsibility for a major safety program within the FAA and important roles in critical infrastructure protection and emergency operations. These areas are vital to FAA's successful accomplishment of its mission.
NTIS
*Hazardous Materials; Commerce; Emergencies*

**20050177072** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Airports**
2005; 28 pp.; In English
Report No.(s): PB2005-106633; No Copyright; Avail: CASI; A03, Hardcopy
ARP establishes regulations for safe operation of commercial service airports and regularly inspects certificated airports for compliance. In FY 2005, we are emphasizing efforts to continue the reductions in runway incursions caused by vehicle/pedestrian deviations. This will require focusing on driver training, as well as implementation of approved Runway Safety Action Team recommendations. We also have a special emphasis program to accelerate improvements to runway safety areas that don't meet current standards. In addition, ARP supports research in airport technology to develop improvements in airport marking and lighting, airport rescue and fire fighting, airport planning and design, and mitigation of wildlife hazards near airports. Further, the Airport Improvement Program (AIP) provides priority consideration for funding safety-related development for airports that benefit both commercial service and general aviation operations.
NTIS
*Airports; Runways; Civil Aviation*

**20050177073** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Regions and Center Operations**
2005; 32 pp.; In English
Report No.(s): PB2005-106632; No Copyright; Avail: CASI; A03, Hardcopy
The Assistant Administrator for Regions and Center Operations (ARC) plays a pivotal role in meeting the FAA mission by providing cross-organizational leadership at all levels of the organization to ensure that operational programs supported by multiple lines of business are delivered on time and in the most efficient and effective manner possible. ARC has an equally vital role as a provider of high quality, corporately shared services including financial systems and operations; emergency readiness through command, control, and communications; enterprise-wide information services and business application development; technical and management training; and logistics services such as acquisition, real estate, materiel management, and National Aviation System supply and support.
NTIS
*Leadership; Information Systems; Project Management; National Aviation System*

**20050177079** Federal Aviation Administration, Washington, DC, USA
**Year One, Taking Flight: Air Traffic Organization Annual Performance Report 2004**
2004; 58 pp.; In English
Report No.(s): PB2005-106631; No Copyright; Avail: CASI; A04, Hardcopy
The FAA's Air Traffic Organization oversees the largest, busiest and most complex aviation system in the world. As part of its mission, the ATO operates and maintains our nation's air traffic system, orchestrating the take-off, landing and routing of about 50,000 aircraft a day across U.S.-controlled airspace. The core business is managing, operating and developing air navigation systems and services safely, efficiently and cost-effectively. The ATO, an operational arm of the FAA, serves commercial, general and military aviation.
NTIS
*Air Traffic Control; Airline Operations; Air Navigation; Commerce*

**20050177082** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: International**
2005; 32 pp.; In English
Report No.(s): PB2005-106630; No Copyright; Avail: CASI; A03, Hardcopy

The Federal Aviation Administration (FAA) International Business Plan for FY 2005 represents the collaborative efforts of the management and staff of FAA line and international organizations in support of the agency's FY 2005 Flight Plan International Leadership Goal. The FY 2005 Business Plan embraces six Flight Plan Performance Targets and 19 Strategic Initiatives as well as five Core Business Measures and five Functions in support of two key Flight Plan international objectives: improving safety and system capacity. Based on our FY 2004 Business Plan experience and results, the six Flight Plan Performance Targets and associated Strategic Initiatives for FY 2005 represent clearly defined agency activities to support the International Leadership Goal.
NTIS
*Flight Plans; Organizations; Commerce*

## 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*.

**20050175856** NASA Glenn Research Center, Cleveland, OH, USA
**Oceanic Situational Awareness Over the Pacific Corridor**
Welch, Bryan; Greenfeld, Israel; April 2005; 46 pp.; In English
Contract(s)/Grant(s): WBS 22-184-10-07
Report No.(s): NASA/TM-2005-213623; E-14370; No Copyright; Avail: CASI; A03, Hardcopy

Air traffic control (ATC) mandated, aircraft separations over the oceans impose a limitation on traffic capacity for a given corridor, given the projected traffic growth over the Pacific Ocean. The separations result from a lack of acceptable situational awareness over oceans where radar position updates are not available. This study considers the use of Automatic Dependent Surveillance (ADS) data transmitted over a commercial satellite communications system as an approach to provide ATC with the needed situational awareness and thusly allow for reduced aircraft separations. This study uses Federal Aviation Administration data from a single day for the Pacific Corridor to analyze traffic loading to be used as a benchmark against which to compare several approaches for coordinating data transmissions from the aircraft to the satellites.
Author
*Pacific Ocean; Satellite Communication; Situational Awareness; Flight Management Systems; Pilot Support Systems; Air Navigation*

**20050175888** NASA Glenn Research Center, Cleveland, OH, USA
**Oceanic Situational Awareness Over the Gulf of Mexico**
Welch, Bryan; Greenfeld, Israel; May 2005; 32 pp.; In English
Contract(s)/Grant(s): WBS 22-184-10-07
Report No.(s): NASA/TM-2005-213631; E-15114; No Copyright; Avail: CASI; A03, Hardcopy

Air traffic control (ATC) mandated, aircraft separations over the oceans impose a limitation on traffic capacity for a given corridor, given the projected traffic growth over the Gulf of Mexico. The separations result from a lack of acceptable situational awareness over oceans where radar position updates are not available. This study considers the use of Automatic Dependent Surveillance (ADS) data transmitted over a commercial satellite communications system as an approach to provide ATC with the needed situational awareness and thusly allow for reduced aircraft separations. This study uses Federal Aviation Administration data from a single day for the Gulf of Mexico to analyze traffic loading to be used as a benchmark against which to compare several approaches for coordinating data transmissions from the aircraft to the satellites.
Author
*Air Traffic Control; Gulf of Mexico; Satellite Communication; Situational Awareness; Flight Paths; Flight Management Systems; Pilot Support Systems*

**20050176045** NASA Glenn Research Center, Cleveland, OH, USA
**Oceanic Situational Awareness Over the Western Atlantic Track Routing System**
Welch, Bryan; Greenfeld, Israel; May 2005; 32 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-184-10-07
Report No.(s): NASA/TM-2005-213630; E-15113; No Copyright; Avail: CASI; A03, Hardcopy

Air traffic control (ATC) mandated, aircraft separations over the oceans impose a limitation on traffic capacity for a given corridor, given the projected traffic growth over the Western Atlantic Track Routing System (WATRS). The separations result from a lack of acceptable situational awareness over oceans where radar position updates are not available. This study considers the use of Automatic Dependent Surveillance (ADS) data transmitted over a commercial satellite communications system as an approach to provide ATC with the needed situational awareness and thusly allow for reduced aircraft separations. This study uses Federal Aviation Administration data from a single day for the WATRS corridor to analyze traffic loading to be used as a benchmark against which to compare several approaches for coordinating data transmissions from the aircraft to the satellites.

Author

*Air Traffic Control; Satellite Communication; Situational Awareness; Pilot Support Systems; Aircraft Communication; Flight Paths; Atlantic Ocean*

**20050176384** NASA Langley Research Center, Hampton, VA, USA

**Flight Experiment Investigation of General Aviation Self-Separation and Sequencing Tasks**

Murdoch, Jennifer L.; Ramiscal, Ermin R.; McNabb, Jennifer L.; Bussink, Frank J. L.; May 2005; 72 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 23-786-10-10

Report No.(s): NASA/TP-2005-213539; L-19101; No Copyright; Avail: CASI; A04, Hardcopy

A new flight operations concept called Small Aircraft Transportation System (SATS) Higher Volume Operations (HVO) was developed to increase capacity during Instrument Meteorological Conditions (IMC) at non-towered, non-radar airports by enabling concurrent operations of multiple aircraft. One aspect of this concept involves having pilots safely self-separate from other aircraft during approaches into these airports using appropriate SATS HVO procedures. A flight experiment was conducted to determine if instrument-rated general aviation (GA) pilots could self-separate and sequence their ownship aircraft, while following a simulated aircraft, into a non-towered, non-radar airport during simulated IMC. Six GA pilots' workload levels and abilities to perform self-separation and sequencing procedures while flying a global positioning system (GPS) instrument approach procedure were examined. The results showed that the evaluation pilots maintained at least the minimum specified separation between their ownship aircraft and simulated traffic and maintained their assigned landing sequence 100-percent of the time. Neither flight path deviations nor subjective workload assessments were negatively impacted by the additional tasks of self-separating and sequencing during these instrument approaches.

Author

*General Aviation Aircraft; Air Transportation; Instrument Approach*

**20050176486** NASA Langley Research Center, Hampton, VA, USA, Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA, Federal Aviation Administration, Moffett Field, CA, USA, Federal Aviation Administration, Washington, DC, USA

**UWB EMI To Aircraft Radios: Field Evaluation on Operational Commercial Transport Airplanes, Volume 1**

Oria, A. J., Editor; Ely, Jay J.; Martin, Warren L.; Shaver, Timothy W.; Fuller, Gerald L.; Zimmerman, John; Fuschino, Robert L.; Larsen, William E.; January 2005; 69 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC3-1043; NCC3-1078

Report No.(s): NASA/TP-2005-213606/VOL1; No Copyright; Avail: CASI; A04, Hardcopy

Ultrawideband (UWB) transmitters may soon be integrated into a wide variety of portable electronic devices (PEDs) that passengers routinely carry on board commercial airplanes. Airlines and the FAA will have difficulty controlling passenger use of UWB transmitters during flights with current airline policies and existing wireless product standards. The aeronautical community is concerned as to whether evolving FCC UWB rules are adequate to protect legacy and emerging aeronautical radio systems from electromagnetic interference (EMI) from emerging UWB products. To address these concerns, the NASA Office of Space Communications and Chief Spectrum Managers assembled a multidisciplinary team from NASA LaRC, NASA JPL, NASA ARC, FAA, United Airlines, Sky West Airlines, and Eagles Wings Inc. to carry out a comprehensive series of tests aimed at determining the nature and extent of any EMI to aeronautical communication and navigation systems from UWB devices meeting FCCapproved and proposed levels for unlicensed handheld transmitters.

Author

*Electromagnetic Interference; Broadband; Aircraft Communication; Radio Communication; Commercial Aircraft*

## 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*.

**20050173846** Naval Postgraduate School, Monterey, CA USA
**Investigation and Development of Oil-Injection Nozzles for High-Cycle Fatigue Rotor Spin Test**
Moreno, Oscar R.; Mar. 2005; 113 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432477; No Copyright; Avail: Defense Technical Information Center (DTIC)

Resonant excitation tests of rotor blades in vacuum spin pits using discrete oil jets showed that impact erosion of the blades could limit test times, but lower excitation amplitudes were produced using mist nozzles. Smaller diameter discrete jets might extend test times, but to fully prevent erosion, oil mist droplet size needed to be 30 microns or less. The present study examined both approaches. Prototype nozzles were developed to create 0.005 inch diameter multiple discrete jets using first alumina, then stainless steel tubing, laser and micro-machine drilling. The latter technique was selected and 50 were manufactured for evaluation in HCF spin tests. A vacuum test chamber was built to observe and photograph spray patterns from the prototype nozzles and from commercially available mist nozzles. An LDV system was used successfully to determine the velocity of the oil droplets within the mist. A complete mapping of mist nozzle sprays is required to allow routine design of blade excitation systems.
DTIC
*Fatigue Tests; Injection; Nozzles; Oils; Rotors; Spin Tests*

**20050175679** NASA Dryden Flight Research Center, Edwards, CA, USA
**Overview With Results and Lessons Learned of the X-43A Mach 10 Flight**
Marshall, Laurie A.; Bahm, Catherine; Corpening, Griffin P.; Sherrill, Robert; [2005]; 23 pp.; In English; AIAA/CIRA 13th International Space Planes and Hypersonic Systems and Technologies Conference, 18 May 2005, Capua, Italy; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper provides an overview of the final flight of the NASA X-43A project. The project consisted of three flights, two planned for Mach 7 and one for Mach 10. The third and final flight, November 16, 2004, was the first Mach 10 flight demonstration of an airframe-integrated, scramjet-powered, hypersonic vehicle. The goals and objectives for the project as well as those for the third flight are presented. The configuration of the Hyper-X stack including the X-43A, Hyper-X launch vehicle, and Hyper-X research vehicle adapter is discussed. The second flight of the X-43A was successfully conducted on March 27, 2004. Mission differences, vehicle modifications and lessons learned from the second flight as they applied to the third flight are also discussed. An overview of flight 3 results is presented.
Author
*Flight Tests; Hypersonic Speed; Research Vehicles; Supersonic Combustion Ramjet Engines; X-43 Vehicle*

**20050175694** NASA Langley Research Center, Hampton, VA, USA
**Automatic Aircraft Structural Topology Generation for Multidisciplinary Optimization and Weight Estimation**
Sensmeier, Mark D.; Samareh, Jamshid A.; [2005]; 12 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA
Contract(s)/Grant(s): NNL04AA72G.; 23-064-20-10; No Copyright; Avail: CASI; A03, Hardcopy

An approach is proposed for the application of rapid generation of moderate-fidelity structural finite element models of air vehicle structures to allow more accurate weight estimation earlier in the vehicle design process. This should help to rapidly assess many structural layouts before the start of the preliminary design phase and eliminate weight penalties imposed when actual structure weights exceed those estimated during conceptual design. By defining the structural topology in a fully parametric manner, the structure can be mapped to arbitrary vehicle configurations being considered during conceptual design optimization. A demonstration of this process is shown for two sample aircraft wing designs.
Author
*Finite Element Method; Aircraft Design; Multidisciplinary Design Optimization; Structural Design; Structural Weight*

**20050175770** NASA Dryden Flight Research Center, Edwards, CA, USA

**A Chief Engineer's View of the NASA X-43A Scramjet Flight Test**

Marshall, Laurie A.; Corpening, Griffin P.; Sherrill, Robert; [2005]; 20 pp.; In English; AIAA/CIRA 13th International Space Planes and Hypersonics Systems and Technologies Conference, 15-20 May 2005, Capus, Italy; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents an overview of the preparation and execution of the first two flights of the NASA X-43A scramjet flight test project. The project consisted of three flights, two planned for Mach 7 and one for Mach 10. The first flight, conducted on June 2, 2001, was unsuccessful and resulted in a nine-month mishap investigation. A two-year return to flight effort ensued and concluded when the second Mach 7 flight was successfully conducted on March 27, 2004. The challenges faced by the project team as they prepared the first ever scramjet-powered airplane for flight are presented. Modifications made to the second flight vehicle as a result of the first flight failure and the return to flight activities are discussed. Flight results and lessons learned are also presented.

Author

*Flight Tests; Supersonic Combustion Ramjet Engines; X-43 Vehicle; Hypersonic Flight; Engine Tests*

**20050176058** NASA Langley Research Center, Hampton, VA, USA

**Higher-Order Spectral Analysis of a Nonlinear Pitch and Plunge Apparatus**

Silva, Walter A.; Strganac, Thomas W.; Hajj, Muhammad R.; [2005]; 20 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 23-065-30-12

Report No.(s): AIAA Paper 2005-2013; No Copyright; Avail: CASI; A03, Hardcopy

Simulated aeroelastic responses of a nonlinear pitch and plunge apparatus are analyzed using various statistical signal processing techniques including higher-order spectral methods. A MATLAB version of the Nonlinear Aeroelastic Testbed Apparatus (NATA) at the Texas A&M University is used to generate various aeroelastic response data including limit cycle oscillations (LCO). Traditional and higher-order spectral (HOS) methods are applied to the simulated aeroelastic responses. Higher-order spectral methods are used to identify critical signatures that indicate the transition from linear to nonlinear (LCO) aeroelastic behavior.

Author

*Aeroelasticity; Nonlinearity; Spectral Methods; Pitch (Inclination); Low Speed Wind Tunnels; Mathematical Models*

**20050176376** NASA Langley Research Center, Hampton, VA, USA

**Probabilistic Design of a Wind Tunnel Model to Match the Response of a Full-Scale Aircraft**

Mason, Brian H.; Stroud, W. Jefferson; Krishnamurthy, T.; Spain, Charles V.; Naser, Ahmad S.; [2005]; 21 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): 23-064-10-23

Report No.(s): AIAA Paper 2005-2185; Copyright; Avail: CASI; A03, Hardcopy

approach is presented for carrying out the reliability-based design of a plate-like wing that is part of a wind tunnel model. The goal is to design the wind tunnel model to match the stiffness characteristics of the wing box of a flight vehicle while satisfying strength-based risk/reliability requirements that prevents damage to the wind tunnel model and fixtures. The flight vehicle is a modified F/A-18 aircraft. The design problem is solved using reliability-based optimization techniques. The objective function to be minimized is the difference between the displacements of the wind tunnel model and the corresponding displacements of the flight vehicle. The design variables control the thickness distribution of the wind tunnel model. Displacements of the wind tunnel model change with the thickness distribution, while displacements of the flight vehicle are a set of fixed data. The only constraint imposed is that the probability of failure is less than a specified value. Failure is assumed to occur if the stress caused by aerodynamic pressure loading is greater than the specified strength allowable. Two uncertain quantities are considered: the allowable stress and the thickness distribution of the wind tunnel model. Reliability is calculated using Monte Carlo simulation with response surfaces that provide approximate values of stresses. The response surface equations are, in turn, computed from finite element analyses of the wind tunnel model at specified design points. Because the response surface approximations were fit over a small region centered about the current design, the response surfaces were refit periodically as the design variables changed. Coarse-grained parallelism was used to simultaneously perform multiple finite element analyses. Studies carried out in this paper demonstrate that this scheme of using moving response surfaces and coarse-grained computational parallelism reduce the execution time of the Monte Carlo

simulation enough to make the design problem tractable. The results of the reliability-based designs performed in this paper show that large decreases in the probability of stress-based failure can be realized with only small sacrifices in the ability of the wind tunnel model to represent the displacements of the full-scale vehicle.
Author
*Design Analysis; Probability Theory; Wind Tunnel Models; Aircraft Design; Aircraft Models; Scale Models; Aerodynamic Configurations*

**20050176407** NASA Langley Research Center, Hampton, VA, USA
**Higher-Order Spectral Analysis of F-18 Flight Flutter Data**
Silva, Walter A.; Dunn, Shane; [2005]; 20 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-065-30-12
Report No.(s): AIAA Paper 2005-2014; No Copyright; Avail: CASI; A03, Hardcopy

Royal Australian Air Force (RAAF) F/A-18 flight flutter test data is presented and analyzed using various techniques. The data includes high-quality measurements of forced responses and limit cycle oscillation (LCO) phenomena. Standard correlation and power spectral density (PSD) techniques are applied to the data and presented. Novel applications of experimentally-identified impulse responses and higher-order spectral techniques are also applied to the data and presented. The goal of this research is to develop methods that can identify the onset of nonlinear aeroelastic phenomena, such as LCO, during flutter testing.
Author
*F-18 Aircraft; Flight Tests; Flutter; Spectrum Analysis; Aeroelasticity*

**20050177147** NASA Lewis Research Center, Cleveland, OH, USA, Pratt and Whitney Aircraft, USA
**Scale-Model, Low-Tip-Speed Turbofan Tested at Simulated Takeoff and Approach Conditions**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Tests are currently being performed in the NASA Lewis Research Center's 9- by 15-Foot Low-Speed Wind Tunnel on a Pratt & Whitney designed low-tip-speed fan. The test objectives are to determine the acoustic, aerodynamic, and aeromechanical performance of this low-speed, high-bypass-ratio fan stage. Noise reductions from various combinations of engine nacelle acoustic treatments are also being obtained.
Derived from text
*Acoustic Properties; Aerodynamic Characteristics; Low Speed; Tip Speed; Turbofans; Wind Tunnel Tests*

**20050177169** NASA Lewis Research Center, Cleveland, OH, USA
**Inlet Performance Analysis Code Developed**
Jules, Kenol; Barnhart, Paul J.; Research and Technology 1997; April 1998; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The design characteristics of an inlet very much depend on whether the inlet is to be flown at subsonic, supersonic, or hypersonic speed. Whichever the case, the primary function of an inlet is to deliver free-stream air to the engine face at the highest stagnation pressure possible and with the lowest possible variation in both stagnation pressure and temperature. At high speeds, this is achieved by a system of oblique and/or normal shock waves, and possibly some isentropic compression. For both subsonic and supersonic flight, current design practice indicates that the inlet should deliver the air to the engine face at approximately Mach 0.45. As a result, even for flight in the high subsonic regime, the inlet must retard (or diffuse) the air substantially. Second, the design of an inlet is influenced largely by the compromise between high performance and low weight. This compromise involves tradeoffs between the mission requirements, flight trajectory, airframe aerodynamics, engine performance, and weight-all of which, in turn, influence each other. Therefore, to study the effects of some of these influential factors, the Propulsion System Analysis Office of the NASA Lewis Research Center developed the Inlet Performance Analysis Code (IPAC). This code uses oblique shock and Prandtl-Meyer expansion theory to predict inlet performance. It can be used to predict performance for a given inlet geometric design such as pitot, axisymmetric, and two-dimensional. IPAC also can be used to design preliminary inlet systems and to make subsequent performance analyses. It computes the total pressure, the recovery, the airflow, and the drag coefficients. The pressure recovery includes losses associated with normal and oblique shocks, internal and external friction, the sharp lip, and diffuser components. Flow rate

includes captured, engine, spillage, bleed, and bypass flows. The aerodynamic drag calculation includes drags associated with spillage, cowl lip suction, wave, bleed, and bypass.
Author
*Engine Inlets; Engine Design; Computer Programs; Performance Prediction*

**20050177184** NASA Lewis Research Center, Cleveland, OH, USA
**Shape-Memory-Alloy-Based Deicing System Developed**
Research and Technology 1995; March 1996; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Ice buildup on aircraft leading edge surfaces has historically been a problem. Most conventional deicing systems rely either on surface heating to melt the accreted ice or pneumatic surface inflation to mechanically debond the ice. Deicers that rely solely on surface heating require large amounts of power. Pneumatic deicers usually cannot remove thin layers of ice and lack durability. Thus, there is a need for an advanced, low-power ice protection system. As part of the NASA Small Business and Innovation Research (SBIR) program, Innovative Dynamics, Inc., developed an aircraft deicing system that utilizes the properties of Shape Memory Alloys (SMA). The SMA-based system has achieved promising improvements in energy efficiency and durability over more conventional deicers. When they are thermally activated, SMA materials change shape; this is analogous to a conventional thermal expansion. The thermal input is currently applied via conventional technology, but there are plans to implement a passive thermal input that is supplied from the energy transfer due to the formation of the ice itself. The actively powered deicer was tested in the NASA Lewis Icing Research Tunnel on a powered rotating rig in early 1995. The system showed promise, deicing both rime and glaze ice shapes as thin as 1/8 in. The first prototype SMA deicer reduced power usage by 45 percent over existing electrothermal systems. This prototype system was targeted for rotorcraft system development. However, there are current plans underway to develop a fixed-wing version of the deicer.
Author
*Deicers; Shape Memory Alloys; Systems Engineering; Wind Tunnel Tests*

**20050177190** NASA Lewis Research Center, Cleveland, OH, USA
**Model-Trained Neural Networks and Electronic Holography Demonstrated to Detect Damage in Blades**
Decker, Arthur J.; Fite, E. Brian; Mehmed, Oral; Thorp, Scott A.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Detect Damage in Blades Electronic holography can show damaged regions in fan blades at 30 frames/sec. The electronic holograms are transformed by finite-element-model-trained artificial neural networks to visualize the damage. The trained neural networks are linked with video and graphics to visualize the bending-induced strain distribution, which is very sensitive to damage. By contrast, it is very difficult to detect damage by viewing the raw, speckled, characteristic fringe patterns. For neural-network visualization of damage, 2 frames or 2 fields are used, rather than the 12 frames normally used to compute the displacement distribution from electronic holograms. At the NASA Lewis Research Center, finite element models are used to compute displacement and strain distributions for the vibration modes of undamaged and cracked blades. A model of electronic time-averaged holography is used to transform the displacement distributions into finite-element-resolution characteristic fringe patterns. Then, a feedforward neural network is trained with the fringe-pattern/strain-pattern pairs, and the neural network, electronic holography, and video are implemented on a workstation. Now that the neural networks have been tested successfully at 30 frames/sec on undamaged and cracked cantilevers, the electronic holography and neural-network processing are being adapted for onsite damage inspection of twisted fan blades and rotormounted blades. Our conclusion is that model-trained neural nets are effective when they are trained with good models whose application is well understood. This work supports the aeromechanical testing portion of the Advanced Subsonic Technology Project.
Author
*Damage; Fan Blades; Holography; Neural Nets; Mathematical Models; Electronics*

## 07
## AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; 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*.

**20050175841** NASA Glenn Research Center, Cleveland, OH, USA

**Solid Oxide Fuel Cell/Gas Turbine Hybrid Cycle Technology for Auxiliary Aerospace Power**

Steffen, Christopher J., Jr.; Freeh, Joshua E.; Larosiliere, Louis M.; April 2005; 16 pp.; In English; Turbo Expo 2005, 6-9 Jun. 2005, Reno, NV, USA

Contract(s)/Grant(s): WBS 22-708-02-03

Report No.(s): NASA/TM-2005-213586; GT2005-68619; E-15053; No Copyright; Avail: CASI; A03, Hardcopy

A notional 440 kW auxiliary power unit has been developed for 300 passenger commercial transport aircraft in 2015AD. A hybrid engine using solid-oxide fuel cell stacks and a gas turbine bottoming cycle has been considered. Steady-state performance analysis during cruise operation has been presented. Trades between performance efficiency and system mass were conducted with system specific energy as the discriminator. Fuel cell performance was examined with an area specific resistance. The ratio of fuel cell versus turbine power was explored through variable fuel utilization. Area specific resistance, fuel utilization, and mission length had interacting effects upon system specific energy. During cruise operation, the simple cycle fuel cell/gas turbine hybrid was not able to outperform current turbine-driven generators for system specific energy, despite a significant improvement in system efficiency. This was due in part to the increased mass of the hybrid engine, and the increased water flow required for on-board fuel reformation. Two planar, anode-supported cell design concepts were considered. Designs that seek to minimize the metallic interconnect layer mass were seen to have a large effect upon the system mass estimates.

Author

*Auxiliary Power Sources; Commercial Aircraft; Passenger Aircraft; Solid Oxide Fuel Cells; System Effectiveness; Electric Generators*

**20050175874** NASA Glenn Research Center, Cleveland, OH, USA

**Modeling of a Sequential Two-Stage Combustor**

Hendricks, R. C.; Liu, N.-S.; Gallagher, J. R.; Ryder, R. C.; Brankovic, A.; Hendricks, J. A.; March 2005; 24 pp.; In English; 10th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, 7-11 Mar. 2004, Honolulu, HI, USA; Original contains color illustrations

Report No.(s): NASA/TM-2005-212631; ISROMAC10-2004-037; E-14193; No Copyright; Avail: CASI; A03, Hardcopy

A sequential two-stage, natural gas fueled power generation combustion system is modeled to examine the fundamental aerodynamic and combustion characteristics of the system. The modeling methodology includes CAD-based geometry definition, and combustion computational fluid dynamics analysis. Graphical analysis is used to examine the complex vortical patterns in each component, identifying sources of pressure loss. The simulations demonstrate the importance of including the rotating high-pressure turbine blades in the computation, as this results in direct computation of combustion within the first turbine stage, and accurate simulation of the flow in the second combustion stage. The direct computation of hot-streaks through the rotating high-pressure turbine stage leads to improved understanding of the aerodynamic relationships between the primary and secondary combustors and the turbomachinery.

Author

*Combustion Chambers; Computational Fluid Dynamics; Turbomachinery; Jet Engines*

**20050175876** NASA Glenn Research Center, Cleveland, OH, USA

**Water Injected Turbomachinery**

Hendricks, R. C.; Shouse, D. T.; Roquemore, W. M.; March 2005; 20 pp.; In English; 10th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, 7-11 Mar. 2004, Honolulu, HI, USA

Report No.(s): NASA/TM-2005-212632; ISROMAC10-2004-039; E-14194; No Copyright; Avail: CASI; A03, Hardcopy

From antiquity, water has been a source of cooling, lubrication, and power for energy transfer devices. More recent applications in gas turbines demonstrate an added facet, emissions control. Fogging gas turbine inlets or direct injection of water into gas turbine combustors, decreases NOx and increases power. Herein we demonstrate that injection of water into the air upstream of the combustor reduces NOx by factors up to three in a natural gas fueled Trapped Vortex Combustor (TVC)

and up to two in a liquid JP-8 fueled (TVC) for a range in water/fuel and fuel/air ratios.
Author
*Gas Turbines; Nitrogen Oxides; Turbomachinery; Exhaust Emission; Water Injection; Combustion Chambers*

**20050175887** NASA Glenn Research Center, Cleveland, OH, USA
**A Survey of Intelligent Control and Health Management Technologies for Aircraft Propulsion Systems**
Litt, Jonathan S.; Simon, Donald L.; Garg, Sanjay; Guo, Ten-Heui; Mercer, Carolyn; Behbahani, Alireza; Bajwa, Anupa; Jensen, Daniel T.; May 2005; 28 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-303-30-72
Report No.(s): NASA/TM-2005-213622; ARL-TR-3413; E-15083; No Copyright; Avail: CASI; A03, Hardcopy

Intelligent Control and Health Management technology for aircraft propulsion systems is much more developed in the laboratory than in practice. With a renewed emphasis on reducing engine life cycle costs, improving fuel efficiency, increasing durability and life, etc., driven by various government programs, there is a strong push to move these technologies out of the laboratory and onto the engine. This paper describes the existing state of engine control and on-board health management, and surveys some specific technologies under development that will enable an aircraft propulsion system to operate in an intelligent way--defined as self-diagnostic, self-prognostic, self-optimizing, and mission adaptable. These technologies offer the potential for creating extremely safe, highly reliable systems. The technologies will help to enable a level of performance that far exceeds that of today s propulsion systems in terms of reduction of harmful emissions, maximization of fuel efficiency, and minimization of noise, while improving system affordability and safety. Technologies that are discussed include various aspects of propulsion control, diagnostics, prognostics, and their integration. The paper focuses on the improvements that can be achieved through innovative software and algorithms. It concentrates on those areas that do not require significant advances in sensors and actuators to make them achievable, while acknowledging the additional benefit that can be realized when those technologies become available. The paper also discusses issues associated with the introduction of some of the technologies.
NASA
*Propulsion System Configurations; Propulsion System Performance; Safety; Systems Health Monitoring; Engine Monitoring Instruments; Life (Durability)*

**20050175891** NASA Glenn Research Center, Cleveland, OH, USA
**Turbomachine Interface Sealing**
Hendricks, Robert C.; Chupp, Raymond E.; Lattime, Scott B.; Steinetz, Bruce M.; April 2005; 28 pp.; In English; International Conference on Metallurgical Coatings and Thin Films, 2-6 May 2005, San Diego, CA, USA; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2005-213633; E-15116; No Copyright; Avail: CASI; A03, Hardcopy

Sealing interfaces and coatings, like lubricants, are sacrificial, giving up their integrity for the benefit of the component. Clearance control is a major issue in power systems turbomachine design and operational life. Sealing becomes the most cost-effective way to enhance system performance. Coatings, films, and combined use of both metals and ceramics play a major role in maintaining interface clearances in turbomachine sealing and component life. This paper focuses on conventional and innovative materials and design practices for sealing interfaces.
Author
*Sealing; Turbomachinery; Aircraft Construction Materials; Service Life*

**20050176385** NASA Glenn Research Center, Cleveland, OH, USA
**Modeling of a Sequential Two-Stage Combustor, Supplement**
Hendricks, R. C.; Liu, N.-S.; Gallagher, J. R.; Ryder, R. C.; Brankovic, A.; Hendricks, J. A.; March 2005; In English; 10th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, 7-11 Mar. 2004, Honolulu, HI, USA
Report No.(s): NASA/TM-2005-212631/SUPPL; ISROMAC10-2004-037-Suppl; E-14193/SUPPL; No Copyright; Avail: CASI; C01, CD-ROM

A sequential two-stage, natural gas fueled power generation combustion system is modeled to examine the fundamental aerodynamic and combustion characteristics of the system. The modeling methodology includes CAD-based geometry definition, and combustion computational fluid dynamics analysis. Graphical analysis is used to examine the complex vortical patterns in each component, identifying sources of pressure loss. The simulations demonstrate the importance of including the rotating high-pressure turbine blades in the computation, as this results in direct computation of combustion within the first turbine stage, and accurate simulation of the flow in the second combustion stage. The direct computation of hot-streaks

through the rotating high-pressure turbine stage leads to improved understanding of the aerodynamic relationships between the primary and secondary combustors and the turbomachinery.
Author
*Combustion Chambers; Computational Fluid Dynamics; Mathematical Models; Two Stage Turbines*

**20050176387** NASA Lewis Research Center, Cleveland, OH, USA
**Performance of Gas Turbine Engines Using Wave Rotors Modeled**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A wave rotor is a device that can boost the pressure and temperature of an airflow. When used as part of the core of a gas turbine engine, a wave rotor can significantly improve the thrust or shaft horsepower by boosting the flow pressure without raising the turbine inlet temperature. The NASA Lewis Research Center's Aeropropulsion Analysis Office, which is identifying technologies and research opportunities that will enhance the technical and economic competitiveness of the U.S. aeronautics industry, is evaluating the wave rotor to quantify the potential benefits of this device. Preliminary studies such as these are critical to identifying technologies that have high payoffs.
Derived from text
*Aircraft Engines; Gas Turbine Engines; Wave Rotors; Models*

**20050177146** NASA Lewis Research Center, Cleveland, OH, USA
**Internal Mixing Studied for GE/ARL Ejector Nozzle**
Zaman, Khairul; Research and Technology 1996; [2005]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

To achieve jet noise reduction goals for the High Speed Civil Transport aircraft, researchers have been investigating the mixer-ejector nozzle concept. For this concept, a primary nozzle with multiple chutes is surrounded by an ejector. The ejector mixes low-momentum ambient air with the hot engine exhaust to reduce the jet velocity and, hence, the jet noise. It is desirable to mix the two streams as fast as possible in order to minimize the length and weight of the ejector. An earlier model of the mixer-ejector nozzle was tested extensively in the Aerodynamic Research Laboratory (ARL) of GE Aircraft Engines at Cincinnati, Ohio. While testing was continuing with later generations of the nozzle, the earlier model was brought to the NASA Lewis Research Center for relatively fundamental measurements. Goals of the Lewis study were to obtain details of the flow field to aid computational fluid dynamics (CFD) efforts and obtain a better understanding of the flow mechanisms, as well as to experiment with mixing enhancement devices, such as tabs. The measurements were made in an open jet facility for cold (unheated) flow without a surrounding coflowing stream.
Author
*Jet Mixing Flow; Exhaust Nozzles; Jet Engines; Ejectors*

**20050177193** NASA Lewis Research Center, Cleveland, OH, USA
**F100 Engine Emissions Tested in NASA Lewis' Propulsion Systems Laboratory**
Wey, Chowen C.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Recent advances in atmospheric sciences have shown that the chemical composition of the entire atmosphere of the planet (gases and airborne particles) has been changed due to human activity and that these changes have changed the heat balance of the planet. National Research Council findings indicate that anthropogenic aerosols1 reduce the amount of solar radiation reaching the Earth's surface. Atmospheric global models suggest that sulfate aerosols change the energy balance of the Northern Hemisphere as much as anthropogenic greenhouse gases have. In response to these findings, NASA initiated the Atmospheric Effects of Aviation Project (AEAP) to advance the research needed to define present and future aircraft emissions and their effects on the Earth's atmosphere. Although the importance of aerosols and their precursors is now well recognized, the characterization of current subsonic engines for these emissions is far from complete. Furthermore, since the relationship of engine operating parameters to aerosol emissions is not known, extrapolation to untested and unbuilt engines necessarily remains highly uncertain. Tests in 1997-an engine test at the NASA Lewis Research Center and the corresponding flight measurement test at the NASA Langley Research Center-attempted to address both issues by measuring emissions when fuels containing different levels of sulfur were burned. Measurement systems from four research groups were involved in the Lewis engine test: A Lewis gas analyzer suite to measure the concentration of gaseous species 1. including NO, NOx, CO, CO2, O2, THC, and SO2 as well as the smoke number; 2. A University of Missouri-Rolla Mobile Aerosol Sampling System to measure aerosol and particulate properties including the total concentration, size distribution, volatility, and hydration property; 3. An Air Force Research Laboratory Chemical Ionization Mass Spectrometer to measure the concentration of SO2 and SO3/H2SO4; and 4. An Aerodyne Research Inc. Tunable Diode Laser System to measure the concentrations of SO2, SO3, NO,

NO2, CO2, and H2O. By September 1997, an F100 engine operating at several power levels at sea level and up to six simulated altitudes had been tested with commercial jet fuels with three levels of sulfur content and one military jet fuel. The data are being vigorously analyzed. A complete report is anticipated for the 1998 Atmospheric Effects of Aviation Project Annual Conference.
Author
*Aerosols; Air Pollution; Atmospheric Composition; Greenhouse Effect; Exhaust Emission; Exhaust Gases; Gas Analysis*

**20050177194** NASA Lewis Research Center, Cleveland, OH, USA, Pratt and Whitney Aircraft, USA
**Effect of Installation of Mixer/Ejector Nozzles on the Core Flow Exhaust of High-Bypass-Ratio Turbofan Engines**
Harrington, Douglas E.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The aerospace industry is currently investigating the effect of installing mixer/ejector nozzles on the core flow exhaust of high-bypass-ratio turbofan engines. This effort includes both full-scale engine tests at sea level conditions and subscale tests in static test facilities. Subscale model tests are to be conducted prior to full-scale testing. With this approach, model results can be analyzed and compared with analytical predications. Problem areas can then be identified and design changes made and verified in subscale prior to committing to any final design configurations for engine ground tests. One of the subscale model test programs for the integrated mixer/ejector development was a joint test conducted by the NASA Lewis Research Center and Pratt & Whitney Aircraft. This test was conducted to study various mixer/ejector nozzle configurations installed on the core flow exhaust of advanced, high-bypass-ratio turbofan engines for subsonic, commercial applications. The mixer/ejector concept involves the introduction of largescale, low-loss, streamwise vortices that entrain large amounts of secondary air and rapidly mix it with the primary stream. This results in increased ejector pumping relative to conventional ejectors and in more complete mixing within the ejector shroud. The latter improves thrust performance through the efficient energy exchange between the primary and secondary streams. This experimental program was completed in April 1997 in Lewis' CE-22 static test facility. Variables tested included the nozzle area ratio (A9/A8), which ranged from 1.6 to 3.0. This ratio was varied by increasing or decreasing the nozzle throat area, A8. Primary nozzles tested included both lobed mixers and conical primaries. These configurations were tested with and without an outer shroud, and the shroud position was varied by inserting spacers in it. In addition, data were acquired with and without secondary flow.
Derived from text
*Ejectors; Mixers; Nozzles; Turbofan Engines; Secondary Flow; Bypass Ratio; Energy Transfer*

**20050177195** NASA Lewis Research Center, Cleveland, OH, USA, Allison Advanced Development Co., Indianapolis, IN, USA
**Lift Fan Nozzle for Joint Strike Fighter Tested in NASA Lewis' Powered Lift Rig**
Lam, David W.; Research and Technology 1997; April 1998; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Under a nonreimbursable space act agreement between the NASA Lewis Research Center and the Allison Advanced Development Company, Allison tested a lift fan nozzle in Lewis' Powered Lift Rig. This test was in support of the Joint Strike Fighter program (formerly the Joint Advanced Strike Technology) sponsored by the Department of Defense, which will develop and field an affordable, multirole, next-generation, strike fighter aircraft for the Navy, Air Force, Marine Corps, and foreign allies. Allison, along with Pratt & Whitney Company, is part of the Lockheed Martin Corporation team that is scheduled to build a concept demonstrator aircraft by fiscal year 2001. The test was initiated in April and successfully completed in mid-July of 1997. Allison supplied a one-third-scale model of the lift fan nozzle, and Lewis provided the facility and the necessary support team. Various configurations, including pitching vectored angles ranging from 15deg forward to 60deg backward, were tested over a range of nozzle pressure ratios. Nozzle flow rates, thrust, and static pressures were measured for each of the configurations. Results from the test met the design requirements for the Joint Strike Fighter program and were in agreement with Allison's internal computational fluid dynamics (CFD) analyses. Data obtained from this test will also be used in the full-scale design of the lift fan system.
Derived from text
*Nozzle Flow; Lift Fans; Flow Velocity; Scale Models; Powered Lift Aircraft; Pressure Ratio*

**20050177213** NASA Lewis Research Center, Cleveland, OH, USA
**Subsonic Jet Noise Reduced With Improved Internal Exhaust Gas Mixers**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Aircraft noise pollution is becoming a major environmental concern for the world community. The Federal Aviation

Administration (FAA) is responding to this concern by imposing more stringent noise restrictions for aircraft certification then ever before to keep the U.S. industry competitive with the rest of the world. At the NASA Lewis Research Center, attempts are underway to develop noise-reduction technology for newer engines and for retrofitting existing engines so that they are as quiet as (or quieter than) required. Lewis conducted acoustic and Laser Doppler Velocimetry (LDV) tests using Pratt & Whitney's Internal Exhaust Gas Mixers (IEGM). The IEGM's mix the core flow with the fan flow prior to their common exhaust. All tests were conducted in Lewis' Aero-Acoustic Propulsion Laboratory--a semihemispheric dome open to the ambient atmosphere. This was the first time Laser Doppler Velocimetry was used in such a facility at Lewis. Jet exhaust velocity and turbulence and the internal velocity fields were detailed. Far-field acoustics were also measured. Pratt & Whitney provided 1/7th scale model test hardware (a 12-lobe mixer, a 20-lobe mixer, and a splitter) for 1.7 bypass ratio engines, and NASA provided the research engineers, test facility, and test time. The Pratt & Whitney JT8D-200 engine power conditions were used for all tests.
Derived from text
*Aeroacoustics; Aerodynamic Noise; Jet Aircraft Noise; Noise Reduction*

**20050177214** NASA Lewis Research Center, Cleveland, OH, USA
**High-Temperature Magnetic Bearings Being Developed for Gas Turbine Engines**
Kascak, Albert F.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Magnetic bearings are the subject of a new NASA Lewis Research Center and U.S. Army thrust with significant industry participation, and cooperation with other Government agencies. The NASA/Army emphasis is on high-temperature applications for future gas turbine engines. Magnetic bearings could increase the reliability and reduce the weight of these engines by eliminating the lubrication system. They could also increase the DN (diameter of bearing times the rpm) limit on engine speed and allow active vibration cancellation systems to be used, resulting in a more efficient, 'more electric' engine. Finally, the Integrated High Performance Turbine Engine Technology (IHPTET) program, a joint Department of Defense/ industry program, identified a need for a high-temperature (1200 F) magnetic bearing that could be demonstrated in their Phase III engine. This magnetic bearing is similar to an electric motor. It has a laminated rotor and stator made of cobalt steel. Wound around the stator's circumference are a series of electrical wire coils which form a series of electric magnets that exert a force on the rotor. A probe senses the position of the rotor, and a feedback controller keeps it centered in the cavity. The engine rotor, bearings, and casing form a flexible structure with many modes. The bearing feedback controller, which could cause some of these modes to become unstable, could be adapted to varying flight conditions to minimize seal clearances and monitor the health of the system.
Derived from text
*Magnetic Bearings; Weight Reduction; Reliability; Lubrication Systems; Engine Design; Gas Turbine Engines*

**20050177215** NASA Lewis Research Center, Cleveland, OH, USA, Fiber Optic Systems, Inc., Whitehouse Station, NJ, USA
**Integrated Fiber-Optic Light Probe: Measurement of Static Deflections in Rotating Turbomachinery**
Kurkov, Anatole P.; Research and Technology 1997; April 1998; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

At the NASA Lewis Research Center, in cooperation with Integrated Fiber Optic Systems, Inc., an integrated fiber-optic light probe system was designed, fabricated, and tested for monitoring blade tip deflections, vibrations, and to some extent, changes in the blade tip clearances of a turbomachinery fan or a compressor rotor. The system comprises a set of integrated fiber-optic light probes that are positioned to detect the passing blade tip at the leading and trailing edges. In this configuration, measurements of both nonsynchronous blade vibrations and steady-state blade deflections can be made from the timing information provided by each light probe-consisting of an integrated fiber-optic transmitting channel and numerical aperture receiving fibers, all mounted in the same cylindrical housing. With integrated fiber-optic technology, a spatial resolution of 50 mm is possible while the outer diameter is kept below 2.5 mm. To evaluate these probes, we took measurements in a single-stage compressor facility and an advanced fan rig in Lewis' 9- by 15-Foot Low-Speed Wind Tunnel.
Author
*Fiber Optics; Blade Tips; Turbomachinery; Compressor Rotors; Spatial Resolution*

## 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*.

**20050176390** McDonnell-Douglas Corp., USA

**Power-by-Wire Development and Demonstration for Subsonic Civil Transport**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

During the last decade, three significant studies by the Lockheed Martin Corporation, the NASA Lewis Research Center, and McDonnell Douglas Corporation have clearly shown operational, weight, and cost advantages for commercial subsonic transport aircraft that use all-electric or more-electric technologies in the secondary electric power systems. Even though these studies were completed on different aircraft, used different criteria, and applied a variety of technologies, all three have shown large benefits to the aircraft industry and to the nation's competitive position. The Power-by-Wire (PBW) program is part of the highly reliable Fly-By-Light/Power-By-Wire (FBL/PBW) Technology Program, whose goal is to develop the technology base for confident application of integrated FBL/PBW systems for transport aircraft. This program is part of the NASA aeronautics strategic thrust in subsonic aircraft/national airspace (Thrust 1) to 'develop selected high-leverage technologies and explore new means to ensure the competitiveness of U.S. subsonic aircraft and to enhance the safety and productivity of the national aviation system' (The Aeronautics Strategic Plan). Specifically, this program is an initiative under Thrust 1, Key Objective 2, to 'develop, in cooperation with U.S. industry, selected high-payoff technologies that can enable significant improvements in aircraft efficiency and cost.'

Author

*Commercial Aircraft; Transport Aircraft; Aircraft Power Supplies; Fly By Wire Control*

## 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)*.

**20050177091** Swedish Defence Research Establishment, Linkoeping, Sweden

**ACES: Air Combat Evaluation System**

Naehlinder, S.; Oct. 2004; 20 pp.; In English

Report No.(s): PB2005-103085; FOI-R-1368-SE; No Copyright; Avail: CASI; A03, Hardcopy

ACES-'Air Combat Evaluation System' is a research flight simulator specialized in within visual range (WVR) air-to-air combat. The system consists of two simulator cabins (pilot stations) and one instructor station. ACES is built around several pedagogical tools intended to make WVR-combat much easier to learn. ACES is a research simulator used for evaluation of pedagogical concepts of learning dogfight and to serve as a development simulator to demonstrate and evaluate the strengths of embedded pedagogical tools and online (real-time) analyses of important air combat fight parameters.

NTIS

*Flight Simulators; Real Time Operation*

**20050177151** NASA Lewis Research Center, Cleveland, OH, USA

**Low Pressure Turbine Flow Physics Program**

Shyne, Rickey J.; Sohn, Ki-Hyeon; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

As part of the collaborative NASA/industry/academia Low Pressure Turbine (LPT) Flow Physics program, smoke flow was visualized from a simulated low-pressure turbine experiment in NASA Lewis Research Center's CW-7 test facility. As shown in the photographs, a laminar separation bubble formed on the bottom flat surface. This is characteristic of the flows in a large-scale, low-pressure turbine operating under off-design conditions. A contoured upper wall was designed to generate a pressure distribution on a flat plate to match the suction surface pressure distribution from a generic low-pressure turbine blade.

Author

*Flow Visualization; Smoke; Turbines; Test Facilities; Fluid Dynamics*

## 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*.

**20050177069** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Safety**
2005; 24 pp.; In English
Report No.(s): PB2005-106636; No Copyright; Avail: CASI; A03, Hardcopy

The ASY FY2005 Business Plan reflects efficiency improvements to help maintain current services in a highly constrained budget environment. We will continue to focus on: developing and disseminating system safety analytical tools and methods; conducting, and supporting conduct of, system safety analyses; and sharing large integrated safety data sets throughout the agency and aviation community. However, we will stretch out implementation of some planned new activities for the coming year in order to do so.
NTIS
*Systems Engineering; Safety Factors; Safety Devices*

**20050177070** Federal Aviation Administration, Washington, DC
**Federal Aviation Administration Fiscal Year 2005 Business Plan: Commercial Space Transportation**
2005; 16 pp.; In English
Report No.(s): PB2005-106635; No Copyright; Avail: CASI; A03, Hardcopy

The mission of the Federal Aviation Administration (FAA) Associate Administrator for Commercial Space Transportation (AST) is to ensure public safety for licensed U.S. launch activities, and to support the continued growth and expansion of the U.S. space transportation industry. Safety is AST's top priority. To meet its safety responsibilities, AST undertakes a variety of core business functions to ensure that uninvolved persons are protected from the dangers and potential hazards associated with commercial space launch operations. These functions include making license determinations, conducting inspections of licensed operations, and developing rulemaking products related to commercial launch activities. Also, AST is driven to evolve its processes and approaches toward ensuring public safety as the commercial space transportation industry evolves. With a focus on the rapid evolution and complexity of new launch vehicles, AST will lead agency efforts to establish new processes to evaluate and approve safety critical launch vehicle components and systems. Further, AST will continue to improve its processes and leverage partnerships with other government organizations to enhance the safety of launches occurring from both federal and non-federal launch sites.
NTIS
*Space Commercialization; Space Transportation; Spacecraft Launching*

## 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)*.

**20050176061** NASA Lewis Research Center, Cleveland, OH, USA, McDonnell-Douglas Corp., USA
**New Low-Gravity Research Aircraft Takes to the Skies**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A new research aircraft began operations at the NASA Lewis Research Center this past year. The aircraft, a McDonnell Douglas Corporation DC-9, began providing researchers funded by NASA Headquarter's Microgravity Science and Applications Division additional opportunities to perform research in a weightless environment, similar to that in orbiting spacecraft.
Author
*Research Aircraft; Dc 9 Aircraft; Weightlessness Simulation*

**20050177116** NASA Lewis Research Center, Cleveland, OH, USA, Thiokol Corp., USA, Rockwell International Corp., USA, McDonnell-Douglas Corp., USA

**Ablative Material Testing at Lewis Rocket Lab**

Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The increasing demand for a low-cost, reliable way to launch commercial payloads to low- Earth orbit has led to the need for inexpensive, expendable propulsion systems for new launch vehicles. This, in turn, has renewed interest in less complex, uncooled rocket engines that have combustion chambers and exhaust nozzles fabricated from ablative materials. A number of aerospace propulsion system manufacturers have utilized NASA Lewis Research Center's test facilities with a high degree of success to evaluate candidate materials for application to new propulsion devices.

Author

*Test Stands; Rocket Engines; Engine Parts; Ablative Materials; High Temperature Tests; Aerospace Industry; Government/ Industry Relations*

**20050177235** NASA Lewis Research Center, Cleveland, OH, USA

**NASA Lewis' Telescience Support Center Supports Orbiting Microgravity Experiments**

Hawersaat, Bob W.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Telescience Support Center (TSC) at the NASA Lewis Research Center was developed to enable Lewis-based science teams and principal investigators to monitor and control experimental and operational payloads onboard the International Space Station. The TSC is a remote operations hub that can interface with other remote facilities, such as universities and industrial laboratories. As a pathfinder for International Space Station telescience operations, the TSC has incrementally developed an operational capability by supporting space shuttle missions. The TSC has evolved into an environment where experimenters and scientists can control and monitor the health and status of their experiments in near real time. Remote operations (or telescience) allow local scientists and their experiment teams to minimize their travel and maintain a local complement of expertise for hardware and software troubleshooting and data analysis. The TSC was designed, developed, and is operated by Lewis' Engineering and Technical Services Directorate and its support contractors, Analex Corporation and White's Information System, Inc. It is managed by Lewis' Microgravity Science Division. The TSC provides operational support in conjunction with the NASA Marshall Space Flight Center and NASA Johnson Space Center. It enables its customers to command, receive, and view telemetry; monitor the science video from their on-orbit experiments; and communicate over mission-support voice loops. Data can be received and routed to experimenter-supplied ground support equipment and/or to the TSC data system for display. Video teleconferencing capability and other video sources, such as NASA TV, are also available. The TSC has a full complement of standard services to aid experimenters in telemetry operations.

Derived from text

*Payloads; International Space Station; Ground Support Equipment; Microgravity; Data Systems; Information Systems; Communication Networks*

## 15
## LAUNCH VEHICLES AND LAUNCH OPERATIONS

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

**20050173861** Surrey Univ., Guildford, UK

**Development of a Next Generation Low Power Small Satellite Thruster**

Gibbon, David M.; Mar. 2004; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A432808; EOARD-SPC-03-3032; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report results from a contract tasking Surrey Satellite Technology, Ltd., as follows: The Grantee will investigate the performance trade-offs for micro-satellite propulsion between a next-generation resistojet using xenon propellant and carbon heaters, and other methods. These include existing resistojets and micro-pulsed plasma thrusters. Development and testing of carbon monolith heaters and a prototype thruster will be performed. Pressure and temperature of the gas in stagnation chamber will be measured. Specific impulse and thrust will be measured if the facility at ESTEC is available: otherwise it will be estimated based on mass flow.

DTIC

*Propulsion; Rocket Thrust*

**20050175712** University of Southern Illinois, Carbondale, IL, USA

**Deconstructing a Few Myths in the Interpretation of Satellite-Altitude Crustal Magnetic Field: Examples from Mars Global Surveyor**

Ravat, D.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A niche for a small, solar powered, autonomous, long range Mars rover is created by the following factors: 1 Landing errors on Mars will likely remain in 1- 10's kilometer range for the foreseeable future, at least for Mars Scout-class missions. 2 High resolution imaging of the surface, in-hand from MGS MOC and coming from the high resolution instruments on MRO, allow us to both: o Pose important scientific questions that can only be addressed by making measurements at specific locations [1], and o Plan traverses to those specific locations that avoid the larger scale (meters to kilometers in scale) obstacles visible in orbital imagery. 3 Existing and planned relay assets at Mars provide communication to surface vehicles at comparatively low mass, power and complexity (compared to a direct to Earth link), but at the operational cost of less frequent contacts. 4 Rover experiments performed in 2002 by MSSS and OU demonstrated that it is feasible for a 20- 30 kg surface vehicle to autonomously traverse long distances by moving between waypoints fifty to hundreds m apart, at speeds of order 400 m per hour, over surfaces similar to those found on Mars, using solar power .

Derived from text

*Surface Vehicles; Roving Vehicles; Mars Surface; Mars Landing; Imaging Techniques; Crusts; Autonomy*

**20050175733** Malin Space Science Systems, San Diego, CA, USA

**Semi-Autonomous Rover Operations: A Mars Technology Program Demonstration**

Ravine, M. A.; Bell, J. F., III; Malin, M. C.; Miller, D. P.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A niche for a small, solar powered, autonomous, long range Mars rover is created by the following factors: 1 Landing errors on Mars will likely remain in 1- 10's kilometer range for the foreseeable future, at least for Mars Scout-class missions. 2 High resolution imaging of the surface, in-hand from MGS MOC and coming from the high resolution instruments on MRO, allow us to both: o Pose important scientific questions that can only be addressed by making measurements at specific locations [1], and o Plan traverses to those specific locations that avoid the larger scale (meters to kilometers in scale) obstacles visible in orbital imagery. 3 Existing and planned relay assets at Mars provide communication to surface vehicles at comparatively low mass, power and complexity (compared to a direct to Earth link), but at the operational cost of less frequent contacts. 4 Rover experiments performed in 2002 by MSSS and OU demonstrated that it is feasible for a 20- 30 kg surface vehicle to autonomously traverse long distances by moving between waypoints fifty to hundreds m apart, at speeds of order 400 m per hour, over surfaces similar to those found on Mars, using solar power .

Derived from text

*Surface Vehicles; Roving Vehicles; Mars Landing; Mars Surface; Autonomy*

**20050175868** McDonnell-Douglas Corp., USA, TRW Space and Electronics Group, USA

**Three Phases of Low-Cost Rocket Engine Demonstration Program Completed**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center and the TRW Space & Technology Group have successfully completed three phases of testing on the Low-Cost Rocket Engine Demonstration Program. TRW and the McDonnell Douglas Corporation are working, in a joint effort, to quickly develop and produce a highly stable, inexpensive, simple, yet reliable, expendable launch vehicle.

Derived from text

*Aerospace Engineering; Launch Vehicles; Low Cost; Rocket Engines*

**20050177062** Federal Aviation Administration, Washington, DC, USA

**Guide to Reusable Launch and Reentry Vehicle Reliability Analysis. Version 1.0**

Apr. 2005; 74 pp.; In English

Report No.(s): PB2005-106738; No Copyright; Avail: CASI; A04, Hardcopy

This guide is designed to help reusable launch vehicle (RLV) and reentry vehicle (RV) operators conduct reliability analyses. Other approaches that fulfill regulatory objectives may be acceptable to the Federal Aviation Administration (FAA).

Such approaches should provide a clear and convincing demonstration of a level of fidelity equivalent to that provided in this document.
NTIS
*Reusable Launch Vehicles; Reentry Vehicles; Reliability Analysis*

## 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; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

**20050177200** NASA Lewis Research Center, Cleveland, OH, USA
**Solid Surface Combustion Experiment Completes a Series of Eight Successful Flights**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Solid Surface Combustion Experiment (SSCE) was the first combustion experiment to fly in the space shuttle and the first such experiment in the NASA spaceflight program since Skylab. SSCE was actually a series of experiments designed to begin to characterize flame spreading over solid fuels in microgravity and the differences of this flame spreading from normal gravity behavior. These experiments should lead to a better understanding of the physical processes involved--increasing our understanding of fire behavior, both in space and on Earth. SSCE results will help researchers evaluate spacecraft fire hazards. These experiments were conceived by the principal investigator, Professor Robert A. Altenkirch, Dean of Engineering at Washington State University. In the first five flights, the fuel sample--ashless filter paper instrumented with three thermocouples--was mounted in a sealed chamber filled with a 50-percent or 35-percent mixture of oxygen in nitrogen at pressures of 1.0, 1.5, and 2.0 atm. In the next three flights, a polymethyl methacrylate (plexiglass) fuel was instrumented with three thermocouples and tested in a 70-percent or 50-percent mixture of oxygen and nitrogen at pressures of 1.0 and 2.0 atm. SSCE is a self-contained, battery-operated experiment that can be flown either in the shuttle middeck or in the Spacelab module. More information about the hardware configuration have been published. This past year, the final two of eight flights were completed on STS-64 and STS-63. The NASA Lewis Research Center designed and built the SSCE payload and performed engineering, testing, scientific, and flight operations support. The SSCE project was supported in some way by nearly every major sector of Lewis' organization. Professor Altenkirch developed a numerical simulation of the flame-spreading process from first principles (of fluid mechanics, heat transfer, and reaction kinetics). The spread rates, flame shape, and thermodynamic data from the SSCE flights are being compared directly with the results of the computational model. Results from the eight flights will be used to formulate an improved solid-phase pyrolysis model. In addition, some results of the flights have been published and presented at international combustion symposiums. Additional solid fuel combustion experiments are being investigated for future tests with the existing hardware.
Author
*Combustion; Solid Surfaces; Space Shuttle Missions; Space Transportation System Flights; Spaceborne Experiments*

## 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*.

**20050173845** Army Missile Command, Redstone Arsenal, AL USA
**Missile Divert System Operating Phenomenonology**
Kennedy, K. D.; Mikkelsen, C. D.; Walker, B. J.; Dec. 2004; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432835; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Atmospheric Interceptor Technologies (AIT) missile airframe uses a solid propellant Divert and Attitude Control System (DACS) to maneuver the interceptor and close with the target. Precise knowledge of the aerodynamic forces and moments is required to insure hit-to-kill (HTK) aim point accuracies required for successful operation of the interceptor. The accuracy of missile interceptors is critically dependent on the fidelity of the DACS system. The fidelity of the DACS is dependent on the accuracy of the force amplification factor due to the flow separation caused by the divert jet interacting with

the free stream flow. Predictions of the behavior of a DACS system at medium altitude (45-50 km) endo-atmospheric operating conditions has shown a very large separated region flow field upstream of the divert jet, a massive separated extent of the flow field around the missile, and very large transient changes in the behavior of this separated region. This behavior has been corroborated with tests of full-scale missile hardware at duplicated flight conditions in Aero-Thermal/Aero-Optics Evaluation Center (AAEC) tests. Surprisingly, lower altitude operations of the DACS (30-35km altitude) has led to the conclusion that jet induced flow separation is an inherently unsteady event at both altitudes, resulting in a variable amplification factor. Comparisons between experiments run in a shock tunnel at duplicated run conditions using a real solid propellant thruster as well as computational fluid dynamic predictions of a powered missile in flight with plume induced flow separation support the conclusions reached above.
DTIC
*Attitude Control; Boundary Layer Separation; Missile Systems; Missiles; Separated Flow*

**20050175692** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Flight Dynamics Analysis Branch End of Fiscal Year 2004 Report**
DeLion, Anne, Editor; Stengle, Thomas; February 28, 2005; 100 pp.; In English
Report No.(s): NASA/TM-2005-212777; Rept-2005-00908-0; No Copyright; Avail: CASI; A05, Hardcopy

This report summarizes the major activities and accomplishments carried out by the Flight Dynamics Analysis Branch (FDAB), Code 595, in support of flight projects and technology development initiatives in Fiscal Year (FY) 2004. The report is intended to serve as a summary of the type of support carried out by the FDAB, as well as a concise reference of key accomplishments and mission experience derived from the various mission support roles. The primary focus of the FDAB is to provide expertise in the disciplines of flight dynamics including spacecraft navigation (autonomous and ground based); spacecraft trajectory design and maneuver planning; attitude analysis; attitude determination and sensor calibration; and attitude control subsystem (ACS) analysis and design. The FDAB currently provides support for missions and technology development projects involving NASA, other government agencies, academia, and private industry.
Author
*Attitude Control; Space Navigation; Spacecraft Trajectories; Support Systems; Trajectory Planning*

**20050175745** Northrop Grumman Corp., Redondo Beach, CA, USA
**Nuclear Powered Spacecraft Enables New Science Capabilities for Future Space Science Missions**
Reuter, Justin M.; Christensen, Andrew; Landecker, Peter; Whiddon, William B.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 1 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The JIMO vehicle will revolutionize planetary and space science. The data received from JIMO will be more than all other planetary missions combined. Additionally, the JIMO vehicle has 30 times more power available for science than Cassini does. This leap in power and data volume enables higher power instruments and more intricate science observations. Finally the vehicle is capable of carrying 1000 s of kg of science payload as opposed to other missions that are severally mass limited. This allows complex payloads, and landers to be flown all over the solar system. The JIMO mission is currently envisioned to orbit Callisto, Ganymede, and Europa. The aspects of this mission are discussed in a separate paper. It is expected that once this technology is developed it will be used to fly missions all over the solar system. These missions have yet to be defined, but in this paper we will look at several potential missions, focusing on the scientific possibilities at each of these targets. A large number of possible missions are available for Prometheus Two, including missions to support Exploration such as Cargo Ships to Mars, Power Stations on the Moon and Mars, High Power Telecommunications Relays, and possibly even Crew transport. However, this paper will concentrate only on space science applications of Prometheus Two. These mission were developed using the decadal survey, interactions with world-class scientists, the NG/JPL JIMO science team, and several other sources. Examples of these missions including: Neptune/ Triton Orbiter, Saturn/Titan Orbiter, 200 AU Mission, Comet Chaser/Sample Return Mission, Solar Probe, Mars Radar Mapping with Polar Landers, Europa Ice Breaker Mission, Multi Kuiper Belt Orbiter, Pluto/Charon Orbiter, Mars Sample Return, Venus Radar Mission with Landers, and Uranus/Miranda Orbiter. This paper will focus on several of these missions including JIMO, Neptune/Triton Orbiter (NTO), 200 AU Mission, Solar Probe with Inner Planet Flybys (SP+), Multi Kuiper Belt Mission (MKBM), and Mars Radar Mapping with Polar Landers (MRMPL). These missions cover a full spectrum of science targets and fields including: Rocky Planets (MRMPL, SP+), Giant Planets and Moons (NTO, JIMO), Planetessimals (MKBM), and Space Physics (200 AU, SP+) among others. Additionally these missions cover all four of NASA s space science directorates, Origins (SP+, 200 AU), Sun-Earth

Connections (SP+), Evolution and Structure of the Universe (JIMO, NTO, 200 AU, MKBM), and Solar System Exploration (JIMO, NTO, MKBM, MRMPL).
Derived from text
*Mars Sample Return Missions; Solar Probes; Space Exploration; Space Missions*

**20050175877** NASA Langley Research Center, Hampton, VA, USA
**Modeling of Triangular Lattice Space Structures with Curved Battens**
Chen, Tzikang; Wang, John T.; [2005]; 14 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA
Contract(s)/Grant(s): WBS 23-817-10-02
Report No.(s): AIAA Paper 2005-1967; No Copyright; Avail: CASI; A03, Hardcopy

Techniques for simulating an assembly process of lattice structures with curved battens were developed. The shape of the curved battens, the tension in the diagonals, and the compression in the battens were predicted for the assembled model. To be able to perform the assembly simulation, a cable-pulley element was implemented, and geometrically nonlinear finite element analyses were performed. Three types of finite element models were created from assembled lattice structures for studying the effects of design and modeling variations on the load carrying capability. Discrepancies in the predictions from these models were discussed. The effects of diagonal constraint failure were also studied.
Author
*Finite Element Method; Large Space Structures; Simulation; Lattices; Orbital Assembly*

**20050175895** NASA Langley Research Center, Hampton, VA, USA
**Finite Element Analysis and Test Correlation of a 10-Meter Inflation-Deployed Solar Sail**
Sleight, David W.; Michii, Yuki; Lichodziejewski, David; Derbes, Billy; Mann. Troy O.; Slade, Kara N.; Wang, John T.; [2005]; 15 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA
Contract(s)/Grant(s): WBS 23-800-92-62
Report No.(s): AIAA Paper 2005-2121; No Copyright; Avail: CASI; A03, Hardcopy

Under the direction of the NASA In-Space Propulsion Technology Office, the team of L Garde, NASA Jet Propulsion Laboratory, Ball Aerospace, and NASA Langley Research Center has been developing a scalable solar sail configuration to address NASA's future space propulsion needs. Prior to a flight experiment of a full-scale solar sail, a comprehensive phased test plan is currently being implemented to advance the technology readiness level of the solar sail design. These tests consist of solar sail component, subsystem, and sub-scale system ground tests that simulate the vacuum and thermal conditions of the space environment. Recently, two solar sail test articles, a 7.4-m beam assembly subsystem test article and a 10-m four-quadrant solar sail system test article, were tested in vacuum conditions with a gravity-offload system to mitigate the effects of gravity. This paper presents the structural analyses simulating the ground tests and the correlation of the analyses with the test results. For programmatic risk reduction, a two-prong analysis approach was undertaken in which two separate teams independently developed computational models of the solar sail test articles using the finite element analysis software packages: NEiNastran and ABAQUS. This paper compares the pre-test and post-test analysis predictions from both software packages with the test data including load-deflection curves from static load tests, and vibration frequencies and mode shapes from vibration tests. The analysis predictions were in reasonable agreement with the test data. Factors that precluded better correlation of the analyses and the tests were uncertainties in the material properties, test conditions, and modeling assumptions used in the analyses.
Author
*Finite Element Method; Solar Sails; Inflatable Structures; Structural Analysis*

**20050175897** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Validation of Commercial Fiber Optic Components for Aerospace Environments**
Ott, Melanie N.; [2005]; 13 pp.; In English; SPIE Conference, 9 Mar. 2005, San Diego, CA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Full qualification for commercial photonic parts as defined by the Military specification system in the past, is not feasible. Due to changes in the photonic components industry and the Military specification system that NASA had relied upon so heavily in the past, an approach to technology validation of commercial off the shelf parts had to be devised. This approach involves knowledge of system requirements, environmental requirements and failure modes of the particular components

under consideration. Synthesizing the criteria together with the major known failure modes to formulate a test plan is an effective way of establishing knowledge based 'qualification'. Although this does not provide the type of reliability assurance that the Military specification system did in the past, it is an approach that allows for increased risk mitigation. The information presented will introduce the audience to the technology validation approach that is currently applied at NASA for the usage of commercial-off-the-shelf (COTS) fiber optic components for space flight environments. The focus will be on how to establish technology validation criteria for commercial fiber products such that continued reliable performance is assured under the harsh environmental conditions of typical missions. The goal of this presentation is to provide the audience with an approach to formulating a COTS qualification test plan for these devices. Examples from past NASA missions will be discussed.
Author
*Aerospace Environments; Fiber Optics; Systems Engineering; Technology Utilization*

**20050176403** Manchester Coll., North Manchester, IN, USA
**Radiation Protection of New Lightweight Electromagnetic Interference Shielding Materials Determined**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Weight savings as high as 80 percent could be achieved by simply switching from aluminum electromagnetic interference (EMI) shielding covers for spacecraft power systems to EMI covers made from intercalated graphite fiber composites. Because EMI covers typically make up about one-fifth of the power system mass, this change would decrease the mass of a spacecraft power system by more than 15 percent. Intercalated graphite fibers are made by diffusing guest atoms or molecules, such as bromine, between the carbon planes of the graphite fibers. The resulting bromine-intercalated fibers have mechanical and thermal properties nearly identical to pristine graphite fibers, but their resistivity is lower by a factor of 5, giving them better electrical conductivity than stainless steel and making these composites suitable for EMI shielding.
Author
*Spacecraft Construction Materials; Radiation Shielding; Electromagnetic Interference*

**20050177145** NASA Lewis Research Center, Cleveland, OH, USA
**SAMPIE Measurements of the Space Station Plasma Current Analyzed**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In March of 1994, STS-62 carried the NASA Lewis Research Center's Solar Array Module Plasma Interactions Experiment (SAMPIE) into orbit, where it investigated the plasma current collected and the arcs from solar arrays and other space power materials immersed in the low-Earth-orbit space plasma. One of the important experiments conducted was the plasma current collected by a four-cell coupon sample of solar array cells for the international space station. The importance of this experiment dates back to the 1990 and 1991 meetings of the Space Station Electrical Grounding Tiger Team. The Tiger Team determined that unless the electrical potentials on the space station structure were actively controlled via a plasma contactor, the space station structure would arc into the plasma at a rate that would destroy the thermal properties of its surface coatings in only a few years of operation. The space station plasma contactor will control its potentials by emitting electrons into the surrounding low-Earth-orbit plasma at the same rate that they are collected by the solar arrays. Thus, the level at which the space station solar arrays can collect current is very important in verifying that the plasma contactor design can do its job.
Derived from text
*Contactors; Electrical Grounding; International Space Station; Plasma Currents; Plasma Interactions; Spacecraft Construction Materials*

**20050177187** NASA Lewis Research Center, Cleveland, OH, USA
**Silicone Contamination Camera for Developed for Shuttle Payloads**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

On many shuttle missions, silicone contamination from unknown sources from within or external to the shuttle payload bay has been a chronic problem plaguing experiment payloads. There is currently a wide range of silicone usage on the shuttle. Silicones are used to coat the shuttle tiles to enhance their ability to shed rain, and over 100 kg of RTV 560 silicone is used to seal white tiles to the shuttle surfaces. Silicones are also used in electronic components, potting compounds, and thermal control blankets. Efforts to date to identify and eliminate the sources of silicone contamination have not been highly successful and have created much controversy. To identify the sources of silicone contamination on the space shuttle, the NASA Lewis Research Center developed a contamination camera. This specially designed pinhole camera utilizes low-Earth-orbit atomic oxygen to develop a picture that identifies sources of silicone contamination on shuttle-launched payloads. The volatile

silicone species travel through the aperture of the pinhole camera, and since volatile silicone species lose their hydrocarbon functionalities under atomic oxygen attack, the silicone adheres to the substrate as SiO_x. This glassy deposit should be spatially arranged in the image of the sources of silicone contamination. To view the contamination image, one can use ultrasensitive thickness measurement techniques, such as scanning variable-angle ellipsometry, to map the surface topography of the camera's substrate. The demonstration of a functional contamination camera would resolve the controversial debate concerning the amount and location of contamination sources, would allow corrective actions to be taken, and would demonstrate a useful tool for contamination documentation on future shuttle payloads, with near negligible effect on cost and weight.
Author
*Silicones; Contamination; Cameras; Space Shuttle Payloads; Thickness*

**20050177198** NASA Lewis Research Center, Cleveland, OH, USA
**Parametric Study Conducted of Rocket- Based, Combined-Cycle Nozzles**
Steffen, Christopher J., Jr.; Smith, Timothy D.; Research and Technology 1997; April 1998; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Having reached the end of the 20th century, our society is quite familiar with the many benefits of recycling and reusing the products of civilization. The high-technology world of aerospace vehicle design is no exception. Because of the many potential economic benefits of reusable launch vehicles, NASA is aggressively pursuing this technology on several fronts. One of the most promising technologies receiving renewed attention is Rocket-Based, Combined-Cycle (RBCC) propulsion. This propulsion method combines many of the efficiencies of high-performance jet aircraft with the power and high-altitude capability of rocket engines. The goal of the present work at the NASA Lewis Research Center is to further understand the complex fluid physics within RBCC engines that govern system performance. This work is being performed in support of NASA's Advanced Reusable Technologies program. A robust RBCC engine design optimization demands further investigation of the subsystem performance of the engine's complex propulsion cycles. The RBCC propulsion system under consideration at Lewis is defined by four modes of operation in a singlestage- to-orbit configuration. In the first mode, the engine functions as a rocket-driven ejector. When the rocket engine is switched off, subsonic combustion (mode 2) is present in the ramjet mode. As the vehicle continues to accelerate, supersonic combustion (mode 3) occurs in the ramjet mode. Finally, as the edge of the atmosphere is approached and the engine inlet is closed off, the rocket is reignited and the final accent to orbit is undertaken in an all-rocket mode (mode 4). The performance of this fourth and final mode is the subject of this present study. Performance is being monitored in terms of the amount of thrust generated from a given amount of propellant.
Derived from text
*Reusable Launch Vehicles; Aerospace Vehicles; Engine Design; Fluid Dynamics; Spacecraft Propulsion; Supersonic Combustion; Rocket-Based Combined-Cycle Engines; Propellants*

## 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 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

**20050174562** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Cassini-Huygens in Orbit Around Saturn**
Matson, Dennis L.; Lebreton, Jean-Pierre; Spilker, J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cassini-Huygens spacecraft was successfully placed in an orbit about Saturn on June 30, 2004. Starting with our approach to Saturn, the instruments carried by the Orbiter have been very active since early 2004. The Huygens probe mission was also recently completed. As a result, all of the Cassini Orbiter investigations and Huygens Probe investigations have scientific results to report.
Author
*Cassini Mission; Huygens Probe; Phoebe; Communication*

**20050177196** NASA Lewis Research Center, Cleveland, OH, USA, Utah State Univ., Logan, UT, USA

**Design Concepts Studied for the Hydrogen On-Orbit Storage and Supply Experiment**

Chato, David J.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center, in conjunction with the Utah State University Space Dynamics Laboratory, studied concepts for the Hydrogen On-Orbit Storage and Supply Experiment (HOSS). HOSS is a space flight experiment whose objectives are (1) to show stable gas supply for solar-thermal thruster designs by using both storage and direct-gain approaches and (2) to evaluate and compare the low-gravity performance of active and passive pressure control via a thermodynamic vent system (TVS) suitable for solar-thermal upper stages. This study showed that the necessary experimental equipment for HOSS can be accommodated in a small hydrogen Dewar (36 to 80 liter). Thermal designs can be achieved that meet the on-orbit storage requirements for these Dewars. Furthermore, ground hold insulation concepts are easily achieved that can store liquid hydrogen in these small Dewars for more than 144 hr without venting.

Derived from text

*Spaceborne Experiments; Liquid Hydrogen; Cryogenic Equipment; Pressure Regulators; Thermodynamics; Active Control*

## 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*.

**20050175881** NASA Glenn Research Center, Cleveland, OH, USA

**An Overview of Power Capability Requirements for Exploration Missions**

Davis, Jose M.; Cataldo, Robert L.; Soeder, James F.; Manzo, Michelle A.; Hakimzadeh, Roshanak; April 2005; 27 pp.; In English; First Space Exploration Conference: Continuing the Voyage of Discovery, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA

Contract(s)/Grant(s): WBS 22-612-10-04-11

Report No.(s): NASA/TM-2005-213600; AIAA Paper 2005-2786; E-15067; No Copyright; Avail: CASI; A03, Hardcopy

Advanced power is one of the key capabilities that will be needed to achieve NASA's missions of exploration and scientific advancement. Significant gaps exist in advanced power capabilities that are on the critical path to enabling human exploration beyond Earth orbit and advanced robotic exploration of the solar system. Focused studies and investment are needed to answer key development issues for all candidate technologies before down-selection. The viability of candidate power technology alternatives will be a major factor in determining what exploration mission architectures are possible. Achieving the capabilities needed to enable the CEV, Moon, and Mars missions is dependent on adequate funding. Focused investment in advanced power technologies for human and robotic exploration missions is imperative now to reduce risk and to make informed decisions on potential exploration mission decisions beginning in 2008. This investment would begin the long lead-time needed to develop capabilities for human exploration missions in the 2015 to 2030 timeframe. This paper identifies some of the key technologies that will be needed to fill these power capability gaps. Recommendations are offered to address capability gaps in advanced power for Crew Exploration Vehicle (CEV) power, surface nuclear power systems, surface mobile power systems, high efficiency power systems, and space transportation power systems. These capabilities fill gaps that are on the critical path to enabling robotic and human exploration missions. The recommendations address the following critical technology areas: Energy Conversion, Energy Storage, and Power Management and Distribution.

Author

*Power Efficiency; Space Exploration; Electric Power Supplies; Space Power Reactors; Spacecraft Power Supplies; Mission Planning*

**20050176044** NASA Glenn Research Center, Cleveland, OH, USA

**Supporting Development for the Stirling Radioisotope Generator and Advanced Stirling Technology Development at NASA Glenn Research Center**

Thieme, Lanny G.; Schreiber, Jeffrey G.; April 2005; 25 pp.; In English; Space Technology and Applications International Forum, 13-17 Feb. 2005, Albuquerque, NM, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-972-20-01

Report No.(s): NASA/TM-2005-213628; E-15111; No Copyright; Avail: CASI; A03, Hardcopy

A high-efficiency, 110-We (watts electric) Stirling Radioisotope Generator (SRG110) for possible use on future NASA Space Science missions is being developed by the Department of Energy, Lockheed Martin, Stirling Technology Company

(STC), and NASA Glenn Research Center (GRC). Potential mission use includes providing spacecraft onboard electric power for deep space missions and power for unmanned Mars rovers. GRC is conducting an in-house supporting technology project to assist in SRG110 development. One-, three-, and six-month heater head structural benchmark tests have been completed in support of a heater head life assessment. Testing is underway to evaluate the key epoxy bond of the permanent magnets to the linear alternator stator lamination stack. GRC has completed over 10,000 hours of extended duration testing of the Stirling convertors for the SRG110, and a three-year test of two Stirling convertors in a thermal vacuum environment will be starting shortly. GRC is also developing advanced technology for Stirling convertors, aimed at substantially improving the specific power and efficiency of the convertor and the overall generator. Sunpower, Inc. has begun the development of a lightweight Stirling convertor, under a NASA Research Announcement (NRA) award, that has the potential to double the system specific power to about 8 We/kg. GRC has performed random vibration testing of a lower-power version of this convertor to evaluate robustness for surviving launch vibrations. STC has also completed the initial design of a lightweight convertor. Status of the development of a multi-dimensional computational fluid dynamics code and high-temperature materials work on advanced superalloys, refractory metal alloys, and ceramics are also discussed.
Author
*Electric Generators; NASA Space Programs; Permanent Magnets; Power Efficiency; Thermoelectric Power Generation; Radioisotope Heat Sources; Radioisotope Batteries; Space Power Reactors; Stirling Cycle*

**20050176396** NASA Lewis Research Center, Cleveland, OH, USA
**Pulsed Plasma Thruster Technology**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The continuing emphasis on reducing costs and downsizing spacecraft is forcing increased emphasis on reducing the subsystem mass and integration costs. For many commercial, scientific, and Department of Defense space missions, onboard propulsion is either the predominant spacecraft mass or it limits the spacecraft lifetime. Electromagnetic-pulsed-plasma thrusters (PPT's) offer the combined benefits of extremely low average electric power requirements (1 to 150 W), high specific impulse (approx. 1000 sec), and system simplicity derived from the use of an inert solid propellant. Potential applications range from orbit insertion and maintenance of small satellites to attitude control for large geostationary communications satellites.
Author
*Pulsed Plasma Thrusters; Weight Reduction*

**20050177111** NASA Lewis Research Center, Cleveland, OH, USA
**NSTAR Ion Propulsion System Power Electronics**
Research and Technology 1995; March 1996; 2 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Solar Electric Propulsion Technology Application Readiness (NSTAR) program, managed by the Jet Propulsion Laboratory (JPL), is currently developing a high performance, simplified ion propulsion system. This propulsion system, which is throttleable from 0.5- to 2.3-kW output power to the thruster, targets primary propulsion applications for planetary and Earth-space missions and has been baselined as the primary propulsion system for the first New Millennium spacecraft. The NASA Lewis Research Center is responsible for the design and delivery of a breadboard power processing unit (PPU) and an engineering model thruster (EMT) for this system and will manage the contract for the delivery of the flight hardware to JPL. The PPU requirements, which dictate a mass of less than 12 kg with an efficiency of 0.9 or greater at a 2.3-kW output, forced a departure from the state-of-the-art ion thruster PPU design. Several innovations--including dual-use topologies, simplified thruster control, and the use of ferrite magnetic materials--were necessary to meet these requirements. Derived from text
*Ion Propulsion; Rocket Engines; Power Conditioning; Weight Reduction*

**20050177113** NASA Lewis Research Center, Cleveland, OH, USA, Phillips Lab., USA
**Valuable Data Provided by PASP Plus Flight Experiment After 1 Year in Orbit**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Successfully launched on August 3, 1994, the Photovoltaic Array Space Power Plus Diagnostics (PASP Plus) flight experiment is a joint Air Force Phillips Laboratory/NASA Lewis Research Center program designed to test a variety of new and existing photovoltaic (PV) cell and array technologies within the space environment. The experiment consists of 12 different experimental photovoltaic modules, along with numerous diagnostic instruments that measure the space environment

and interactions between the experimental modules and that environment. Power Technology Division personnel at Lewis, who had the primary responsibility for integrating the individual photovoltaic module experiments, continue to analyze and interpret the current-voltage characteristics and environmental effects data received back from the spacecraft. The major goals of the experiment included determining the long-term performance of the photovoltaic modules within a high-radiation environment (PASP Plus was launched into an elliptical, high-radiation orbit) and measuring the interactions between the experimental modules and the space plasma when the modules were biased at high positive and negative voltages. Understanding array interactions within the space plasma is critical to spacecraft power system operations and important to providing higher bus voltage designs in the future.
Derived from text
*Aerospace Environments; Environment Effects; Photovoltaic Cells; Spacecraft Power Supplies*

**20050177126** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**CFD Analysis of Mine Fire Smoke Spread and Reverse Flow Conditions**
Edwards, J. C.; Hwang, C. C.; 2005; 10 pp.; In English; 8th Pub. in Proceedings of the U.S. Mine Ventilation Symposium Report No.(s): PB2005-106008; No Copyright; Avail: CASI; A02, Hardcopy

A Computational Fluid Dynamics (CFD) program was used to model buoyancy induced Product-Of-Combustion (POC) spread from experimental fires in the National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Research Laboratory (PRL), safety research coal mine. In one application, the CFD program was used to predict spread from fires in an entry under zero airflow conditions. At a location, 0.41 m below the entry's roof at a distance of 30 m from the fire, the measured smoke spread rates were 0.093 and 0.23 m/s for a 30 and a 296 kw fire, respectively.
NTIS
*Computational Fluid Dynamics; Fires; Mines*

**20050177141** NASA Lewis Research Center, Cleveland, OH, USA
**Thermal and Structural Analysis Conducted on Hollow-Core Turbine Blade of the Space Shuttle Main Engine**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Hot-section components of spacecraft engines are exposed to severe thermal-structural loading conditions, especially during the startup and shutdown portions of the engine cycle. For instance, the thermal transient during startup within the space shuttle main engine (SSME) can lead to a gas temperatures in excess of 3000 C, affecting the operating life of key components, such as the turbine blades. To improve the durability of these components and in particular the turbine blade, single crystal superalloys have been considered. PWA-1480, a nickel-base superalloy, has been used as the turbine blade material for the Alternate Turbopump Development (ATD) program for the SSME.
Derived from text
*Engine Parts; Space Shuttle Main Engine; Structural Analysis; Thermal Analysis; Turbine Blades*

**20050177144** NASA Lewis Research Center, Cleveland, OH, USA
**Thermodynamic Vent System Applied as Propellant Delivery System for Air Force**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Responding to a request from the Air Force, NASA Lewis Research Center engineers designed a combination pressure control and propellant delivery system based on thermodynamic vent system (TVS) technology. The Air Force is designing a new type of orbit transfer vehicle that uses energy from sunlight to both propel and power the vehicle. Because this vehicle uses propellant at a substantially slower rate than higher-energy rockets, it needed the Lewis-developed TVS technology for long-duration storage of cryogen propellants. Lewis engineers, in conjunction with industry partners, showed how this TVS technology could also be used to deliver propellant to the thruster. The Air Force has now begun the ground test demonstration phase. After successful completion of ground testing, the Air Force plans to use this technology in a space flight as early as 1999.
Derived from text
*Orbit Transfer Vehicles; Vents; Propellant Transfer*

**20050177149** NASA Lewis Research Center, Cleveland, OH, USA, Ballistic Missile Defense Organization, USA
**SCARLET Solar Array Delivered for METEOR Mission**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Solar Concentrator Array with Refractive Linear Element Technology (SCARLET) is a joint NASA Lewis Research

Center/Ballistic Missile Defense Organization program to develop advanced photovoltaic array technology for future space missions. This advanced power system technology uses a unique refractive concentrator design to focus sunlight onto a line of photovoltaic cells located below the optical element. The concentrator design is based on previous work conducted at Lewis under a Small Business Innovation Research Program (SBIR) with Entech, Inc.
Derived from text
*Concentrators; Photovoltaic Cells; Solar Arrays; Solar Collectors; Spacecraft Structures*

**20050177155** NASA Lewis Research Center, Cleveland, OH, USA
**Mir Cooperative Solar Array**
Skor, Mike; Hoffman, Dave J.; Research and Technology 1996; March 1997; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Mir Cooperative Solar Array (MCSA), produced jointly by the USA and Russia, was deployed on the Mir Russian space station on May 25, 1996. The MCSA is a photovoltaic electrical power system that can generate up to 6 kW. The power from the MCSA is needed to extend Mir's lifetime and to support experiments conducted there by visiting U.S. astronauts. The MCSA was brought to Mir via the Space Shuttle Atlantis on the STS-74 mission, launched November 12, 1995. This cooperative venture combined the best technology of both countries: the USA provided high-efficiency, lightweight photovoltaic panel modules, whereas Russia provided the array structure and deployment mechanism. Technology developed in the Space Station Freedom Program, and now being used in the International Space Station, was used to develop MCSA's photovoltaic panel. Performance data obtained from MCSA operation on Mir will help engineers better understand the performance of the photovoltaic panel modules in orbit. This information will be used to more accurately predict the performance of the International Space Station solar arrays. Managed by the NASA Lewis Research Center for NASA's International Space Station Program Office in Houston, Texas, the MCSA Project was completed on time and under budget despite a very aggressive schedule.
Author
*Mir Space Station; Spacecraft Power Supplies; Photovoltaic Cells; International Cooperation; Russian Space Program*

**20050177181** NASA Lewis Research Center, Cleveland, OH, USA, Pittsburgh Univ., PA, USA
**Aerospace Power Systems Design and Analysis (APSDA) Tool**
Truong, Long V.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The conceptual design of space and/or planetary electrical power systems has required considerable effort. Traditionally, in the early stages of the design cycle (conceptual design), the researchers have had to thoroughly study and analyze tradeoffs between system components, hardware architectures, and operating parameters (such as frequencies) to optimize system mass, efficiency, reliability, and cost. This process could take anywhere from several months to several years (as for the former Space Station Freedom), depending on the scale of the system. Although there are many sophisticated commercial software design tools for personal computers (PC's), none of them can support or provide total system design. To meet this need, researchers at the NASA Lewis Research Center cooperated with Professor George Kusic from the University of Pittsburgh to develop a new tool to help project managers and design engineers choose the best system parameters as quickly as possible in the early design stages (in days instead of months). It is called the Aerospace Power Systems Design and Analysis (APSDA) Tool. By using this tool, users can obtain desirable system design and operating parameters such as system weight, electrical distribution efficiency, bus power, and electrical load schedule. With APSDA, a large-scale specific power system was designed in a matter of days. It is an excellent tool to help designers make tradeoffs between system components, hardware architectures, and operation parameters in the early stages of the design cycle. user interface. It operates on any PC running the MS-DOS (Microsoft Corp.) operating system, version 5.0 or later. A color monitor (EGA or VGA) and two-button mouse are required. The APSDA tool was presented at the 30th Intersociety Energy Conversion Engineering Conference (IECEC) and is being beta tested at several NASA centers. Beta test packages are available for evaluation by contacting the author.
Author
*Aerospace Systems; Energy Technology; Systems Engineering; Electric Power*

**20050177204** Massachusetts Inst. of Tech., MA, USA, NASA Lewis Research Center, Cleveland, OH, USA
**Stable Lobed Mixer With Combustion Demonstrated and Measured**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center collaborated with the Massachusetts Institute of Technology (MIT) on an experiment to study the use of lobed mixers to improve the fuel-air mixing process and increase combustion intensity in combustors with

minimal pressure loss. This experiment is the first known stable combusting flow studied for this device, and the data show a much faster and much more uniform combustion process than for flat-plate mixers. Several potential benefits may be realized from this study in future combustors, including a reduction in NO_x emissions because of the more uniform temperature distribution. The experiment was done in Lewis' Planar Reacting Shear Layer facility, which was adapted to accept a lobed mixer in addition to the original planar tip. A graduate student at MIT provided the mixer design concept, and Lewis provided the engineering, operations, and research expertise. The experiment used hydrogen-nitrogen mixtures to react with vitiated hot air at 920 K. A flow speed of about 120 m/sec and a speed ratio of 0.5 were used. Flow diagnostics consisted of traversing fine-wire thermocouples and pitot probes for flow mapping. Supplementary fluorescence images were taken with a charged coupled device (CCD) camera to show the location and temporal behavior of the reaction zone. The data showed that the lobed mixer consumed the reactants between 3 to 10 times faster than a corresponding planar shear layer. The figure shows the dramatic difference in the measured temperature distribution with and without the lobed mixer. The increased mixing rate was due to a larger interfacial area as well as to the secondary flow from the streamwise vortices off the tips of the lobes. In addition, the fluorescence images showed that the lobes acted as flame stabilizers.
Author
*Combustible Flow; Flames; Flow Distribution; Combustion Chambers*

## 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 25 through 29*. For astrochemistry see category *90 Astrophysics*.

**20050174515** Media and Process Technology, Inc., Pittsburgh, PA
**CO2 Selective Ceramic Membrane for Water-Gas-Shift Reaction with Concomitant Recovery of CO2. Quarterly Report, July 1, 2004-September 30, 2004**
Liu, P. K.; Nov. 2004; 24 pp.; In English
Report No.(s): DE2004-835004; No Copyright; Avail: Department of Energy Information Bridge

For the purpose of process simulation and economic analysis of the proposed CO(sub 2) selective membrane process, we began to generate the equilibrium and rate data at the operating condition interested to our applications. In the last quarter we presented the results obtained at 200 C. In this quarter, we have concentrated on the experiments at 250 C and CO(sub 2) pressure of 0 to 1 bar. In this report we present the equilibrium isotherm and the mathematical treatment using the commonly accepted Langmuir equation. The data fit the Langmuir isotherm well and will be used for future adsorber and membrane reactor modeling. In addition, unsupported hydrotalcite membranes have been successfully synthesized on the silicon wafer with micro-channels. The membrane developed in this quarter ranges 2 to 5 (micro)m in thickness. No visible cracks or defects were observed. Performance characterization of these membranes will begin in the next quarter. Since the interference from substrate in the characterization of the supported membrane is no longer existent, it is hoped that the hydrotalcite membrane thus formed can be optimized for its CO(sub 2) selectivity and performance with the aid of the morphological and performance characterization.
NTIS
*Carbon Dioxide; Ceramics; Membranes*

**20050174517** University of Southern Mississippi, Hattiesburg, MS, USA
**Smart Multifunctional Polymers for Enhanced Oil Recovery**
McCormick, C.; Lowe, A.; 2005; 36 pp.; In English
Report No.(s): DE2005-835629; No Copyright; Avail: Department of Energy Information Bridge

Herein we report the aqueous polymerization of acrylamide using reversible addition fragmentation chain transfer (RAFT) polymerization to perform a comprehensive study on the polymerization of acrylamide. More specifically, the effect of polymerization conditions on the polymerization kinetics, molecular weight control, and blocking ability were examined. With this in mind, it was necessary to prepare 'A' block (corona of the micelle) from a hydrophilic monomer. The responsive 'B' block present in the core will be disclosed in the next two reports.
NTIS
*Polymers; Oil Recovery*

**20050174541** Pennsylvania State Univ., University Park, PA, USA

**Physical, Chemical and Structural Evolution of Zeolite-Containing Waste Forms Produced from Metakaolinite and Calcined Sodium Bearing Waste (HLW and/or LLW)**

Grutzeck, M. W.; Jun. 15, 2003; 20 pp.; In English

Report No.(s): DE2004-834996; No Copyright; Avail: Department of Energy Information Bridge

Zeolites can adsorb liquids and gases, take part in catalytic reactions and serve as cation exchange media. They are commercially available as finely divided powders. Using zeolites to manage radioactive waste is not new, but a process by which zeolites can be made to act both as a host phase and a cementing agent is. It is notable that zeolites occur in nature as well consolidated/cemented deposits. The Romans used blocks of Neapolitan zeolitized tuff as a building material and some of these buildings are still standing. Zeolites are easy to synthesize from a wide range of both natural and man-made precursor materials. The method of making a 'hydroceramic' is derived from a process in which metakaolinite (thermally dehydroxylated kaolinite) is slurried with a dilute sodium hydroxide (NaOH) solution and then reacted for hours to days at mildly elevated temperatures (60-200 C). The zeolites that form in solution are finely divided powders containing micrometer sized crystals.

NTIS

*Zeolites; Radioactive Wastes*

**20050174548** California Inst. of Tech., Pasadena, CA, Massachusetts Inst. of Tech., Cambridge, MA, USA, Pennsylvania Univ., Philadelphia, PA, USA, Washington State Univ., Pullman, WA, USA

**Material Strength at High Pressure. LDRD Stategic Initiative. Final Report**

Feb. 17, 2004; 14 pp.; In English

Report No.(s): DE2004-15009805; No Copyright; Avail: Department of Energy Information Bridge

Various aspects of the Laboratory's national security mission are now highly dependent on accurate computer code simulations of plastic flow (i.e., non-reversible deformation) of materials under conditions of high hydrostatic pressure. Strength models are typically dependent on pressure, temperature, and strain rate. Current strength models can not be extrapolated to high pressure because they are not based on the underlying mechanisms of plastic deformation. The critical need for predictive models of material strength, which describe flow stress in computer code simulations, has motivated LLNL's multiscale modeling efforts. Over the past three years, the 'Material Strength at High Pressure' LDRD Strategic Initiative has established a framework for the development of predictive strength models for deformation of metals under conditions of high hydrostatic pressure. Deformation experiments have been developed to measure the effect of high pressure on the yield strength and work hardening behavior of high purity Mo and Ta single crystals. The over arching goal of the SI is to experimentally validate multiscale-modeling capabilities for deformation of metals under conditions of high pressure.

NTIS

*Hydrostatic Pressure; High Pressure; Plastic Flow; Strain Rate; Yield Strength*

**20050174608** Centre de Recherches Petrographiques et Geochimiques, Nancy, France

**Trapping of Xenon Upon Evaporation-Condensation of Organic Matter Under UV Irradiation: Isotopic Fractionation and Electron Paramagnetic Resonance Analysis**

Marrocchi, Y.; Robert, F.; Binet, L.; Marty, B.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Carbonaceous chondrites contain an important concentration of carbon, up to 3 wt% in the most primitive meteorites. Most of C occurs as macromolecular insoluble organic matter (IOM) obtained by demineralization of bulk meteorite by HF and HCl. The structure of the IOM, poorly characterized, appears to a mixture of presolar components and amorphous carbon. Meteoritic noble gases are located in the IOM and mainly hosted by two carbon-rich phases : nanodiamonds and phase. Phase Q is the enigmatic carrier of P1 noble gases which represent the majority of Ar, Kr and Xe trapped in primitive meteorites. P1 noble gases are present in different classes of primitive meteorites as well as in differentiated meteorites. They exhibit comparable elemental and isotopic composition that suggest a common process for shaping P1 characteristic. The mechanism leading to the trapping of P1 is poorly understood. Recently, investigation of the IOM by Electron Paramagnetic Resonance (EPR) shed a new light on possible formation processes of IOM. Results have revealed the presence of heterogeneities in the free radicals distributed in micro-regions. In addition, the EPR signals of Orgueil and Murchison present a temperature dependency which can be interpreted as the occurrence of diradicaloid moieties hosted by aromatic structures of 10 to 15 rings. Derived from text

*Trapping; Xenon; Evaporation; Condensation; Organic Materials; Ultraviolet Radiation*

**20050175705** NASA Johnson Space Center, Houston, TX, USA

**Micro-XANES Measurements on Experimental Spinels and the Oxidation State of Vanadium in Coexisting Spinel and Silicate Melt**

Righter, K.; Sutton, S. R.; Newville, M.; Le. L.; Schwandt, C. S.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Spinel can be a significant host phase for V which has multiple oxidation states V(sup 2+), V(sup 3+), V(sup 4+) or V(sup 5+) at oxygen fugacities relevant to natural systems. The magnitude of D(V) spinel/melt is known to be a function of composition, temperature and fO2, but the uncertainty of the oxidation state under the range of natural conditions has made elusive a thorough understanding of D(V) spinel/melt. For example, V(sup 3+) is likely to be stable in spinels, based on exchange with Al in experiments in the CaO-MgO-Al2O3-SiO2 system. On the other hand, it has been argued that V(sup 4+) will be stable across the range of natural oxygen fugacities in nature. In order to build on our previous work in more oxidized systems, we have carried out experiments at relatively reducing conditions from the FMQ buffer to 2 log fO2 units below the IW buffer. These spinel-melt pairs, where V is present in the spinel at natural levels (approx. 300 ppm V), were analyzed using an electron microprobe at NASA-JSC and micro- XANES at the Advanced Photon Source at Argonne National Laboratory. The new results will be used together with previous results to understand the valence of V in spinel-melt systems across 12 orders of magnitude of oxygen fugacity, and with application to natural systems.

Author

*Aluminum Oxides; Magnesium Oxides; Melts (Crystal Growth); Oxidation; Silicon Dioxide; Spinel; Vanadium*

**20050176386** NASA Lewis Research Center, Cleveland, OH, USA

**Passive Optical Sample Assembly (POSA-2) Space Flight Experiment**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

NASA Lewis Research Center's Electro-Physics Branch is participating in the POSA-2 Space Flight Experiment to assess the effects of low Earth orbit and spacecraft environment contamination on power system materials and surfaces. This experiment package will be flown for 1 year in low Earth orbit and will be returned to Earth for subsequent evaluation of optical and thermal properties. Representative samples of solar array blanket materials, solar dynamic reflector materials, thermal control coatings, and sapphire are included in the experiment package.

Derived from text

*Low Earth Orbits; Solar Arrays; Spacecraft Environments; Thermodynamic Properties; Optical Properties; Spacecraft Construction Materials*

**20050177123** NASA Lewis Research Center, Cleveland, OH, USA

**Advanced High-Temperature Engine Materials Technology Progresses**

Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The objective of the Advanced High Temperature Engine Materials Technology Program (HITEMP) at the NASA Lewis Research Center is to generate technology for advanced materials and structural analysis that will increase fuel economy, improve reliability, extend life, and reduce operating costs for 21st century civil propulsion systems. The primary focus is on fan and compressor materials (polymer-matrix composites - PMC's), compressor and turbine materials (superalloys, and metal-matrix and intermetallic-matrix composites - MMC's and IMC's), and turbine materials (ceramic-matrix composites - CMC's). These advanced materials are being developed in-house by Lewis researchers and on grants and contracts.

Author

*Refractory Materials; Aircraft Engines; Engine Parts; Aircraft Construction Materials*

**20050177127** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA

**Thermal Stability of ANFO Made with Recycled Oil**

Ruhe, T. C.; Bajpayee, T. S.; 2005; 12 pp.; In English

Report No.(s): PB2005-106006; No Copyright; Avail: CASI; A03, Hardcopy

The research seeks to determine the safe operating conditions for using recycled (used) lubricating oil from mining equipment as a partial replacement for diesel fuel to make ANFO-type blasting agents. The use of recycled oil conserves energy, saves oil imports, and reduces mining costs.

NTIS

*Thermal Stability; Ammonium Nitrates; Fuel Oils*

## 24
## COMPOSITE MATERIALS

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

**20050173848** Watervliet Arsenal, NY USA
**Composite Gun Tube Support**
Littlefield, Andrew G.; Root, Joshua B.; Dec. 2004; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432848; No Copyright; Avail: Defense Technical Information Center (DTIC)

A composite gun tube support was designed for the main armament of the Future Combat Systems Mounted Combat System (FCS-MCS). The goal was to increase wheelbase for accuracy and to add stiffness to the gun tube while saving as much weight as possible. The initial tube support design was all titanium and weighed 207 lbs. By using composite materials rather than titanium, the tube support was reduced to 67 lbs, for a weight savings of nearly 70%. This paper will discuss the design, fabrication, and testing of the tube support and compare experimental test results with finite element models. The tube support was designed for the FCS-MRAAS (Multi-Role Armament and Ammunition System) Swing Chamber Launcher. The swing chamber launcher provides the benefits of loading while the tube is elevated and stabilized, enabling a much simplified autoloader design, and minimizing weight and space claims. These benefits allow for faster firing rates in a smaller and lighter system. However, there are some drawbacks to this design. In a conventional gun tube design, the chamber would be part of the gun tube and the tube could be gripped in two places, providing an appropriate wheelbase to help with accuracy. With the swing chamber, the tube is screwed into the breech ring and is thus held in only one location. This single support point, though, is insufficient to keep tube deflections at an acceptable level.
DTIC
*Composite Materials; Composite Structures; Guns (Ordnance); Pipes (Tubes)*

**20050175859** NASA Lewis Research Center, Cleveland, OH, USA
**Thermomechanical Fatigue Behavior of Coated and Uncoated Enhanced SiC/SiC Studied**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Thermomechanical fatigue (TMF) testing provides a method of evaluating candidate continuous-fiber-reinforced ceramic composites under thermal and mechanical loading conditions. Although these tests are complicated, they provide a reasonable approximation of the combined thermal and mechanical loads that will be experienced by the material in service. The resulting data will be used to develop life-prediction models as well as to aid materials development.
Derived from text
*Ceramic Matrix Composites; Fatigue Tests; Life (Durability); Prediction Analysis Techniques*

**20050176375** Ohio State Univ., Columbus, OH, USA
**The Effects of Elevated Temperatures on the Response of Resins Under Dynamic and Static Loadings**
Gilat, Amos; May 2005; 33 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNC04AA55A; RF Proj. 746623; No Copyright; Avail: CASI; A03, Hardcopy

The overall objective of the research is to experimentally study the combined effects of temperature and strain rate on the response of two resins that are commonly used for the matrix material in composites. The resins are loaded at various temperatures in shear and in tension over a wide range of strain rates. These two types of loadings provide an opportunity to examine also the effect that temperature might have on the effects of the hydrostatic stress component on the material response. The experimental data provide the information needed for NASA scientists for the development of a nonlinear, strain rate, and temperature dependent deformation and strength models for composites that can subsequently be used in design. This year effort was directed into the development and testing of the epoxy resin at elevated temperatures. Two types of epoxy resins were tested in shear at high strain rates of about 10(exp-4)/s and elevated temperatures of 50 and 8OC. The results show that the temperature significantly affects the response of epoxy.
Author
*Epoxy Resins; High Temperature; Resins; Shear Strain; Strain Rate; Temperature Effects; Hydrostatics*

**20050177143** NASA Lewis Research Center, Cleveland, OH, USA, Ohio State Univ., OH, USA
**Thermochemical Degradation Mechanisms for Reinforced Carbon/Carbon Panels on the Space Shuttle**
Research and Technology 1995; March 1996; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The wing leading edge and nose cone of the space shuttle are fabricated from a reinforced carbon/carbon material (RCC).

This material attains its durability from a diffusion coating of silicon carbide (SiC) and a glass sealant (ref. 1). During reentry, this material is subjected to an oxidizing high-temperature environment. Joint work between the Ohio State University and the NASA Lewis Research Center led to a survey of potential degradation mechanisms of the reinforced carbon/carbon (RCC) material at high temperatures
Derived from text
*Carbon-Carbon Composites; Coating; Composite Materials; Space Shuttles; Wings; Spacecraft Construction Materials; Thermal Analysis; Thermal Degradation*

**20050177159** NASA Lewis Research Center, Cleveland, OH, USA, Hughes Space and Communications Co., Los Angeles, CA, USA, Applied Sciences, Inc., Cedarville, OH, USA
**New Electromagnetic Interference Shielding Material Demonstrated**
Gaier, James R.; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A demonstration electromagnetic interference (EMI) shielding cover that has a potential mass savings in excess of 80 percent over conventional aluminum has been fabricated and tested. It was the culmination of a 3-yr effort involving Hughes Space and Communications (Los Angeles), Applied Sciences, Inc. (Cedarville, Ohio), and the NASA Lewis Research Center. The cover was fabricated from a composite of polycyanate ester resin and graphite fibers that had been chemically modified by intercalation to enhance their electrical conductivity.
Author
*Electromagnetic Interference; Electromagnetic Shielding; Graphite; Intercalation; Spacecraft Shielding; Weight Reduction*

**20050177161** NASA Lewis Research Center, Cleveland, OH, USA
**Probabilistic Thermomechanical Fatigue of Polymer Matrix Composites**
Chamis, Christos C.; Research and Technology 1996; March 1997; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Traditional computational approaches for predicting the life and long-term behavior of materials rely on empirical data and are neither generic nor unique in nature. Also, those approaches are not easy to implement in a design procedure in an effective, integrated manner. The focus of ongoing research at the NASA Lewis Research Center has been to develop advanced integrated computational methods and related computer codes for a complete reliability-based assessment of composite structures. These methods - which account for uncertainties in all the constituent properties, fabrication process variables, and loads to predict probabilistic micromechanics, ply, laminate, and structural responses - have already been implemented in the Integrated Probabilistic Assessment of Composite Structures (IPACS) computer code. The main objective of this evaluation is to illustrate the effectiveness of the methodology to predict the long-term behavior of composites under combined mechanical and thermal cyclic loading conditions.
Author
*Polymer Matrix Composites; Thermodynamics; Thermal Fatigue; Fatigue Life*

**20050177171** NASA Lewis Research Center, Cleveland, OH, USA
**Cyclic Fiber Push-In Test Monitors Evolution of Interfacial Behavior in Ceramic Matrix Composites**
Eldridge, Jeffrey I.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

SiC fiber-reinforced ceramic matrix composites are being developed for high-temperature advanced jet engine applications. Obtaining a strong, tough composite material depends critically on optimizing the mechanical coupling between the reinforcing fibers and the surrounding matrix material. This has usually been accomplished by applying a thin C or BN coating onto the surface of the reinforcing fibers. The performance of these fiber coatings, however, may degrade under cyclic loading conditions or exposure to different environments. Degradation of the coating-controlled interfacial behavior will strongly affect the useful service lifetime of the composite material. Cyclic fiber push-in testing was applied to monitor the evolution of fiber sliding behavior in both C- and BN-coated small-diameter (15-mm) SiC-fiber-reinforced ceramic matrix composites. The cyclic fiber push-in tests were performed using a desktop fiber push-out apparatus. At the beginning of each test, the fiber to be tested was aligned underneath a 10- mm-diameter diamond punch; then, the applied load was cycled between selected maximum and minimum loads. From the measured response, the fiber sliding distance and frictional sliding stresses were determined for each cycle. Tests were performed in both room air and nitrogen. Cyclic fiber push-in tests of C-coated, SiC-fiber-reinforced SiC showed progressive increases in fiber sliding distances along with decreases in frictional sliding stresses for continued cycling in room air. This rapid degradation in interfacial response was not observed for cycling

in nitrogen, indicating that moisture exposure had a large effect in immediately lowering the frictional sliding stresses of C-coated fibers. These results indicate that matrix cracks bridged by C-coated fibers will not be stable, but will rapidly grow in moisture-containing environments. In contrast, cyclic fiber push-in tests of both BN-coated, SiC-fiber-reinforced SiC and BNcoated, SiC-fiber-reinforced barium strontium aluminosilicate showed no significant changes in fiber sliding behavior with continued short-term cycling in either room air or nitrogen. Although the composites with BN-coated fibers showed stable short-term cycling behavior in both environments, long-term (several-week) exposure of debonded fibers to room air resulted in dramatically increased fiber sliding distances and decreased frictional sliding stresses. These results indicate that although matrix cracks bridged by BNcoated fibers will show short-term stability, such cracks will show substantial growth with long-term exposure to moisture-containing environments. Newly formulated BN coatings, with higher moisture resistance, will be tested in the near future.

Author

*Ceramic Matrix Composites; Boron Nitrides; Silicon Carbides; Fiber Composites; Interfacial Tension*

**20050177206** NASA Lewis Research Center, Cleveland, OH, USA

**Method Developed for the High-Temperature Nondestructive Evaluation of Fiber-Reinforced Silicon Carbide Ceramic Matrix Composites**

Goldsby, Jon C.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Ceramic matrix composites have emerged as candidate materials to allow higher operating temperatures (1000 to 1400 C) in gas turbine engines. A need, therefore, exists to develop nondestructive methods to evaluate material integrity at the material operating temperature by monitoring thermal and mechanical fatigue. These methods would also have potential as quality inspection tools. The goal of this investigation at the NASA Lewis Research Center is to survey and correlate the temperature-dependent damping and stiffness of advanced ceramic composite materials with imposed thermal and stress histories that simulate in-service turbine engine conditions. A typical sample size of 100 by 4 by 2 cubic millimeters, along with the specified stiffness and density, placed the fundamental vibration frequencies between 100 and 2000 Hz. A modified Forster apparatus seemed most applicable to simultaneously measure both damping and stiffness. Testing in vacuum reduced the effects of air on the measurements. In this method, a single composite sample is vibrated at its fundamental tone; then suddenly, the mechanical excitation is removed so that the sample's motion freely decays with time. Typical results are illlustrated in this paper.

Derived from text

*Ceramic Matrix Composites; Composite Materials; Fiber Composites; High Temperature; Nondestructive Tests; Silicon Carbides*

**20050177209** NASA Lewis Research Center, Cleveland, OH, USA

**Mechanical Characterization of Thermomechanical Matrix Residual Stresses Incurred During MMC Processing**

Castelli, Michael G.; Research and Technology 1997; April 1998; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In recent years, much effort has been spent examining the residual stress-strain states of advanced composites. Such examinations are motivated by a number of significant concerns that affect composite development, processing, and analysis. The room-temperature residual stress states incurred in many advanced composite systems are often quite large and can introduce damage even prior to the first external mechanical loading of the material. These stresses, which are induced during the cooldown following high-temperature consolidation, result from the coefficient of thermal expansion mismatch between the fiber and matrix. Experimental techniques commonly used to evaluate composite internal residual stress states are non-mechanical in nature and generally include forms of x-ray and neutron diffraction. Such approaches are usually complex, involving a number of assumptions and limitations associated with a wide range of issues, including the depth of penetration, the volume of material being assessed, and erroneous effects associated with oriented grains. Furthermore, and more important to the present research, these techniques can assess only 'single time' stress in the composite. That is, little, if any, information is obtained that addresses the time-dependent point at which internal stresses begin to accumulate, the manner in which the accumulation occurs, and the presiding relationships between thermoelastic, thermoplastic, and thermoviscous behaviors. To address these critical issues, researchers at the NASA Lewis Research Center developed and implemented an innovative mechanical test technique to examine in real time, the time-dependent thermomechanical stress behavior of a matrix alloy as it went through a consolidation cycle.

Author

*Residual Stress; Stress-Strain Relationships; Thermodynamics; Composite Structures; Composite Materials; High Temperature*

**20050177210** NASA Lewis Research Center, Cleveland, OH, USA

**Noncontact Determination of Antisymmetric Plate Wave Velocity in Ceramic Matrix Composites**

Kautz, Harold E.; Research and Technology 1997; April 1998; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

High-temperature materials are of increasing importance in the development of more efficient engines and components for the aeronautics industry. In particular, ceramic matrix composite (CMC) and metal matrix composite (MMC) structures are under active development for these applications. The acousto-ultrasonic (AU) method has been shown to be useful for assessing mechanical properties in composite structures. In particular, plate wave analysis can characterize composites in terms of their stiffness moduli. It is desirable to monitor changes in mechanical properties that occur during thermomechanical testing and to monitor the health of components whose geometry or position make them hard to reach with conventional ultrasonic probes. In such applications, it would be useful to apply AU without coupling directly to the test surface. For a number of years, lasers have been under investigation as remote ultrasonic input sources and ultrasound detectors. The use of an ultrasonic transducer coupled through an air gap has also been under study. So far at the NASA Lewis Research Center, we have been more successful in using lasers as ultrasonic sources than as output devices. On the other hand, we have been more successful in using an air-coupled piezoelectric transducer as an output device than as an input device. For this reason, we studied the laser in/air-coupled-transducer out combination-using a pulsed NdYAG laser as the ultrasonic source and an air-coupled-transducer as the detector. The present work is focused on one of the AU parameters of interest, the ultrasonic velocity of the antisymmetric plate-wave mode. This easily identified antisymmetric pulse can be used to determine shear and flexure modulus. It was chosen for this initial work because the pulse arrival times are likely to be the most precise. The following schematic illustrates our experimental arrangement for using laser in/air-transducer out on SiC/SiC composite tensile specimens. The NdYAG pulse was directed downward by a 90 infrared prism to the top of the specimen, but at the edge of one end. An energy sensor measured a single pulse at 13 millijoules (mJ) before it passed through the prism, which attenuated 15 percent of its energy. It also provided an output trigger for the waveform time-delay synthesizer.

Author

*Ceramic Matrix Composites; Metal Matrix Composites; Ultrasonics; Composite Structures; Mechanical Properties*

## 25
## INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

**20050173838** Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

**Standardized UXO Technology Demonstration Site Open Field Scoring Record Number 245**

Overbay, Larry; Mar. 2005; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A432773; ATC-8942; No Copyright; Avail: Defense Technical Information Center (DTIC)

This scoring record documents the efforts of the Naval Research Laboratories (NRL) to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG Standardized UXO Technology Demonstration Site Open Field. The scoring record was coordinated by Larry Overbay and by the Standardized UXO technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.

DTIC

*Ammunition; Scoring; Standardization*

**20050173849** Logistics Management Inst., McLean, VA USA

**Potential Use of Hydrogen as a Defense Logistics Fuel - Revision 1**

Funk, Stuart; Gross, Tom; Oh, Sonny; Powell, Lisa; McConahy, Marc; Haberman, David; Nov. 2004; 103 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): GS-00F-0026M

Report No.(s): AD-A432545; LMI-DES41M1-REV-1; No Copyright; Avail: Defense Technical Information Center (DTIC)

In response to a provision within the National Defense Authorization Act for fiscal year 2004, the Defense Logistics Agency's Defense Energy Support Center (DLA DESC) contracted with LMI to examine the potential use of hydrogen as a defense logistics fuel. Congress directed DLA to assess the feasibility of substituting hydrogen fuel and fuel cell technology,

in both transportation and power generation applications, domestically and overseas; the potential for reducing air emissions; and the implications for the cost and footprint of military operations. To frame a response to those requirements, we formulated three key questions: 1) Is the use of hydrogen a viable option for DoD? 2) What infrastructure development would be necessary, and what timeline would be expected, to begin using hydrogen fuel in step with industry developments? 3) What would be the costs and benefits of making the transition to a hydrogen fuel-based force, for both a home-based force and a deployed war-fighting force? Our investigation of these issues involved reviewing literature in detail and conducting interviews and personal communications with industry leaders and DoD personnel with subject matter expertise.
DTIC
*Fuels; Hydrogen; Logistics*

**20050174714** Argonne National Lab., IL
**MM-Wave Cavity/Klystron Developments Using Deep X-Ray Lithography at the Advanced Photon Source**
Song, J. J.; Decarlo, F.; Kang, Y. W.; Kustom, R. L.; 2004; 8 pp.; In English
Report No.(s): DE2004-16702; No Copyright; Avail: Department of Energy Information Bridge
Recent microfabrication technologies based on LIGA (German acronym for Li thographe, G alvanoformung, und A bformung) have been applied to build high-aspect-ratio, metallic or dielectric, planar structures suitable for high frequency rf cavity structures. The cavity structures would be used as parts of linear accelerators, microwave undulators, and mm-wave amplifiers. The microfabrication process includes manufacturing of precision x-ray masks, exposure of positive resist by x-rays through the mask, resist development, and electroforming of the final microstructure. Prototypes of a 32-cell, 108-GHz constant impedance cavity and a 66-cell, 94-GHz constant-gradient cavity were fabricated using the synchrotron radiation sources at APS. Preliminary design parameters for a 91- GHz modulator klystron along with an overview of the new technology are discussed.
NTIS
*Micromachining; Planar Structures*

**20050175630** Brookhaven National Lab., Upton, NY, Covalent Associates, Inc., Woburn, MA, USA
**In Situ XAS and XRD Studies of Substituted Spinel Lithium Manganese Oxides in the 4-5 V Region**
McBreen, J.; Murkerjee, S.; Yang, X. Q.; Sun, X.; Ein-Eli, Y.; Nov. 1998; 14 pp.; In English
Report No.(s): DE2004-770796; BNL-66244; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
*Cathodes; Electrochemistry; Lithium Oxides; Spinel*

**20050176388** NASA Lewis Research Center, Cleveland, OH, USA, Michigan Univ., MI, USA
**Pool Boiling Experiment Has Successful Flights**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy
The Pool Boiling Experiment (PBE) is designed to improve understanding of the fundamental mechanisms that constitute nucleate pool boiling. Nucleate pool boiling is a process wherein a stagnant pool of liquid is in contact with a surface that can supply heat to the liquid. If the liquid absorbs enough heat, a vapor bubble can be formed. This process occurs when a pot of water boils. On Earth, gravity tends to remove the vapor bubble from the heating surface because it is dominated by buoyant convection. In the orbiting space shuttle, however, buoyant convection has much less of an effect because the forces of gravity are very small. The Pool Boiling Experiment was initiated to provide insight into this nucleate boiling process, which has many Earthbound applications, such as steam-generation power plants, petroleum, and other chemical plants. Also, by using the test fluid R-113, the Pool Boiling Experiment can provide some basic understanding of the boiling behavior of cryogenic fluids without the large cost of an experiment using an actual cryogen.
Author
*Cryogenic Fluids; Spaceborne Experiments; Nucleate Boiling; Heating Equipment*

**20050176400** NASA Lewis Research Center, Cleveland, OH, USA, National Inst. of Standards and Technology, USA, Aerospace Design and Fabrication, Inc., Brook Park, OH, USA
**Radiative Ignition and the Transition to Flame Spread Investigated in the Japan Microgravity Center's 10-sec Drop Shaft**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy
The Radiative Ignition and Transition to Spread Investigation (RITSI) is a shuttle middeck Glovebox combustion

experiment developed by the NASA Lewis Research Center, the National Institute for Standards and Technology (NIST), and Aerospace Design and Fabrication (ADF). It is scheduled to fly on the third USA Microgravity Payload (USMP-3) mission in February 1996. The objective of RITSI is to experimentally study radiative ignition and the subsequent transition to flame spread in low gravity in the presence of very low speed air flows in two- and three-dimensional configurations. Toward this objective, a unique collaboration between NASA, NIST, and the University of Hokkaido was established to conduct 15 science and engineering tests in Japan's 10-sec drop shaft. For these tests, the RITSI engineering hardware was mounted in a sealed chamber with a variable oxygen atmosphere. Ashless filter paper was ignited during each drop by a tungsten-halogen heat lamp focused on a small spot in the center of the paper. The flame spread outward from that point. Data recorded included fan voltage (a measure of air flow), radiant heater voltage (a measure of radiative ignition energy), and surface temperatures (measured by up to three surface thermocouples) during ignition and flame spread.
Author (revised)
*Microgravity; Combustion Physics; Drop Tests; Ignition*

**20050177131** National Fisheries Research Lab., Columbia, MO, USA
**Assessment of Missouri River Habitat Quality with Semipermeable Membrane Devices (SPMDs)**
Petty, J. D.; Huckins, J. N.; Orazio, C. E.; Lebo, J. A.; Poulton, B. C.; Aug. 31, 1993; 186 pp.; In English
Report No.(s): PB2005-105900; No Copyright; Avail: CASI; A09, Hardcopy

The semipermeable membrane device (SPMD) technology was used to define the presence of organic contaminants in the main stem of the Missouri River. Specifically, the SPMDs were deployed at five sites - Sioux City, IA; Nebraska City, NE; Kansas City, MO; Glasgow, MO; and Hermann, MO - for a period of 28 days. The SPMDs and associated containment cages were prepared at National Fisheries Contaminant Research Center (NFCRC). Following retrieval of the SPMDs, the devices were processed and the extracts analyzed for organochlorine pesticide, polyaromatic hydrocarbon, and polychlorinated biphenyl residues. Over 400 analyses were performed on samples from the five deployment sites.
NTIS
*Contaminants; Hydrocarbons; Deployment*

## 26
## METALS AND METALLIC MATERIALS

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

**20050174611** Lunar and Planetary Inst., Houston, TX, USA
**Uranium and Lead in the Early Planetary Core Formation: New Insights Given by High Pressure and Temperature Experiments**
Malavergne, V.; Tarrida, M.; Combes, R.; Bureau, H.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Geologists and geochemists have been studying the abundance and distribution of the isotopes of U for more than a century. If we want to understand how U is distributed in the Earth or Mars, the abundance and isotope characteristics of Pb (the radiogenic daughter of U-235 and U-238) are useful parameters. Pb has a relatively low abundance in the primitive Earth s mantle in comparison with meteorites. Pb could be lost during planetary accretion (because of its volatile nature) and core segregation. In parallel, many authors have discussed the possibility that radioactive decay of U and Th might be an important heat source within planetary cores. Previous experimental studies have shown that under reducing conditions U and Th deviated from lithophile character and concentrated in sulfides. Several lines of evidence suggest that the Earth s core and the Martian core possess a significant proportion of light elements. The light components could be constrained from determining the physical conditions of core formation in these early planets. In order to quantify possible fractionation of U and Pb into a metallic core containing light elements, we have performed an experimental study at high pressure (HP) and high temperature (HT) and determined the partition coefficient D(met-sil) of Pb and U (wt% in metal / wt% in silicate) between metal and silicates at HP-HT. Experimental and analytical procedures.
Author
*Geological Surveys; Planetary Cores; Radioactive Decay; Lead (Metal); Heat Sources*

**20050176065** NASA Lewis Research Center, Cleveland, OH, USA

**New Theoretical Technique Developed for Predicting the Stability of Alloys**

Research and Technology 1995; March 1996; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

When alloys are being designed for aeronautical and other applications, a substantial experimental effort is necessary to make incremental changes in the desired alloy properties. A scheme to narrow the field to the most promising candidates would substantially reduce the high cost of this experimental screening. Such a method for determining alloy properties, called the BFS (Bozzolo, Ferrante, and Smith) method, has been developed at the NASA Lewis Research Center. This method was used to calculate the thermal stability and mechanical strength of 200 alloys of Ni3Al, with Cu and Au impurities forming ternary and quaternary compounds. With recent advances in the method, almost any metallic impurity and crystal structure can be addressed. In addition, thermal effects can be addressed with Monte Carlo techniques. At present, an experimental program is in progress to verify these results. The method identified a small number of the most promising candidates from the 200 alloys with the largest negative heat of formation and the highest bulk modulus. This calculation required only 5 min of CPU time on a VAX computer. It is clear that semi-empirical methods have achieved the level of development and reliability to warrant examining this new approach to the problem of alloy design. The present work was meant to demonstrate, perhaps in a rather simple way, this power. This type of application of atomistic simulation methods can narrow the gap and improve the feedback between theoretical predictions and laboratory experimentation.

Author

*Alloys; Materials Selection; Thermal Stability; Mechanical Properties*

**20050176383** NASA Lewis Research Center, Cleveland, OH, USA

**Transparent, Conductive Coatings Developed for Arc-Proof Solar Arrays**

Research and Technology 1995; March 1996; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Transparent, conductive thin-film coatings have many potential applications where a surface must be able to dissipate electrical charges without sacrificing its optical properties. Such applications include automotive and aircraft windows, heat mirrors, optoelectronic devices, gas sensors, and solar cell array surfaces for space applications. Many spacecraft missions require that solar cell array surfaces dissipate charges in order to avoid damage such as electronic upsets, formation of pinholes in the protective coatings on solar array blankets, and contamination due to deposition of sputtered products. In tests at the NASA Lewis Research Center, mixed thin-films of sputter-deposited indium tin oxide (ITO) and magnesium fluoride (MgF2) that could be tailored to the desired sheet resistivity, showed transmittance values of greater than 90 percent. The samples evaluated were composed of mixed, thin-film ITO/MgF2 coatings, with a nominal thickness of 650 angstroms, deposited onto glass substrates. Preliminary results indicated that these coatings were durable to vacuum ultraviolet radiation and atomic oxygen. These coatings show promise for use on solar array surfaces in polar low-Earth-orbit environments, where a sheet resistivity of less than 10(exp 8)/square is required, and in geosynchronous orbit environments, where a resistivity of less than 10(exp 9)/square is required.

Author (revised)

*Thin Films; Metal Coatings; Protective Coatings; Solar Arrays*

**20050176402** NASA Lewis Research Center, Cleveland, OH, USA

**Rhenium Rocket Manufacturing Technology**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center's On-Board Propulsion Branch has a research and technology program to develop high-temperature (2200 C), iridium-coated rhenium rocket chamber materials for radiation-cooled rockets in satellite propulsion systems. Although successful material demonstrations have gained much industry interest, acceptance of the technology has been hindered by a lack of demonstrated joining technologies and a sparse materials property data base. To alleviate these concerns, we fabricated rhenium to C-103 alloy joints by three methods: explosive bonding, diffusion bonding, and brazing. The joints were tested by simulating their incorporation into a structure by welding and by simulating high-temperature operation. Test results show that the shear strength of the joints degrades with welding and elevated temperature operation but that it is adequate for the application. Rhenium is known to form brittle intermetallics with a number of elements, and this phenomena is suspected to cause the strength degradation. Further bonding tests with a tantalum diffusion barrier between the rhenium and C-103 is planned to prevent the formation of brittle intermetallics.

Author

*Rhenium; Thrust Chambers; Refractory Materials; Spacecraft Construction Materials*

**20050177114** NASA Lewis Research Center, Cleveland, OH, USA

**Temperature-Dependent Effects on the Mechanical Behavior and Deformation Substructure of Haynes 188 Under Low-Cycle Fatigue**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The mechanical behavior of a cobalt-nickel-chromium-tungsten superalloy, Haynes 188, is being critically examined at the NASA Lewis Research Center. This dynamic, strain-aging (DSA) alloy is used for combustor liners in many military and commercial aircraft turbine engines and for the liquid oxygen posts in the main injectors of the space shuttle main engine. Its attractive features include a good combination of high monotonic yield and tensile strength, and excellent fabricability, weldability, and resistance to high-temperature oxidation for prolonged exposures.

Derived from text

*Heat Resistant Alloys; Mechanical Properties; Yield Strength; Cobalt Isotopes; Chromium Isotopes*

**20050177117** NASA Lewis Research Center, Cleveland, OH, USA

**Development of Creep-Resistant NiAl(Ti,Hf) Single-Crystal Alloys**

Research and Technology 1996; March 1997; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Nickel-base superalloys are the current choice for high-temperature jet engine applications such as turbine blades and vanes. However, after more than five decades of use, nickel-base superalloys have reached their limit, since the operating temperatures in gas turbine engines are now approaching the melting temperature of these alloys. Thus alternative materials, such as lightweight NiAl intermetallic alloys with superior properties, (e.g., high melting temperature, high thermal conductivity, and excellent chemical stability and oxidation resistance) are required for the next generation of high-temperature structural materials for more efficient 21st century civil transport systems. The two major disadvantages that have historically prevented the application of NiAl as a high-temperature structural material are its poor creep resistance and low room-temperature ductility. Alloying strategies similar to those used for nickel-base superalloys are being used to improve the high-temperature strength via solid-solution and precipitate-hardening effects. This study highlights the potent role of Ti and Hf as potential solid-solution strengtheners in NiAl and also the added effect of second-phase particles when Ti and Hf are both used.

Author

*Creep Strength; Nickel Alloys; Aluminum Alloys; Heat Resistant Alloys; Titanium; Hafnium; High Temperature Tests*

**20050177158** NASA Lewis Research Center, Cleveland, OH, USA

**Oxidation Resistance and Critical Sulfur Content of Single-Crystal Superalloys**

Smialek, James L.; Research and Technology 1996; March 1997; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The high-temperature components of a jet turbine engine are made from nickel-base superalloys. These components must be able to withstand high stresses, fatigue, and corrosive reactions with high-temperature gases. Such oxidation resistance is associated with slow-growing Al2O3 scales that remain adherent to superalloy components after many thermal cycles. Historically, good oxidation resistance has been obtained by coating these components with Ni-Cr-Al-Y coatings, where small additions of yttrium (Y) were necessary for scale adhesion. Subsequently, it was found that the Y aids scale adhesion by preventing sulfur from segregating to the scale metal interface and thus preventing the sulfur from weakening the oxide-metal bonds. Y is a difficult element to incorporate in single-crystal superalloy castings, but it was shown in early work at the NASA Lewis Research Center that good adhesion could be obtained for low-sulfur, uncoated, singlecrystal superalloys, without Y additions. Low sulfur contents for these uncoated superalloys were achieved in the laboratory by a high-temperature hydrogen annealing process. This process allows segregation and surface cleaning of sulfur monolayers in a reducing environment. Another approach is to remove sulfur from the alloy in the melting process. The present study was designed to establish a guideline for the minimum level of desulfurization needed to achieve maximum performance. Coupons of various thicknesses of the superalloy PWA 1480 were hydrogen annealed at various times (8 to 100 hr) and temperatures (1000 to 1300 C), resulting in coupons with sulfur contents ranging from about 0.05 to 5 ppm. Cyclic oxidation tests at 1100 C were then used to assess adhesion and spalling. The weight change of one set of 20-mil (0.5-mm) samples, annealed for 20 hr at 1000, 1100, 1200, and 1300 C, is shown in the following figure. Clearly, the effect of the annealing temperature is quite dramatic in that the higher temperatures produced scales that spalled very little, whereas the lower temperatures resulted in severe weight losses comparable to those for the as-received, unannealed sample.

Author (revised)

*Oxidation Resistance; Single Crystals; Sulfur; Nickel Alloys*

**20050177176** NASA Lewis Research Center, Cleveland, OH, USA

**Residual Stresses Modeled in Thermal Barrier Coatings**

Freborg, A. M.; Ferguson, B. L.; Petrus, G. J.; Brindley, W. J.; Research and Technology 1997; April 1998; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Thermal barrier coating (TBC) applications continue to increase as the need for greater engine efficiency in aircraft and land-based gas turbines increases. However, durability and reliability issues limit the benefits that can be derived from TBC's. A thorough understanding of the mechanisms that cause TBC failure is a key to increasing, as well as predicting, TBC durability. Oxidation of the bond coat has been repeatedly identified as one of the major factors affecting the durability of the ceramic top coat during service. However, the mechanisms by which oxidation facilitates TBC failure are poorly understood and require further characterization. In addition, researchers have suspected that other bond coat and top coat factors might influence TBC thermal fatigue life, both separately and through interactions with the mechanism of oxidation. These other factors include the bond coat coefficient of thermal expansion, the bond coat roughness, and the creep behavior of both the ceramic and bond coat layers. Although it is difficult to design an experiment to examine these factors unambiguously, it is possible to design a computer modeling 'experiment' to examine the action and interaction of these factors, as well as to determine failure drivers for TBC's. Previous computer models have examined some of these factors separately to determine their effect on coating residual stresses, but none have examined all the factors concurrently. The purpose of this research, which was performed at DCT, Inc., in contract with the NASA Lewis Research Center, was to develop an inclusive finite element model to characterize the effects of oxidation on the residual stresses within the TBC system during thermal cycling as well as to examine the interaction of oxidation with the other factors affecting TBC life. The plasma sprayed, two-layer thermal barrier coating that was modeled incorporated a superalloy substrate, a NiCrAlY bond coat, and a ZrO2-8 wt % Y2O3 ceramic top coat. We examined the effect on stress during burner rig thermal cycling of the following independent variables: creep in the bond coat and top coat, oxidation, bond coat coefficient of thermal expansion, number of thermal cycles, and interfacial roughness. All these factors were suspected of influencing TBC failure. The model showed that all the material properties studied had a significant effect on the coating's residual stresses if the interface of the bond coat was rough. Bond coat expansion, bond coat oxidation, and bond coat creep had the highest effect on coating stresses, and these were highly interactive. The model also showed that the mechanism of stress generation during thermal cycling changed with the number of thermal cycles. Bond coat and top coat creep dominated stress generation during early thermal cycles, greatly increasing delamination stresses at the peaks of the bond coat. Therefore, creep is the prime driver for delamination cracking early in life, but cracking is limited to the bond coat peak region. Oxidation of the bond coat, on the other hand, tended to dominate stress generation during later cycles by greatly increasing delamination stresses over bond coat valleys. These results indicate that oxidation is the driver for the continued cracking necessary to cause ceramic layer spallation.

Author

*Residual Stress; Thermal Control Coatings; Mathematical Models; Mechanical Properties*

**20050177182** NASA Lewis Research Center, Cleveland, OH, USA

**Self-Lubricating, Wear-Resistant Diamond Films Developed for Use in Vacuum Environment**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Diamond's outstanding properties--extreme hardness, chemical and thermal inertness, and high strength and rigidity--make it an ideal material for many tribological applications, such as the bearings, valves, and engine parts in the harsh environment found in internal-combustion engines, jet engines, and space propulsion systems. It has been demonstrated that chemical-vapor-deposited diamond films have low coefficients of friction (on the order of 0.01) and low wear rates (less than 10(sup -7) mm (sup 3/N-m)) both in humid air and dry nitrogen but that they have both high coefficients of friction (greater than 0.4) and high wear rates (on the order of 1(sup -4) mm sup 3/N-m)) in vacuum. It is clear that surface modifications that provide acceptable levels of friction and wear properties will be necessary before diamond films can be used for tribological applications in a space-like, vacuum environment. Previously, it was found that coatings of amorphous, non-diamond carbon can provide low friction in vacuum. Therefore, to reduce the friction and wear of diamond film in vacuum, carbon ions were implanted in an attempt to form a surface layer of amorphous carbon phases on the diamond films.

Derived from text

*Lubrication; Wear Resistance; Diamond Films; Vacuum; Product Development*

**20050177202** NASA Lewis Research Center, Cleveland, OH, USA

**Source of Scatter in the Creep Lives of NiAl(Hf) Single Crystals Revealed**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In recent years, there has been an increased emphasis in developing NiAl-based alloys for high- temperature applications

in aircraft engines. In comparison to commercial superalloys, binary NiAl has a higher melting temperature, lower density, larger thermal conductivity, and better oxidation resistance. These properties make it a desirable material to replace superalloys as blades and vanes in aircraft engines. Despite this attractive combination of properties, binary NiAl cannot be used as a reliable structural material because of its low-temperature brittleness and poor high-temperature creep strength. GE Aircraft Engines in Cincinnati, Ohio, has recently developed NiAl(Hf) alloys that have creep strengths comparable to commercial superalloys while maintaining the other desirable properties of binary NiAl. The microstructures of these alloys consist of finely distributed G-phase (Ni_(16)Hf_(6)Si_(7)) precipitates, which strengthen the NiAl matrix. However, while the creep properties of these alloys were being evaluated, considerable scatter was observed in the creep lives of specimens tested under identical stress and temperature conditions. Although these alloys had nominally the same composition, the test specimens were obtained from four different ingots (A, B, C, and D) that had been heat treated under similar conditions. The NASA Lewis Research Center began the present study at the request of GE Aircraft Engines under a Space Act Agreement to identify the source of this scatter.
Derived from text
*Brittleness; Creep Properties; Creep Strength; Nickel Aluminides; Hafnium; Thermal Conductivity; Heat Resistant Alloys*

## 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*.

**20050175636** Massachusetts Inst. of Tech., Cambridge, MA, USA, Pacific Northwest National Lab., Richland, WA, USA, Westinghouse Savannah River Co., Aiken, SC, USA
**Millimeter-Wave Monitoring of Nuclear Waste Glass Melts: An Overview**
Woskov, P. P.; Machuzak, J. S.; Thomas, P.; Sundaram, S. K.; Daniel, W. E.; 2004; 18 pp.; In English
Report No.(s): DE2004-834816; No Copyright; Avail: Department of Energy Information Bridge

Molten glass characteristics of temperature, resistivity, and viscosity can be monitored reliably in the high temperature and chemically corrosive environment of nuclear waste glass melters using millimeter-wave sensor technology. Millimeter-waves are ideally suited for such measurements because they are long enough to penetrate optically unclear atmospheres, but short enough for spatially resolved measurements. Also efficient waveguide and optic components can be fabricated from refractory materials such as ceramics. Extensive testing has been carried out at a frequency of 137 GHz to temperatures up to 1500 C. Performance of refractory waveguides at high temperature has been shown to be satisfactory. A novel new method for viscosity monitoring has also been tested with simulated nuclear waste glasses. It has been shown that a viscosity range of over 30 to 3000 Poise can be monitored with one instrument. Results of these laboratory tests and the potential of millimeter-wave sensors for on-line glass process monitoring are presented.
NTIS
*Melts (Crystal Growth); Ceramics; Millimeter Waves*

**20050175883** NASA Glenn Research Center, Cleveland, OH, USA
**Estimation of ZnSe Slow-Crack-Growth Properties for Design of the Flow Enclosure Accommodating Novel Investigations in Combustion of Solids (FEANICS) Windows**
Salem, Jonathan A.; April 2005; 36 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-400-35-40-07
Report No.(s): NASA/TM-2005-213359; E-14827; No Copyright; Avail: CASI; A03, Hardcopy

This report reviews some of the literature on the fracture strength, fracture toughness, and crack growth properties of chemical-vapor-deposited ZnSe. The literature was reviewed to determine if the existing data on ZnSe is adequate to design windows for the Flow Enclosure Accommodating Novel Investigations in Combustion of Solids (FEANICS) project. Unfortunately, most of the published reports do not give all of the necessary design parameters despite having measured the data to do so. Further, the original data is not available. The data tabulated herein was determined by digitizing plots in original reprints of the publications. Based on the published data, an estimate of the slow-crack-growth parameters for small cracks in 100 percent humidity was made. For 100 percent humidity, the slow-crack-growth parameters n and A for small crack (or single crystal) failure were estimated. Weibull moduli estimated from bending of beams and circular plates ranged from 4 to 9, while fracture strengths ranged from 29 MPa in water to 72 MPa in dry nitrogen. Fracture toughness measurements yielded ranges, with the lower values representing failure from small flaws within grains and the larger values representing

macroscopic cracks. Much of the data analyzed exhibited significant scatter, and the standard deviations were very large.
NASA
*Crack Propagation; Fracture Strength; Zinc Selenides; Fatigue Life*

**20050176377** Northrop Grumman Corp., USA, Allied-Signal Corp., USA, Allison Advanced Development Co., USA
**Nuclear Magnetic Resonance Used to Quantify the Effect of Pyrolysis Conditions on the Oxidative Stability of Silicon Oxycarbide Ceramics**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

This work was undertaken in support of the Low Cost Ceramic Composite Virtual Company, (LC^3), whose members include Northrop Grumman Corporation, AlliedSignal Inc., and Allison Advanced Development Company. LC^3 is a cost-shared effort funded by the Advanced Research Projects Agency (ARPA) and the LC^3 participants to develop a low-cost fabrication methodology for manufacturing ceramic matrix composite structural components. The program, which is being administered by the U.S. Air Force Wright Laboratory Materials Directorate, is focused on demonstrating a ceramic matrix composite turbine seal for a regional aircraft engine. This part is to be fabricated by resin transfer molding of a siloxane polymer into a fiber preform that will be transformed into a ceramic by pyrolytic conversion.
Author
*Pyrolysis; Silicon Carbides; Magnetic Resonance Spectroscopy*

**20050176397** NASA Lewis Research Center, Cleveland, OH, USA
**Protective, Abrasion-Resistant Coatings With Tailorable Properties**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Because of their light weight and impact resistance, transparent plastic structures are becoming increasingly desirable for use not only on aircraft but also in terrestrial applications such as automotive windshields and ophthalmic lenses. However, plastics are typically soft and scratch readily, reducing their transparency with use. At the NASA Lewis Research Center, reactively deposited aluminum oxide coatings as thin as 12,000 angstroms have been demonstrated to provide improved resistance to most scratches encountered during normal use. The properties of the coating can be adjusted to tailor the surface to meet other needs, such as water shedding. These adjustments can be made during the deposition process so that multiple manufacturing steps are eliminated.
Derived from text
*Aluminum Oxides; Plastics; Protective Coatings; Materials Selection; Abrasion Resistance*

**20050177088** Khlopin Radium Inst., Saint Petersburg, Russia
**Durability of Actinide Ceramic Waste Forms Under Conditons of Granitoid Rocks**
Burakov, B. E.; Anderson, E. B.; Feb. 2002; 10 pp.; In English
Report No.(s): DE2004-828347; No Copyright; Avail: Department of Energy Information Bridge

Three samples of (sup 239)Pu-(sup 241)Am-doped ceramics obtained from previous research were used for alteration experiments simulating corrosion of waste forms in ion-saturated solutions. These were ceramics based on: pyrochlore, (Ca,Hf,Pu,U,Gd)(sub 2)Ti(sub 2)O(sub 7), containing 10 wt.% Pu and 0.1 wt.% Am; zircon, (Zr,Pu)SiO(sub 4), containing 5-6 wt.% Pu and 0. 05 wt.% Am; cubic zirconia, (Zr,Gd,Pu)O(sub 2), containing 10 wt.% Pu and 0.1 wt.% Am. All these samples were milled in an agate mortar to obtain powder with particle sizes less than 30 micron. Sample of granite taken from the depth 500-503 m was studied and then used for preparing ion-saturated water solutions. A rock sample was ground, washed and classified. A fraction with particle size 0.10-0.25 mm was selected for alteration experiments. Powdered ceramic samples were separately placed into deionized water together with ground granite (approximately 1gram granite per 12-ml water) in special Teflon(trademark) vessels and set at 90 C in the oven for 3 months. After alteration experiments, the ceramic powders were studied by precise XRD analysis. Aqueous solutions and granite grains were analyzed for Am and Pu contents. The results show that alteration did not cause significant phase transformation in all ceramic samples. For all altered samples, the Am contents in aqueous solutions after experiments were similar (approximately n x 10(sup 2) Bq/ml) as well as Am amounts absorbed on granite grains (approximately n x 10(sup 5) Bq/g). Results on Pu contents were varied: for the solutions--from 60 Bq/ml for pyrochlore ceramic to 2.1 x 10(sup 3) Bq/ml for zircon ceramic; and for the absorption on granite--from 2.6 x 10(sup 4) Bq/g for zirconia ceramic to 1.4-6.8 x 10(sup 5) Bq/g for pyrochlore and zircon ceramics.
NTIS
*Durability; Ceramics; Radioactive Wastes*

**20050177121** NASA Lewis Research Center, Cleveland, OH, USA

**First Single-Crystal Mullite Fibers**

Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Ceramic-matrix composites strengthened by suitable fiber additions are being developed for high-temperature use, particularly for aerospace applications. New oxide-based fibers, such as mullite, are particularly desirable because of their resistance to high-temperature oxidative environments. Mullite is a candidate material in both fiber and matrix form. The primary objective of this work was to determine the growth characteristics of single-crystal mullite fibers produced by the laser-heated floating zone method. Directionally solidified fibers with nominal mullite compositions of 3Al2O3 2SiO2 were grown by the laser-heated floating zone method at the NASA Lewis Research Center. SEM analysis revealed that the single-crystal fibers grown in this study were strongly faceted and that the facets act as critical flaws, limiting fiber strength. The average fiber tensile strength is 1.15 GPa at room temperature. The mullite fibers exhibit superior strength retention (80 percent of their room temperature tensile strength at 1450 C). Examined by transmission electron microscopy, these mullite single crystals are free of dislocations, low-angle boundaries, and voids. In addition, they show a high degree of oxygen vacancy ordering. High-resolution digital images from an optical microscope furnish evidence of the formation of a liquid-liquid miscibility gap during crystal growth. These images represent the first experimental evidence of liquid immiscibility for these compositions and temperatures. Continuing investigation with controlled seeding of mullite single crystals is planned.

Author

*Mullites; Single Crystals; Fiber Composites; Ceramic Matrix Composites*

**20050177162** NASA Lewis Research Center, Cleveland, OH, USA

**Protective Coating Enhances the Durability of Retroreflectors for the International Space Station**

Rutledge, Sharon K.; Research and Technology 1996; March 1997; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Corner cube reflectors (retroreflectors) will be used on the International Space Station to aid in rendezvous and docking. They are designed to reflect light, such as that from a laser, directly back to the source. The resulting bright reflection from the surface can be used for critical alignment purposes. The housing for the reflectors is composed of polyoxymethylene, a polymer known as Delrin (DuPont), which is highly susceptible to erosion by the atomic oxygen environment that surrounds the station. Atomic oxygen is highly chemically reactive and will convert polymers such as Delrin into volatile oxidation products. This could cause the reflectors to detach from the housing or could cause volatile products and other contamination to recondense onto the surface of the reflectors, causing them to darken. The NASA Lewis Research Center is applying their patented fluoropolymer-filled silicon dioxide coating to the surface of the Delrin retroreflector to prevent degradation in performance caused by reactions with atomic oxygen.

Author

*Protective Coatings; Retroreflectors; Fluoropolymers; Silicon Dioxide*

**20050177217** NASA Lewis Research Center, Cleveland, OH, USA, Rensselaer Polytechnic Inst., Troy, NY, USA, Aerospace Design and Fabrication, Inc., USA

**Successful Isothermal Dendritic Growth Experiment (IDGE) Proves Current Theories of Dendritic Solidification are Flawed**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The scientific objective of the Isothermal Dendritic Growth Experiment (IDGE) is to test fundamental assumptions about dendritic solidification of molten materials. 'Dendrites'-- from the ancient Greek word for tree--are tiny branching structures that form inside molten metal alloys when they solidify during manufacturing. The size, shape, and orientation of the dendrites have a major effect on the strength, ductility (ability to be molded or shaped), and usefulness of an alloy. Nearly all of the cast metal alloys used in everyday products (such as automobiles and airplanes) are composed of thousands to millions of tiny dendrites. Gravity, present on Earth, causes convection currents in molten alloys that disturb dendritic solidification and make its precise study impossible. In space, gravity is negated by the orbiting of the space shuttle. Consequently, IDGE (which was conducted on the space shuttle) gathered the first precise data regarding undisturbed dendritic solidification. IDGE is a microgravity materials science experiment that uses an apparatus which was designed, built, tested, and operated by people from the NASA Lewis Research Center. This experiment was conceived by the principal investigator, Professor Martin E. Glicksman, from Rensselaer Polytechnic Institute in Troy, New York. The experiment was a team effort of Lewis civil

servants, contractors from Aerospace Design & Fabrication Inc. (ADF), and personnel at Rensselaer.
Derived from text
*Crystal Growth; Dendritic Crystals; Solidification*

**20050177218** NASA Lewis Research Center, Cleveland, OH, USA
**Technique to Predict Ultraviolet Radiation Embrittlement of Polymers in Space**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In the low-Earth-orbit environment, solar ultraviolet (UV) radiation embrittles polymer materials through bond breaking and crosslinking. This UV embrittlement increases the surface hardness of the polymer. Before the durability of polymer materials in the low- Earth-orbit environment can be predicted, the extent of UV embrittlement needs to be determined. However, traditional techniques for measuring the microhardness of materials cannot be employed to measure changes in the hardness of UV-embrittled surfaces because traditional techniques measure bulk hardness and are not sensitive enough to surface changes. A unique technique was used at the NASA Lewis Research Center to quantify polymer surface damage that had been induced by UV radiation. The technique uses an atomic force microscope (AFM) to measure surface microhardness. An atomic force microscope measures the repulsive forces between the atoms in a microscopic cantilevered tip and the atoms on the surface of a sample. Typically, an atomic force microscope produces a topographic image of a surface by monitoring the movement of the tip over features of the surface. The force applied to the cantilevered tip, and the indention of the tip into the surface, can be measured. The relationship between force and distance of indentation, the quantity force/distance (newtons/meter), provides a measure of the surface hardness. Under identical operating conditions, direct comparisons of surface hardness values can be made.
Derived from text
*Solar Radiation; Ultraviolet Radiation; Polymers; Embrittlement; Hardness*

## 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*.

**20050177074** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Catalytic Metal Free Production of Large Cage Structure Carbon Particles: A Candidate for Hydrogen Storage**
Kimura, Yuki; Nuth, Joseph A., III; Ferguson, Frank T.; [2005]; 13 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

We will demonstrate that carbon particles consisting of large cages can be produced without catalytic metal. The carbon particles were produced in CO gas as well as by introduction of 5% methane gas into the CO gas. The gas-produced carbon particles were able to absorb approximately 16.2 wt% of hydrogen. This value is 2.5 times higher than the 6.5 wt% goal for the vehicular hydrogen storage proposed by the Department of Energy in the USA. Therefore, we believe that this carbon particle is an excellent candidate for hydrogen storage for fuel cells.
Derived from text
*Fuel Cells; Hydrogen; Catalysts; Carbon Nanotubes; Particles*

**20050177201** NASA Lewis Research Center, Cleveland, OH, USA
**Soot Imaging and Measurement**
Research and Technology 1995; March 1996; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Soot, sometimes referred to as smoke, is made up primarily of the carbon particles generated by most combustion processes. For example, large quantities of soot can be seen issuing from the exhaust pipes of diesel-powered vehicles. Heated soot also is responsible for the warm orange color of candle flames, though that soot is generally consumed before it can exit the flame. Research has suggested that heavy atmospheric soot concentrations aggravate conditions such as pneumonia and asthma, causing many deaths each year. To understand the formation and oxidation of soot, NASA Lewis Research Center scientists, together with several university investigators, are investigating the properties of soot generated in reduced gravity, where the absence of buoyancy allows more time for the particles to grow. The increased time allows researchers to better study the life cycle of these particles, with the hope that increased understanding will lead to better control strategies. To quantify the amount of soot present in a flame, Lewis scientists developed a unique imaging technique that provides

quantitative and qualitative soot data over a large field of view. There is significant improvement over the single-point methods normally used. The technique is shown in the sketch, where light from a laser is expanded with a microscope objective, rendered parallel, and passed through a flame where soot particles reduce the amount of light transmitted to the camera. A filter only allows light at the wavelength of the laser to pass to the camera, preventing any extraneous signals. When images of the laser light with and without the flame are compared, a quantitative map of the soot concentration is produced. In addition to that data, a qualitative image of the soot in the flame is also generated, an example of which is displayed in the photo. This technique has the potential to be adapted to real-time process control in industrial powerplants.
Author
*Combustion Physics; Imaging Techniques; Soot*

## 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*.

**20050175855** NASA Glenn Research Center, Cleveland, OH, USA
**STS-107 Microgravity Environment Summary Report**
Jules, Kenol; Hrovat, Kenneth; Kelly, Eric; Reckhart, Timothy; April 2005; 178 pp.; In English
Contract(s)/Grant(s): WBS 22-400-35-40-05
Report No.(s): NASA/TM-2005-213621; E-15082; No Copyright; Avail: CASI; A09, Hardcopy

This summary report presents the results of the processed acceleration data measured aboard the Columbia orbiter during the STS-107 microgravity mission from January 16 to February 1, 2003. Two accelerometer systems were used to measure the acceleration levels due to vehicle and science operations activities that took place during the 16-day mission. Due to lack of precise timeline information regarding some payload's operations, not all of the activities were analyzed for this report. However, a general characterization of the microgravity environment of the Columbia Space Shuttle during the 16-day mission is presented followed by a more specific characterization of the environment for some designated payloads during their operations. Some specific quasi-steady and vibratory microgravity environment characterization analyses were performed for the following payloads: Structure of Flame Balls at Low Lewis-number-2, Laminar Soot Processes-2, Mechanics of Granular Materials-3 and Water Mist Fire-Suppression Experiment. The Physical Science Division of the National Aeronautics and Space Administration sponsors the Orbital Acceleration Research Experiment and the Space Acceleration Measurement System for Free Flyer to support microgravity science experiments, which require microgravity acceleration measurements. On January 16, 2003, both the Orbital Acceleration Research Experiment and the Space Acceleration Measurement System for Free Flyer accelerometer systems were launched on the Columbia Space Transportation System-107 from the Kennedy Space Center. The Orbital Acceleration Research Experiment supported science experiments requiring quasi-steady acceleration measurements, while the Space Acceleration Measurement System for Free Flyer unit supported experiments requiring vibratory acceleration measurement. The Columbia reduced gravity environment analysis presented in this report uses acceleration data collected by these two sets of accelerometer systems: The Orbital Acceleration Research Experiment is a low frequency sensor, which measures acceleration up to 1 Hz, but the 1 Hz acceleration data is trimmean filtered to yield much lower frequency acceleration data up to 0.01 Hz. This filtered data can be mapped to other locations for characterizing the quasi-steady environment for payloads and the vehicle. The Space Acceleration Measurement System for Free Flyer measures vibratory acceleration in the range of 0.01 to 200 Hz at multiple measurement locations. The vibratory acceleration data measured by this system is used to assess the local vibratory environment for payloads as well as to measure the disturbance causes by the vehicle systems, crew exercise devices and payloads operation disturbances. This summary report presents analysis of selected quasi-steady and vibratory activities measured by these two accelerometers during the Columbia 16-day microgravity mission from January 16 to February 1, 2003.
Author
*Acceleration Measurement; Gravitational Effects; Microgravity*

**20050176379** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
**Two U.S. Experiments to Fly Aboard European Spacelab Facility in 1996**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Space provides researchers a way to study the behavior of fluids when the forces of gravity are removed. The studies

described here involve international cooperative research projects to study various aspects of fluid behavior in a microgravity environment. These projects utilize the Bubble Droplet Particle Unit (BDPU), which was built by the European Space Agency's (ESA) Technology Center in Noordwijk, The Netherlands. This Spacelab-based multiuser facility flew for the first time in July 1994 on the second International Microgravity Laboratory (IML-2). It is scheduled for reflight on the Life and Microgravity Sciences (LMS) mission in June 1996. This experiment hardware was designed primarily to conduct fluid physics experiments with transparent fluids. LMS will fly both European and U.S. investigations including experiments defined by Professor R.S. Subramanian of Clarkson University in Potsdam, New York, and Professor S.A. Saville of Princeton University, Princeton, New Jersey.
Author
*Spaceborne Experiments; Spacelab; Bubbles; Fluid Dynamics*

**20050177148** NASA Lewis Research Center, Cleveland, OH, USA
**Facilitating Science--The International Space Station Fluids and Combustion Facility**
Winsa, Edward A.; Schubert, Kathleen E.; Sedlak, Deborah A.; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Scientists in many fields would like to perform experiments on the International Space Station (ISS) to take advantage of the unique environment of microgravity (which is the near-absence of gravity). The ISS will provide the opportunity for scientists to perform microgravity tests over much longer time periods than previously available on the space shuttle--months rather than hours or days--providing more data that could lead to new discoveries. Many of the experiments on ISS will be conducted through the use of new microgravity science facilities. A microgravity science facility is a complete system of on-orbit and ground (on-Earth) hardware, software, operations, and plans that have been optimized to perform sustained microgravity research in one or two scientific disciplines. The facility concept includes hardware that remains on-orbit (because of its general usefulness) and a small amount of unique hardware that is developed for each principal investigator. Such unique hardware customizes the facility to perform a given principal investigator's experiment effectively. Many facilities are planned for the ISS to accommodate scientists' needs. While the quality and quantity of scientific data are being improved, per-experiment costs will be lowered relative to other ways of performing such experiments. The NASA Lewis Research Center is developing a Fluids and Combustion Facility (FCF) to perform microgravity fluids and combustion experiments on the ISS. The FCF will be the lowest cost, most resource efficient approach to performing fluid physics and combustion science experiments on the ISS. Experiments performed in the FCF will be 3 to 9 times less expensive than similar Spacelab experiments. Moreover, use of key ISS resources, such as upmass, power, cooling, and astronaut crew time, will be cut by the same factor.
Author
*International Space Station; Spaceborne Experiments; Test Facilities*

**20050177156** NASA Lewis Research Center, Cleveland, OH, USA, Rensselaer Polytechnic Inst., Troy, NY, USA, Aerospace Design and Fabrication, Inc., Brook Park, OH, USA
**Isothermal Dendritic Growth Experiment (IDGE) Is the First USA Microgravity Experiment Controlled From the Principal Investigator's University**
Malarik, Diane C.; Glicksman, Martin E.; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The scientific objective of the Isothermal Dendritic Growth Experiment (IDGE) is to test fundamental assumptions about dendritic solidification of molten materials. IDGE is a microgravity materials science experiment using apparatus that was designed, built, tested, and operated by people from the NASA Lewis Research Center. The IDGE experiment was conceived by the principal investigator, Professor Martin E. Glicksman from Rensselaer Polytechnic Institute in Troy, New York. This experiment was a team effort of civil servants from the NASA Lewis Research Center, contractors from Aerospace Design & Fabrication, Inc. (ADF), and personnel at Rensselaer.
Author
*Dendritic Crystals; Crystal Growth; Spaceborne Experiments; Ground Based Control; Test Facilities; Remote Control*

## 31
## ENGINEERING (GENERAL)

Includes general research topics related 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*.

**20050173850** Army Missile Command, Redstone Arsenal, AL USA

**Test Methods for Short-Range Lethality Evaluation of Full-Scale Hypersonic Kinetic-Energy Missiles**

Johnson, G. L.; Brooks, L. M.; Morton, J. L.; Dec. 2004; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A432906; No Copyright; Avail: Defense Technical Information Center (DTIC)

Lethality evaluation tests of anti-armor missile systems require flight-test of tactical missiles against threat targets under highly controlled impact conditions. Variables such as terminal dive angle, impact velocity, missile orientation at impact, hit-point on the target, and shot-line through the target all must be carefully controlled and documented to properly evaluate and analyze the damage caused and extrapolate this data to other impact conditions. Development missile systems have difficulty achieving control of the impact conditions at early stages in the program due to immature or nonexistent missile guidance technologies and hardware.

DTIC

*Damage Assessment; Hypersonic Flight; Hypersonics; Impact Tests; Kinetic Energy; Lethality; Missiles; Projectiles*

## 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*.

**20050173851** Army Missile Research, Development and Engineering Lab., Redstone Arsenal, AL USA

**Fundamental Communication Range Limitation of Ultra Wideband Communications for Military Application**

Levitt, Larry J.; Dec. 2004; 3 pp.; In English; Original contains color illustrations

Report No.(s): AD-A432713; No Copyright; Avail: Defense Technical Information Center (DTIC)

An analysis of ultra wideband (UWB) channel capacity as a function of communications range is provided in this paper. Potential military application of UWB communications are indicated based on this analysis, with particular emphasis on unmanned systems. The relevance of UWB communications for ground-to-ground or air-to-ground applications includes low probability of interception or detection (covertness), relative immunity to multipath effects, large spatial capacity compared to other wireless systems, simultaneous precision ranging and communicating, and extremely low transmit power which reduces the possibility of interfering with other radio systems. Implementation challenges for advanced UWB applications are briefly noted.

DTIC

*Broadband; Military Technology; Telecommunication; Wideband Communication*

**20050173855** Army Command and Control Directorate, Fort Monmouth, NJ USA

**The Design and Requirements Evolution of a Speech Recognition Technology for Tactical Applications and Environments**

Reed, Lockwood; Dec. 2004; 3 pp.; In English; Original contains color illustrations

Report No.(s): AD-A432741; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper presents a discussion of the unique and specialized requirements for a militarized speech recognizer. It also presents the tactical advantages of militarized speech recognition technology, as it could be applied in several Command and Control (C2) applications and environments. Additionally, this paper will present the results of a comparison study, which was performed between a custom military speech recognition technology and various manual input modalities, including keyboard and trackball, for activating a selected C2 application. The results of this paper demonstrate a clear superiority of continuous speech recognition over discrete speech recognition in both metrics, and a tradeoff of task execution speed for error rate for continuous speech recognition verses manual input normal operation was evaluated at normal environmental levels. Helicopter environments are relatively stationary. The environment does not spectrally vary enough during various flight profiles to affect recognition performance. However, the noise environment of military track vehicles is not nearly as stationary as the helicopter environment, and these variations must be taken into consideration. For our own work we wanted to eliminate the user from

having to enroll in the environment altogether, and we wanted to eliminate environmental dependency. Our approach to eliminating the noise during the enrollment session (at least as far as the test subject was concerned) was to electrically mix environmental noise into the test subject input stream to the target speech recognizer. The RADC work indicated that the precise signal-to-noise ratio should not be too critical, and indeed, through
DTIC
*Command and Control; Speech Recognition; Technology Utilization; Warfare*

**20050173856** Army Command and Control Directorate, Fort Monmouth, NJ USA
**Future 'Battle Command Prototype' for Military Experimentation and Training**
Gorman, Harold J.; Hassan, Irfan; Dec. 2004; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432747; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Army is transforming itself into a lighter, modular and more rapidly deployable force. The new Army will be capable of adjusting to a changing set of missions, ranging from warfighting to peacekeeping, as requirements dictate. Desired operational capabilities will be achieved via evolution to a System of Systems (SOS) utilizing mobile-networked command, control, communication and computer (C4) functionalities. The SOS functions include: autonomous robotic systems, precision direct and indirect fires, airborne and ground organic sensor platforms, and adverse-weather reconnaissance, surveillance, targeting and acquisition. Using modeling, simulation and experimentation will facilitate this evolution to this design. The primary focus of this paper is to provide an overview of CERDEC s Future Battle Command prototype, the Mobile Command and Control (MC2) system: its capabilities and how it is supporting Future Force M&S, experimentation and training.
DTIC
*Command and Control; Education*

**20050173877** McAfee, Inc., Rockville, MD USA
**Efficient Multicast Key Management for Dynamic Army Tactical Networks**
Matt, Brian J.; Jan. 2004; 3 pp.; In English
Report No.(s): AD-A432279; No Copyright; Avail: Defense Technical Information Center (DTIC)

Many of the applications vital to the Objective Force will rely on multicast and other forms of group communication using the wireless battlefield networks of Future Combat Systems. Achieving secure and survivable communications for these applications requires group key management techniques that meet the unique challenges of battlefield networks. These challenges include minimizing re-keying delay while maximizing re-keying reliability, minimizing energy consumption, etc. The techniques must also provide scalability, and minimize communication while conforming to key storage and processing constraints.
DTIC
*Tactics; Weapon Systems; Management Methods; Reliability*

**20050173879** Naval Postgraduate School, Monterey, CA USA
**An Analysis of Hardware Requirements for Airborne Tactical Mesh Networking Nodes**
Milicic, Gregory J.; Mar. 2005; 53 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432355; No Copyright; Avail: Defense Technical Information Center (DTIC)

Wireless mesh mobile ad hoc networks (MANETs) provide the military with the opportunity to spread information superiority to the tactical battlespace in support of network-centric warfare (NCW). These mesh networks provide the tactical networking framework for providing improved situational awareness through ubiquitous sharing of information including remote sensor and targeting data. The Naval Postgraduate School's Tactical Network Topology (TNT) project sponsored by US Special Operations Command seeks to adapt commercial off the shelf (COTS) information technology for use in military operational environments. These TNT experiments rely on a variety of airborne nodes including tethered balloon and UAVs such as the Tern to provide reachback from nodes on the ground to the Tactical Operations Center (TOC) as well as to simulate the information and traffic streams expected from UAVs conducting surveillance missions and fixed persistent sensor nodes. Airborne mesh nodes have unique requirements that can be implemented with COTS technology including single board computers and compact flash.
DTIC
*Networks; Nodes (Standing Waves); Ground Operational Support System*

**20050175885** NASA Glenn Research Center, Cleveland, OH, USA

**Demonstration of an X-Band Multilayer Yagi-Like Microstrip Patch Antenna With High Directivity and Large Bandwidth**

Nessel, James A.; Zaman, Afroz; Lee, Richard Q.; Lambert, Kevin; April 2005; 11 pp.; In English; IEEE International Symposium on Antennas and Propagation, 3-8 Jul. 2005, Washington, DC, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-612-30-81-04

Report No.(s): NASA/TM-2005-213554; E-14994; No Copyright; Avail: CASI; A03, Hardcopy

The feasibility of obtaining large bandwidth and high directivity from a multilayer Yagi-like microstrip patch antenna at 10 GHz is investigated. A measured 10-dB bandwidth of approximately 20 percent and directivity of approximately 11 dBi is demonstrated through the implementation of a vertically-stacked structure with three parasitic directors, above the driven patch, and a single reflector underneath the driven patch. Simulated and measured results are compared and show fairly close agreement. This antenna offers the advantages of large bandwidth, high directivity, and symmetrical broadside patterns, and could be applicable to satellite as well as terrestrial communications.

Author

*Microstrip Antennas; Patch Antennas; Antenna Design; Laminates*

**20050176054** Pennsylvania State Univ., University Park, PA, USA

**The Development of a Plan for the Assessment, Improvement and Deployment of a Radar Acoustic Sounding System (RASS) for Wake Vortex Detection**

Morris, Philip J.; McLaughlin, Dennis K.; Gabrielson, Thomas B.; Boluriaan, Said; September 2004; 32 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG1-03084; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the activities completed under a grant from the NASA Langley Research Center to develop a plan for the assessment, improvement, and deployment of a Radar Acoustic Sounding System (RASS) for the detection of wake vortices. A brief review is provided of existing alternative instruments for wake vortex detection. This is followed by a review of previous implementations and assessment of a RASS. As a result of this review, it is concluded that the basic features of a RASS have several advantages over other commonly used wake vortex detection and measurement systems. Most important of these features are the good fidelity of the measurements and the potential for all weather operation. To realize the full potential of this remote sensing instrument, a plan for the development of a RASS designed specifically for wake vortex detection and measurement has been prepared. To keep costs to a minimum, this program would start with the development an inexpensive laboratory-scale version of a RASS system. The new instrument would be developed in several stages, each allowing for a critical assessment of the instrument s potential and limitations. The instrument, in its initial stages of development, would be tested in a controlled laboratory environment. A jet vortex simulator, a prototype version of which has already been fabricated, would be interrogated by the RASS system. The details of the laboratory vortex would be measured using a Particle Image Velocimetry (PIV) system. In the early development stages, the scattered radar signal would be digitized and the signal post-processed to determine how extensively and accurately the RASS could measure properties of the wake vortex. If the initial tests prove to be successful, a real-time, digital signal processing system would be developed as a component of the RASS system. At each stage of the instrument development and testing, the implications of the scaling required for a full-scale instrument would be considered. It is concluded that a RASS system, developed for the specific application of wake vortex detection, could become part of a robust Aircraft Vortex Spacing System (AVOSS). This system, in turn, could contribute to Reduced Spacing Operations (RSO) in US airports and improvements in Terminal Area productivity (TAP).

Author

*Acoustic Sounding; Remote Sensing; Vortices; Wakes; Radar Detection*

**20050176389** NASA Lewis Research Center, Cleveland, OH, USA, Space Systems/Loral, Palo Alto, CA, USA

**Potential Market for Satellite Technology in Meeting Telecommunication Needs of Developing Nations**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A recent study examined the potential for satellite technology to meet the telecommunication needs of developing nations. The growth of these nations depends on their attracting and holding the industrial investments of developed nations. This will not be likely with the antiquated telecommunications infrastructure typical of developing nations. On the contrary, it will require an infrastructure that is compatible with international standards. Most of the developing nations perceive this necessity and are pursuing the necessary upgrades. The rate of replacement, types of technology, services affected, and the

terrestrial/satellite mix differ by each nation's priorities and gross national product (GNP).
Derived from text
*Developing Nations; Satellite Transmission; Telecommunication; Economic Factors*

**20050176399** NASA Lewis Research Center, Cleveland, OH, USA
**Role of Communications Satellites in the National and Global Information Infrastructure**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Early in 1995, the Satellite Industry Task Force (SITF) was initiated by executives of the satellite industry to define the role for communication satellites in the National and Global Information Infrastructure (NII/GII). Satellites are essential to this information network because they offer ubiquitous coverage and less time to market. SITF, which was chaired by Dr. Thomas Brackey of the Hughes Space and Communication Division, grew out of a series of workshops held during the summer of 1994 by the communication industry, NASA, and the Defense Information Systems Agency (DISA). Experts were convened from 20 companies representing satellite and terrestrial network builders, operators, and users. For 8 months they worked to identify challenges for the satellite industry to play a pivotal role in the National and Global Information Infrastructure. NASA Lewis Research Center personnel helped out with technical and policy matters.
Author
*Communication Satellites; Satellite Networks; Satellite Communication; Communication Networks*

**20050177094** Maine Dept. of Transportation, Augusta, ME, USA
**Transit AVL/AD Mobile Data Communications Feasibility Study**
Oct. 2004; 68 pp.; In English
Report No.(s): PB2005-103110; ME-04-07; No Copyright; Avail: CASI; A04, Hardcopy

This study is the second phase of a three-phase project that may result in the deployment of a statewide, multi-modal electronic payment system. Phase I of the project was completed in March, 2002 and focused on conducting a feasibility study in assessing the opportunities to develop and deploy a statewide, multi-modal electronic payment system. At the conclusion of Phase I, two recommendations were proposed for pilot programs. The purpose of the Phase II effort is to identify general requirements for a radio voice/data communications subsystem to support deploying a regional GPS-based Automatic Vehicle Location/Computer Aided Dispatch (AVL/CAD) system. This system could integrate onboard Mobile Data Terminals (MDTs) and central AVL/CAD software with the radio data communications infrastructure. The MDTs would allow frequent updates for dispatch on location, schedule and route adherence, driver-dispatch text messaging and driver schedule and route adherence feedback.
NTIS
*Mobile Communication Systems; Data Transmission; Global Positioning System*

**20050177112** NASA Lewis Research Center, Cleveland, OH, USA, Cleveland Clinic Foundation, Cleveland, OH, USA, Virginia Univ., VA, USA
**Telemammography Using Satellite Communications**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Telemammography, the electronic transmission of digitized mammograms, can connect patients with timely, critical medical expertise; however, an adequate terrestrial communications infrastructure does not exist in these areas. NASA Lewis Research Center's Advanced Space Communications Laboratory is now working with leading breast cancer research hospitals, including the Cleveland Clinic and the University of Virginia, to perform the critical research necessary to allow new satellite networks to support telemammography.
Derived from text
*Breast; Patients; Satellite Communication; X Ray Imagery; Space Communication*

**20050177122** NASA Lewis Research Center, Cleveland, OH, USA
**Lewis Investigates Frequency Sharing Between Future NASA Space Systems and Local Multipoint Distribution Systems in the 27-GHz Band**
Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

At the request of the Federal Communications Commission (FCC), the NASA Lewis Research Center undertook an intensive study to examine the feasibility of frequency sharing between future NASA space services and proposed Local Multipoint Distribution Systems (LMDS) in the 25.25- to 27.5-GHz band. This follows NASA's earlier involvement in the

FCC's 1994 Negotiated Rule Making Committee which studied frequency sharing between Ka-band Fixed Satellite Services and LMDS in the 27.5- to 29.5-GHz band. LMDS is a terrestrial, cellular, wireless communication service primarily intended to provide television distribution from hub stations located within relatively small cells to fixed subscriber receivers. Some proposed systems, however, also plan to offer interactive services via subscriber-to-hub transmissions. LMDS providers anticipate that their systems will be a cost-effective alternative to cable television systems, especially in urban areas. LMDS proponents have expressed an interest in using frequencies below 27.5 GHz. NASA, however, plans to operate three types of space systems below 27.5 GHz. The H, I, and J follow-on satellites for the Tracking and Data Relay Satellite System (TDRSS), which are planned for launch beginning in 1999, are designed to receive high-data-rate transmissions (up to 800 Mbps) from low-Earth orbiting 'user' spacecraft in the 25.25- to 27.5-GHz band. In this case, the potential interference is the aggregate interference from LMDS transmitters (both hubs and subscribers) into the TDRSS tracking receive beams as they sweep over the Earth's surface while tracking lower altitude user spacecraft.
Author
*Frequency Assignment; Satellite Television; Ground Stations; Communication Satellites*

**20050177222** NASA Lewis Research Center, Cleveland, OH, USA
**Multichannel Error Correction Code Decoder**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

NASA Lewis Research Center's Digital Systems Technology Branch has an ongoing program in modulation, coding, onboard processing, and switching. Recently, NASA completed a project to incorporate a time-shared decoder into the very-small-aperture terminal (VSAT) onboard-processing mesh architecture. The primary goal was to demonstrate a time-shared decoder for a regenerative satellite that uses asynchronous, frequency-division multiple access (FDMA) uplink channels, thereby identifying hardware and power requirements and fault-tolerant issues that would have to be addressed in a operational system. A secondary goal was to integrate and test, in a system environment, two NASA-sponsored, proof-of-concept hardware deliverables: the Harris Corp. high-speed Bose Chaudhuri-Hocquenghem (BCH) codec and the TRW multichannel demultiplexer/demodulator (MCDD). A beneficial byproduct of this project was the development of flexible, multichannel-uplink signal-generation equipment.
Author
*Decoders; Error Correcting Codes; Multichannel Communication; Satellite Communication; Communication Equipment*

## 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*.

**20050174532** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA, Kentucky Univ., Lexington, KY, USA
**Experimental Investigation of On-Line Methods for Incipient Fault Detection**
Sottile, J.; Trutt, F. C.; Kohler, J. L.; 2005; 10 pp.; In English
Report No.(s): PB2005-105978; No Copyright; Avail: CASI; A02, Hardcopy

Condition-based maintenance (CBM) of industrial equipment is generally recognized as being the most cost-effective means for improving equipment availability. However, prerequisite to successful implementation of CBM is a reliable detector of failing components. One such detector, termed the effective negative-sequence impedance, had previously been identified as an indicator of induction motor stator winding degradation. However, a limitation of this detector is that it does not change in a predictable manner under certain motor operating conditions. This paper presents an experimental investigation of an improved technique for on-line detection of induction motor stator winding degradation. The paper begins with a brief description of the detectors, followed by a detailed description of the experimental setup, the experiments conducted, and results.
NTIS
*Cost Effectiveness; Fault Detection; Electrical Faults; Electric Motors*

**20050175627** Brookhaven National Lab., Upton, NY, Sandia National Labs., Albuquerque, NM, USA
**Ionic Current Mapping Techniques and Applications to Aluminum-Copper Corrosion**
Isaacs, H. S.; Jeffcoate, C. S.; Missert, N. A.; Barbour, J. C.; 2004; 14 pp.; In English
Report No.(s): DE2004-770787; BNL-67015; No Copyright; Avail: Department of Energy Information Bridge

Measurements have been made of the aluminum metal galvanic couple. A wide range of geometries were investigated varying the areas of anodic and cathodic surfaces and employing specially designed galvanic cells with crevices. In situ ionic current density mapping was used to monitor galvanic corrosion and currents flowing between separated metals was measured. NTIS

*Corrosion; Current Density; Mapping*

**20050177124** NASA Lewis Research Center, Cleveland, OH, USA
**High-Temperature Passive Power Electronics**
Research and Technology 1996; March 1997; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

In many future NASA missions - such as deep-space exploration, the National AeroSpace Plane, minisatellites, integrated engine electronics, and ion or arcjet thrusters - high-power electrical components and systems must operate reliably and efficiently in high-temperature environments. The high-temperature power electronics program at the NASA Lewis Research Center focuses on dielectric and insulating material research, the development and characterization of high-temperature components, and the integration of the developed components into a demonstrable 200 C power system - such as an inverter. NASA Lewis has developed high-temperature power components through collaborative efforts with the Air Force Wright Laboratory, Northrop Grumman, and the University of Wisconsin. Ceramic and film capacitors, molypermalloy powder inductors, and a coaxially wound transformer were designed, developed, and evaluated for high-temperature operation. Author

*Spacecraft Electronic Equipment; Spacecraft Power Supplies; Refractory Materials*

**20050177165** NASA Lewis Research Center, Cleveland, OH, USA
**Reliable Breakdown Obtained in Silicon Carbide Rectifiers**
Neudeck, Philip G.; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The High Temperature Integrated Electronics and Sensor (HTIES) Program at the NASA Lewis Research Center is currently developing silicon carbide (SiC) for use in harsh conditions where silicon, the semiconductor used in nearly all of today's electronics, cannot function. Silicon carbide's demonstrated ability to function under extreme high-temperature, high-power, and/or high-radiation conditions will enable significant improvements to a far-ranging variety of applications and systems. These range from improved high-voltage switching for energy savings in public electric power distribution and electric vehicles, to more powerful microwave electronics for radar and cellular communications, to sensor and controls for cleaner-burning, more fuel-efficient jet aircraft and automobile engines. Author

*Silicon Carbides; Semiconductors (Materials); Semiconductor Devices; Rectifiers; Electrical Faults*

**20050177179** NASA Lewis Research Center, Cleveland, OH, USA, Sundstrand Aerospace, USA
**Advanced Electric Distribution, Switching, and Conversion Technology for Power Control**
Soltis, James V.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Electrical Power Control Unit currently under development by Sundstrand Aerospace for use on the Fluids Combustion Facility of the International Space Station is the precursor of modular power distribution and conversion concepts for future spacecraft and aircraft applications. This unit combines modular current-limiting flexible remote power controllers and paralleled power converters into one package. Each unit includes three 1-kW, current-limiting power converter modules designed for a variable-ratio load sharing capability. The flexible remote power controllers can be used in parallel to match load requirements and can be programmed for an initial ON or OFF state on powerup. The unit contains an integral cold plate. The modularity and hybridization of the Electrical Power Control Unit sets the course for future spacecraft electrical power systems, both large and small. In such systems, the basic hybridized converter and flexible remote power controller building blocks could be configured to match power distribution and conversion capabilities to load requirements. In addition, the flexible remote power controllers could be configured in assemblies to feed multiple individual loads and could be used in parallel to meet the specific current requirements of each of those loads. Ultimately, the Electrical Power Control Unit design concept could evolve to a common switch module hybrid, or family of hybrids, for both converter and switchgear applications.

By assembling hybrids of a common current rating and voltage class in parallel, researchers could readily adapt these units for multiple applications. The Electrical Power Control Unit concept has the potential to be scaled to larger and smaller ratings for both small and large spacecraft and for aircraft where high-power density, remote power controllers or power converters are required and a common replacement part is desired for multiples of a base current rating.
Author
*Power Converters; Electric Power; Switching; Technology Utilization*

**20050177185** NASA Lewis Research Center, Cleveland, OH, USA
**Silicon Carbide Epitaxial Films Studied by Atomic Force Microscopy**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Silicon carbide (SiC) holds great potential as an electronic material because of its wide band gap energy, high breakdown electric field, thermal stability, and resistance to radiation damage. Possible aerospace applications of high-temperature, high-power, or high-radiation SiC electronic devices include sensors, control electronics, and power electronics that can operate at temperatures up to 600 C and beyond. Commercially available SiC devices now include blue light-emitting diodes (LED's) and high-voltage diodes for operation up to 350 C, with other devices under development. At present, morphological defects in epitaxially grown SiC films limit their use in device applications. Research geared toward reducing the number of structural inhomogeneities can benefit from an understanding of the type and nature of problems that cause defects. The Atomic Force Microscope (AFM) has proven to be a useful tool in characterizing defects present on the surface of SiC epitaxial films. The in-house High-Temperature Integrated Electronics and Sensors (HTIES) Program at the NASA Lewis Research Center not only extended the dopant concentration range achievable in epitaxial SiC films, but it reduced the concentration of some types of defects. Advanced structural characterization using the AFM was warranted to identify the type and structure of the remaining film defects and morphological inhomogeneities. The AFM can give quantitative information on surface topography down to molecular scales. Acquired, in part, in support of the Advanced High Temperature Engine Materials Technology Program (HITEMP), the AFM had been used previously to detect partial fiber debonding in composite material cross sections. Atomic force microscopy examination of epitaxial SiC film surfaces revealed molecular-scale details of some unwanted surface features. Growth pits propagating from defects in the substrate, and hillocks due, presumably, to existing screw dislocations in the substrates, were imaged. Away from local defects, step bunching was observed to yield step heights of hundreds of angstroms, with possible implications for the uniformity of dopants incorporated in SiC devices during fabrication. The quantitative topographic data from the AFM allow the relevant defect information to be extracted, such as the size and distribution of step bunching and the Burgers vector of screw dislocations. These atomic force microscopy results have furthered the understanding of the dynamic epitaxial SiC growth process. A model describing the observed hillock step bunching has been proposed. This cooperation between researchers involved in crystal growth, electronic device fabrication, and surface structural characterization is likely to continue as atomic force microscopy is used to improve SiC films for high-temperature electronic devices for NASA's advanced turbine engines and space power devices, as well as for future applications in the automotive industry.
Derived from text
*Atomic Force Microscopy; Epitaxy; Silicon Carbides; Thin Films*

**20050177186** NASA Lewis Research Center, Cleveland, OH, USA
**Silicon Carbide High-Temperature Power Rectifiers Fabricated and Characterized**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The High Temperature Integrated Electronics and Sensors (HTIES) team at the NASA Lewis Research Center is developing silicon carbide (SiC) for use in harsh conditions where silicon, the semiconductor used in nearly all of today's electronics, cannot function. Silicon carbide's demonstrated ability to function under extreme high-temperature, high power, and/or high-radiation conditions will enable significant improvements to a far ranging variety of applications and systems. These improvements range from improved high-voltage switching for energy savings in public electric power distribution and electric vehicles, to more powerful microwave electronics for radar and cellular communications, to sensors and controls for cleaner-burning, more fuel-efficient jet aircraft and automobile engines. In the case of jet engines, uncooled operation of 300 to 600 C SiC power actuator electronics mounted in key high-temperature areas would greatly enhance system performance and reliability. Because silicon cannot function at these elevated temperatures, the semiconductor device circuit components must be made of SiC. Lewis' HTIES group recently fabricated and characterized high-temperature SiC rectifier diodes whose record-breaking characteristics represent significant progress toward the realization of advanced high-temperature actuator control circuits. The first figure illustrates the 600 C probe-testing of a Lewis SiC pn-junction rectifier diode sitting on top of a glowing red-hot heating element. The second figure shows the current-versus voltage rectifying characteristics recorded at

600 C. At this high temperature, the diodes were able to 'turn-on' to conduct 4 A of current when forward biased, and yet block the flow of current ($quot;turn-off') when reverse biases as high as 150 V were applied. This device represents a new record for semiconductor device operation, in that no previous semiconductor electronic device has ever simultaneously demonstrated 600 C functionality, and 4-A turn-on and 150-V rectification. The high operating current was achieved despite severe device size limitations imposed by present-day SiC wafer defect densities. Further substantial increases in device performance can be expected when SiC wafer defect densities decrease as SiC wafer production technology matures.
Author
*Silicon Carbides; High Temperature; Fabrication; Silicon Controlled Rectifiers; Semiconductor Devices*

**20050177189** NASA Lewis Research Center, Cleveland, OH, USA, Army Research Lab., USA
**Silicon Carbide Mixers Demonstrated to Improve the Interference Immunity of Radio-Based Aircraft Avionics**
Neudeck, Philip G.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Concern over the interference of stray radiofrequency (RF) emissions with key aircraft avionics is evident during takeoff and landing of every commercial flight when the flight attendant requests that all portable electronics be switched off. The operation of key radio-based avionics (such as glide-slope and localizer approach instruments) depends on the ability of front-end RF receivers to detect and amplify desired information signals while rejecting interference from undesired RF sources both inside and outside the aircraft. Incidents where key navigation and approach avionics malfunction because of RF interference clearly represent an increasing threat to flight safety as the radio spectrum becomes more crowded. In an initial feasibility experiment, the U.S. Army Research Laboratory and the NASA Lewis Research Center recently demonstrated the strategic use of silicon carbide (SiC) semiconductor components to significantly reduce the susceptibility of an RF receiver circuit to undesired RF interference. A pair of silicon carbide mixer diodes successfully reduced RF interference (intermodulation distortion) in a prototype receiver circuit by a factor of 10 (20 dB) in comparison to a pair of commercial silicon-based mixer diodes.
Derived from text
*Radio Frequencies; Interference Immunity; Avionics; Semiconductors (Materials); Silicon Carbides; Receivers; Diodes*

**20050177240** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Photoionization of Trapped Carriers in Avalanche Photodiodes to Reduce Afterpulsing During Geiger-Mode Photon Counting**
Krainak, Michael A.; March 08, 2005; 3 pp.; In English; 2005 CLEO/QELS: Conference on Lasers and Electro-Optics, 22-27 May 2005, Baltimore, MD, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

We reduced the afterpulsing probability by a factor of five in a Geiger-mode photon-counting InGaAs avalanche photodiode by using sub-band-gap (lambda = 1.95 micron) laser diode illumination, which we believe photoionizes the trapped carriers.
Author
*Photoionization; Avalanche Diodes; Radiation Counters; Photodiodes*

## 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*.

**20050175871** NASA Lewis Research Center, Cleveland, OH, USA
**Transient Analysis Used to Study Thermal Radiation Effects in Single and Composite Semitransparent Layers**
Research and Technology 1995; March 1996; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In a continuing in-house program at the NASA Lewis Research Center, analytical and numerical methods are being developed to apply radiative analysis to predict transient temperature distributions and heat flows in partially transmitting materials. Results have been obtained for a single plane layer, and a transient analysis is being developed for a two-layer composite where each layer has a different refractive index. Because the ceramic refractive indices are larger than one, internal

reflections are produced at the surfaces and at the internal interface. Reflections tend to distribute energy within a layer, and this affects the transient temperature distributions.
NASA
*Heat Transfer; Numerical Analysis; Refractivity; Transient Heating*

**20050175882** NASA Glenn Research Center, Cleveland, OH, USA
**Quadrant CFD Analysis of a Mixer-Ejector Nozzle for HSCT Applications**
Yoder, Dennis A.; Georgiadis, Nicholas J.; Wolter, John D.; April 2005; 20 pp.; In English
Contract(s)/Grant(s): WBS 22-714-09-47
Report No.(s): NASA/TM-2005-213602; E-15069; HSR-071; No Copyright; Avail: CASI; A03, Hardcopy

This study investigates the sidewall effect on flow within the mixing duct downstream of a lobed mixer-ejector nozzle. Simulations which model only one half-chute width of the ejector array are compared with those which model one complete quadrant of the nozzle geometry and with available experimental data. These solutions demonstrate the applicability of the half-chute technique to model the flowfield far away from the sidewall and the necessity of a full-quadrant simulation to predict the formation of a low-energy flow region near the sidewall. The quadrant solutions are further examined to determine the cause of this low-energy region, which reduces the amount of mixing and lowers the thrust of the nozzle. Grid resolution and different grid topologies are also examined. Finally, an assessment of the half-chute and quadrant approaches is made to determine the ability of these simulations to provide qualitative and/or quantitative predictions for this type of complex flowfield.
NASA
*Computational Fluid Dynamics; Quadrants; Simulation; Aerodynamic Noise; Jet Aircraft Noise; Jet Mixing Flow; Exhaust Nozzles*

**20050175886** NASA Glenn Research Center, Cleveland, OH, USA
**Experimental Investigation of the Differences Between Reynolds-Averaged and Favre-Averaged Velocity in Supersonic Jets**
Panda, J.; Seasholtz, R. G.; May 2005; 23 pp.; In English; 43rd Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-781-30-61
Report No.(s): NASA/TM-2005-213564; AIAA Paper 2005-0514; E-15009; No Copyright; Avail: CASI; A03, Hardcopy

Recent advancement in the molecular Rayleigh scattering based technique allowed for simultaneous measurement of velocity and density fluctuations with high sampling rates. The technique was used to investigate unheated high subsonic and supersonic fully expanded free jets in the Mach number range of 0.8 to 1.8. The difference between the Favre averaged and Reynolds averaged axial velocity and axial component of the turbulent kinetic energy is found to be small. Estimates based on the Morkovin's 'Strong Reynolds Analogy' were found to provide lower values of turbulent density fluctuations than the measured data.
Author
*Mach Number; Rayleigh Scattering; Reynolds Averaging; Supersonic Jet Flow; Flow Velocity*

**20050176382** NASA Langley Research Center, Hampton, VA, USA
**Three-Dimensional Aeroelastic and Aerothermoelastic Behavior in Hypersonic Flow**
McNamara, Jack J.; Friedmann, Peretz P.; Powell, Kenneth G.; Thuruthimattam, Biju J.; Bartels, Robert E.; [2005]; 47 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-065-30-12
Report No.(s): AIAA Paper 2005-2175; Copyright; Avail: CASI; A03, Hardcopy

The aeroelastic and aerothermoelastic behavior of three-dimensional configurations in hypersonic flow regime are studied. The aeroelastic behavior of a low aspect ratio wing, representative of a fin or control surface on a generic hypersonic vehicle, is examined using third order piston theory, Euler and Navier-Stokes aerodynamics. The sensitivity of the aeroelastic behavior generated using Euler and Navier-Stokes aerodynamics to parameters governing temporal accuracy is also examined. Also, a refined aerothermoelastic model, which incorporates the heat transfer between the fluid and structure using CFD generated aerodynamic heating, is used to examine the aerothermoelastic behavior of the low aspect ratio wing in the hypersonic regime. Finally, the hypersonic aeroelastic behavior of a generic hypersonic vehicle with a lifting-body type fuselage and canted fins

is studied using piston theory and Euler aerodynamics for the range of 2.5 less than or equal to M less than or equal to 28, at altitudes ranging from 10,000 feet to 80,000 feet. This analysis includes a study on optimal mesh selection for use with Euler aerodynamics. In addition to the aeroelastic and aerothermoelastic results presented, three time domain flutter identification techniques are compared, namely the moving block approach, the least squares curve fitting method, and a system identification technique using an Auto-Regressive model of the aeroelastic system. In general, the three methods agree well. The system identification technique, however, provided quick damping and frequency estimations with minimal response record length, and therefore o ers significant reductions in computational cost. In the present case, the computational cost was reduced by 75%. The aeroelastic and aerothermoelastic results presented illustrate the applicability of the CFL3D code for the hypersonic flight regime.

Author

*Aeroelasticity; Aerothermoelasticity; Computational Fluid Dynamics; Hypersonic Flow; Three Dimensional Flow; Mathematical Models*

**20050176395** NASA Lewis Research Center, Cleveland, OH, USA, Arnold Engineering Development Center, USA

**NPARC Code Upgraded with Two-Equation Turbulence Models**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The National PARC (NPARC) Alliance was established by the NASA Lewis Research Center and the Air Force Arnold Engineering Development Center to provide the U.S. aeropropulsion community with a reliable Navier-Stokes code for simulating the nonrotating components of propulsion systems. Recent improvements to the turbulence model capabilities of the NPARC code have significantly improved its capability to simulate turbulent flows. Specifically, the Chien k-epsilon and Wilcox k-omega turbulence models were implemented at Lewis. Lewis researchers installed the Chien k-epsilon model into NPARC to improve the code's ability to calculate turbulent flows with attached wall boundary layers and free shear layers. Calculations with NPARC have demonstrated that the Chien k-epsilon model provides more accurate calculations than those obtained with algebraic models previously available in the code. Grid sensitivity investigations have shown that computational grids must be packed against the solid walls such that the first point off of the wall is placed in the laminar sublayer. In addition, matching the boundary layer and momentum thicknesses entering mixing regions is necessary for an accurate prediction of the free shear-layer growth.

Author (revised)

*Navier-Stokes Equation; K-Epsilon Turbulence Model; K-Omega Turbulence Model*

**20050177078** NASA Lewis Research Center, Cleveland, OH, USA

**Controls/CFD Interdisciplinary Research Software Generates Low-Order Linear Models for Control Design From Steady-State CFD Results**

Melcher, Kevin J.; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center is developing analytical methods and software tools to create a bridge between the controls and computational fluid dynamics (CFD) disciplines. Traditionally, control design engineers have used coarse nonlinear simulations to generate information for the design of new propulsion system controls. However, such traditional methods are not adequate for modeling the propulsion systems of complex, high-speed vehicles like the High Speed Civil Transport. To properly model the relevant flow physics of high-speed propulsion systems, one must use simulations based on CFD methods. Such CFD simulations have become useful tools for engineers that are designing propulsion system components. The analysis techniques and software being developed as part of this effort are an attempt to evolve CFD into a useful tool for control design as well. One major aspect of this research is the generation of linear models from steady-state CFD results. CFD simulations, often used during the design of high-speed inlets, yield high resolution operating point data. Under a NASA grant, the University of Akron has developed analytical techniques and software tools that use these data to generate linear models for control design. The resulting linear models have the same number of states as the original CFD simulation, so they are still very large and computationally cumbersome. Model reduction techniques have been successfully applied to reduce these large linear models by several orders of magnitude without significantly changing the dynamic response. The result is an accurate, easy to use, low-order linear model that takes less time to generate than those generated by traditional means. The development of methods for generating low-order linear models from steady-state CFD is most complete at the one-dimensional level, where software is available to generate models with different kinds of input and output variables. One-dimensional methods have been extended somewhat so that linear models can also be generated from two- and three-dimensional steady-state results. Standard techniques are adequate for reducing the order of one-dimensional CFD-based linear models. However, reduction of linear models based on two- and three-dimensional CFD results is complicated by very

sparse, ill-conditioned matrices. Some novel approaches are being investigated to solve this problem.
Derived from text
*Computational Fluid Dynamics; Mathematical Models; Steady State; Control Systems Design; Computer Programs; Linearity; Civil Aviation*

**20050177084** NASA Lewis Research Center, Cleveland, OH, USA, Department of the Air Force, USA, Aerojet-General Corp., USA, General Applied Science Labs., Inc., USA
**Computational Fluid Dynamics Analysis Method Developed for Rocket-Based Combined Cycle Engine Inlet**
Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Renewed interest in hypersonic propulsion systems has led to research programs investigating combined cycle engines that are designed to operate efficiently across the flight regime. The Rocket-Based Combined Cycle Engine is a propulsion system under development at the NASA Lewis Research Center. This engine integrates a high specific impulse, low thrust-to-weight, airbreathing engine with a low-impulse, high thrust-to-weight rocket. From takeoff to Mach 2.5, the engine operates as an air-augmented rocket. At Mach 2.5, the engine becomes a dual-mode ramjet; and beyond Mach 8, the rocket is turned back on. One Rocket-Based Combined Cycle Engine variation known as the 'Strut-Jet' concept is being investigated jointly by NASA Lewis, the U.S. Air Force, Gencorp Aerojet, General Applied Science Labs (GASL), and Lockheed Martin Corporation. Work thus far has included wind tunnel experiments and computational fluid dynamics (CFD) investigations with the NPARC code. The CFD method was initiated by modeling the geometry of the Strut-Jet with the GRIDGEN structured grid generator. Grids representing a subscale inlet model and the full-scale demonstrator geometry were constructed. These grids modeled one-half of the symmetric inlet flow path, including the precompression plate, diverter, center duct, side duct, and combustor. After the grid generation, full Navier-Stokes flow simulations were conducted with the NPARC Navier-Stokes code. The Chien low-Reynolds-number k-e turbulence model was employed to simulate the high-speed turbulent flow. Finally, the CFD solutions were postprocessed with a Fortran code. This code provided wall static pressure distributions, pitot pressure distributions, mass flow rates, and internal drag. These results were compared with experimental data from a subscale inlet test for code validation; then they were used to help evaluate the demonstrator engine net thrust.
Derived from text
*Computational Fluid Dynamics; Rocket-Based Combined-Cycle Engines; Engine Inlets; Supersonic Wind Tunnels*

**20050177099** Vermont Univ., Burlington, VT, USA
**Transport Modeling of Industrial Ventilation**
Squires, K. D.; Jun. 1997; 74 pp.; In English
Report No.(s): PB2005-105193; No Copyright; Avail: CASI; A04, Hardcopy

The focus of work performed under Grant R01 OH03052 was development of new computational models appropriate for predicting contaminant transport in the complex turbulent flows encountered in industrial ventilation applications, with an emphasis on contaminants comprised of dense particulates. The newly developed models are based on large eddy simulation (LES), a more accurate technique for predicting turbulent transport than methods currently used in engineering practice. The goal of this work was to extend LES to prediction of turbulent flows transporting small particles which do not follow the flow and to validate the model against experimental measurements from well-defined test problems.
NTIS
*Turbulence Models; Industrial Plants; Ventilation Fans*

**20050177118** NASA Lewis Research Center, Cleveland, OH, USA
**Effects of Rotor Wake on Film Cooling Investigated**
Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Through a combination of experimental and computational studies, researchers at the NASA Lewis Research Center investigated the effect of upstream blade-row wake passing on the showerhead (leading edge) film cooling of a downstream turbine. The experiments were performed in a steady-flow annular turbine cascade facility equipped with an upstream rotating row of cylindrical rods to produce a periodic wake field similar to that found in an actual turbine. Spanwise, chordwise, and temporal resolution of the blade surface temperature were achieved through the use of an array of nickel thin-film surface gauges covering one unit cell of a showerhead film hole pattern. Film effectiveness and Nusselt numbers were determined for a test matrix of various injectants, injectant blowing ratios, and wake Strouhal numbers (St).
Author
*Rotors; Wakes; Film Cooling; Annular Flow; Blowing; Cascade Flow*

**20050177154** NASA Lewis Research Center, Cleveland, OH, USA

**Measurement of Gust Response on a Turbine Cascade**

Kurkov, Anatole P.; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

This in-house experiment on the gust response of an annular turbine cascade was particularly designed to provide data to compare with the results of a typical, linearized gust-response analysis. Reduced frequency, Mach number, and incidence were varied independently. Except for the lowest reduced frequency, the gust velocity distribution was nearly sinusoidal. For the high inlet-velocity series of tests, the cascade was near choking. The mean flow was documented by measuring blade surface pressures and the cascade exit flow, and high-response pressure transducers were used to measure the unsteady pressure distribution. Inlet-velocity components and turbulence parameters were measured using hot wire anemometry. In addition to the synchronous time-averaged pressure spectra, typical power spectra are included for several representative conditions.

Author

*Turbines; Cascade Flow; Gusts*

**20050177157** NASA Lewis Research Center, Cleveland, OH, USA, Department of Defense, USA, Department of Energy, USA

**National Combustion Code: A Multidisciplinary Combustor Design System**

Stubbs, Robert M.; Liu, Nan-Suey; Research and Technology 1996; March 1997; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The Internal Fluid Mechanics Division conducts both basic research and technology, and system technology research for aerospace propulsion systems components. The research within the division, which is both computational and experimental, is aimed at improving fundamental understanding of flow physics in inlets, ducts, nozzles, turbomachinery, and combustors. This article and the following three articles highlight some of the work accomplished in 1996. A multidisciplinary combustor design system is critical for optimizing the combustor design process. Such a system should include sophisticated computer-aided design (CAD) tools for geometry creation, advanced mesh generators for creating solid model representations, a common framework for fluid flow and structural analyses, modern postprocessing tools, and parallel processing. The goal of the present effort is to develop some of the enabling technologies and to demonstrate their overall performance in an integrated system called the National Combustion Code.

Author

*Combustion Physics; Computer Aided Design; Computerized Simulation; Turbulent Flow*

**20050177160** NASA Lewis Research Center, Cleveland, OH, USA

**Pool Boiling Experiment Has Five Successful Flights**

Chiaramonte, Fran; Research and Technolgy 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Pool Boiling Experiment (PBE) is designed to improve understanding of the fundamental mechanisms that constitute nucleate pool boiling. Nucleate pool boiling is a process wherein a stagnant pool of liquid is in contact with a surface that can supply heat to the liquid. If the liquid absorbs enough heat, a vapor bubble can be formed. This process occurs when a pot of water boils. On Earth, gravity tends to remove the vapor bubble from the heating surface because it is dominated by buoyant convection. In the orbiting space shuttle, however, buoyant convection has much less of an effect because the forces of gravity are very small. The Pool Boiling Experiment was initiated to provide insight into this nucleate boiling process, which has many earthbound applications in steamgeneration power plants, petroleum plants, and other chemical plants. In addition, by using the test fluid R-113, the Pool Boiling Experiment can provide some basic understanding of the boiling behavior of cryogenic fluids without the large cost of an experiment using an actual cryogen.

Author

*Nucleate Boiling; Spaceborne Experiments*

**20050177170** NASA Lewis Research Center, Cleveland, OH, USA

**Conceptual Design Method Developed for Advanced Propulsion Nozzles**

Nadell, Shari-Beth; Barnhart, Paul J.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

As part of a contract with the NASA Lewis Research Center, a simple, accurate method of predicting the performance

characteristics of a nozzle design has been developed for use in conceptual design studies. The Nozzle Performance Analysis Code (NPAC) can predict the on- and off-design performance of axisymmetric or two-dimensional convergent and convergent-divergent nozzle geometries. NPAC accounts for the effects of overexpansion or underexpansion, flow divergence, wall friction, heat transfer, and small mass addition or loss across surfaces when the nozzle gross thrust and gross thrust coefficient are being computed. NPAC can be used to predict the performance of a given nozzle design or to develop a preliminary nozzle system design for subsequent analysis. The input required by NPAC consists of a simple geometry definition of the nozzle surfaces, the location of key nozzle stations (entrance, throat, exit), and the nozzle entrance flow properties. NPAC performs three analysis 'passes' on the nozzle geometry. First, an isentropic control volume analysis is performed to determine the gross thrust and gross thrust coefficient of the nozzle. During the second analysis pass, the skin friction and heat transfer losses are computed. The third analysis pass couples the effects of wall shear and heat transfer with the initial internal nozzle flow solutions to produce a system of equations that is solved at steps along the nozzle geometry. Small mass additions or losses, such as those resulting from leakage or bleed flow, can be included in the model at specified geometric sections. A final correction is made to account for divergence losses that are incurred if the nozzle exit flow is not purely axial.

Derived from text

*Nozzle Design; Propulsion System Configurations; Computational Fluid Dynamics; Systems Engineering*

**20050177178** NASA Lewis Research Center, Cleveland, OH, USA

**Thermal High- and Low-Cycle Fatigue Behavior of Thick Thermal Barrier Coating Systems**

Miller, Robert A.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Ceramic thermal barrier coatings have received increasing attention for advanced gas turbine and diesel engine applications because of their ability to provide thermal insulation to engine components. However, the durability of these coatings under the severe thermal cycling conditions encountered in a diesel engine (ref. 1) still remains a major issue. In this research at the NASA Lewis Research Center, a high-power laser was used to investigate the thermal fatigue behavior of a yttria-stabilized zirconia coating system under simulated diesel engine conditions. The mechanisms of fatigue crack initiation and propagation, and of coating failure under complex thermal low-cycle fatigue (LCF, representing stop/start cycles) and thermal high-cycle fatigue (HCF, representing operation at 1300 rpm) are described. Continuous wave and pulse laser modes were used to simulate pure LCF and combined LCF/HCF, respectively (ref. 2). The LCF mechanism was found to be closely related to the coating sintering and creep at high temperatures. These creep strains in the ceramic coating led to a tensile stress state during cooling, thus providing the major driving force for crack growth under LCF conditions. The combined LCF/HCF tests induced more severe coating surface cracking, microspallation, and accelerated crack growth than did the pure LCF test. HCF thermal loads also facilitated lateral crack branching and ceramic/bond coat interface delaminations. HCF is associated with the cyclic stresses originating from the high-frequency temperature fluctuation at the ceramic coating surface. The HCF thermal loads act on the crack by a wedging mechanism (ref. 1), resulting in continuous crack growth at temperature. The HCF stress intensity factor amplitude increases with the interaction depth and temperature swing, and decreases with the crack depth. HCF damage also increases with the thermal expansion coefficient and the Young's modulus of the ceramic coating (refs. 1 and 3).

Derived from text

*Ceramic Coatings; Fatigue (Materials); Thermal Control Coatings; Gas Turbine Engines; Diesel Engines; Thermal Fatigue; High Temperature*

**20050177191** NASA Lewis Research Center, Cleveland, OH, USA

**Particle Imaging Velocimetry Used in a Transonic Compressor Facility**

Wernet, Mark P.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Particle Imaging Velocimetry (PIV) is an optical technique whereby a pulsed laser sheet is used to illuminate particles entrained in a fluid across an extended planar cross section of a flow field. Electronic recording of the particle positions at two closely timed laser pulses permits the computation of the flow velocity. PIV captures the instantaneous flow field, permitting the study of unsteady flow phenomena. Mean flow statistics can be computed by acquiring several hundred images and averaging the results. The first-ever successful application of PIV to acquire measurements in a high-speed rotating turbomachinery blade row was completed in NASA Lewis Research Center's W-8 Single Stage Axial Compressor Facility. Measurements were acquired in a 20-in.-diameter transonic compressor rotor operating at 17,188 rpm. A custom-designed light-sheet generating probe was used to insert the high-energy, pulsed light-sheet illumination required for recording the unblurred images of particles entrained in the fluid. Measurements of the shock wave formed within the rotor blade passage and of unsteady structures within the blade wakes were acquired. These measurements provide insight into unsteady spatial

structures in the flow field which cannot be measured with the more conventional laser anemometry technique. The PIV technique provides both instantaneous and average velocity data in a transonic compressor in an order of magnitude less time than required for other conventional optical diagnostic techniques.
Author
*Particle Image Velocimetry; Transonic Compressors; Test Facilities*

**20050177199** NASA Lewis Research Center, Cleveland, OH, USA
**Thermal Effects Modeling Developed for Smart Structures**
Lee, Ho-Jun; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Applying smart materials in aeropropulsion systems may improve the performance of aircraft engines through a variety of vibration, noise, and shape-control applications. To facilitate the experimental characterization of these smart structures, researchers have been focusing on developing analytical models to account for the coupled mechanical, electrical, and thermal response of these materials. One focus of current research efforts has been directed toward incorporating a comprehensive thermal analysis modeling capability. Typically, temperature affects the behavior of smart materials by three distinct mechanisms: Induction of thermal strains because of coefficient of thermal expansion mismatch 1. Pyroelectric effects on the piezoelectric elements; 2. Temperature-dependent changes in material properties; and 3. Previous analytical models only investigated the first two thermal effects mechanisms. However, since the material properties of piezoelectric materials generally vary greatly with temperature (see the graph), incorporating temperature-dependent material properties will significantly affect the structural deflections, sensory voltages, and stresses. Thus, the current analytical model captures thermal effects arising from all three mechanisms through thermopiezoelectric constitutive equations. These constitutive equations were incorporated into a layerwise laminate theory with the inherent capability to model both the active and sensory response of smart structures in thermal environments. Corresponding finite element equations were formulated and implemented for both the beam and plate elements to provide a comprehensive thermal effects modeling capability.
Derived from text
*Thermal Analysis; Smart Structures; Aircraft Engines; Pyroelectricity; Mathematical Models; Noise Reduction*

**20050177216** NASA Lewis Research Center, Cleveland, OH, USA
**Fiber-Supported Droplet Combustion Experiment-2**
Colantonio, Renato O.; Research and Technology 1997; April 1998; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A major portion of the energy produced in the world today comes from the burning of liquid hydrocarbon fuels in the form of droplets. Understanding the fundamental physical processes involved in droplet combustion is not only important in energy production but also in propulsion, in the mitigation of combustion-generated pollution, and in the control of the fire hazards associated with handling liquid combustibles. Microgravity makes spherically symmetric combustion possible, allowing investigators to easily validate their droplet models without the complicating effects of gravity. The Fiber-Supported Droplet Combustion (FSDC-2) investigation was conducted in the Microgravity Glovebox facility of the shuttles' Spacelab during the reflight of the Microgravity Science Laboratory (MSL- 1R) on STS-94 in July 1997. FSDC-2 studied fundamental phenomena related to liquid fuel droplet combustion in air. Pure fuels and mixtures of fuels were burned as isolated single and duo droplets with and without forced air convection. FSDC-2 is sponsored by the NASA Lewis Research Center, whose researchers are working in cooperation with several investigators from industry and academia. The rate at which a droplet burns is important in many commercial applications. The classical theory of droplet burning assumes that, for an isolated, spherically symmetric, single-fuel droplet, the gas-phase combustion processes are much faster than the droplet surface regression rate and that the liquid phase is at a uniform temperature equal to the boiling point. Recent, more advanced models predict that both the liquid and gas phases are unsteady during a substantial portion of the droplet's burning history, thus affecting the instantaneous and average burning rates, and that flame radiation is a dominant mechanism that can extinguish flames in a microgravity environment. FSDC-2 has provided well-defined, symmetric droplet burning data including radiative emissions to validate these theoretical models for heptane, decane, ethanol, and methanol fuels. Since most commercial combustion systems burn droplets in a convective environment, data were obtained without and with convective flow over the burning droplet (see the following photos).
Author
*Hydrocarbon Fuels; Drops (Liquids); Combustion Physics; Burning Rate; Convective Flow; Vapor Phases; Liquid Phases*

**20050177231** NASA Lewis Research Center, Cleveland, OH, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Stanford Univ., Stanford, CA, USA

**Liquid-Vapor Interface Configurations Investigated in Low Gravity**

Concus, Paul; Finn, Robert; Weislogel, Mark M.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Interface Configuration Experiment (ICE) is part of a multifaceted study that is exploring the often striking behavior of liquid-vapor interfaces in low-gravity environments. Although the experiment was posed largely as a test of current mathematical theory, applications of the results should be manifold. In space almost every fluid system is affected, if not dominated, by capillarity (the effects of surface tension). As a result, knowledge of fluid interface behavior, in particular an equilibrium interface shape from which any analysis must begin, is fundamental--from the control of liquid fuels and oxygen in storage tanks to the design and development of inspace thermal systems, such as heat pipes and capillary pumped loops. ICE has increased, and should continue to increase, such knowledge as it probes the specific peculiarities of current theory upon which our present understanding rests. Several versions of ICE have been conducted in the drop towers at the NASA Lewis Research Center, on the space shuttles during the first and second USA Microgravity Laboratory missions (USML-1 and USML-2), and most recently aboard the Russian Mir space station. These studies focused on interfacial problems concerning the existence, uniqueness, configuration, stability, and flow characteristics of liquid-vapor interfaces. Results to date have clearly demonstrated the value of the present theory and the extent to which it can predict the behavior of capillary systems.

Derived from text

*Liquid-Vapor Interfaces; Microgravity; Interfacial Tension; Flow Characteristics; Capillary Flow*

**20050177238** NASA Lewis Research Center, Cleveland, OH, USA, Aerospace Design and Fabrication, Inc., Brook Park, OH, USA, Dayton Univ., OH, USA

**Capillary-Driven Heat Transfer Experiment: Keeping It Cool in Space**

Lekan, Jack F.; Allen, Jeffrey S.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Capillary-pumped loops (CPL's) are devices that are used to transport heat from one location to another--specifically to transfer heat away from something. In low-gravity applications, such as satellites (and possibly the International Space Station), CPL's are used to transfer heat from electrical devices to space radiators. This is accomplished by evaporating one liquid surface on the hot side of the CPL and condensing the vapor produced onto another liquid surface on the cold side. Capillary action, the phenomenon that causes paper towels to absorb spilled liquids, is used to 'pump' the liquid back to the evaporating liquid surface (hot side) to complete the 'loop.' CPL's require no power to operate and can transfer heat over distances as large as 30 ft or more. Their reliance upon evaporation and condensation to transfer heat makes them much more economical in terms of weight than conventional heat transfer systems. Unfortunately, they have proven to be unreliable in space operations, and the explanation for this unreliability has been elusive. The Capillary-Driven Heat Transfer (CHT) experiment is investigating the fundamental fluid physics phenomena thought to be responsible for the failure of CPL's in low-gravity operations. If the failure mechanism can be identified, then appropriate design modifications can be developed to make capillary phase-change heat-transport devices a more viable option in space applications. CHT was conducted onboard the Space Shuttle Columbia during the first Microgravity Science Laboratory (MSL-1) mission, STS-94, which flew from July 1 to 17, 1997. The CHT glovebox investigation, which was conceived by Dr. Kevin Hallinan and Jeffrey Allen of the University of Dayton, focused on studying the dynamics associated with the heating and cooling at the evaporating meniscus within a capillary phase-change device in a low-gravity environment. The CHT experimental hardware was designed by a small team of engineers from Aerospace Design & Fabrication (ADF), the NASA Lewis Research Center, and the University of Dayton. The hardware consisted of two experiment modules that each contained an instrumented test loop (idealized capillary-pumped loop), a base unit for power conversion and backlighting, a display unit with 15 LED's (light-emitting diodes) to display temperatures, pressure, heater power, and time, a control unit to select heaters and heater settings, a cooling fan, and associated cables.

Author

*Capillary Flow; Capillary Pumped Loops; Heat Transfer; Cooling Systems; Fluid Dynamics; Pressure Regulators; Light Emitting Diodes*

**20050177239** NASA Lewis Research Center, Cleveland, OH, USA

**LSPRAY: Lagrangian Spray Solver for Applications With Parallel Computing and Unstructured Gas-Phase Flow Solvers**

Raju, Manthena S.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Sprays occur in a wide variety of industrial and power applications and in the processing of materials. A liquid spray is a phase flow with a gas as the continuous phase and a liquid as the dispersed phase (in the form of droplets or ligaments). Interactions between the two phases, which are coupled through exchanges of mass, momentum, and energy, can occur in different ways at different times and locations involving various thermal, mass, and fluid dynamic factors. An understanding of the flow, combustion, and thermal properties of a rapidly vaporizing spray requires careful modeling of the rate-controlling processes associated with the spray's turbulent transport, mixing, chemical kinetics, evaporation, and spreading rates, as well as other phenomena. In an attempt to advance the state-of-the-art in multidimensional numerical methods, we at the NASA Lewis Research Center extended our previous work on sprays to unstructured grids and parallel computing. LSPRAY, which was developed by M.S. Raju of Nyma, Inc., is designed to be massively parallel and could easily be coupled with any existing gas-phase flow and/or Monte Carlo probability density function (PDF) solver. The LSPRAY solver accommodates the use of an unstructured mesh with mixed triangular, quadrilateral, and/or tetrahedral elements in the gas-phase solvers. It is used specifically for fuel sprays within gas turbine combustors, but it has many other uses. The spray model used in LSPRAY provided favorable results when applied to stratified-charge rotary combustion (Wankel) engines and several other confined and unconfined spray flames. The source code will be available with the National Combustion Code (NCC) as a complete package.

Author

*Flow Characteristics; Fuel Sprays; Massively Parallel Processors; Numerical Analysis; Thermodynamic Properties*

**20050177242** NASA Lewis Research Center, Cleveland, OH, USA

**Three-Dimensional Measurements of Fuel Distribution in High-Pressure, High- Temperature, Next-Generation Aviation Gas Turbine Combustors**

Hicks, Yolanda R.; Locke, Randy J.; Anderson, Robert C.; Zaller, Michelle M.; Research and Technology 1997; April 1998; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In our world-class, optically accessible combustion facility at the NASA Lewis Research Center, we have developed the unique capability of making three-dimensional fuel distribution measurements of aviation gas turbine fuel injectors at actual operating conditions. These measurements are made in situ at the actual operating temperatures and pressures using the JP-grade fuels of candidate next-generation advanced aircraft engines for the High Speed Research (HSR) and Advanced Subsonics Technology (AST) programs. The inlet temperature and pressure ranges used thus far are 300 to 1100 F and 80 to 250 psia. With these data, we can obtain the injector spray angles, the fuel mass distributions of liquid and vapor, the degree of fuel vaporization, and the degree to which fuel has been consumed. The data have been used to diagnose the performance of injectors designed both in-house and by major U.S. engine manufacturers and to design new fuel injectors with overall engine performance goals of increased efficiency and reduced environmental impact. Mie scattering is used to visualize the liquid fuel, and laser-induced fluorescence is used to visualize both liquid and fuel vapor.

Derived from text

*Three Dimensional Models; High Pressure; High Temperature; Combustion Chambers; Gas Turbines; Mass Distribution*

## 35
## INSTRUMENTATION AND PHOTOGRAPHY

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

**20050173950** NASA Ames Research Center, Moffett Field, CA, USA

**Spectroscopic Results from the Life in the Atacama (LITA) Project 2004 Field Season**

Piatek, J. L.; Moersch, J. E.; Wyatt, M.; Rampey, M.; Cabrol, N. A.; Wettergreen, D. S.; Whittaker, R.; Grin, E. A.; Diaz, G. Chong, et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: The Life in the Atacama (LITA) project includes rover field tests designed to look for life in the arid environment of the Atacama Desert (Chile). Field instruments were chosen to help remote observers identify potential habitats and the presence of life in these habitats, and included two spectrometers for help in identifying the mineralogy of the field sites. Two field trials were undertaken during the 2004 field season. The remote science team had no prior knowledge of the local geology, and relied entirely on orbital images and rover-acquired data to make interpretations. Each field trial lasted approximately one week: the sites for these trials were in different locations, and are designated 'Site B' and 'Site C.'
Author
*Arid Lands; Field Tests; Habitats; Spectroscopy*

**20050174567** Academy of Sciences (Russia), Moscow, Russia
**Lunar Exploration Neutron Detector for NASA Lunar Reconnaissance Orbiter**
Mitrofanov, I. G.; Sanin, A. B.; Kozyrev, A. S.; Litvak, M. L.; Mokrousov, M. I.; Tretyakov, V. I.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We would like to present here the Lunar Exploration Neutron Detector (LEND) instrument, which will accomplish the primary goals of lunar space exploration - to find the hydrogen and water resources on the Moon and to measure the radiation environment for future human missions. The LEND instrument will operates onboard the NASA Lunar Reconnaissance Orbiter (LRO), which are in close relationship with the objectives of Lunar Exploration Program (LEP). Additional information is included in the original extended abstract.
Author (revised)
*Instrument Packages; Satellite-Borne Instruments; Lunar Satellites; Neutron Counters*

**20050174586** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**CHAMP - Camera, Handlens, and Microscope Probe**
Mungas, G. S.; Beegle, L. W.; Boynton, J.; Sepulveda, C. A.; Balzer, M. A.; Sobel, H. R.; Fisher, T. A.; Deans, M.; Lee, P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

CHAMP (Camera, Handlens And Microscope Probe) is a novel field microscope capable of color imaging with continuously variable spatial resolution from infinity imaging down to diffraction-limited microscopy (3 micron/pixel). As an arm-mounted imager, CHAMP supports stereo-imaging with variable baselines, can continuously image targets at an increasing magnification during an arm approach, can provide precision range-finding estimates to targets, and can accommodate microscopic imaging of rough surfaces through a image filtering process called z-stacking. Currently designed with a filter wheel with 4 different filters, so that color and black and white images can be obtained over the entire Field-of-View, future designs will increase the number of filter positions to include 8 different filters. Finally, CHAMP incorporates controlled white and UV illumination so that images can be obtained regardless of sun position, and any potential fluorescent species can be identified so the most astrobiologically interesting samples can be identified.
Author
*Cameras; Microscopy; Probes; Magnification; Imaging Techniques*

**20050174621** Centre de Recherches Petrographiques et Geochimiques, Nancy, France
**Nitrogen-Noble Gas Static Mass Spectrometry of Genesis Collector Materials**
Marty, Bernard; Bernard, Pete; Zimmermann, Laurent; Robert, Pascal; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A new system for analysis of N and noble gases in GENESIS collector materials has been constructed at the Centre de Recherches Petrographiques et Geochimiques (CRPG), Nancy, France. The new extraction and purification system, constructed specifically for analysis of GENESIS target material has, at its core, a similar design to that developed by Marty et al at CRPG and, for example, used by Hashizume et al for N and Ar analyses of lunar soil fines.
Derived from text
*Nitrogen; Systems Analysis; Rare Gases; Purification*

**20050174677** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**A Prototype Flux-Plate Heat-Flow Sensor for Venus Surface Heat-Flow Determinations**

Morgan, Paul; Reyes, Celso; Smrekar, Suzanne E.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Venus is the most Earth-like planet in the Solar System in terms of size, and the densities of the two planets are almost identical when selfcompression of the two planets is taken into account. Venus is the closest planet to Earth, and the simplest interpretation of their similar densities is that their bulk compositions are almost identical. Models of the thermal evolution of Venus predict interior temperatures very similar to those indicated for the regions of Earth subject to solid-state convection, but even global analyses of the coarse Pioneer Venus elevation data suggest Venus does not lose heat by the same primary heat loss mechanism as Earth, i.e., seafloor spreading. The comparative paucity of impact craters on Venus has been interpreted as evidence for relatively recent resurfacing of the planet associated with widespread volcanic and tectonic activity. The difference in the gross tectonic styles of Venus and Earth, and the origins of some of the enigmatic volcano-tectonic features on Venus, such as the coronae, appear to be intrinsically related to Venus heat loss mechanism(s). An important parameter in understanding Venus geological evolution, therefore, is its present surface heat flow. Before the complications of survival in the hostile Venus surface environment were tackled, a prototype fluxplate heat-flow sensor was built and tested for use under synthetic stable terrestrial surface conditions. The design parameters for this prototype were that it should operate on a conforming (sand) surface, with a small, self-contained power and recording system, capable of operating without servicing for at least several days. The precision and accuracy of the system should be \h 5 mW/sq m. Additional information is included in the original extended abstract.

Author (revised)

*Prototypes; Temperature Measuring Instruments; Heat Transmission; Venus Surface*

**20050174681** Hawaii Univ., Honolulu, HI, USA

**Single Pulse Remote Raman Detection of Minerals and Organics Under Illuminated Condition from 10 Meters Distance**

Misra, A. K.; Sharma, S. K.; Lucey, P. G.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558

Contract(s)/Grant(s): NAG5-13101; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A directly coupled portable remote Raman instrument developed by the University of Hawaii has been shown here to identify several minerals, chemicals and organics from a distance of 10 m using a single laser pulse in a well illuminated background. Raman spectra, obtained during a very short period of time, of common minerals e.g., dolomite, calcite, marble, barite, gypsum, quarts, rutile, fluorapatite etc. clearly show Raman features which could be used as fingerprints for mineral identification. Raman features of organics such as benzene, cyclohexane, 2-propanol, naphthalene, etc. and other chemicals containing various functional groups like oxides, silicates, sulphates, nitrates, phosphates and carbonates were also easily detected. Ability to measure Raman spectra with a single laser pulse would be promising for future space missions where power consumption is critical and a rapid survey of the minerals with moderate to high Raman cross section might be desirable for selecting rocks that would provide high scientific return or for acquiring rocks for sample return to the Earth.

Author

*Raman Spectra; Remote Sensing; Minerals; Organic Compounds*

**20050174688** Academy of Sciences (Russia), Moscow, Russia

**Dynamic Albedo of Neutrons (DAN): Active Nuclear Experiment Onboard NASA Mars Science Laboratory**

Mitrofanov, I. G.; Litvak, M. L.; Kozyrev, A. S.; Mokrousov, M. I.; Sanin, A. B.; Tretyakov, V.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Successful nuclear experiments GRS, NS and HEND onboard NASA Mars Odyssey has proved the high research power of nuclear methods for Mars exploration. The difference of epithermal neutron flux is found to be about one order of magnitude for different regions of Mars, which is associated with strong regional variations of water content in the shallow subsurface from tens of weight percents at high latitudes down to 1-3 weight percents at the driest area of Solis Planium. The orbital neutron data from Odyssey corresponds to surface resolution of few hundreds of kilometers, and one could guess that similar of even larger variations of water content would be detected from a neutron detector onboard surface mobile laboratory on Mars. This surface experiment with neutron instrumentation will be performed onboard NASA Mars Science Laboratory

(MSL), which is scheduled for launch at 2009. This mobile platform will have radio-isotope sources of energy, which produce local radiation background of neutrons and gamma-rays around MSL. Therefore, neutron instrument for characterization of water content in subsurface has to be active one: it should emit short pulses of high energy neutrons and then detect dynamic albedo of neutrons after each of them. Local radiation background could be excluded from variable time profiles of induced neutrons die away curves, and shapes of these curves allows to measure content of water and layering structure of subsurface below wheels of MSL. This is the physical concept of Dynamic Albedo of Neutrons (DAN) experiment, which is contribution of Russian Federal Space Agency to NASA MSL mission. Additional information is included in the original extended abstract. Author (revised)

*Neutron Counters; 2001 Mars Odyssey; Instrument Packages; Planetary Radiation*

**20050175711** Redlands Univ., CA, USA

**Io from High-Resolution Galileo PPR Data Taken Simultaneously with SSI or NIMS Observations**

Rathbun, J. A.; Block, M. G.; Spencer, J. R.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Io, the closest Galilean satellite to Jupiter, is the most volcanically active body in the Solar System. Between 1999 and 2002, the Galileo spacecraft made 6 close flybys of Io. At Io, the Galileo Photopolarimeter-Radiometer (PPR)was primarily used in radiometry mode, as a long-wavelength infrared single-aperture photometer. This photometer was sensitive to temperatures from about 60 to several hundred K, and is therefore useful for studying cooling volcanoes and background temperatures on Io (Rathbun et al., 2004). It could also continue to record data when other instruments were being used, allowing PPR to obtain data simultaneously with SSI and NIMS. These data tend to be of higher resolution than the typical PPR raster scan images, but consist of only a one-dimensional scan across the surface.

Derived from text

*Io; Galilean Satellites; Volcanoes; Infrared Photometry; Photometers*

**20050175740** Northwestern Univ., Evanston, IL, USA

**LROC: Lunar Reconnaissance Orbiter Camera**

Robinson, M. S.; Eliason, E. M.; Hiesinger, H.; Jolliff, B. L.; McEwen, A. S.; Malin, M. C.; Ravine, M. A.; Roberts, D.; Thomas, P. C.; Turtle, E. P.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Lunar Reconnaissance Orbiter Camera (LROC) is designed to address two of the prime LRO measurement requirements: 1) Assess meter and smaller-scale features to facilitate safety analysis for potential lunar landing sites near polar resources, and elsewhere on the Moon. 2) Acquire multi-temporal synoptic imaging of the poles every orbit to characterize the polar illumination environment (100 m scale), identifying regions of permanent shadow and permanent or near-permanent illumination over a full lunar year. The LROC consists of two narrow angle camera components (NACs) to provide 0.5-m scale panchromatic images over a 5-km swath, a wide-angle camera component (WAC) to provide images at a scale of 100 m in seven color bands over a 100-km swath, and a common Sequence and Compressor System (SCS).

Derived from text

*Moon; Reconnaissance; Cameras; Lunar Landing Sites*

**20050175865** NASA Lewis Research Center, Cleveland, OH, USA

**Thin-Film Thermocouple Technology Demonstrated for Reliable Heat Transfer Measurements**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Exploratory work is in progress to apply thin-film thermocouples to localized heat transfer measurements on turbine engine vanes and blades. The emerging thin-film thermocouple technology shows great potential to improve the accuracy of local heat transfer measurements. To verify and master the experimental methodology of thin-film thermocouples, the NASA Lewis Research Center conducted a proof-of-concept experiment in a controlled environment before applying the thin-film sensors to turbine tests.

Derived from text

*Heat Transfer; Thermocouples; Thin Films*

**20050175950** NASA Ames Research Center, Moffett Field, CA, USA

**PoDS: A Powder Delivery System for Mars In-Situ Organic, Mineralogic and Isotopic Analysis Instruments**

Saha, C. P.; Bryson, C. E.; Sarrazin, P.; Blake, D. F.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Many Mars in situ instruments require fine-grained high-fidelity samples of rocks or soil. Included are instruments for the determination of mineralogy as well as organic and isotopic chemistry. Powder can be obtained as a primary objective of a sample collection system (e.g., by collecting powder as a surface is abraded by a rotary abrasion tool (RAT)), or as a secondary objective (e.g, by collecting drill powder as a core is drilled). In the latter case, a properly designed system could be used to monitor drilling in real time as well as to deliver powder to analytical instruments which would perform complementary analyses to those later performed on the intact core. In addition, once a core or other sample is collected, a system that could transfer intelligently collected subsamples of power from the intact core to a suite of analytical instruments would be highly desirable. We have conceptualized, developed and tested a breadboard Powder Delivery System (PoDS) intended to satisfy the collection, processing and distribution requirements of powder samples for Mars in-situ mineralogic, organic and isotopic measurement instruments.

Derived from text

*Powder (Particles); Real Time Operation; Mineralogy; Isotopes; In Situ Measurement; Abrasion; Collection*

**20050176060** Smithsonian Astrophysical Observatory, Cambridge, MA, USA

**Microcalorimeters with Germanium Thermistors for High Resolution Soft and Hard X-ray Astronomy**

Silver, Eric; May 2005; 9 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-5269; No Copyright; Avail: CASI; A02, Hardcopy

This is a progress report for the third year of a three year SR&T grant to continue the advancement of NTD-based microcalorimeters. We highlight our progress to date that allowed us to garner an additional three years of funding for this work.

Author

*Calorimeters; X Ray Astronomy; X Ray Detectors*

**20050176398** NASA Lewis Research Center, Cleveland, OH, USA

**Real-Time Data from the Orbital Acceleration Research Experiment (OARE)**

Research and Technology 1996; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The objective of the Orbital Acceleration Research Experiment (OARE) is to measure, with high accuracy, the low-frequency, low-magnitude acceleration levels onboard the space shuttle. The shuttle experiences acceleration from atmospheric drag, gravity gradient forces, shuttle rotations, crew activities, water/waste dumps, and shuttle attitude thrusters. The OARE instrument has successfully flown on five past shuttle missions and is scheduled for five upcoming microgravity science missions. The data collected by OARE will be utilized by microgravity scientists to better predict and analyze the influence and effects of the shuttle's on-orbit microgravity environment on experiments in materials, combustion, and fluids research.

Author

*Spaceborne Experiments; Real Time Operation; Acceleration Measurement*

**20050177125** NASA Lewis Research Center, Cleveland, OH, USA

**Integrated Digital Video and Experimental Data Analysis for Microgravity Combustion Experiment**

Research and Technology 1996; March 1997; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of the Diffusive and Radiative Transport in Fires (DARTFire) Project is to study various mechanisms of energy transport in the ignition and growth of flames in microgravity. This sounding rocket experiment incorporates two multispectral video cameras, two 8-mm video recorders, and several temperature and pressure probes that record information on two separate flames, burning under different oxygen concentrations and flow rates. Mirrors allow each camera to view side-by-side images of both flames.

Author

*Spaceborne Experiments; Combustion Physics; Digital Television; Data Integration; Video Data*

**20050177205** NASA Lewis Research Center, Cleveland, OH, USA

**Stereo Imaging Velocimetry**

Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Stereo imaging velocimetry (SIV) will permit the collection of quantitative, three-dimensional flow data from any optically transparent fluid that can be seeded with tracer particles. This includes such diverse experiments as the study of multiphase flow, bubble nucleation and migration, pool combustion, and crystal growth. This technique will be useful to the microgravity science community as our investigations of fluid behavior in reduced-gravity environments enhance our knowledge of heat transfer, surface tension, concentration-gradient-driven anomalies, and residual effects from g-jitter. In its proposed configuration, the NASA Lewis Research Center's Stereo Imaging Velocimeter will consist of at least two charged coupled device (CCD) cameras, oriented at some relative angle with respect to each other. The cameras will observe a fluid experiment that has been seeded with tracer particles that are neutrally buoyant to permit accurate flow tracking. Except for the tracer particles, this measurement technique will be nonintrusive. Velocity accuracies will be on the order of 1 to 5 percent of full field. Each camera will make a two-dimensional record of the motion of the seed particles in the observation volume. Three-dimensional data will be obtained by computationally combining the two-dimensional information.

Derived from text

*Velocity Measurement; Stereoscopic Vision; Three Dimensional Flow; Imaging Techniques*

## 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*.

**20050174534** Environmental Protection Agency, Washington, DC

**Guidance on Quatifying NOx Benefits for Cetane Improvement Programs for Use in SIPS and Transportation Conformity**

Jun. 2004; 36 pp.; In English

Report No.(s): PB2005-104798; EPA-420-B-04-005; No Copyright; Avail: CASI; A03, Hardcopy

This document provides guidance and sets forth the Environmental Protection Agencys (EPA) policy and interpretation regarding the granting of State Implementation Plan (SIP) credit under section 110 of the Clean Air Act (CAA) for emission reductions attributable to the use of cetane additives in diesel fuel. Cetane improvement programs have the potential to contribute emission reductions needed for progress toward attainment and maintenance of the National Ambient Air Quality Standards (NAAQS). EPA believes that SIP credit is appropriate when there is confidence that cetane improvement programs can achieve emission reductions and meet any other applicable requirements. This document identifies the terms and conditions for establishing and implementing a cetane improvement program and the requirements for approvable SIP submittals and transportation conformity determinations under the Clean Air Act.

NTIS

*Nitrogen Oxides; Diesel Fuels; Transportation*

**20050175821** NASA Lewis Research Center, Cleveland, OH, USA

**High-Temperature Extensometry and PdCr Temperature-Compensated Wire Resistance Strain Gages Compared**

Research and Technology 1995; March 1996; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A detailed experimental evaluation is underway at the NASA Lewis Research Center to compare and contrast the performance of the PdCr/Pt dual-element temperature-compensated wire resistance strain gage with that of conventional high-temperature extensometry. The advanced PdCr gage, developed by researchers at Lewis, exhibits desirable properties and a relatively small and repeatable apparent strain to 800 C. This gage represents a significant advance in technology because existing commercial resistance strain gages are not reliable for quasi-static strain measurements above approximately 400 C. Various thermal and mechanical loading spectra are being applied by a high-temperature thermomechanical uniaxial testing system to evaluate the two strain-measurement systems. This is being done not only to compare and contrast the two strain sensors, but also to investigate the applicability of the PdCr strain gage to the coupon-level specimen testing environment typically employed when the high-temperature mechanical behavior of structural materials is characterized. Strain measurement capabilities to 800 C are being investigated with a nickel-base superalloy, Inconel 100 (IN 100), substrate material and application to TMC's is being examined with the model system, SCS-6/Ti-15-3. Furthermore, two gage

application techniques are being investigated in the comparison study: namely, flame-sprayed and spot welding.
Derived from text
*Extensometers; Heat Resistant Alloys; High Temperature; Mechanical Properties; Strain Gages; Palladium; Chromium; Wire; Resistance*

**20050175861** NASA Lewis Research Center, Cleveland, OH, USA
**Thermomechanical Multiaxial Fatigue Testing Capability Developed**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Structural components in aeronautical gas turbine engines typically experience multiaxial states of stress under nonisothermal conditions. To estimate the durability of the various components in the engine, one must characterize the cyclic deformation and fatigue behavior of the materials used under thermal and complex mechanical loading conditions. To this end, a testing protocol and associated test control software were developed at the NASA Lewis Research Center for thermomechanical axial-torsional fatigue tests. These tests are to be performed on thin-walled, tubular specimens fabricated from the cobalt-based superalloy Haynes 188. The software is written in C and runs on an MS-DOS based microcomputer.
Derived from text
*Durability; Fatigue Tests; Thermodynamics*

**20050175878** NASA Glenn Research Center, Cleveland, OH, USA
**Torque Transmission Device at Zero Leakage**
Hendricks, R. C.; Mullen, R. L.; March 2005; 13 pp.; In English; 10th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, 7-11 Mar. 2004, Honolulu, HI, USA
Report No.(s): NASA/TM-2005-212693; ISROMAC10-2004-038; E-14195; No Copyright; Avail: CASI; A03, Hardcopy

In a few critical applications, mechanical transmission of power by rotation at low speed is required without leakage at an interface. Herein we examine a device that enables torque to be transmitted across a sealed environmental barrier. The barrier represents the restraint membrane through which the torque is transmitted. The power is transferred through elastic deformation of a circular tube into an elliptical cross-section. Rotation of the principle axis of the ellipse at one end results in a commensurate rotation of an elliptical cross section at the other end of the tube. This transfer requires no rigid body rotation of the tube allowing a membrane to seal one end from the other. Both computational and experimental models of the device are presented.
Author
*Circular Tubes; Leakage; Rotation; Torque; Power Transmission*

**20050177087** Exxon Research and Engineering Co., Linden, NJ, USA
**Chemistry of the Thermal DeNOx Process: A Review of the Technology's Possible Application to control of NOx from Diesel Engines**
Lyon, R. K.; 2004; 16 pp.; In English
Report No.(s): DE2004-827988; No Copyright; Avail: Department of Energy Information Bridge

This paper presents a review of the Thermal DeNOx process with respect to its application to control of NOx emissions from diesel engines. The chemistry of the process is discussed first in empirical and then theoretical terms. Based on this discussion the possibilities of applying the process to controlling NOx emissions from diesel engines is considered. Two options are examined, modifying the requirements of the chemistry of the Thermal DeNOx process to suit the conditions provided by diesel engines and modifying the engines to provide the conditions required by the process chemistry. While the former examination did not reveal any promising opportunities, the latter did. Turbocharged diesel engine systems in which the turbocharger is a net producer of power seem capable of providing the conditions necessary for NOx reduction via the Thermal DeNOx reaction.
NTIS
*Nitrogen Oxides; Exhaust Emission; Diesel Engines*

**20050177153** NASA Lewis Research Center, Cleveland, OH, USA, Colorado State Univ., CO, USA, Colorado School of Mines, Golden, CO, USA
**Ion Implantation of Perfluoropolyether-Lubricated Surfaces for Improved Tribological Performance**
Shogrin, Brad; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

For over 30 years, perfluoropolyethers (PFPE's) have been the liquid lubricants of choice for space applications because

of their proven tribological performance and desirable properties, such as low vapor pressure and a wide liquid temperature range. These oils are used in such space mechanisms as gyroscopes, scanning mirrors, actuators, and filter wheels. In the past few years, there have been several incidents during which PFPE-lubricated space mechanisms have shown anomalous behavior. These anomalies are thought to be the result of PFPE degradation. Investigative research focused on understanding and modeling the degradation of PFPE lubricants has shown that PFPE's degrade and lose their desirable properties while under boundary-lubricated, sliding/rolling contacts and at elevated temperatures. These performance deficiencies are strongly dependent on the surface chemistry and reactivity of the lubricated contacts, which dictate the formation of harmful catalytic by-products. One way to inhibit tribo-induced degradation may be to use passivated surfaces that do not promote the formation of harmful by-products. Such a passivated surface would inhibit PFPE degradation and increase the lifetime of the lubricated mechanism. Ion implantation is one such passivation technique. This surface-treatment technique can modify the surface properties of materials without affecting either the properties or dimensions of the bulk material beneath the treated layer. By introducing a foreign species into a submicron surface layer, ion implantation can induce unique surface microstructures.
Author
*Ion Implantation; Lubricating Oils; Tribology; Surface Treatment*

**20050177172** NASA Lewis Research Center, Cleveland, OH, USA
**Tribometer for Lubrication Studies in Vacuum**
Pepper, Stephen V.; Research and Technology 1997; April 1998; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center has developed a new way to evaluate the liquid lubricants used in ball bearings in space mechanisms. For this evaluation, a liquid lubricant is exercised in the rolling contact vacuum tribometer shown in the photo. This tribometer, which is essentially a thrust bearing with three balls and flat races, has contact stresses similar to those in a typical preloaded, angular contact ball bearing. The rotating top plate drives the balls in an outward-winding spiral orbit instead of a circular path. Upon contact with the 'guide plate,' the balls are forced back to their initial smaller orbit radius; they then repeat this spiral orbit thousands of times. The orbit rate of the balls is low enough, 2 to 5 rpm, to allow the system to operate in the boundary lubrication regime that is most stressful to the liquid lubricant. This system can determine the friction coefficient, lubricant lifetime, and species evolved from the liquid lubricant by tribodegradation. The lifetime of the lubricant charge is only few micrograms, which is 'used up' by degradation during rolling. The friction increases when the lubricant is exhausted. The species evolved by the degrading lubricant are determined by a quadrupole residual gas analyzer that directly views the rotating elements. The flat races (plates) and 0.5-in.-diameter balls are of a configuration and size that permit easy post-test examination by optical and electron microscopy and the full suite of modern surface and thin-film chemical analytical techniques, including infrared and Raman microspectroscopy and x-ray photoelectron spectroscopy. In addition, the simple sphere-on-a-flat-plate geometry allows an easy analysis of the contact stresses at all parts of the ball orbit and an understanding of the frictional energy losses to the lubricant. The analysis showed that when the ball contacts the guide plate, gross sliding occurs between the ball and rotating upper plate as the ball forced back to a smaller orbit radius. The friction force due to gross sliding is sensed by the piezoelectric force transducer behind the guide plate and furnishes the coefficient of friction for the system. This tribometer has been used to determine the relative lifetimes of Fomblin Z-25, a lubricant often used in space mechanisms, as a function of the material of the plates against which it was run. The balls were 440C steel in all cases; the plate materials were aluminum, chromium (Cr), 440C steel (17 wt % Cr), and 4150 steel (1 wt % Cr). As shown in the bar graph, the lifetime is greatest for the plate material with least chromium, thus implicating chromium as a tribochemically active element attacking Fomblin Z-25.
Author
*Lubrication; Vacuum; Tribometers; Ball Bearings*

**20050177183** NASA Lewis Research Center, Cleveland, OH, USA
**Separator Materials Used in Secondary Alkaline Batteries Characterized and Evaluated**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Nickel-cadmium (Ni/Cd) and nickel-hydrogen (Ni/H2) secondary alkaline batteries are vital to aerospace applications. Battery performance and cycle life are significantly affected by the type of separators used in those batteries. A team from NASA Lewis Research Center's Electrochemical Technology Branch developed standardized testing procedures to characterize and evaluate new and existing separator materials to improve performance and cycle life of secondary alkaline batteries. Battery separators must function as good electronic insulators and as efficient electrolyte reservoirs. At present, new types of organic and inorganic separator materials are being developed for Ni/Cd and Ni/H2 batteries. The separator material previously used in the NASA standard Ni/Cd was Pellon 2505, a 100-percent nylon-6 polymer that must be treated with zinc

chloride (ZnCl2) to bond the fibers. Because of stricter Environmental Protection Agency regulation of ZnCl2 emissions, the battery community has been searching for new separators to replace Pellon 2505. As of today, two candidate separator materials have been identified; however, neither of the two materials have performed as well as Pellon 2505. The separator test procedures that were devised at Lewis are being implemented to expedite the search for new battery separators. The new test procedures, which are being carried out in the Separator Laboratory at Lewis, have been designed to guarantee accurate evaluations of the properties that are critical for sustaining proper battery operation. These properties include physical and chemical stability, chemical purity, gas permeability, electrolyte retention and distribution, uniformity, porosity, and area resistivity. A manual containing a detailed description of 12 separator test procedures has been drafted and will be used by the battery community to evaluate candidate separator materials for specific applications. These standardized procedures will allow for consistent, uniform, and reliable results that will ensure that separator materials have the desired properties for long life and good performance in secondary alkaline cells.
Author
*Alkaline Batteries; Separators; Aerospace Engineering; Polymers*

**20050177203** NASA Lewis Research Center, Cleveland, OH, USA, Department of Energy, USA, Cummins Engine Co., Inc., USA
**Spherical Joint Piston and Connecting Rod Developed**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Under an interagency agreement with the Department of Energy, the NASA Lewis Research Center manages a Heavy-Duty Diesel Engine Technology (HDET) research program. The overall program objectives are to reduce fuel consumption through increased engine efficiency, reduce engine exhaust emissions, and provide options for the use of alternative fuels. The program is administered with a balance of research contracts, university research grants, and focused in-house research. The Cummins Engine Company participates in the HDET program under a cost-sharing research contract. Cummins is researching and developing in-cylinder component technologies for heavy-duty diesel engines. An objective of the Cummins research is to develop technologies for a low-emissions, 55-percent thermal efficiency (LE-55) engine. The best current-production engines in this class achieve about 46-percent thermal efficiency. Federal emissions regulations are driving this technology. Regulations for heavy duty diesel engines were tightened in 1994, more demanding emissions regulations are scheduled for 1998, and another step is planned for 2002. The LE-55 engine emissions goal is set at half of the 1998 regulation level and is consistent with plans for 2002 emissions regulations. LE-55 engine design requirements to meet the efficiency target dictate a need to operate at higher peak cylinder pressures. A key technology being developed and evaluated under the Cummins Engine Company LE-55 engine concept is the spherical joint piston and connecting rod. Unlike conventional piston and connecting rod arrangements which are joined by a pin forming a hinged joint, the spherical joint piston and connecting rod use a ball-and-socket joint. The ball-and-socket arrangement enables the piston to have an axisymmetric design allowing rotation within the cylinder. The potential benefits of piston symmetry and rotation are reduced scuffing, improved piston ring sealing, improved lubrication, mechanical and thermal load symmetry, reduced bearing stresses, reduced running clearances, and reduced oil consumption. The spherical joint piston is a monolithic, squeeze-cast, fiber-reinforced aluminum piston. The connecting rod has a ball end that seats on a spherical saddle within the piston and is retained by a pair of aluminum bronze holder rings. The holder rings are secured by a threaded ring that mates with the piston. As part of the ongoing research and development activity, the Cummins Engine Company successfully completed a 100-hr test of the spherical joint piston and connecting rod at LE- 55 peak steady-state engine conditions. In addition, a 100-hr transient cycle test that varied engine conditions between LE-55 no-load and LE-55 full-load was successfully completed.
Author
*Joints (Junctions); Pistons; Rods; Diesel Engines; Engine Design*

**20050177228** NASA Lewis Research Center, Cleveland, OH, USA
**Study of Gear Dynamic Forces Completed**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Gearbox-generated noise and vibration is objectionable in many vehicles, particularly helicopters. This noise excitation is caused by the load fluctuation as gear teeth enter and leave mesh. In high-quality gears, a common technique to reduce gear noise and vibration is to modify the tooth profile. Gear noise reduction is a NASA and U.S. Army goal, and a NASA/U.S. Army research project sponsored development of gear dynamics computer codes to help design quiet gears. As part of this project, a series of experiments was performed in the NASA Lewis Research Center's Gear Noise Rig to develop a data base

of dynamic test data and to validate the predictions of the codes for several gear designs under a variety of test conditions. Author

*Gears; Helicopters; Noise Reduction; Aircraft Noise*

## 38
## QUALITY ASSURANCE AND RELIABILITY

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

**20050177164** NASA Lewis Research Center, Cleveland, OH, USA

**Real-Time Sensor Validation System Developed for Reusable Launch Vehicle Testbed**

Jankovsky, Amy L.; Research and Technology 1996; March 1997; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A real-time system for validating sensor health has been developed for the reusable launch vehicle (RLV) program. This system, which is part of the propulsion checkout and control system (PCCS), was designed for use in an integrated propulsion technology demonstrator testbed built by Rockwell International and located at the NASA Marshall Space Flight Center. Work on the sensor health validation system, a result of an industry-NASA partnership, was completed at the NASA Lewis Research Center, then delivered to Marshall for integration and testing. The sensor validation software performs three basic functions: it identifies failed sensors, it provides reconstructed signals for failed sensors, and it identifies off-nominal system transient behavior that cannot be attributed to a failed sensor. The code is initiated by host software before the start of a propulsion system test, and it is called by the host program every control cycle. The output is posted to global memory for use by other PCCS modules. Output includes a list indicating the status of each sensor (i.e., failed, healthy, or reconstructed) and a list of features that are not due to a sensor failure. If a sensor failure is found, the system modifies that sensor's data array by substituting a reconstructed signal, when possible, for use by other PCCS modules.

Author

*Real Time Operation; Test Stands; Systems Health Monitoring*

## 39
## STRUCTURAL MECHANICS

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

**20050174527** Federal Emergency Management Agency, Washington, DC

**Primer for Design Professionals: Communicating with Owners and Managers of New Buildings on Earthquake. Providing Protection to People and Buildings**

Jan. 2004; 118 pp.; In English

Report No.(s): PB2005-103055; FEMA-389; No Copyright; Avail: CASI; A06, Hardcopy

Primer for Design Professionals: Communicating with Owners and Managers of New Buildings on Earthquake Risk (FEMA 389) has been developed to facilitate the process of educating building owners and managers about seismic risk management tools that can be effectively and economically employed by them during the building development phase-from site selection through design and construction-as well as the operational phase. Written principally for design professionals (architects and structural engineers), the document introduces and discusses (1) seismic risk management and the means to develop a risk management plan; (2) guidance for identifying and assessing earthquake-related hazards during the site selection process; (3) emerging concepts in performance-based seismic design; and (4) seismic design and performance issues related to six specific building occupancies-commercial office facilities, commercial retail facilities, light manufacturing facilities, healthcare facilities, local schools (kindergarten through grade 12), and higher education facilities (universities). NTIS

*Architecture; Buildings; Construction*

**20050175860** NASA Glenn Research Center, Cleveland, OH, USA

**Effect of Silicon Nitride Balls and Rollers on Rolling Bearing Life**

Zaretsky, Erwin V.; Vlcek, Brian L.; Hendricks, Robert C.; April 2005; 31 pp.; In English; 2004 International Joint Tribology Conference, 24-27 Oct. 2004, Long Beach, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-714-09-16

Report No.(s): NASA/TM-2005-213061; TRIB2004-64246; E-14521-1; No Copyright; Avail: CASI; A03, Hardcopy

Three decades have passed since the introduction of silicon nitride rollers and balls into conventional rolling-element bearings. For a given applied load, the contact (Hertz) stress in a hybrid bearing will be higher than an all-steel rolling-element bearing. The silicon nitride rolling-element life as well as the lives of the steel races were used to determine the resultant bearing life of both hybrid and all-steel bearings. Life factors were determined and reported for hybrid bearings. Under nominal operating speeds, the resultant calculated lives of the deep-groove, angular-contact, and cylindrical roller hybrid bearings with races made of post-1960 bearing steel increased by factors of 3.7, 3.2, and 5.5, respectively, from those calculated using the Lundberg-Palmgren equations. An all-steel bearing under the same load will have a longer life than the equivalent hybrid bearing under the same conditions. Under these conditions, hybrid bearings are predicted to have a lower fatigue life than all-steel bearings by 58 percent for deep-groove bearings, 41 percent for angular-contact bearings, and 28 percent for cylindrical roller bearings.

Author

*Fatigue Life; Roller Bearings; Rollers; Silicon Nitrides; Service Life*

**20050175880** NASA Glenn Research Center, Cleveland, OH, USA

**Damage Assessment of Aerospace Structural Components by Impedance Based Health Monitoring**

Gyekenyesi, Andrew L.; Martin, Richard E.; Sawicki, Jerzy T.; Baaklini, George Y.; April 2005; 14 pp.; In English

Contract(s)/Grant(s): WBS 22-728-30-06

Report No.(s): NASA/TM-2005-213579; E-15046; No Copyright; Avail: CASI; A03, Hardcopy

This paper addresses recent efforts at the NASA Glenn Research Center at Lewis Field relating to the set-up and assessment of electro-mechanical (E/M) impedance based structural health monitoring. The overall aim is the application of the impedance based technique to aeronautic and space based structural components. As initial steps, a laboratory was created, software written, and experiments conducted on aluminum plates in undamaged and damaged states. A simulated crack, in the form of a narrow notch at various locations, was analyzed using piezoelectric-ceramic (PZT: lead, zirconate, titarate) patches as impedance measuring transducers. Descriptions of the impedance quantifying hardware and software are provided as well as experimental results. In summary, an impedance based health monitoring system was assembled and tested. The preliminary data showed that the impedance based technique was successful in recognizing the damage state of notched aluminum plates.

Author

*Damage Assessment; Electromechanical Devices; Impedance; Piezoelectric Ceramics; Systems Health Monitoring; Component Reliability; Structural Members*

**20050176066** NASA Langley Research Center, Hampton, VA, USA

**Nonlinear Reduced Order Random Response Analysis of Structures With Shallow Curvature**

Przekop, Adam; Rizzi, Stephen A.; [2005]; 14 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 23-794-40-4A

Report No.(s): AIAA Paper 2005-2260; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this investigation is to further develop nonlinear modal numerical simulation methods for application to geometrically nonlinear response of structures with shallow curvature under random loadings. For reduced order analysis, the modal basis selection must be capable of reflecting the coupling in both the linear and nonlinear stiffness. For the symmetric shallow arch under consideration, four categories of modal basis functions are defined. Those having symmetric transverse displacements (ST modes) can be designated as transverse dominated (ST-T) modes and in-plane dominated (ST-I) modes. Those having anti-symmetric transverse displacements (AT modes) can similarly be designated as transverse dominated (AT-T) modes and in-plane dominated (AT-I) modes. The response of an aluminum arch under a uniformly distributed transverse random loading is investigated. Results from nonlinear modal simulations made using various modal bases are compared with those obtained from a numerical simulation in physical degrees-of-freedom. While inclusion of ST-T modes is important for all response regimes, it is found that the ST-I modes become increasingly important in the nonlinear response

regime, and that AT-T and AT-I modes are critical in the autoparametric regime.
Author
*Curvature; Nonlinearity; Random Loads; Direct Numerical Simulation; Structural Analysis*

**20050176374** NASA Langley Research Center, Hampton, VA, USA
**Dynamic and Static Shape Test/Analysis Correlation of a 10 Meter Quadrant Solar Sail**
Taleghani, Barmac K.; Lively, Peter S.; Gaspar, James L.; Murphy, David M.; Trautt, Thomas A.; [2005]; 14 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-800-92-65
Report No.(s): AIAA Paper 2005-2123; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes finite element analyses and correlation studies to predict deformations and vibration modes/frequencies of a 10-meter quadrant solar sail system. Thin film membranes and booms were analyzed at the component and system-level. The objective was to verify the design and structural responses of the sail system and to mature solar sail technology to a TRL 5. The focus of this paper is in test/analysis correlation.
Author
*Dynamic Tests; Finite Element Method; Solar Sails; Static Tests*

**20050176381** NASA Langley Research Center, Hampton, VA, USA
**Characterization of Meta-Materials Using Computational Electromagnetic Methods**
Deshpande, Manohar; Shin, Joon; [2005]; 4 pp.; In English; NAI 2005, 10-14 Apr. 2005, Boulder, CO, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

An efficient and powerful computational method is presented to synthesize a meta-material to specified electromagnetic properties. Using the periodicity of meta-materials, the Finite Element Methodology (FEM) is developed to estimate the reflection and transmission through the meta-material structure for a normal plane wave incidence. For efficient computations of the reflection and transmission over a wide band frequency range through a meta-material a Finite Difference Time Domain (FDTD) approach is also developed. Using the Nicholson-Ross method and the Genetic Algorithms, a robust procedure to extract electromagnetic properties of meta-material from the knowledge of its reflection and transmission coefficients is described. Few numerical examples are also presented to validate the present approach.
Author
*Electromagnetic Properties; Genetic Algorithms; Slabs*

**20050177207** NASA Lewis Research Center, Cleveland, OH, USA
**Test Standard Developed for Determining the Slow Crack Growth of Advanced Ceramics at Ambient Temperature**
Choi, Sung R.; Salem, Jonathan A.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The service life of structural ceramic components is often limited by the process of slow crack growth. Therefore, it is important to develop an appropriate testing methodology for accurately determining the slow crack growth design parameters necessary for component life prediction. In addition, an appropriate test methodology can be used to determine the influences of component processing variables and composition on the slow crack growth and strength behavior of newly developed materials, thus allowing the component process to be tailored and optimized to specific needs. At the NASA Lewis Research Center, work to develop a standard test method to determine the slow crack growth parameters of advanced ceramics was initiated by the authors in early 1994 in the C 28 (Advanced Ceramics) committee of the American Society for Testing and Materials (ASTM). After about 2 years of required balloting, the draft written by the authors was approved and established as a new ASTM test standard: ASTM C 1368-97, Standard Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Ambient Temperature. Briefly, the test method uses constant stress-rate testing to determine strengths as a function of stress rate at ambient temperature. Strengths are measured in a routine manner at four or more stress rates by applying constant displacement or loading rates. The slow crack growth parameters required for design are then estimated from a relationship between strength and stress rate. This new standard will be published in the Annual Book of ASTM Standards, Vol. 15.01, in 1998. Currently, a companion draft ASTM standard for determination of the slow crack growth parameters of advanced ceramics at elevated temperatures is being prepared by the authors and will be presented to the committee by the middle of 1998. Consequently, Lewis will maintain an active leadership role in advanced ceramics standardization within ASTM. In addition, the authors have been and are involved with several

international standardization organizations including the Versailles Project on Advanced Materials and Standards (VAMAS), the International Energy Agency (IEA), and the International Organization for Standardization (ISO). The associated standardization activities involve fracture toughness, strength, elastic modulus, and the machining of advanced ceramics.
Author
*Ambient Temperature; Ceramics; Crack Propagation; Service Life; Structural Design; Fracture Strength*

**20050177208** NASA Lewis Research Center, Cleveland, OH, USA
**Constitutive Theory Developed for Monolithic Ceramic Materials**
Janosik, Lesley A.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

With the increasing use of advanced ceramic materials in high-temperature structural applications such as advanced heat engine components, the need arises to accurately predict thermomechanical behavior that is inherently time-dependent and that is hereditary in the sense that the current behavior depends not only on current conditions but also on the material's thermomechanical history. Most current analytical life prediction methods for both subcritical crack growth and creep models use elastic stress fields to predict the time-dependent reliability response of components subjected to elevated service temperatures. Inelastic response at high temperatures has been well documented in the materials science literature for these material systems, but this issue has been ignored by the engineering design community. From a design engineer's perspective, it is imperative to emphasize that accurate predictions of time-dependent reliability demand accurate stress field information. Ceramic materials exhibit different time-dependent behavior in tension and compression. Thus, inelastic deformation models for ceramics must be constructed in a fashion that admits both sensitivity to hydrostatic stress and differing behavior in tension and compression. A number of constitutive theories for materials that exhibit sensitivity to the hydrostatic component of stress have been proposed that characterize deformation using time-independent classical plasticity as a foundation. However, none of these theories allow different behavior in tension and compression. In addition, these theories are somewhat lacking in that they are unable to capture the creep, relaxation, and rate-sensitive phenomena exhibited by ceramic materials at high temperatures. The objective of this effort at the NASA Lewis Research Center has been to formulate a macroscopic continuum theory that captures these time-dependent phenomena. Specifically, the effort has focused on inelastic deformation behavior associated with these service conditions by developing a multiaxial viscoplastic constitutive model that accounts for time-dependent hereditary material deformation (such as creep and stress relaxation) in monolithic structural ceramics. Using continuum principles of engineering mechanics, we derived the complete viscoplastic theory from a scalar dissipative potential function.
Derived from text
*Ceramics; High Temperature; Structural Design; Thermodynamics; Continuum Mechanics; Crack Propagation; Stress Distribution*

**20050177211** NASA Lewis Research Center, Cleveland, OH, USA
**Experimental Techniques Verified for Determining Yield and Flow Surfaces**
Lerch, Brad A.; Ellis, Rod; Lissenden, Cliff J.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Structural components in aircraft engines are subjected to multiaxial loads when in service. For such components, life prediction methodologies are dependent on the accuracy of the constitutive models that determine the elastic and inelastic portions of a loading cycle. A threshold surface (such as a yield surface) is customarily used to differentiate between reversible and irreversible flow. For elastoplastic materials, a yield surface can be used to delimit the elastic region in a given stress space. The concept of a yield surface is central to the mathematical formulation of a classical plasticity theory, but at elevated temperatures, material response can be highly time dependent. Thus, viscoplastic theories have been developed to account for this time dependency. Since the key to many of these theories is experimental validation, the objective of this work (refs. 1 and 2) at the NASA Lewis Research Center was to verify that current laboratory techniques and equipment are sufficient to determine flow surfaces at elevated temperatures. By probing many times in the axial-torsional stress space, we could define the yield and flow surfaces. A small offset definition of yield (10 me) was used to delineate the boundary between reversible and irreversible behavior so that the material state remained essentially unchanged and multiple probes could be done on the same specimen. The strain was measured with an off-the-shelf multiaxial extensometer that could measure the axial and torsional strains over a wide range of temperatures. The accuracy and resolution of this extensometer was verified by comparing its data with strain gauge data at room temperature. The extensometer was found to have sufficient resolution for these experiments. In addition, the amount of crosstalk (i.e., the accumulation of apparent strain in one direction when strain in the other direction is applied) was found to be negligible. Tubular specimens were induction heated to determine the flow surfaces at elevated temperatures. The heating system induced a large amount of noise in the data. By reducing thermal

fluctuations and using appropriate data averaging schemes, we could render the noise inconsequential. Thus, accurate and reproducible flow surfaces (see the figure) could be obtained.
Author
*Loads (Forces); Structural Design; Axial Stress; Axial Strain; Mechanical Properties; Mathematical Models; Prediction Analysis Techniques; Life (Durability)*

## 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 42 through 48*.

**20050173932** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**The Mn-53-Cr-53 System in CAIs: An Update**
Papanastassiou, D. A.; Wasserburg, G. J.; Bogdanovski, O.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations
Contract(s)/Grant(s): RTOP 344-31-55-01; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

High precision techniques have been developed for the measurement of Cr isotopes on the Triton mass spectrometer, at JPL. It is clear that multiple Faraday cup, simultaneous ion collection may reduce the uncertainty of isotope ratios relative to single Faraday cup ion collection, by the elimination of uncertainties from ion beam instabilities (since ion beam intensities for single cup collection are interpolated in time to calculate isotope ratios), and due to a greatly increased data collection duty cycle, for simultaneous ion collection. Efforts to measure Cr by simultaneous ion collection have not been successful in the past. Determinations on Cr-50-54Cr, by simultaneous ion collection on the Finnigan/ MAT 262 instrument at Caltech, resulted in large variations in extrinsic precision, for normal Cr, of up to 1% in Cr-53/Cr-52 (data corrected for mass fractionation, using Cr-50/Cr-52).
Derived from text
*Chromium Isotopes; Fractionation; Isotope Ratios; Mass Spectrometers*

**20050173935** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**A Marine Origin for the Meridiani Planum Landing Site?**
Parker, T. J.; Haldemann, A. F., et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Opportunity instruments have provided compelling evidence that the sulfate-rich chemical and siliciclastic sediments at the Meridiani Planum landing site were deposited in shallow water. The local paleo-environment is most often characterized as a broad, shallow sea or large playa, with surface conditions cycling between wet and dry episodes, interbedding evaporates with eolian fine sediments [e.g., 1,2]. This particular working hypothesis is reasonable, considering the area characterized by the rover s mobility. An alternative, marine origin will be considered here, a working hypothesis that we feel provides a better fit to the local-scale results identified by Opportunity, and the regional-scale characteristics of Meridiani Planum provided by data from orbiting spacecraft, when considered together.
Derived from text
*Landing Sites; Surface Properties; Mars Surface; Evaporation*

**20050174574** Eidgenoessische Technische Hochschule, Zurich, Switzerland
**Tungsten Isotopic Constraints on the Formation and Evolution of Iron Meteorite Parent Bodies**
Markowski, A.; Quitte, G.; Kleine, T.; Halliday, A. N.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Hf-182-W-182 short-lived chronometer (half-life = 8.9 Myr) has proven useful for dating metal-silicate separation (i.e., core formation) in planetary bodies [1-4]. Hafnium and W are both refractory elements and thus expected to be present in chondritic proportions in planetesimals, but W is siderophile and partitions preferentially into the metal core, whereas Hf is lithophile and strongly enriched in the silicate mantle. Horan et al. [5] reported W isotope data for a representative suite of magmatic and nonmagmatic iron meteorites and showed that all irons display similar W isotope compositions within a narrow

range between -5.1 and -3.1 Epsilon(sub W) (Epsilon(sub W) is the deviation of the W-182/W-184 of a sample from the value of the terrestrial standard in parts per 10,000). This indicates that all irons segregated within approx.5 Myr of each other. We present new high-precision W isotope data for a comprehensive set of iron meteorites that reveal small variations in W isotope compositions both within and between some of the groups.
Derived from text
*Iron Meteorites; Time Measurement; Chronometers; Half Life; Silicates; Chronology*

**20050174691** Yamaguchi Univ., Japan
**Shocked Data of Silica-rich Breccias and X-Ray CT Images of Buried Craters at Takamatsu-Kagawa District in Japan**
Miura, Y.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Almost all shocked quart data of impact structure are well-reserved without any change of coexisting minerals, though quartz with altered mineral (from feldspar to zeolite) is found in volcanic islands of Japan. Such crater structure of volcanic islands is Takamatsu-Kagawa buried structure originally with about 8km size, which is located in Busshozan-Cho, Takamatsu City, Kagawa Prefecture (in center site) to Kagawa-Gun, Kagawa Prefecture (in southern part). The center of the structure is Latitude 34.3 deg and Longitude 134.05 deg. The main purpose of this paper is 1) to elucidate shocked quartz with altered minerals, 2) to classify three types of shocked quartz, 3) to show X-ray CT (Computer tomography) images of the samples, and 4) indicates intrusion of andesitic vein to shocked melt rock. Additional information is included in the original extended abstract.
Author (revised)
*Breccia; Quartz; Computer Aided Tomography; X Ray Imagery; Meteorite Craters; Metamorphism (Geology); Underground Structures; Structural Properties (Geology)*

**20050175624** Arizona State Univ., Tempe, AZ, USA
**Monitoring the Hazards of Silicic Volcanoes with Remote Sensing**
Fink, Jonathan; Wessels, Rick; Eisinger, Chris; Ramsey, Michael; Hellman, Melanie; Kuhn, Sally; August 31, 2004; 7 pp.; In English
Contract(s)/Grant(s): NAG5-9070
Report No.(s): ASU-PVA6597/TE; No Copyright; Avail: CASI; A02, Hardcopy

This report details the final progress on the Solid Earth and Natural Hazards project: Monitoring of Hazards of Silicic Volcanoes with Remote Sensing (SENH99-0000-0159). The original award went to Arizona State University (ASU) with Dr. Jonathan Fink as the P.I. and Dr. Michael Ramsey as the Co-I. In May 2000, Dr. Ramsey left ASU to take a tenure-track faculty position at the University of Pittsburgh. The principle investigators and NASA Headquarters agreed to split the grant award at the HQ level and therefore avoid the double overhead charges that would arise from a university subcontract. The objectives of the science were divided, and coordinated yearly progress reports have been submitted from each University. This report details the final progress on work carried out at Arizona State. A report by Dr. Ramsey at the University of Pittsburgh has already been submitted. The work from both institutions is closely related and this report will reflect that connection.
Derived from text
*Remote Sensing; Volcanoes; Volcanic Eruptions; Volcanology*

**20050175690** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Documentation and Validation of the Goddard Earth Observing System (GEOS) Data Assimilation System, Version 4**
Suarez, Max J., Editor; daSilva, Arlindo; Dee, Dick; Bloom, Stephen; Bosilovich, Michael; Pawson, Steven; Schubert, Siegfried; Wu, Man-Li; Sienkiewicz, Meta; Stajner, Ivanka, et al.; April 04, 2005; 187 pp.; In English
Report No.(s): NASA/TM-2005-104606/ VOL26/VER4; Rept- 2005-01264-0/VOL26/VER4; No Copyright; Avail: CASI; A09, Hardcopy

This document describes the structure and validation of a frozen version of the Goddard Earth Observing System Data Assimilation System (GEOS DAS): GEOS-4.0.3. Significant features of GEOS-4 include: version 3 of the Community Climate Model (CCM3) with the addition of a finite volume dynamical core; version two of the Community Land Model (CLM2); the Physical-space Statistical Analysis System (PSAS); and an interactive retrieval system (iRET) for assimilating TOVS radiance data. Upon completion of the GEOS-4 validation in December 2003, GEOS-4 became operational on 15

January 2004. Products from GEOS-4 have been used in supporting field campaigns and for reprocessing several years of data for CERES.
Author
*Data Systems; Information Retrieval; On-Line Systems; EOS Data and Information System; Information Systems; Data Products*

**20050175734** Chicago Univ., Chicago, IL, USA
**On the Temperature Dependence of the Kinetic Isotope Fractionation of Type B CAI-like Melts During Evaporation**
Richter, F. M.; Janney, P. E.; Mendybaev, R. A.; Davis, A. M.; Wadhwa, M.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Type B CAIs are often enriched in the heavy isotopes of magnesium and silicon, suggesting that a fraction of these elements was lost by evaporation [1]. Detailed comparisons between compositions calculated for a cooling solar composition gas and recent estimates of the bulk composition of Type B CAIs further suggests that evaporation played a significant role in that the Type B CAIs contain significantly less of the relatively volatile magnesium than calculated [2]. The silicon content, on the other hand, is not as useful a measure of evaporation because solids condensing from a solar composition gas in the temperature interval over which the typical mineral assemblages of the Type B CAIs are stable can have a large range in silicon content not much different from that of the CAIs themselves. For this reason we will focus on the behavior of magnesium during the evaporation of a Type B CAI-like melt. The proposition that the elemental and isotopic compositions of the Type B CAIs have been measurably affected by evaporation can be quantitatively tested, given the right data and a realistic representation of the relationship between elemental and isotopic fractionation during evaporation. For example, given data on the heavy isotopic enrichment of magnesium and/or silicon of a set of Type B CAIs one could calculate the amount of magnesium and/or silicon that must have evaporated to account for the isotopic data and then check whether the observed composition of the CAIs, adjusted to take this loss into account, corresponds to plausible condensates from a solar composition gas (see [3] for such an attempt). A key issue is the appropriate relationship one should use for relating elemental and isotopic fractionations in the specific case of magnesium evaporation from a molten Type B CAI-like composition.
Derived from text
*Magnesium; Silicon; Isotopic Enrichment; Mineral Deposits; Fractionation; Condensing; Chemical Composition; Temperature Dependence; Evaporation*

**20050175988** Ecole Nationale Superieure de Chimie, Paris, France
**Characterization of a 3.5 Billion Year Old Organic Matter: Electron Paramagnetic Resonance and Pyrolysis GC-MS, Tools to Assess Syngeneity and Biogenecity**
Skrzypczak, Audrey; Derenne, Sylvie; Binet, L.; Gourier, D.; Robert F.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The question of the origin of life is one of the most debated scientific questions to date. The search for evidence for life and its former traces on Earth, and possibly on Mars, is hindered by the difficulty to assess both the syngeneity and the biogenicity of the organic matter preserved in ancient rocks. So, the discovery of microstructures, similar to fossils of photosynthetic filamentous cyanobacteria, in a 3.465-billion-year-old chert from the Warrawoona group created a considerable interest for this deposit [1]. The occurrence of carbonaceous material associated with these structures revealed by laser Raman microprobe spectroscopy was put forward as an additional evidence for a biogenic origin of the aforementioned microstructures [2]. The latter were considered as the oldest microfossils on Earth. However, their biogenicity has been recently debated since it was shown that similar structures, in terms of morphology and Raman signature, can be formed through abiotic reactions to such a point that these microstructures were even considered as secondary artefacts, formed under hydrothermal conditions, in which inorganic carbon would have condensed [3, 4, 5]. Moreover, even if the biogenicity can be proved, numerous examples show that subsurface biological activity and circulating water could also have contributed to biomolecular contamination of archean host rocks [6].
Derived from text
*Organic Materials; Electron Paramagnetic Resonance; Pyrolysis; Biological Evolution; Carbonaceous Materials; Fossils; Microorganisms*

**20050176421** Centre de Recherches Petrographiques et Geochimiques, Nancy, France

**Simulating Micro-Gravity in the Laboratory**

Thoman, A.; Pack, A.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Experimentalists are often facing the problem of choosing an appropriate container for their high-T experiments. Experiments with liquid silicates are conducted in metal containers (either loops or crucibles). For experiments with liquid metals, one chooses preferably oxide containers, such as Al2O3. For experiments with both, liquid metals and silicates the choice of the right container becomes difficult. Important processes, such as the core formation on planets, however, involved liquid silicates and metals. The problem of reaction of the experimental loads with the container can partly be overcome by short run durations. Equilibration of liquid metals and silicates with crystalline phases of appreciable size, however, is then difficult to achieve. Also chondrules represent complex mixtures of once molten silicates, metals and sulfides (Fig. 1).

Derived from text

*Microgravity; Simulation; Liquid Metals; Silicates; Aluminum Oxides; Chondrule*

## 43
## EARTH RESOURCES AND REMOTE SENSING

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

**20050176380** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Remote Sensing of Vertical Distributions of Smoke Aerosol Off the Coast of Africa**

Kaufman, Y. J.; Haywood, J. M.; Hobbs, P. V.; Hart, W.; Schmid, B.; Geophysical Research Letters; 2003; ISSN 0094-8276; Volume 30, No. 16, pp. 1831; In English

Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

In 2004 NASA plans to launch the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations- CALIPSO mission, with a two-wavelength lidar aboard. CALIPSO will fly in formation with the Moderate Resolution Imaging Spectro-Radiometer (MODIS) on the Aqua satellite. Here we present inversions of combined aircraft lidar and MODIS data to study the properties of smoke off the southwest coast of Southern Africa. The inversion derives profiles of the aerosol extinction due to fine and coarse particles. Comparisons with three sets of airborne in situ measurements show excellent agreement of the aerosol extinction profiles; however the inversion derives smaller spectral dependence of the extinction than the in situ measurements. The inversion is sensitive to the aerosol backscattering-to-extinction ratio (BER). Due to nonsphericity of the coarse aerosols, the range of BERs of the smoke aerosol is 0.014 to 0.021 sr(sup -l) for the fine and coarse particles at 0.53 and 1.06 pm wavelengths, which do not differ much from the value for dust (0.016 sr(sup -1)) at these wavelengths.

Author

*Aerosols; Africa; Remote Sensing; Smoke; Vertical Distribution*

**20050177034** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Overview of Terra and Aqua MODIS Status**

Salomonson, Vincent V.; [2005]; 1 pp.; In English; Quantitative Earth Observation, 15-16 Mar. 2005, Oxford, UK; No Copyright; Avail: Other Sources; Abstract Only

This presentation will consist of two one-hour lectures. The first lecture will review the characteristics of the MODIS instrument and how it responds to the performance specifications. The pre-launch and on-orbit procedures and results to characterize and maintain instrument output so as to allow the prescribed science to be done will also be outlined. This will include defining the equations used to account for gain changes and any degradation in the optics of the instrument or the on-board calibration devices themselves. The changes in the solar diffuser and the radiance versus scan angle performance of the scan mirror will also be reviewed. Overall it will be shown that the instrument has and is meeting specifications of 2% reflectance relative to the sun, 5% in the radiance observed in the reflected solar radiation bands, and 0.5-1% in the thermal bands. The second lecture will review and describe highlights in the geophysical products and related science results. There are approximately 40 geophysical products related to observations of land, ocean and atmosphere features. Many of the results are unprecedented and offer considerable advances over those achievable with heritage instruments such as the NOAA

Advanced Very High Resolution Radiometer (AVHRR). The literature is showing a steady growth of publications in scientific journals using MODIS data or products. The future is also bright in that a follow-on instrument based on the MODIS will be flown on the National Polar-Orbiting Environmental Satellite Series (NPOESS) starting around 2010.
Author
*Aqua Spacecraft; Imaging Spectrometers; Terra Spacecraft; General Overviews; MODIS (Radiometry)*

**20050177041** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**NASA's Earth Observations of the Global Environment**
King, Michael D.; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

A birds eye view of the Earth from afar and up close reveals the power and magnificence of the Earth and juxtaposes the simultaneous impacts and powerlessness of humankind. The NASA Electronic Theater presents Earth science observations and visualizations in an historical perspective. Fly in from outer space to Africa and Cape Town. See the latest spectacular images from NASA & NOAA remote sensing missions like Meteosat, TRMM, Landsat 7, and Terra, which will be visualized and explained in the context of global change. See visualizations of global data sets currently available from Earth orbiting satellites, including the Earth at night with its city lights, aerosols from biomass burning in the Middle East and Africa, and retreat of the glaciers on Mt. Kilimanjaro. See the dynamics of vegetation growth and decay over Africa over 17 years. New visualization tools allow us to roam & zoom through massive global mosaic images including Landsat and Terra tours of Africa and South America, showing land use and land cover change from Bolivian highlands. Spectacular new visualizations of the global atmosphere & oceans are shown. See massive dust storms sweeping across Africa and across the Atlantic to the Caribbean and Amazon basin. See ocean vortexes and currents that bring up the nutrients to feed tiny phytoplankton and draw the fish, pant whales and fisher- man. See how the ocean blooms in response to these currents and El Nino/La Nifia. We will illustrate these and other topics with a dynamic theater-style presentation, along with animations of satellite launch deployments and orbital mapping to highlight aspects of Earth observations from space.
Author
*Earth Observations (From Space); NASA Programs; Remote Sensing; Earth Environment*

**20050177042** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Aura Satellite Mission: Oxford/RAL Spring School in Quantitative Earth Observation**
Douglass, Anne; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The four instruments on Aura are providing new and exciting measurements of stratospheric and tropospheric ozone, species that contribute to ozone production and loss, and long-lived gases such as nitrous oxide and methane that provide information about atmospheric transport. These discussions of atmospheric chemistry will start with the basic principles of ozone production and loss. Aura data will be used where possible to illustrate the pertinent atmospheric processes. Three-dimensional model simulations will be used both to illustrate present capabilities in constituent modeling and to demonstrate how observations are used to evaluate and improve models and our ability to predict future ozone evolution.
Author
*Earth Observations (From Space); Aura Spacecraft; Space Missions; Atmospheric Chemistry*

**20050177043** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**NASA's Earth Observing System (EOS): Observing the Atmosphere, Land, Oceans, and Ice from Space**
King, Michael D.; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The Earth Observing System (EOS) is a space-based observing system comprised of a series of satellite sensors by whch scientists can monitor the Earth, a Data and Information System (EOSDIS) enabling researchers worldwide to access the satellite data, and an interdisciplinary science research program to interpret the satellite data. During this year, the last of the first series of EOS missions, Aura, was launched. Aura is designed exclusively to conduct research on the composition, chemistry, and dynamics of the Earth's upper and lower atmosphere, employing multiple instruments on a single spacecraft. Aura is the third in a series of major Earth observing satellites to study the environment and climate change and is part of NASA's Earth Science Enterprise. The first and second missions, Terra and Aqua, are designed to study the land, oceans, atmospheric constituents (aerosols, clouds, temperature, and water vapor), and the Earth's radiation budget. The other seven EOS spacecraft include satellites to study (i) land cover & land use change, (ii) solar irradiance and solar spectral variation, (iii) ice volume, (iv) ocean processes (vector wind and sea surface topography), and (v) vertical variations of clouds, water vapor, and aerosols up to and including the stratosphere. Aura's chemistry measurements will also follow up on measurements that began with NASA's Upper Atmosphere Research Satellite and continue the record of satellite ozone data collected from

the TOMS missions. In this presentation I will describe how scientists are using EOS data to examine the health of the earth's atmosphere, including atmospheric chemistry, aerosol properties, and cloud properties, with a special look at the latest earth observing mission, Aura.
Author
*Earth Observing System (EOS); Remote Sensing; Technology Utilization; Satellite Sounding; Aura Spacecraft; Earth Atmosphere*

**20050177046** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Global Retrieval of Aerosol Properties over Desert and Semi-Desert Regions from SeaWiFS and MODIS**
Hsu, Nai-Yung; Tsay, Si-Chee; King, M. D.; Herman, J. R.; [2005]; 1 pp.; In English; Aerosol Study and Climate Change Workshop, Bangkok, Thailand; No Copyright; Avail: Other Sources; Abstract Only

Mineral aerosols (dust) play an important role in both climate forcing and oceanic productivity throughout the entire year. Due to the relatively short lifetime (a few hours to about a week), the distributions of these airborne dust particles vary extensively in both space and time. Consequently, satellite observations are needed over both source and sink regions for continuous temporal and spatial sampling of dust properties. However, despite their importance, the high spatial resolution satellite measurements of dust near its source have been lacking. In this paper, we will demonstrate the capability of a new satellite algorithm to retrieve aerosol optical thickness and single scattering albedo over bright-reflecting surfaces such as urban areas and deserts. Such retrievals have been difficult to perform using previously available algorithms that use wavelengths from the mid-visible to the near IR because they have trouble separating the aerosol signal from the contribution due to the bright surface reflectance. The new algorithm, called Deep Blue, utilizes blue-wavelength measurements from instruments such as SeaWiFS and MODIS to infer the properties of aerosols, sinre the stirfare reflectance nver land in the blue part of the spectrum is much lower than for longer wavelength channels. We have validated the satellite retrieved aerosol optical thickness with data from AERONET sunphotometers over desert and semi-desert regions. The comparisons show reasonable agreements between these two. These new satellite products will allow scientists to determine quantitatively the aerosol properties near sources using high spatial resolution measurements from SeaWiFS and MODIS-like instruments.
Author
*Aerosols; Deserts; MODIS (Radiometry); Sea-Viewing Wide Field-of-View Sensor; Regions*

**20050177075** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Monitoring Change Through Hierarchical Segmentation of Remotely Sensed Image Data**
Tilton, James C.; Lawrence, William T.; [2005]; 6 pp.; In English; Multi Temp 2005 Conference, 16-18 May 2005, Biloxi, MS, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

NASA's Goddard Space Flight Center has developed a fast and effective method for generating image segmentation hierarchies. These segmentation hierarchies organize image data in a manner that makes their information content more accessible for analysis. Image segmentation enables analysis through the examination of image regions rather than individual image pixels. In addition, the segmentation hierarchy provides additional analysis clues through the tracing of the behavior of image region characteristics at several levels of segmentation detail. The potential for extracting the information content from imagery data based on segmentation hierarchies has not been fully explored for the benefit of the Earth and space science communities. This paper explores the potential of exploiting these segmentation hierarchies for the analysis of multi-date data sets, and for the particular application of change monitoring.
Author
*Imaging Techniques; Remote Sensing; Hierarchies; Data Acquisition; Segments*

## 44
## ENERGY PRODUCTION AND CONVERSION

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

**20050173847** Army Construction Engineering Research Lab., Champaign, IL USA
**Central Heating and Power Plant Alternatives Review, Fort Wainwright, Alaska**
Savoie, Martin J.; Vavnn, John L.; Kemme, Michael R.; Schmidt, Charles; Westerman, John; Lanzarone, John; Gignilliat, Hank; Miller, Norm; May 2003; 144 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-MIPR
Report No.(s): AD-A432496; ERDC/CERL-TR-03-11; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Fort Wainwright (FWA) military community has a critical need to establish its power and heating requirements to successfully complete a series of planned capital improvements. The CHPP upgrade coincides with an expansion of FWA's mission within the next 5 years. To help the installation successfully complete these changes within the specified time frame, the Construction Engineering Research Laboratory (CERL) conducted an independent technical assessment of the FWA CHPP in which: (1) the current condition, capabilities, and maintenance status of the FWA CHPP were evaluated; (2) recent performance tests and supporting combustion data were evaluated to determine baseline-operating conditions and efficiencies; (3) regional private sector opportunities were investigated; (4) current heating and power loads and projected loads were reviewed based on master plans; and (5) alternatives to the current CHPP were developed and recommendations made to implement the most cost effective combinations of technologies that would meet required heating and power loads.
DTIC
*Alternatives; Energy Conservation*

**20050175631** Brookhaven National Lab., Upton, NY, Covalent Associates, Inc., Woburn, MA, USA
**In Situ Synchrotron X-Ray Techniques for the Study of Lithium Battery Materials**
McBreen, J.; Mukerjee, S.; Yang, X. Q.; Ein-Eli, Y.; Apr. 1999; 18 pp.; In English
Report No.(s): DE2004-770795; BNL-66209; No Copyright; Avail: Department of Energy Information Bridge
The combination of in situ X-ray diffraction (XRD) and x-ray absorption spectroscopy (XAS) is a very powerful technique in the study of lithium battery cathode materials. XRD identifies the phase changes that occur during cycling and XAS gives information on the redox charge compensation processes that occur on the transition metal oxides. Because of its element specific nature XAS can identify the occurrence of redox processes on the various cations in doped oxide cathode materials. Since XAS probes short range order and is particularly useful in the study of amorphous tin based composite oxide anode materials.
NTIS
*Lithium Batteries; X Ray Diffraction; Cathodes*

**20050176401** NASA Lewis Research Center, Cleveland, OH, USA
**Regenerative Fuel Cell System Testbed Program for Government and Commercial Applications**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy
NASA Lewis Research Center's Electrochemical Technology Branch has led a multiagency effort to design, fabricate, and operate a regenerative fuel cell (RFC) system testbed. Key objectives of this program are to evaluate, characterize, and demonstrate fully integrated RFC's for space, military, and commercial applications. The Lewis-led team is implementing the program through a unique international coalition that encompasses both Government and industry participants. Construction of the 25-kW RFC testbed at the NASA facility at Edwards Air Force Base was completed in January 1995, and the system has been operational since that time.
Author
*Regenerative Fuel Cells; Research and Development; Technology Utilization*

**20050177095** Texas Univ., El Paso, TX, USA
**El Paso Solar Pond Test Project. Phase 1 Final Report October 1, 1985-March 31, 1987**
Reid, R. L.; Swift, A. H. P.; Sewell, M. P.; Liao, Y.; Knudsen, J. D.; Apr. 1992; 158 pp.; In English
Report No.(s): PB2005-105185; No Copyright; Avail: CASI; A08, Hardcopy
The University of Texas at El Paso is conducting a solar pond research project for the Bureau of Reclamation. This report details the results of the project for the period October 1985 through March 1987. During the initial stages of the project from July 1983 through September 1985, a 3355 sq. m. water storage pond in E1Paso, Texas was converted to a salt gradient solar pond. This involved draining the pond, constructing two 400-ms evaporation ponds, installing an XR-5 liner over the existing hypalon liner, obtaining raw salt from New Mexico, installing an instrumentation tower, designing and installing a brine extraction system, dissolving the salt, and establishing a salinity gradient. In late spring 1985 the first gradient was established. During the summer of 1985 the solar pond reached 72 degrees C, and process heat was extracted for the first time. However, in August 1985, instabilities developed and the pond cooled to 49 degrees C by September 30, 1985. The inability to reach and maintain higher temperatures in the pond is now thought to have resulted from several factors. These factors include (1) too thick an upper convective zone (UCZ); (2) too high a salinity in the UCZ (8% salt by weight), (3) too low a salinity in

the lower convective zone (LCZ) (20% salt); and (4) too weak a salinity gradient at the upper part of the NCZ.
NTIS
*Solar Ponds (Heat Storage); Evaporation; Process Heat*

**20050177150** NASA Lewis Research Center, Cleveland, OH, USA, Lockheed Martin Corp., USA, Ultralife Batteries, Inc., USA
**Lithium Ion Batteries**
Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Lithium ion batteries, which use a new battery chemistry, are being developed under cooperative agreements between Lockheed Martin, Ultralife Battery, and the NASA Lewis Research Center. The unit cells are made in flat (prismatic) shapes that can be connected in series and parallel to achieve desired voltages and capacities. These batteries will soon be marketed to commercial original-equipment manufacturers and thereafter will be available for military and space use. Current NiCd batteries offer about 35 W-hr/kg compared with 110 W-hr/kg for current lithium ion batteries. Our ultimate target for these batteries is 200 W-hr/kg.
Author
*Lithium Batteries; Product Development*

## 45
## ENVIRONMENT POLLUTION

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

**20050174516** Apogee Scientific, Inc., Englewood, CO, USA, United Research Services, Austin, TX, Electric Power Research Inst., Palo Alto, CA, USA, Illinois State Geological Survey, Champaign, IL, USA
**Assessment of Low Cost Novel Sorbents for Coal-Fired Power Plant Mercury Control. (Report for August 2, 2001-March 31, 2004)**
2004; 62 pp.; In English
Report No.(s): DE2004-835235; No Copyright; Avail: Department of Energy Information Bridge

The injection of sorbents upstream of a particulate control device is one of the most promising methods for controlling mercury emissions from coal-fired utility boilers with electrostatic precipitators and fabric filters. Studies carried out at the bench-, pilot-, and full-scale have shown that a wide variety of factors may influence sorbent mercury removal effectiveness. These factors include mercury species, flue gas composition, process conditions, existing pollution control equipment design, and sorbent characteristics. The objective of the program is to obtain the necessary information to assess the viability of lower cost alternatives to commercially available activated carbon for mercury control in coal-fired utilities. Prior to injection testing, a number of sorbents were tested in a slipstream fixed-bed device both in the laboratory and at two field sites. Based upon the performance of the sorbents in a fixed-bed device and the estimated cost of mercury control using each sorbent, seventeen sorbents were chosen for screening in a slipstream injection system at a site burning a Western bituminous coal/petcoke blend, five were chosen for screening at a site burning a subbituminous Powder River Basin (PRB) coal, and nineteen sorbents were evaluated at a third site burning a PRB coal. Sorbents evaluated during the program were of various materials, including: activated carbons, treated carbons, other non-activated carbons, and non-carbon material. The economics and performance of the novel sorbents evaluated demonstrate that there are alternatives to the commercial standard. Smaller enterprises may have the opportunity to provide lower price mercury sorbents to power generation customers under the right set of circumstances.
NTIS
*Mercury Compounds; Sorbents*

**20050174518** North Dakota Univ., Grand Forks, ND, USA
**Hot-Gas Filter Testing with a Transport Reactor Gasifier**
Swanson, M. L.; Hajicek, D. R.; 2005; 20 pp.; In English
Report No.(s): DE2005-835767; No Copyright; Avail: Department of Energy Information Bridge

Today, coal supplies over 55% of the electricity consumed in the USA and will continue to do so well into the next century. One of the technologies being developed for advanced electric power generation is an integrated gasification combined cycle (IGCC) system that converts coal to a combustible gas, cleans the gas of pollutants, and combusts the gas in a gas turbine to generate electricity. The hot exhaust from the gas turbine is used to produce steam to generate more electricity from a steam turbine cycle. The utilization of advanced hot-gas particulate and sulfur control technologies together with the

combined power generation cycles make IGCC one of the cleanest and most efficient ways available to generate electric power from coal. One of the strategic objectives for U. S. Department of Energy (DOE) IGCC research and development program is to develop and demonstrate advanced gasifiers and second-generation IGCC systems.
NTIS
*Filters; Particulates; Gasification*

**20050174519** National Energy Technology Lab., Pittsburgh, PA, North Dakota Univ., Grand Forks, ND, USA
**Pilot and Full-Scale Demonstration of Advanced Mercury Control Technologies for Lignite-Fired Power Plants. Quarterly Report**
Benson, S. A.; Crocker, C. R.; Galbreath, K. C.; Gunderson, J. R.; Holmes, M. J.; Feb. 2004; 38 pp.; In English
Report No.(s): DE2005-836113; No Copyright; Avail: Department of Energy Information Bridge

North Dakota lignite-fired power plants have shown a limited ability to control mercury emissions in currently installed electrostatic precipitators (ESPs), dry scrubbers, and wet scrubbers. This low level of control can be attributed to the high proportions of Hg(sup 0) present in the flue gas. Speciation of Hg in flue gases analyzed as part of the U.S. Environmental Protection Agency (EPA) information collection request (ICR) for Hg data showed that Hg(sup 0) ranged from 56% to 96% and oxidized mercury ranged from 4% to 44%. The Hg emitted from power plants firing North Dakota lignites ranged from 45% to 91% of the total Hg, with the emitted Hg being greater than 85% elemental. The higher levels of oxidized mercury were only found in a fluidized-bed combustion system.
NTIS
*Mercury (Metal); Fossil Fuels*

**20050174520** Oak Ridge National Lab., TN, Global Energy Inc., West Terre Haute, IN, USA, Pall Process Equipment Development, Cortland, NY, USA
**Characterization of Field-Exposed Iron Aluminide Hot Gas Filters**
McKamey, C. G.; Tortorelli, P. F.; Lara-Curzio, E.; McCleary, D.; Sawyer, J.; 2005; 20 pp.; In English
Report No.(s): DE2005-836126; No Copyright; Avail: Department of Energy Information Bridge

The use of a power turbine fired with coal-derived synthesis gas will require some form of gas cleaning in order to protect turbine and downstream components from degradation by erosion, corrosion, or deposition. Hot-gas filtration is one form of cleaning that offers the ability to remove particles from the gases produced by gasification processes without having to substantially cool and, possibly, reheat them before their introduction into the turbine. This technology depends critically on materials durability and reliability, which have been the subject of study for a number of years.
NTIS
*Filters; Gasification; High Temperature Gases*

**20050174528** Environmental Protection Agency, Washington, DC, USA
**Clean Air Interstate Rule Emissions Inventory Technical Support Document**
Mar. 04, 2005; 168 pp.; In English
Report No.(s): PB2005-104824; No Copyright; Avail: CASI; A08, Hardcopy

This document is the emission inventory Technical Support Document (TSD) for the Clean Air Interstate Rule (CAIR) rulemaking by the U.S. Environmental Protection Agency (EPA). It includes descriptions of the approach and data used for the emissions inventory and emissions processing for air quality modeling, as described in the CAIR Air Quality Modeling TSD. The emissions modeling effort has involved preparation of emissions input data for the Community Multiscale Air Quality (CMAQ) model, for the purposes of modeling particulate matter (PM). The model required hourly emissions for the entire year of 2001 on a 36-km national grid of the following pollutants: carbon monoxide (CO), nitrogen oxides (NOX), volatile organic compounds (VOC), sulfur dioxide (SO2), ammonia (NH3), particulate matter less than or equal to 10 microns (PM10), and particulate matter less than or equal to 2. 5 microns (PM2.5).
NTIS
*Air Quality; Carbon Monoxide; Particulates; Sulfur Dioxides*

**20050174529** Environmental Protection Agency, Washington, DC, USA
**Demonstration that CAIR Satisfies the 'Better than BART' Test as Proposed in the Guidelines for Making BART Determinations. Technical Support Document for the Final Clean Air Interstate Rule**
Mar. 2005; 48 pp.; In English
Report No.(s): PB2005-104826; No Copyright; Avail: CASI; A03, Hardcopy

This document provides additional background and analyses demonstrating that the Clean Air InterState Rule (CAIR) cap and trade program for EGUs would result in greater overall visibility improvement than BART for EGUs, and would not result in visibility degradation at any Class I area. Section IX.C. of the Notice of Final Rulemaking (NFR) of the Clean Air InterState Rule (CAIR) discusses the regulatory context of this demonstration, noting that a determination whether CAIR achieves greater progress than BART is contingent upon the finalization of the proposed guidelines for implementing BART (to be finalized by April 15, 2005, under a consent decree), as well as finalization of the criteria for evaluating alternative programs to BART.
NTIS
*Air Quality; Degradation*

**20050174530** Environmental Protection Agency, Washington, DC, USA
**Regional and State SO2 and NOx Emissions Budgets. Technical Support Document for the Final Clean Air Interstate Rule**
Mar. 2005; 34 pp.; In English
Report No.(s): PB2005-104827; No Copyright; Avail: CASI; A03, Hardcopy
This technical support document (TSD) provides a description of the data sources used in the calculation of regional and State emission budgets for sulfur dioxide (SO2) and nitrogen oxides (NOx) under the final Clean Air Interstate Rule (CAIR) and EPAs proposal to include Delaware and New Jersey in the CAIR region. In addition, it describes in further detail the approaches used in State budget calculations, and the data used in each of these approaches.
NTIS
*Air Quality; Nitrogen Oxides; Sulfur Dioxides*

**20050174531** Harvard Center for Risk Analysis, Boston, MA, USA, NESCAUM, Boston, MA, USA
**Economic Valuation of Human Health Benefits of Controlling Mercury Emissions from U.S. Coal-Fired Power Plants**
Rice, G.; Hammitt, J. K.; Feb. 2005; 248 pp.; In English
Report No.(s): PB2005-104850; No Copyright; Avail: CASI; A11, Hardcopy
This report describes the results of a comprehensive study to estimate the health benefits of reducing mercury emissions from coal-fired power plants in the USA. Reductions in mercury emissions from coal-fired power plants are anticipated to decrease methylmercury concentrations in fish. Fish consumption is the primary pathway of human exposure to methylmercury, which is a human neurotoxicant and possibly a cardiovascular toxicant. Some babies born to U.S. residents, a population sensitive to the neurotoxic effects of methylmercury, are currently exposed to intrauterine methylmercury concentrations above the EPA's Reference Dose (RfD). The RfD is considered by some to be an acceptable level of exposure.
NTIS
*Fossil Fuels; Mercury (Metal); Health*

**20050174544** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**Relationships Between Electrostatic Charging Characteristics, Moisture Content, and Airborne Dust Generation for Subbituminous and Bituminous Coals**
Page, S. J.; 2005; 24 pp.; In English
Report No.(s): PB2005-106033; No Copyright; Avail: CASI; A03, Hardcopy
Small scale laboratory pulverizing experiments were performed on humidified coal material sieved to size 6. 35mm (O.250 in) and below to eliminate effects due to inherent planes of weakness (Cleats or joints). Experimental factors studied include the coal seam proximate analysis constituents, the breakage-induced electrostatic field of airborne dust, and the specific airborne dust generated. Results of these pulverizing experiments show that only coals below 1-2% air dry loss (ADL) moisture content are in a highly charged state after pulverization and that the amount of charging decreases rapidly with increasing ADL up to 1-2%.
NTIS
*Coal; Bitumens; Electric Fields; Electrostatics*

**20050175621** Washington Univ., USA
**University of Washington Participation in SAFARI-2000**
Hobbs, Peter V.; January 2005; 6 pp.; In English
Contract(s)/Grant(s): NAG5-9022; No Copyright; Avail: CASI; A02, Hardcopy

This report presents a summary, of the participation in the 6-week field study in southern Africa. During the field study there were flown 119.02 research hours (31 research flights). In these flights the researchers obtained many unique data sets for evaluating the effects of biomass burning and other sources of particles and gases on the climate of southern Africa, and obtained simultaneous measurements with NASA ER-2 and Terra overflights. They also analyzed portions of the large data sets acquired in SAFARI-2000. They attended several SAFARI-2000 workshops, national and international conferences to present SAFARI-2000 results.
CASI
*Africa; Biomass Burning; Man Environment Interactions; Climate Change*

**20050176052** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
**Airborne Measurements of Carbonaceous Aerosols in Southern Africa during the Dry Biomass Burning Season**
Kirchstetter, Thomas W.; Novakov, T.; Hobbs, Peter V.; Magi, Brian; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 8476; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Particulate matter collected aboard the University of Washington's (UW) Convair-580 research aircrafi over southem Afiica during the dry biomass burning season was analyzed for total carbon (TC), organic carbon (OC), and black carbon (BC) contents using thermal and optical methods. Samples were collected in smoke plumes of burning savanna and in regional haze. A known artifact, produced by the adsorption of organic gases on the quartz filter substrates used to collect the particulate matter samples, comprised a significant portion of the TC collected. Consequently, conclusions derived from the data are greatly dependent on whether or not OC concentrations are corrected for this artifact. For example, the estimated aerosol coalbedo (1 - single scattering albedo (SSA)), which is a measure of aerosol absorption, of the biomass smoke samples is 60% larger using corrected OC concentrations. Thus, the corrected data imply that the biomass smoke is 60% more absorbing than do the uncorrected data. The BC to (corrected) OC mass ratio (BC/OC) of smoke plume samples (0.18 plus or minus 0.06) is lower than that of samples collected in the regional haze (0.25 plus or minus 0.08). The difference may be due to mixing of biomass smoke with background air characterized by a higher BC/OC ratio. A simple source apportionment indicates that biomass smoke contributes about three quarters of the aerosol burden in the regional haze, while other souxes (e.g., fossil fuel burning) contribute the remainder.
Author
*Aerosols; Biomass Burning; Seasons; Africa; Carbonaceous Materials*

**20050176378** Washington Univ., Seattle, WA, USA
**Emissions of Trace Gases and Particles from Two Ships in the Southern Atlantic Ocean**
Sinha, Parikhit; Hobbs, Peter V.; Yokelson, Robert J.; Christian, Ted J.; Kirchstetter, Thomas W.; Bruintjes, Roelof; Atmospheric Environment; 2003; ISSN 1352-2310; Volume 37, pp. 2139-2148; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Measurements were made of the emissions of particles and gases from two diesel-powered ships in the southern Atlantic Ocean off the coast of Namibia. The measurements are used to derive emission factors from ships of three species not reported previously, namely, black carbon, accumulation-mode particles, and cloud condensation nuclei (CCN), as well as for carbon dioxide, carbon monoxide (CO), methane (CH4), non-methane hydrocarbons, sulfur dioxide (SO2), nitrogen oxides (NOx), and condensation nuclei. The effects of fuel grade and engine power on ship emissions are discussed. The emission factors are combined with fuel usage data to obtain estimates of global annual emissions of various particles and gases from ocean-going ships. Global emissions of black carbon, accumulation- mode particles, and CCN from ocean-going ships are estimated to be 19-26 Gg yr(sup -1), (4.4-6.1) x 10(exp 26) particles yr(sup -1), and (1.0-1.5) x l0(exp 26) particles yr(sup -1), respectively. Black carbon emissions from ocean-going ships are approximately 0.2% of total anthropogenic emissions. Emissions of NOx and SO2 from ocean-going ships are approximately 10-14% and approximately 3-4%, respectively, of the total emissions of these species from the burning of fossil fuels, and approximately 40% and approximately 70%, respectively, of the total emissions of these species from the burning of biomass. Global annual emissions of CO and CH4 from ocean-going ships are approximately 2% and approximately 2-5%, respectively, of natural oceanic emissions of these species.
Author
*Atlantic Ocean; Exhaust Emission; Exhaust Gases; Ships; Trace Elements*

**20050176489** Battelle Pacific Northwest Labs., Richland, WA, USA
**Global Climate Change and the Unique Challenges Posed by the Transportation Sector**
Dooley, J. J.; Geffen, C. A.; Edmonds, J. A.; Aug. 2002; 14 pp.; In English
Report No.(s): DE2004-826254; No Copyright; Avail: Department of Energy Information Bridge

Addressing the challenges posed by global climate change will eventually require the active participation of all industrial sectors and consumers on the planet. To date, however, most efforts to address climate change have focused on only a few sectors of the economy (e.g., refineries and fossil-fired electric power plants) and a handful of large industrialized nations. While useful as a starting point, these efforts must be expanded to include other sectors of the economy and other nations. The transportation sector presents some unique challenges, with its nearly exclusive dependence on petroleum based products as a fuel source coupled with internal combustion engines as the prime mover. Reducing carbon emissions from transportation systems is unlikely to be solely accomplished by traditional climate mitigation policies that place a price on carbon. Our research shows that price signals alone are unlikely to fundamentally alter the demand for energy services or to transform the way energy services are provided in the transportation sector. We believe that a technological revolution will be necessary to accomplish the significant reduction of greenhouse gas emissions from the transportation sector.
NTIS
*Climate Change; Transportation*

**20050177027** Montana Univ., Missoula, MT, USA
**Trace Gas Measurements in Nascent, Aged and Cloud-processed Smoke from Africa Savanna Fires by Airborne Fourier Transform Infrared Spectroscopy (AFTIR)**
Yokelson, Robert J.; Bertschi, Isaac T.; Christian, Ted J.; Hobbs, Peter V.; Ward, Darold E.; Hao, Wei Min; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 8478; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

We measured stable and reactive trace gases with an airborne Fourier transform infrared spectrometer (AFTIR) on the University of Washington Convair-580 research aircraft in August/September 2000 during the SAFARI 2000 dry season campaign in Southern Africa. The measurements included vertical profiles of C02, CO, H20, and CH4 up to 5.5 km on six occasions above instrumented ground sites and below the TERRA satellite and ER-2 high-flying research aircraft. We also measured the trace gas emissions from 10 African savanna fires. Five of these fires featured extensive ground-based fuel characterization, and two were in the humid savanna ecosystem that accounts for most African biomass burning. The major constituents we detected in nascent CH3OOH, HCHO, CH30H, HCN, NH3, HCOOH, and C2H2. These are the first quantitative measurements of the initial emissions of oxygenated volatile organic compounds (OVOC), NH3, and HCN from African savanna fires. On average, we measured 5.3 g/kg of OVOC and 3.6 g/kg of hydrocarbons (including CH4) in the initial emissions from the fires. Thus, the OVOC will have profound, largely unexplored effects on tropical tropospheric chemistry. The HCN emission factor was only weakly dependent on fire type; the average value (0.53 g/kg) is about 20 times that of a previous recommendation. HCN may be useful as a tracer for savanna fires. Delta O3/Delta CO and Delta CH3COO/Delta CO increased to as much as 9% in \h1 h of photochemical processing downwind of fires. Direct measurements showed that cloud processing of smoke greatly reduced CH30H, NH3, CH3COOH, SO2, and NO2 levels, but significantly increased HCHO and NO.
Author
*Atmospheric Composition; Biomass Burning; Ecosystems; Fires; Gas Analysis; Smoke; Trace Contaminants; Trace Elements; Tropical Regions; Volatile Organic Compounds*

**20050177029** Washington Univ., Seattle, WA, USA
**Vertical Profiles of Light Scattering, Light Absorption, and Single Scattering Albedo during the Dry, Biomass Burning Season in Southern Africa and Comparisons of In Situ and Remote Sensing Measurements of Aerosol Optical Depths**
Magi, Brian I.; Hobbs, Peter V.; Schmid, Beat; Redermann, Jens; Journal of Geophysical Research; June 19, 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 40-1; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Airborne in situ measurements of vertical profiles of aerosol light scattering, light absorption, and single scattering albedo (omega (sub 0)) are presented for a number of locations in southern Africa during the dry, biomass burning season. Features of the profiles include haze layers, clean air slots, and marked decreases in light scattering in passing from the boundary layer into the free troposphere. Frequency distributions of omega (sub 0) reflect the strong influence of smoke from biomass burning. For example, during a period when heavy smoke was advected into the region from the north, the mean value of omega (sub 0) in the boundary layer was 0.81 +/- 0.02 compared to 0.89 +/- 0.03 prior to this intrusion. Comparisons of layer aerosol optical depths derived from the in situ measurements with those measured by a Sun photometer aboard the aircraft show excellent agreement.
Author
*Aerosols; Africa; Albedo; Biomass Burning; Electromagnetic Absorption; Optical Thickness; Remote Sensing; Smoke; Air Pollution*

**20050177030** Washington Univ., Seattle, WA, USA

**Distributions of Trace Gases and Aerosols during the Dry Biomass Burning Season in Southern Africa**

Sinha, Parikhit; Hobbs, Peter V.; Yokelson, Robert J.; Blake, Donald R.; Gao, Song; Kirchstetter, Thomas W.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D17, pp. 4536; In English

Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Vertical profiles in the lower troposphere of temperature, relative humidity, sulfur dioxide (SO2), ozone (O3), condensation nuclei (CN), and carbon monoxide (CO), and horizontal distributions of twenty gaseous and particulate species, are presented for five regions of southern Africa during the dry biomass burning season of 2000. The regions are the semiarid savannas of northeast South Africa and northern Botswana, the savanna-forest mosaic of coastal Mozambique, the humid savanna of southern Zambia, and the desert of western Namibia. The highest average concentrations of carbon dioxide (CO2), CO, methane (CH4), O3, black particulate carbon, and total particulate carbon were in the Botswana and Zambia sectors (388 and 392 ppmv, 369 and 453 ppbv, 1753 and 1758 ppbv, 79 and 88 ppbv, 2.6 and 5.5 micrograms /cubic meter and 13.2 and 14.3 micrograms/cubic meter). This was due to intense biomass burning in Zambia and surrounding regions. The South Africa sector had the highest average concentrations of SO2, sulfate particles, and CN (5.1 ppbv, 8.3 micrograms/cubic meter, and per 6400 cubic meter , respectively), which derived from biomass burning and electric generation plants and mining operations within this sector. Air quality in the Mozambique sector was similar to the neighboring South Africa sector. Over the arid Namibia sector there were polluted layers aloft, in which average SO2, O3, and CO mixing ratios (1.2 ppbv, 76 ppbv, and 3 10 ppbv, respectively) were similar to those measured over the other more polluted sectors. This was due to transport of biomass smoke from regions of widespread savanna burning in southern Angola. Average concentrations over all sectors of CO2 (386 +/- 8 ppmv), CO (261 +/- 81 ppbv), SO2 (2.5 +/- 1.6 ppbv), O3 (64 +/- 13 ppbv), black particulate carbon (2.3 +/- 1.9 microgram/cubic meter), organic particulate carbon (6.2 +/- 5.2 microgram/cubic meter), total particle mass (26.0 +/- 4.7 microgram/cubic meter), and potassium particles (0.4 +- 0.1 microgram/cubic meter) were comparable to those in polluted, urban air. Since the majority of the measurements in this study were obtained in locations well removed from industrial sources of pollution, the high average concentrations of pollutants reflect the effects of widespread biomass burning. On occasions, relatively thin (-0.5 km) layers of remarkably clean air were located at -3 km above mean sea level, sandwiched between heavily polluted air. The data presented here can be used for inputs to and validation of regional and global atmospheric chemical models.

Author

*Air Pollution; Atmospheric Chemistry; Biomass Burning; Carbon Monoxide; Gas Composition; Particulates; Pollution; Trace Elements; Troposphere; Africa; Combustion Products; Environment Pollution; Pollution Transport; Atmospheric Effects*

**20050177048** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Overview of Aerosol Distribution**

Kaufman, Yoram; [2005]; 1 pp.; In English; ISSI Workshop, 6-11 Jun. 2005, Bern, Switzerland; No Copyright; Avail: Other Sources; Abstract Only

Our knowledge of atmospheric aerosols (smoke, pollution, dust or sea salt particles, small enough to be suspended in the air), their evolution, composition, variability in space and time and interaction with clouds and precipitation is still lacking despite decades of research. Understanding the global aerosol system is fundamental for progress in climate change and hydrological cycle research. While a single instrument was used to demonstrate 50 years ago that the global CO2 levels are rising, posing threat of global warming, we need an array of satellites and field measurements coupled with chemical transport models to understand the global aerosol system. This complexity of the aerosol problem results from their short lifetime (1 week) and variable chemical composition. A new generation of satellites provides exciting opportunities to measure the global distribution of aerosols, distinguishing natural from anthropogenic aerosol and measuring their interaction with clouds and climate. I shall discuss these topics and application of the data to air quality monitoring.

Author

*Aerosols; Air Quality; Environmental Transport*

**20050177051** National Inst. for Occupational Safety and Health, Cincinnati, OH, USA

**In-Depth Survey Report: Evaluation of Ventilation and Filtration System for LMDS and DPRC**

Garcia, A.; Beamer, B. R.; Crouch, K. G.; Hammond, D.; May 2005; 20 pp.; In English

Report No.(s): PB2005-106329; No Copyright; Avail: CASI; A03, Hardcopy

Researchers from the National Institute for Occupational Safety and Health (NOSH) conducted an evaluation of the Ventition/Filtration System (VfS) developed for the USA Postal Service (USPS) mail processing equipment--the Loose Mail

ditribution System (LMDS) and Dual Pass Rough Cull (DPRC). The VFS was developed and installed by a private contractor hired by the USPS to reduce the potential for employee exposure to harmful substances that could be contained in mail pieces processed by the equipment. NIOSH was asked to assist the USPS in evaluating controls for this and other processing equipment after the 2001 terrorist attacks that used the mail as a delivery system for anthrax.
NTIS
*Filtration; Ventilation; Air Mail; Health; Safety*

**20050177056** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**NASA's East and Southeast Asia Initiatives: BASE-ASIA and EAST-AIRE**
Tsay, S.; Maring, H.; [2005]; 1 pp.; In English; Aerosol Study and Climate Change Workshop, 22-30 Apr. 2005, Bangkok, Thailand; No Copyright; Avail: Other Sources; Abstract Only

Airborne dust from northern China influences air quality and regional climate in Asia during springtime. However, with the economic growth in China, increased emission of particulate air pollutants from industrial and vehicular sources will not only impact the earth's radiation balance, but also adversely affect human health year round. In addition, both of dust and aerosol pollutants can be transported swiftly across the Pacific affecting North America within a few days. Asian dust and pollutant aerosols can be detected by their colored appearance using current Earth observing satellites (e.g., MODIS, SeaWiFS, TOMS, etc.) and by sunphotometers deployed on the surface of the earth. Biomass burning has been a regular practice for land clearing and conversion in many countries, especially those in Africa, South America, and Southeast Asia. However, the climatology of Southeast Asia is very different than that of Africa and South America, such that large-scale biomass burning causes smoke to interact extensively with clouds during the peak-burning season of March to April. Globally significant sources of greenhouse gases (eg., CO2, CH4), chemically active gases (e.g., NO, CO, HC, CH3Br), and atmospheric aerosols are produced by biomass burning. These gases influence the Earth-atmosphere system, impacting both global climate and tropospheric chemistry. Some aerosols can serve as cloud condensation nuclei, which play a role in determining cloud lifetime and precipitation, altering the earth's radiation and water budgets. Biomass burning also affects the biogeochemical cycling of nitrogen and carbon compounds; the hydrological cycle; land surface reflectivity and emissivity; and ecosystem biodiversity and stability. Two NASA initiatives, EAST-AIRE (East Asian Study of Tropospheric Aerosols: an International Regional Experiment) and BASE-ASIA (Biomass-burning Aerosols in South East-Asia: Smoke Impact Assessment) will be presented. The objectives of these initiatives is to develop a better understanding of the impacts of aerosols on regional-to-global climate, hydrological and carbon cycles, and tropospheric chemistry.
Author (revised)
*Biomass Burning; Air Pollution; Aerosols; Southeast Asia; Environment Effects; Pollution Monitoring*

**20050177081** Battelle Pacific Northwest Labs., Richland, WA, USA
**NOx Reduction Behavior of Alumina and Zeolite Catalysts in Combination with Non-Thermal Plasma**
Panov, A. G.; Tonkyn, R.; Yoon, S.; Kolwaite, A.; Barlow, S.; 2004; 12 pp.; In English
Report No.(s): DE2004-827866; No Copyright; Avail: Department of Energy Information Bridge

Lean burn gasoline and diesel engines provide improved fuel economy when compared to engines operating under stoichiometric fuel/air conditions. At the same time, lean burn and diesel engines present a problem for emission control. Because they operate under oxidizing conditions, the conventional three-way catalyst is not effective in NOx reduction. In addition, the wide temperature range of automobile exhaust gases present a challenge for catalyst design. The temperature of exhaust gases from a light duty diesel engine can vary from 150 to 500 C, depending on the operating conditions. To date, a catalyst that operates with high NOx conversion efficiency over the entire operating range has not been found. Non-thermal plasma assisted catalysis has been shown to be a promising technology for NOx reduction in lean burn and diesel exhaust gases. The approach exploited in this paper is to use a plasma in combination with several catalysts, each of which are active over unique temperature ranges. It was reported in the literature, that the one of the essential roles of plasma treatment is to oxidize NO to easier reducible NO2. In this contribution, the other important function of plasma treatment, namely partial oxidation of propylene, will be demonstrated.
NTIS
*Catalysts; Thermal Plasmas; Catalysis*

**20050177092** Environmental Protection Agency, Washington, DC
**Bellevue Carbon Monoxide Study, December 29, 1987 to February 20, 1988**
Palmer, J. C.; Schweiss, J. W.; Jul. 1988; 32 pp.; In English
Report No.(s): PB2005-103104; No Copyright; Avail: CASI; A03, Hardcopy

Since the onset of continuous monitoring in 1978, a carbon monoxide (CO) problem has been indentified with the city of Bellevue. The city was delcared in nonattainment of the State and Federal air quality standards for CO*. Maximum ambient concentrations at the permanent site continue to exceed the level of the standard. Some uncertainty persists over the ability of this site to adequately characterize maximum CO impacts throughout the central business district (CBD) of Bellevue. A special study was conceived by the City of Believue, Washington Department of Ecology (Ecology), and the Environmental Protection Agency (EPA) to provide information relative to the magnitude and spatial distribution of CO in downtown Bellevue. This report presents the major results and conclusions from that study.
NTIS
*Carbon Monoxide; Environment Protection; Air Quality*

**20050177098** Minnesota Univ., Minneapolis, MN, USA, Cincinnati Univ., OH, USA
**Silica Exposure and Silicosis: Effect of Mixed Exposures**
Alexander, B. H.; Banerjee, S.; Rice, C.; 2004; 74 pp.; In English
Report No.(s): PB2005-105190; No Copyright; Avail: CASI; A04, Hardcopy

The quantitative relationship between exposure to crystalline silica and development of silicosis is certain despite a number of studies addressing the problem. The uncertainty is due to the following reasons: (a) the exposure reconstructions were based on sparse data with tremendous uncertainties; (b) dose reconstructions, to estimate the cumulative lung burden of the worker, did not account for retention and clearance of inhaled dusts; (c) exposure reconstructions for silica, a highly toxic dust, did not account for simultaneous exposures to less toxic dusts, (non-silica dusts). The purpose of this study was to obtain the quantitative dose-response relationship between crystalline silica and silicosis in a manner that addressed the above issues. The North Carolina Dusty Trades program provides a large dataset of human exposures to silica and non-silica dust and silicosis from 1935-1980. Pharmacokinetic modeling was used to estimate the cumulative lung dose of silica and non-silica dust and time to macrophage overload in the presence of this mixed exposure. A case-control study was conducted to compare silicotics and disease-free referents.
NTIS
*Silicon Dioxide; Exposure; Toxicity*

**20050177100** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**NIOSH Research for Controlling Respirable Dust and Methane Gas on Continuous Miner Faces**
Goodman, G. V. R.; Taylor, C. D.; Colinet, J. F.; Thimons, E. D.; Apr. 10, 2000; 12 pp.; In English
Report No.(s): PB2005-106023; No Copyright; Avail: CASI; A03, Hardcopy

The importance of controlling respirable dust and methane gas levels in underground coal mining cannot be underestimated. While respirable dust can significantly affect the occupational health of underground coal miners, methane gas accumulations pose significant safety concerns for these same workers. Water sprays and machine mounted dust scrubbers offer effective control of respirable dust exposures and methane gas accumulations. Water must not only be applied carefully to avoid dust rollback to the machine operator but must create sufficient turbulence to remove dead zones that could contain high concentrations of methane gas. While the flooded-bed dust scrubber has been generally responsible for decreased worker exposures to respirable dusts, this device has proved effective in controlling methane levels at the face. This paper reviews practical applications of water sprays and dust scrubbers to control respirable dust and methane gas on continuous miner faces.
NTIS
*Mining; Coal Derived Gases; Dust Collectors*

**20050177132** Minnesota Univ., Minneapolis, MN, USA
**Retrospective Exposure Assessment in Industrial Settings**
Ramachandran, G.; Jun. 2000; 60 pp.; In English
Report No.(s): PB2005-105204; No Copyright; Avail: CASI; A04, Hardcopy

A variety of health effects are caused by chronic, cumulative exposure over time to pollutants. In these cases, to establish dose-response relationships for epidemiological and risk assessment purposes, it is vital to determine the exposures of individuals or cohorts as functions of time. Most existing occupational exposure databases, however, do not contain continuous records of historical exposures to airborne contaminants. These gaps in historical record may be filled by using the knowledge-base that experts and professionals in the field possess. In this project, we present a new framework, based on Bayesian probabilistic reasoning for obtaining estimates of exposure histories for airborne particulates from limited historical measurements, using subjective expert judgment. The framework has great potential applications in instances where there is

sparse information or missing data on past exposures. Traditional methods, using only available historical measurements result in estimates with large uncertainties. Limited information on estimates of airborne concentrations and worker exposures to airborne nickel aerosol are used to estimate the uncertainty in historical air monitoring data. This uncertainty arises from environmental variabilities, systematic biases as well as uncertainty due to various measurement criteria used over a period of several decades. Retrospective exposure reconstruction based solely on such historical measurements leads to estimates with such large error bars as to be not useful for developing quantitative dose-response relationships for epidemiology.
NTIS
*Environmental Monitoring; Air Pollution; Aerosols*

**20050177133** McGill Univ., Montreal, Quebec, Canada
**Irritant-Induced Asthma: Epidemiology and Pathogenesis**
Malo, J. L.; Gautrin, D.; Martin, J.; 2005; 60 pp.; In English
Report No.(s): PB2005-105203; No Copyright; Avail: CASI; A04, Hardcopy

It has been recently recognized that exposure to irritant materials can cause asthma, a type of asthma called Irritant-Induced asthma (IrIA). One of the most dramatic manifestations of this condition was the bronchopulmonary disease that occurred in the survivors of the World Trade Center. When this syndrome occurs at work, it is a type of occupational asthma. The general aim of this proposal was to explore the following questions related to IrIA from both epidemiological and physiopathological approaches: (1) Do single irritant exposures (Reactive Airways Dysfunction Syndrome-RADS--) and multiple irritant exposures (IrIA) result in equivalent consequences for airway structure and function; (2) Are baseline characteristics (atopy, airway caliber and responsiveness) relevant to susceptibility of developing IrIA and RADS.
NTIS
*Asthma; Epidemiology; Pathogenesis*

**20050177139** Texas Univ. Health Science Center, Houston, TX, USA
**Utility of Biomarkers as Exposure and Dose Measures**
Symanski, E.; Dec. 20, 2001; 24 pp.; In English
Report No.(s): PB2005-105199; No Copyright; Avail: CASI; A03, Hardcopy

This study examined variation in the levels of biological measures of exposure to workplace contaminants. Although intra- and inter-individual differences have been characterized for a large number of airborne exposures across occupational groups, similar variation had not been investigated extensively for biological measures. A primary objective of this study was to compile a database of repeated biological measures so that the within- and between-worker sources of variability could be partitioned for as wide a range of biomarkers as possible. Following a review of the world's published literature, biological monitoring data were abstracted from 52 studies that examined workers' exposures to metals, solvents, polycyclic aromatic hydrocarbons, and pesticides. Forty-four percent of the studies also reported personal sampling results, which were compiled as well. Over 4,000 measurements collected on 577 workers in 55 workplaces are contained in the biological database, which represents a wide range of biomarkers collected in blood, urine, and exhaled air.
NTIS
*Biomarkers; Exposure; Contaminants*

**20050177142** Johns Hopkins Univ., Baltimore, MD, USA, Los Alamos National Lab., NM
**Cytotoxicity and Solubility of Beryllium Particles**
Breysse, P. N.; Stefaniak, A. B.; Scripsick, R. C.; Hoover, M. D.; Nov. 23, 2004; 42 pp.; In English
Report No.(s): PB2005-105200; No Copyright; Avail: CASI; A03, Hardcopy

The long-term goal of this research is to develop more protective industrial hygiene metrics of exposure that are related to bioavailability, and therefore, potential risk of immune-mediated diseases caused by exposure to metals. We chose chronic beryllium disease (CBD) as a model for this research because it is a potentially fatal cell-mediated immune disease of the lung with no known cure that continues to be diagnosed among workers exposed to beryllium and former workers no longer exposed to beryllium. CBD is associated with exposure to beryllium- containing particles; however, at the cellular level a dissolved beryllium species is the hypothesized input to the immune reaction that drives development of CBD, As beryllium containing particles dissolve in phagocytic lung cells, a fraction of the dissolve material may be consumed in the formation of the beryllium antigen, which is hypothesized to cause CBD. Little is known about the physicochemical properties or

dissolution behavior of respirable beryllium aerosols, suggesting that the relationship between exposure to beryllium and dose is not well understood.
NTIS
*Respiratory Diseases; Beryllium*

**20050177188** Washington Univ., Seattle, WA, USA
**Effects of Humidity on Aerosols in Southern Africa during the Biomass Burning Season**
Magi, Brian I.; Hobbs, Peter V.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 8495; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Measurements of the aerosol total light scattering coefficient, asp, and the aerosol hemispheric backscatter ratio, p(1), as functions of relative humidity (RH in %) (so-called humidographs) at three wavelengths (450,550, and 700 nm) were obtained in the dry season in southern Africa (1) in ambient air in South Africa, Botswana, Mozambique and Zambia, (2) at various distances downwind in identifiable smoke plumes from biomass fires, and (3) along the southwest coast of Africa. The ratio of sigma(sub sp) at an RH of 80% to that at 30% provides a measure of the effects of RH on sigma(sub sp), and similarly for Beta(1). For the three broad sampling categories given above, and at a wavelength of 550 nm, these ratios varied from 1.42 +/- 0.05 to 2.07 +/- 0.03 for sigma(sub sp), and from 0.69 +/- 0.05 to 0.99 +/- 0.14 for Beta(1). In general, humidographs for the ambient air samples showed a greater dependence on RH than those for smoke from identifiable biomass fires. During a period when dense, aged smoke was transported to the region from the north, the humidographs for sigma(sub sp) for ambient air samples were similar to those for identifiable smoke plume samples just approximately 10- to 50-min old. This suggests that as far as the effects of RH on sigma(sub sp) are concerned the effects of aging of smoke and its mixing with ambient air are realized within less than about an hour.
Author
*Africa; Biomass Burning; Humidity; Smoke; Air Pollution; Pollution Transport; Combustion Products*

**20050177224** NASA Ames Research Center, Moffett Field, CA, USA
**Evolution of Gases and Particles from a Savanna Fire in South Africa**
Hobbs, Peter V.; Sinha, Parikhit; Yokelson, Robert J.; Christian, Ted J.; Blake, Donald R.; Gao, Song; Kirchstetter, Thomas W.; Novakov, Tica; Pilewskie, Peter; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 8485; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Airborne measurements of particles and gases fiom a 1000-ha savanna fire in South Africa are presented. These measurements represent the most extensive data set reported on the aging of biomass smoke. The measurements include total concentrations of particles (CN), particle sizes, particulate organic carbon and black carbon, light-scattering coefficients, downwelling UV fluxes, and mixing ratios for 42 trace gases and 7 particulate species. The ratios of excess nitrate, ozone, and gaseous acetic acid to excess CO increased significantly as the smoke aged over approximately 40-45 min, indicating that these species were formed by photochemistry in the plume. For 17 other species, the excess mixing ratio normalized by the excess mixing ratio of CO decreased significantly with ‘ smoke age. The relative rates of decrease for a number of chemical species imply that the average OH concentration in the plume was approximately 1.7 x l0(exp 7) molecules /cubic centimeter. Excess CN, normalized by excess CO, decreased rapidly during the first approximately 5 min of aging, probably due to coagulation, and then increased, probably due to gas-to-particle conversion. The CO-normalized concentrations of particles \h 1.5 microns in diameter decreased, and particles \g1.5 micron diameter increased, with smoke age. The spectral depletion of solar radiation by the smoke is depicted. The downwelling UV flux near the vertical center of the plume was about two-thirds of that near the top of the plume.
Author
*Atmospheric Composition; Gas Analysis; Gas Evolution; Ozone; Particulates; Photochemical Reactions; Smoke; Biomass Burning; Air Pollution*

**20050177234** Washington Univ., Seattle, WA, USA
**Clean Air Slots Amid Atmospheric Pollution**
Hobbs, Peter V.; Nature; February 21, 2002; Volume 415, pp. 861; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Layering in the Earth’s atmosphere is most commonly seen where parts of the atmosphere resist the incursion of air

parcels from above and below - for example, when there is an increase in temperature with height over a particular altitude range. Pollutants tend to accumulate underneath the resulting stable layers. which is why visibility often increases markedly above certain altitudes. Here we describe the occurrence of an opposite effect, in which stable layers generate a layer of remarkably clean air (we refer to these layers as clean-air 'slots') sandwiched between layers of polluted air. We have observed clean-air slots in various locations around the world, but they are particularly well defined and prevalent in southern Africa during the dry season August-September). This is because at this time in this region, stable layers are common and pollution from biomass burning is widespread.
Author
*Air Pollution; Biomass Burning; Earth Atmosphere; Pollution Transport; Atmospheric Boundary Layer; Air Flow*

## 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*.

**20050173914** California Inst. of Tech., Pasadena, CA, USA
**CAI Thermal History Constraints from Spinel: Ti Zoning Profiles and Melilite Boundary Clinopyroxenes**
Paque, J. M.; Burnett, D. S.; Beckett, J. R.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Extensive study of Ca-Al-rich Inclusions (CAIs) from Allende has revealed a complex series of events subsequent to the initial crystallization, including pervasive alteration, primarily of melilite. Allende TS 34 (Type B1) is unique in having atypically large spinel grains, permitting detailed study of minor element zoning based on whole crystal contour maps [1]. Profiles for V and Fe can be understood in terms of diffusion of elements mobilized by the alteration. The Fe profiles imply heating for a few hundred years in the 600-700 temperature range. However, the Ti zoning profiles have proved difficult to explain. We have undertaken additional analysis of the environment surrounding the spinels in an effort to determine the origin of the Ti in spinel.
Derived from text
*Crystallization; Meteoritic Composition; Diffusion; Boundaries; Mineralogy; Grain Size*

**20050173915** Tennessee Univ., Knoxville, TN, USA
**Mineralogy and Petrography of Lunar Mare Regolith Breccia Meteorite MET 01-210**
Patchen, Allan D.; Taylor, Lawrence A.; Day, James M. D.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

MET 01-210 is a 22.8g lunar regolith breccia collected in 2001 from the Meteorite Hills, Antarctica [1]. We present results that indicate this regolith breccia is composed predominantly of basaltic clasts and mineral fragments with lunar mare affinities, rather than being an anorthositic regolith breccia, as it was originally described.
Derived from text
*Meteorites; Petrography; Mineralogy; Lunar Maria; Breccia; Basalt*

**20050173921** Kingston Univ., Kingston-Upon-Thames, UK
**Rheology and Multiphase Flow in Congested Ammonia-Water-Ice Slurries**
Petford, Nick; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Some aspects of the rheological behaviour of ammonia-water-ice slurries have been investigatedby Kargel et al. [1] over a range of temperaturesand compositions relevant to the icy satellites. However,a proper quantification of the rheology and flow behaviour of fluid-particle suspensions remains a majortheoretical and experimental challenge. This complex,multiphysics problem is somewhat difficult to generalize,as many mechanisms occur simultaneously and interdependently. Suspension rheology is particularlyrelevant in this respect due to its strong influence onthe style of flow and emplacement of cryomagmas both internally and at the surface [2].This study is concerned with estimates of flow rheologyat high crystal loads ( \g 50%), well above theexperimental range investigated in [1]. Such materialsare referred to in the

micromechanics literature as congested[3], and magmas during their latter stages offlow, where cooling and crystallisation dominate, provideexcellent natural examples.
Derived from text
*Slurries; Ammonia; Rheology; Micromechanics; Multiphase Flow; Crystallization; Water; Icy Satellites*

**20050173926** Washington Univ., Saint Louis, MO, USA
**I-Xe Dating: The Time Line of Chondrule Formation and Metamorphism in LL Chondrites**
Pravdivtseva, O. V.; Hohenberg, C. M.; Meshik, A. P.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations
Contract(s)/Grant(s): NAG5-12776; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Refractory inclusions, considered to be the oldest solids formed in the solar nebula. (4567.2 0.6 Ma) [1], are common in many carbonaceous and in some ordinary and enstatite chondrites. High-precision Pb- Pb ages for CAI s and chondrules (from different meteorites) suggested that chondrule formation appeared to have started about 2 Ma later than that of CAIs [1]. However, recent 26Al/26Mg data suggest simultaneous formation of CAI s and chondrules in Allende [2]. The I-Xe ages of CAI s in Allende are about 2 Ma younger than the I-Xe ages of Allende chondrules [3] but, like all chronometers, the I-Xe system records closure time of its particular host phase. In the case of Allende CAI s, the major iodine-bearing phase is sodalite, a secondary phase presumably formed by aqueous alteration, so I-Xe reflects the post-formational processes in these objects. In chondrules the iodine host phases vary and can reflect formation and/or alteration but, to put chondrule ages on a quantative basis, some problems should first be addressed.
Derived from text
*Inclusions; Solar Nebula; Chondrule; Chondrites; Metamorphism (Geology); Meteorites; Enstatite; Solids*

**20050173930** Centre de Recherches Petrographiques et Geochimiques, Nancy, France
**Experimental Study of Fe-, Co- and Ni-partitioning Between Forsterite and low-Co Fe,Ni-Alloys: Implications for Formation of Olivine Condensates in Equilibrium with Primitive Metal**
Pack, A.; Schoenbeck, T.; Shelley, J. M.; Deloule, E.; Rollion-Bard, C.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The first major phases to condense from a gas of Solar composition are FeO-poor forsterite and Fe,Ni-metal [1]. T(sub c) varies with total ambient pressure. At p(sub tot) = 10(exp -3) bar, Fe,Ni-metal starts to condense at 1462 K and forsterite at 1444 K. At lower pressure (p(sub tot) = 10(exp -6) bar), Fe,Ni-metal is less refractory than forsterite and starts to condense at 1210 K, whereas forsterite at 1270 K [1]. Grains of metal condensate were described from carbonaceous chondrites. They are enriched in Ni and Co relative to Fe, but have approximately chondritic Co/Ni ratios [2, 3]. It was suggested that refractory forsterite (RF) grains that occur in unequilibrated chondrites formed by gas/solid condensation [4] or by crystallization in silicate melt condensates [5, 6]. In first case, they would be the silicate counterparts to metal condensates. The purpose of our study is to predict concentrations of Fe, Co and Ni of olivine in equilibrium with primitive metal condensates. Partitioning of Fe, Co and Ni was determined in experiments. We compare predicted composition of metal condensates with concentrations of Fe, Co and Ni in RF grains in order to reconstruct the conditions (p, T, f(sub O2)) during their formation.
Derived from text
*Iron Oxides; Carbonaceous Chondrites; Forsterite; Condensates; Melts (Crystal Growth); Gas Composition*

**20050173933** New Mexico Univ., Albuquerque, NM, USA
**Comparative Planetary Mineralogy: Valence State Partitioning of Cr, Fe, Ti, and V Among Crystallographic Sites in Olivine, Pyroxene, and Spinel from Planetary Basalts**
Papike, J. J.; Karner, J. M.; Shearer, C. K.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have considered the valence-state partitioning of Cr, Fe, Ti, and V over crystallographic sites in olivine, pyroxene, and spinel from planetary basalts. The sites that accommodate these cations are the M2 site (6-8 coordinated) and M1 site (6 coordinated) in pyroxene, the M2 site (6-8 coordinated) and M1 site (6 coordinated) in olivine, and the tetrahedral and octahedral sites in spinel. The samples we studied are basalts from Earth, Moon, and Mars, which have fO2 conditions that range from IW-2 (Moon) to IW+6 (Earth) with Mars somewhere between at IW to IW+2. In this range of fO2 the significant

elemental valences are (from low to high fO2) Ti4+, V3+, Fe2+, Cr2+, Cr3+, V3+, V4+, and Fe3+. V2+ and Ti3+ play a minor role in the phases considered for the Moon, and are probably in very low concentrations. V5+ plays a minor role in these phases in terrestrial basalts because it is probably in lower abundance than V4+ and it has an ionic radii that is so small (0.054 nm, 6- coordinated,[1]) that it is almost at the lower limit for octahedral coordination. The role of Cr2+ in the Moon is significant, as Sutton et al. [2] found that lunar olivine contains mostly Cr2+ while coexisting pyroxene contains mostly Cr3+. Hanson one vacancy only accommodates one V4+. Thus more vacancies are required in V4+ substitutions into olivine. In the Moon V3+ is much more abundant than V4+ [7, 8]. Thus in lunar chromite V3+ follows Cr3+, whereas in Earth V4+ (which is much greater in abundance than V3+) follows Ti4+ (eg in ulv spinel). We could go on in this vein for some time but space limitations do not permit us to do so.
Derived from text
*Chromites; Crystallography; Valence; Mineralogy*

**20050173937** Aberdeen Univ., UK
**Endolithic Colonization of Fluid Inclusion Trails in Mineral Grains**
Parnell, J.; Baron, M.; Cockell, C. S; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Endoliths in sandstones: Many scenarios for the colonization of planetary surfaces by microbial life involve endoliths [1, 2]. The need to avoid the damaging effects of ultraviolet radiation makes colonization of the immediate sub-surface desirable, particularly at an early stage of evolution before screening pigments have been developed [3, 4]. Minimal (millimetre- to sub-millimetre-scale) penetration of the surface may filter ultraviolet radiation but admit enough light for photosynthesis. Endolithic borings in minerals are found through the terrestrial geological record at least back to the Proterozoic [5], and are an important potential trace fossil that may be sought in extraterrestrial materials [6]. Endolithic communities in sandstones have been studied in detail, particularly in the quartzose Beacon Sandstone in the dry valleys of southern Victoria Land, Antarctica [1, 2, 7], where they inhabit a hostile (cold, dry) terrestrial environment. These rocks also contain permineralized fossil endoliths [1]. Cyanobacteria inbetween sand grains in the Beacon Sandstone can photosynthesize because the quartz grains are highly translucent. The present study records that some of the microbial mass colonizes microfractures in the quartz grains, i.e. it is intragranular as well as intergranular.
Derived from text
*Sandstones; Planetary Surfaces; Photosynthesis; Millimeter Waves; Minerals*

**20050173942** Brown Univ., Providence, RI, USA
**A Quantitative Analysis of Plate Motion on Europa: Implications for the Role of Rigid vs. Nonrigid Behavior of the Lithosphere**
Patterson, G. W.; Head, J. W.; Pappalardo, R. T.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Voyager and Galileo images of Europa have shown its surface to be highly deformed by tectonic features. The formation of these features has been attributed to deformation of the outer ice shell from stresses induced by diurnal tides, nonsynchronous rotation, and/or polar wander [1-5]. The effects of these stress fields (acting independently and/or in concert) are inferred to fracture the ice shell into plates that subsequently rotate with respect to one another [e.g. see 4]. The expression of these plate rotations can be observed in the ubiquitous presence of strike-slip and extensional features on the surface. Dark, wedge-shaped bands on Europa (interpreted as extensional [1,3]) have been used to suggest that surface plates, up to 50-100 km across, have moved and rotated relative to each other [1]. Furthermore, it has been noted that the dark material of some of the features could be removed, allowing the margins of the bands to fit closely together and the surrounding preexisting lineaments to be reconstructed [1]. This has been used to suggest that these plates behaved rigidly during deformation (i.e. all deformation was accommodated at the margins of the plates). This assumption has been further reinforced by strike-slip zones on Europa with displacements of 1-10km [6,7]. It has been suggested that such motion is a plausible result of the accommodation of tidal strain in a crust broken into mobile, rigid blocks [8]. Assuming rigid plate behavior, a number of qualitative and quantitative reconstructions of Europa s tectonically disrupted surface have been performed [1,2,5,9-11]. The distinction we use between these two types of reconstruction is the determination of an Euler pole of rotation (a pivot point for the motion of two rigid plates relative to each other on a sphere). This is a commonly determined quantity when describing terrestrial plate motions but has been only sparingly determined when describing plate motions on Europa [e.g. 1,11].

Interestingly, one of these quantitative analyses indicated that Europa s lithosphere might behave nonrigidly [11].
Derived from text
*Europa; Crusts; Structural Properties (Geology); Tectonics; Displacement; Quantitative Analysis; Deformation*

**20050173948** Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
**LA-ICP-MS Study of Trace Elements in the Chaunskij Metal**
Petaev, M.; Jacobsen, S. B.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Although some data on average chemical compositions of mesosideritic metals have been obtained in earlier studies [1], the most comprehensive chemical dataset was first presented by Hassanzadeh et al. [2] who measured concentrations of Fe, Ni, Co, Cr, Cu, Ga, As, Sb, W, Re, Ir, Pt, and Au in the large metal nodules from 13 mesosiderites. Using cluster analysis, they divided mesosideritic metals into three groups with different concentrations of Ni, Cu, Au, As, and W. The authors noted that the strong depletion of RKPA79015 in refractory siderophiles along with the slight enrichment in volatile siderophiles requires a formation distinct from common mesosiderite metal . Wasson et al. [3] reported the concentrations of Fe, Ni, Co, Cr, Cu, Ga, As, W, Re, Ir, Pt, and Au in two small samples (442 and 516 mg) of the Chaunskij host metal that differ significantly from one another as well as from the mesosideritic metals reported by [2]. Both samples contain small amounts of silicates and/or troilite. Although the concentrations of many elements in Chaunskij metal are consistent with an extrapolation of compositional trends established by [2], the Ir concentrations are much lower than those in typical mesosiderites.
Derived from text
*Iron Meteorites; Trace Elements; Cluster Analysis; Chemical Composition; Silicates; Troilite*

**20050173949** Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
**Nebular Condensation Under Incomplete Equilibrium: Implications for the Fine-grained Spinel-rich CAIs**
Petaev, M. I.; Krot, A. N.; Wood, J. A.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

For more than three decades the equilibrium condensation sequence has been successfully used to interpret the chemistry and mineralogy of primitive chondrites. Many observed deviations in mineralogy and chemistry of some nebular components from the classic condensation sequence calculated for a gas of solar composition at a nebular pressure of 10-3 bar [1] can be corrected either by the use of improved thermodynamic data [e.g., 2-5], or by condensation in fractionated nebular systems [e.g., 2, 4-6], or by condensation at different pressures [7, 8], or by the condensate isolation [9, 10]. However, none of these equilibrium condensation models can resolve the wellknown discrepancy between the equilibrium condensation sequence and the structure of individual nodules of fine-grained CAIs, where spinel cores surrounded by melilite mantles provide unequivocal evidence for condensation of spinel prior to melilite. Two different explanations for this discrepancy have been put forward. First, it has been suggested [11, 12] that the equilibrium condensation of melilite was suppressed either for kinetic reasons or by extreme Ca/Al fractionation. However, neither of these mechanisms seems plausible [13]. For example, because both melilite and spinel under equilibrium conditions form by reactions of primary condensates C hibonite and/or grossite C with the residual nebular gas, it is difficult to understand why the reaction hibonite+gas melilite which requires no evaporation would be delayed by approx. 100 K relative to the reaction hibonite+gas spinel which requires Ca evaporation. An alternative explanation would be rapid (probably disequilibrium) condensation in a parcel of supercooled nebular gas [e.g., 14] in which spinel nucleates before melilite. This hypothesis is numerically tested here.
Derived from text
*Chondrites; Condensates; Evaporation; Fractionation; Gas Composition; Mineralogy*

**20050174569** Museum of Natural History, London, UK
**Enstatite Chondrites: An Iron and Zinc Isotope Study**
Mullane, E.; Russell, S. S.; Gounelle, M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Enstatite chondrites formed in a very reducing environment and consist predominantly of FeO-free enstatite, with varying amounts of Fe,Ni metal and troilite [1]. Elements which are normally lithophile under more oxidizing conditions occur in

chalcophile or siderophile associations, giving rise to a variety of rare minerals. A number of models for the formation of enstatite chondrites have been proposed. One theory holds that both EH and EL chondrites formed on a single stratified parent body [2,3]. The alternative scenario is that EH and EL chondrites formed in separate parent bodies [e.g. 4-5].
Derived from text
*Chondrites; Enstatite; Iron Isotopes; Iron Oxides; Zinc Isotopes; Troilite*

**20050174571** Lunar and Planetary Inst., Houston, TX, USA
**Light Lithophile Element Trends in Nakhlite NWA 817 Pyroxenes: Implications for Water on Mars**
Musselwhite, D. S.; Treiman, A. H.; Shearer, C.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Abundances of LLE (Li, B, Be) are strongly zoned in augite grains of the NWA 817 nakhlite [1,2]. Be and B consistently increase to grain rims (like Fe* and Ti), consistent with their geochemical behavior as incompatible elements. Li abundances increase outward in some rims, but decrease significantly in others. The cause of this bipolar behavior is not clear. LLE are not zoned in augites in the nakhlites Nakhla and Lafayette [3], which may suggest LLE mobility in late- and post-igneous cooling [4].
Author
*Light Elements; Nakhlites; Abundance; Geochemistry; Lithium; Mars Surface*

**20050174572** Brown Univ., Providence, RI, USA
**Crustal Formation, Volcanism, and Alteration in the Syrtis Major Region Revealed by Omega Data**
Mustard, J. F.; Poulet, F.; Gendrin, A.; Head, J. W.; Mangold, N.; Bibring, J.-P.; Langevin, Y.; Gondet, B.; Sotin, C.; LeMouelic, S.; Pinet, P., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Syrtis Major region, with its volcanic construct, position on the rim of the Isidis Basin, and astride the boundary of the hemispheric dichotomy, occupies an important position for understanding Mars geologic evolution [1]. Remotely sensed data from the OMEGA experiment on the Mars Express spacecraft provide a new perspective on the formation and evolution of this region. Here we show the distributions of mafic minerals olivine, low-Ca pyroxene, and high-Ca pyroxene on the volcanic shield and surrounding highlands. We also map the distribution of hydrated silicate minerals and their association with the volcanic regions.
Derived from text
*Volcanology; Planetary Geology; Mars Surface; Mars Express; Crusts; Dichotomies; Silicates; Structural Basins*

**20050174581** NASA Johnson Space Center, Houston, TX, USA
**Mineralogy and Petrology of New Antarctic Nakhlite MIL 03346**
McKay, G.; Schwandt, C.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Among the approx.1300 meteorites returned from Antarctica by the 2003-2004 ANSMET expedition was a 715g nakhlite, MIL 03346, recovered from the Miller Range. Samples of this meteorite were distributed to investigators on December 16, 2004. We were allocated PTS MIL 03346,63,100. This abstract is our preliminary report on the mineralogy and petrology of this important new sample.
Derived from text
*Petrology; Mineralogy; Nakhlites; Meteorites*

**20050174584** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**Rampart Ejecta Volume Measurements in Xanthe Terra, Mars, Using MOLA: Relation to HRSC-Camera Derived Age Measurements**
Michael, G. G.; Reiss, D.; Hauber, E.; Scholten, F.; Jaumann, R.; Neukum, G.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations
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We studied 32 craters with fluidized ejecta ramparts in Xanthe Terra, making measurements of their ages using crater-counts on the ejecta in HRSC images [1], and of the thickness and volume of the ejecta using MOLA data. The formation of this type of ejecta is generally attributed to the presence of volatile material, likely ground ice, in the target at the time of impact [2]. In this abstract, we use these measurements to investigate a) the relationship between the crater size and the volume of ejecta produced, in particular to consider how that might relate to the depth of a ground ice layer [3] and b) whether there has been any variation of this relationship over time [4, 5], which could throw light on the evolution of the ground ice.
Derived from text
*Craters; Ejecta; Counting; Depth; Ice*

**20050174592** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**Flat Spectral Curves of Low-Albedo Asteroids: Thermal Metamorphism or Space Weathering?**
Moroz, L. V.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Primitive carbonaceous chondrites (CI/CMs) containing hydrated minerals are believed to originate from low-albedo asteroids belonging to C complex. The C-complex [1] is composed of relatively featureless asteroids with near-infrared (NIR) spectral slopes ranging from slightly red to slightly blue, and mostly corresponds to types C, B, F, and G in Tholen's taxonomy. Many of these asteroids have spectral features consistent with the presence of hydrated minerals on their surfaces. These spectral features include: UV falloff [2], 3-micron absorption due to water of hydration [3], and weak 0.7-micron absorption band due to Fe(2+) approaches Fe(3+) transitions in hydrated silicates [4]. The latter feature is common in the spectra of low-albedo asteroids between 2.6 and 3.5 AU [5]. Not all primitive carbonaceous chondrites (CCs) show this absorption band in their reflectance spectra, but only some members of CM2 group [6]. This suggests that CM2-like chondritic material is rather common within the C asteroid complex.
Derived from text
*Albedo; Absorption Spectra; Asteroids; Carbonaceous Chondrites; Metamorphism (Geology); Silicates*

**20050174593** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**Synchrotron-based Infrared Microspectroscopy as a Useful Tool to Study Hydration States of Meteorite Constituents**
Moroz, L. V.; Schmidt, M.; Schade, U.; Hiroi, T.; Ivanova, M. A.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations
Contract(s)/Grant(s): NAG5-13609; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The meteorites Dho 225 and Dho 735 were recently found in Oman. Studies of their mineralogical and chemical composition suggest that these unusual meteorites are thermally metamorphosed CM2 chondrites [1,2,3]. Similar to Antarctic metamorphosed carbonaceous chondrites, the Dho 225 and Dho 735 are enriched in heavy oxygen compared to normal CMs [1,2]. However, IR studies indicating dehydration of matrix phyllosilicates are needed to confirm that the two new meteorites from Oman are thermally metamorphosed [4]. Synchrotron-based IR microspectroscopy is a new promising technique which allows the acquisition of IR spectra from extremely small samples. Here we demonstrate that this non-destructive technique is a useful tool to study hydration states of carbonaceous chondrites in situ. In addition, we acquired reflectance spectra of bulk powders of the Dho 225 and Dho 735 in the range of 0.3-50 microns.
Derived from text
*Synchrotrons; Carbonaceous Chondrites; Meteorites; Microanalysis; Infrared Spectra; Silicates; Metamorphism (Geology); Chemical Composition*

**20050174613** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**The Mast Cameras and Mars Descent Imager (MARDI) for the 2009 Mars Science Laboratory**
Malin, M. C.; Bell, J. F.; Cameron, J.; Dietrich, W. E.; Edgett, K. S.; Hallet, B.; Herkenhoff, K. E.; Lemmon, M. T.; Parker, T. J.; Sullivan, R. J., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Based on operational experience gained during the Mars Exploration Rover (MER) mission, we proposed and were selected to conduct two related imaging experiments: (1) an investigation of the geology and short-term atmospheric vertical

wind profile local to the Mars Science Laboratory (MSL) landing site using descent imaging, and (2) a broadly-based scientific investigation of the MSL locale employing visible and very near infra-red imaging techniques from a pair of mast-mounted, high resolution cameras. Both instruments share a common electronics design, a design also employed for the MSL Mars Hand Lens Imager (MAHLI) [1]. The primary differences between the cameras are in the nature and number of mechanisms and specific optics tailored to each camera s requirements.
Derived from text
*Cameras; Imaging Techniques; Lenses; Mars Exploration; Mars Landing Sites*

**20050174630** Mogilev State Univ., Mogilev, Belarus
**An Earth Sedimentary Deposit as Analogue to Martian: The Comparison of IR-**
Maxe, Larissa P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Sedimentary deposits of rock planets in our solar system can have similar chemical composition and spectral characteristics in case of similar conditions during their formation, accordingly, transformation and decomposition. It can be useful to analyze spectral peculiarities and similarities of end products of transformation and decomposition of Earth sedimentary deposits and Martian. On the territory of modern Belarus (in the Mogilev region) on the bottom of an ancient sea a sedimentary deposit - trepel (similar to the deposit Tripoli), was formed during cretaceous period. This sedimentary deposit is studied with the practical purposes. And it was used to find spectral similarities and spectral features in comparison with IR-spectra of the Martian surface components. Different trepels vary in chemical composition. The trepel extracted in Belarus includes amorphous SiO2 20 - 30 %. It includes zeolites 20 - 22 %, crystalline SiO2 about 2 %, CaCO3 from 18 to 25 %, clays (montmorillonite) up to 20 %, oxides and compounds of iron from 7 to 15 %. Also it includes oxides and compounds of magnesium, aluminum, titanium, chromium and other elements.
Derived from text
*Sedimentary Rocks; Amorphous Materials; Chemical Composition; Crystallinity; Decomposition; Infrared Spectra*

**20050174635** Lunar and Planetary Inst., Houston, TX, USA
**Potential Effects of Melt Composition on Redox Ratio: Implications for Oxygen Fugacity Measurements**
McCanta, M. C.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ability to measure the intrinsic oxygen fugacity (fO2) of a system (e.g., magma storage region, planetary body, etc.) is essential to understanding elementary geologic processes such as crystallization and differentiation. Of all the major elements, only iron commonly exists in multiple valence states. Thus, accurate knowledge of the Fe3+/Fe2+ ratio provides the best proxy for the amount of oxygen present in a crystallizing system and allows for estimation of magmatic fO2. To quantify fO2, a variety of oxybarometers are utilized. An oxybarometer commonly applied to terrestrial igneous rocks is based on the ratio of Fe3+/Fe2+ present in the melt phase [1].
Derived from text
*Melts (Crystal Growth); Crystallization; Oxidation-Reduction Reactions; Oxygen*

**20050174636** Brown Univ., Providence, RI, USA
**Venus Geologic Mapping: Insights into Crustal Evolution on Local, Regional, and Global Scales**
McColley, s. M; Head, J. W., III.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction and Background: The surface of Venus is geologically young with a crater retention age of 300-500 Ma [1, 2, 3]. A broad range of geodynamic models have been proposed to explain the apparent youth of the surface. Models include: heat pipe mechanisms [4], hot/cold spot tectonics [5], stagnant lid convection [6], mantle overturn [7], a thin-to-thick lid transition [8], shift from plate tectonics to a one-plate planet [9], and several other derivations. Each geodynamic model contains implications regarding the evolution of Venus both internally and on the surface. A critical assumption embedded in most models is the way in which heat is transferred from the interior to the exterior of Venus. It is this process that predominantly dictates feature (tectonic, volcanic, etc.) formation on the surface as well as the type and style of volcanism that occur with time. Over the last several years, two views have emerged regarding the large scale evolution of the crust of Venus. A global stratigraphic model supported by [10] and [11] has been defined as directional by [12]; [10] and [11] find

evidence for a time-dependent evolution in both surface feature formation and style of volcanism for the visible geologic past of Venus. [12] suggested that coronae, rifts, wrinkle ridges, small and large edifices, and large flow fields have all formed throughout the visible history of Venus implying a more non-directional evolution. Thus, what type of features might be predicted within the framework of one or a combination of the geodynamic models listed above and does the model or combination of models imply a more directional or nondirectional evolution for the observable history of Venus.
Derived from text
*Geological Faults; Mapping; Venus Surface; Tectonics; Stratigraphy; Volcanology; Planetary Crusts; Geodynamics; Coronas*

**20050174643** California Univ., Los Angeles, CA, USA
**In Situ Investigation of Mg Isotope Compositions in a FUN Inclusion**
Davis, A. M.; MacPherson, G. J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A small subset of Ca-Al-rich inclusions (CAIs) in the CV chondrites is characterized by highly mass fractionated major and minor elements accompanied by relatively large isotopic anomalies of unknown nuclear origin in many minor and trace elements [1]. The origin of these so-called 'FUN' CAIs has remained enigmatic, as has their relationship to 'normal' CAIs. Particularly puzzling is the apparent lack of evidence for the incorporation of short-lived radioactivity, especially Al-26, in FUN CAIs (although 10Be has been found [2]). This has led to a hypothesis that FUN CAIs, and some platy hibonite crystals from CM chondrites with even more highly anomalous isotopic properties, may represent an older generation of refractory solar system materials that formed prior to injection of short-lived isotopes into the solar nebula [3]. Why large degrees of mass fractionation favoring the heavy isotopes, indicating extensive evaporation from a molten state, should occur mostly in these presumably older inclusions is a perplexing question.
Derived from text
*Aluminum Isotopes; Magnesium Isotopes; Fractionation; Chondrites; Anomalies; Trace Elements*

**20050174647** NASA Johnson Space Center, Houston, TX, USA
**Genesis Field Recovery**
McNamara, K. M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Genesis mission returned to Earth on September 8, 2004 after a nearly flawless three-year mission to collect solar matter. The intent was to deploy a drogue chute and parafoil high over the Utah desert and to catch the fragile payload capsule in mid-air by helicopter. The capsule would then be opened in a clean-room constructed for that purpose at UTTR, and a nitrogen purge was to be installed before transporting the science canister to JSC. Unfortunately, both chutes failed to deploy, causing the capsule to fall to the desert floor at a speed of nearly 200 MPH. Still, Genesis represents a milestone in the US space program, comprising the first sample return since the Apollo Missions as well as the first return of materials exposed to the space environment outside of low Earth orbit and beyond the Earth s magnetosphere for an extended period. We have no other comparable materials in all of our collections on Earth. The goal of the Genesis Mission was to collect a representative sample of the composition of the solar wind and thus, the solar nebula from which our solar system originated. This was done by allowing the naturally accelerated species to implant shallowly in the surfaces of ultra-pure, ultra-clean collector materials. These collectors included single crystal silicon (FZ and CZ), sapphire, silicon carbide; those materials coated with aluminum, silicon, diamond like carbon, and gold; and isotopically enriched polycrystalline diamond and amorphous carbon. The majority of these materials were distributed on five collector arrays. Three of the materials were housed in an electrostatic concentrator designed to increase the flux of low-mass ions. There was also a two-inch diameter bulk metallic glass collector and a gold foil, polished aluminum, and molybdenum coated platinum foil collector. An excellent review of the Genesis collector materials is offered in reference [1].
Derived from text
*Genesis Mission; Solar Nebula; Silicon Carbides; Sample Return Missions; Amorphous Materials*

**20050174658** Tokyo Univ., Japan
**MIL03346 Nakhlite and NWA2737 ('Diderot') Chassignite: Two New Martian Cumulate Rocks from Hot and Cold Deserts**
Mikouchi, T.; Monkawa, A.; Koizumi, E.; Chokai, J.; Miyamoto, M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Nakhlites and chassignite are olivine-pyroxene cumulates sharing identical crystallization and ejection ages [1]. Although Chassigny is the only sample of the chassignite group, several nakhlite samples have been found, and they show similar mineralogy and petrology, clearly suggesting a common origin from the same igneous body [2]. However, each nakhlite sample is slightly different from one another, and considered that the formation at different areas (or burial depths) in the same cumulate piles caused systematic mineralogical changes [3]. The discovery of new samples of these groups is important to better understand their formation processes and petrogenetic relationship. In this abstract we report mineralogy and petrology of the newly discovered nakhlite (MIL03346) from Antarctica and chassignite (NWA2737) from the Sahara. Because we have just started analyzing these rocks, the results here are mostly preliminary.
Derived from text
*Nakhlites; Mars Surface; Chassignites; Planetary Geology; Mineralogy*

**20050174659** Tennessee Univ., Knoxville, TN, USA
**Petrogenesis of Central Uplifts in Complex Terrestrial Impact Craters**
Milam, K. A.; Deane, B.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Central uplifts, or central peaks, in complex impact craters are thought to form during the modification stage of impact by uplift of target strata through a process known as acoustic fluidization [1]. Deformation during the contact/compression stage of impact results in target rock weakening [2], creating potential pathways for subsequent movement of large blocks of material from the center of craters ~ \g3 km in diameter [3] on Earth. Target rock from central uplifts shows signs of fracturing, faulting, shock deformation, and even localized melting (pseudotachylites), most of which appear to be related to impact. While central uplifts have been the subject of significant study, only limited investigations have begun to uncover the complex paragenesis they reveal [4-6].
Derived from text
*Deformation; Craters; Impact Melts; Petrogenesis; Strata*

**20050174661** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Joint Inversion and Forward Modeling of Gravity and Magnetic Data in the Ismenius Region of Mars**
Milbury, C. A.; Raymond, C. A.; Jewell, J. B.; Smrekar, S. E.; Schubert, G.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The unexpected discovery of remanent crustal magnetism on Mars was one of the most intriguing results from the Mars Global Surveyor mission. The origin of the pattern of magnetization remains elusive. Correlations with gravity and geology have been examined to better understand the nature of the magnetic anomalies. In the area of the Martian dichotomy between 50 and 90 degrees E (here referred to as the Ismenius Area), we find that both the Bouguer and the isostatic gravity anomalies appear to correlate with the magnetic anomalies and a buried fault, and allow for a better constraint on the magnetized crust].
Derived from text
*Crusts; Magnetic Fields; Magnetic Anomalies; Mars Surface; Magnetic Properties*

**20050174670** Arizona Univ., Tucson, AZ, USA
**Endogenic Thermal Activity at Cerberus Fossae, Mars?**
Milazzo, M. P.; McEwen, A. S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There is great interest in discovery of Martian oases , where liquid water may be present near the surface today, as part of the search for extant life. The recent detections of trace methane in the atmosphere [1,2,3] has led to renewed discussion of possible hydrothermal and biotic activity in communication with the atmosphere. Based on geologic evidence, the Cerberus plains (SE Elysium Planitia) is one of the best candidate regions on Mars for such activity. The Cerberus Fossae, in particular, exhibit evidence for very recent activity. The Cerberus Plains are covered by some of the most recent Martian flood lavas [4], and the Cerberus Fossae were identified as likely vents for some or all of the lava flows by [5,6]. Small lava flows are clearly seen in MOC images as having erupted from a portion of the Cerberus fractures [7]. The Cerberus Fossae were also identified as probable sources for recent floodwaters [8,5]. Secondary craters from the recent (probably less than a few Ma) 10 km impact crater, Zunil [9] pepper these lavas, yet there is a lack of craters within the fissures and at least one high resolution visible

image shows one of Zunil's likely secondaries as having been cut by the wall of a fissure, although this could be explained by the widening of the fissure by collapse of the walls. Thus there has likely been very recent or ongoing activity, perhaps tectonic and probably by mass-wasting of the walls. Many of the fissures have walls with slopes near 90 , as shown by MOC images where the geometry enables shadow measurements. Estimated rates of mass wasting may enable better age constraints on the tectonic activity.
Derived from text
*Oases; Mars Surface; Fissures (Geology); Fluid Flow*

**20050174682** Museum of Natural History, London, UK
**Mid-Infrared Spectroscopy of CAI and AOA from the Allende CV3.2 Chondrite**
Morlok, A.; Menzies, O. N.; Koehler, M.; Bland, P.; Cressey, G.; Grady, M. M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Infrared spectroscopy of dust grains in circumstellar debris disks is the main way to obtain information about the mineralogical composition of such material. To find out what these spectra actually mean, infrared spectra of standard materials are needed for comparison. While so far mainly synthetic or terrestrial minerals have been used for this purpose, we use mineral separates or components from primitive meteorite for this purpose. This is based on the assumption, that these phases formed in environments similar to those where the astronomical spectra originate. Like meteorites, the astronomical dust is often not completely pristine, but represents a later generation of processed material [1]. In the first part of our project, we analysed olivines and pyroxenes from unequilibrated chondrites [2,3]. Following this, we turned to Calcium-Aluminium-Rich inclusions (CAI) and Amoeboid Olivine Aggregates (AOA). These bodies represent the first step in condensation and processing of minerals in the Solar System. Here we present further results of the spectroscopy of these objects.
Derived from text
*Infrared Spectroscopy; Dust; Debris; Mineralogy; Meteorites*

**20050174685** Open Univ., Milton Keynes, UK
**Evolved Gas Analysis of Hydrated Phases in Murchison and Orgueil**
Morris, A. A.; Baker, L.; Franchi, I. A.; Wright, I. P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Chondritic meteorites represent some of the most primitive material in the Solar System and thus can provide a central role in understanding its early history. Many chondrites have experienced secondary processing; aqueous alteration is one of the most widespread. Recognition and characterization of such processes offer valuable insight into the early stages of planetesimal formation and evolution. Aqueous alteration can generate large isotopic fractionation of oxygen isotopes [e.g. 1], a key parameter in the study of meteoritic material. Therefore it is important to have detailed knowledge about the minerals present and the isotopic variability within these complex meteorites. However, the carbonaceous chondrites are fine grained, complex mineral assemblages making unequivocal mineral specific isotopic analyses difficult. Baker et al [2] have attempted to determine the isotopic composition of hydrated phases directly from measurement of the structural OH groups in the phyllosilicates in carbonaceous chondrites using a stepped heating extraction procedure to resolve terrestrial contamination and characterize the host phases. The aim of this work is to apply Evolved Gas Analysis (EGA) with combined Thermogravimetric (TG) and Differential Scanning Calorimetry (DSC) to carbonaceous chondrite matrices to better characterize the hydrated mineral phases present and their OH thermal release characteristics. This is particularly important when attempting to unravel the isotopic fractionations found in these rocks. This study presents preliminary findings from EGA of OH for Murchison (CM) and Orgueil (CI).
Derived from text
*Carbonaceous Chondrites; Meteorites; Mineral Deposits; Silicates; Gas Analysis; Heat Measurement*

**20050174692** Tokyo Univ., Japan
**Emplacement of Pahoehoe Lobes: A Simplified Two-Component Model and Field Measurements by Ground Penetrating Radar**
Miyamoto, H.; Crown, D. A.; Haruyama, J.; Kobayashi, T.; Nishibori, T.; Okada, T.; Rodriguez, J. A.; Rokugawa, S.; Tokunaga, T.; Suzuki, K., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Observations of active pahoehoe flow advance reveal that, typically, a series of small lobes and toes continually appear from breakouts in a surface crust, and perhaps these are interconnected to each other to form a broad pahoehoe field. Although the formation of a lobe itself seems chaotic, the gross shapes of lobes seem to be more deterministic, because (1) the width of a pahoehoe lobe is relatively constant, and (2) a lobe often shows a transverse profile that has a central ridge, a crude bilateral symmetry, and decay in the thickness of the deposit toward the margin. These observations strongly suggest the existence of a lateral self-confinement mechanism at the scale of a lobe. Baloga and Glaze took a stochastic approach and proposed the random walk model to describe the emplacement of toes and lobes. In this work, we take a more deterministic approach and present a simple two-component model as a possible theoretical explanation of the self-confinement mechanism of the lateral spreading of an isolated lobe. Our model requires an estimation of the thickness of chilled crust at the surface of a pahoehoe flow; however, its direct measurement is usually quite difficult. Here, we also present a preliminary result of the ground penetrating radar (GPR) measurement at the Aokigahara pahoehoe flow field, which indicates that the GPR method is a useful technique to understand the subsurface structure of a pahoehoe lava flow. Additional information is included in the original extended abstract.
Author (revised)
*Ground Penetrating Radar; Lava; Fluid Flow; Flow Distribution*

**20050174694** Max-Planck-Inst. fuer Chemie, Mainz, Germany
**The Search for Extinct Iron-60 in Iron Meteorites**
Mostaefaoui, s.; Lugmair, G. W.; Hoppe, P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The search for Ni-60 isotopic anomalies produced by the decay of short lived 60Fe (T(sub ) = 1.5 Ma) was successful in primitive chondrites and in the eucrite Chervony Kut [1,2,3]. Correlated with the Fe/Ni ratio, 60Ni excesses of up to approx.100% were found in Semarkona troilite and an inferred initial Fe-60/Fe-56 of approx.10(exp -6) was determined [1]. Recent work on iron meteorites, using the Hf-W system showed that the types IIIAB, IVA, IVB, and IC are as primitive as CAIs [4,5]. If this is true, one would expect Ni-60-excesses in iron meteorites as high or higher than previously found, provided that the Fe-Ni system closed at the same time as the Hf-W system. In an attempt to verify such a hypothesis we present here an in situ NanoSIMS study of the Fe-Ni system in sulfides from two selected iron meteorites.
Derived from text
*Chondrites; Iron Isotopes; Iron Meteorites; Nickel Isotopes; Sulfides; Extinction*

**20050174699** Museum of Natural History, London, UK
**Aubrites: An Iron and Zinc Isotope Study**
Mullane, E.; Russell, S. S.; Gounelle, M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aubrites are highly reduced meteorites, a property they share with the enstatite chondrites. Other similarities between the two groups are O-isotope signatures [1], low FeO content, mineralogy and mineral composition [2,3]. However, significant differences between the two groups point towards origin of the aubrites on a parent body distinct from that of the enstatite chondrites [4]. It has been suggested that aubrites formed by either direct condensation [5-7] or from partial melting of an enstatite-like precursor [3]. Evidence of an igneous origin includes large crystal sizes [up to 10mm, 3], melt inclusions in enstatite [8], europium anomaly [9] and mineralogy consistent with fractional crystallization from an Mg-rich magma [10,11]. The aubrite parent body may have been involved in a major collision, which resulted in disruption of the body, followed by gravitational reassembly into a rubble pile body [10].
Derived from text
*Meteorites; Achondrites; Chondrites; Iron Oxides; Meteoritic Composition; Mineralogy; Enstatite*

**20050175709** Oulu Univ., Finland
**Claritas Paleolake Studied from the MEX HRSC Data**
Raitala, J.; Aittola, M.; Korteniemi, J.; Kostama, V.-P.; Hauber, E.; Kronberg, P.; Neukum, G., et al.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Claritas Fossae (CF) deforms the southern Tharsis slope. The history of its southern reach has included volcanic, tectonic, and water- and ice-related phases. Water was transported from the upland peaks into the Claritas basin. The drainage carved a channel from the paleolake into Icaria Planum. Along the channel, there were also sapping, a crater lake with delta, and an alluvial fan formation.
Derived from text
*Craters; Lakes; Mars Surface; Plains; Tectonics; Alluvium; Drainage*

**20050175710** Tennessee Univ., Knoxville, TN, USA
**Lava and Flows of the Arcadia Region of Mars**
Rampey, M. L.; Milam, K. A.; McSween, H. Y., Jr.; Moersch, J. E.; Christensen, P. R.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Tyndall Dome Field (TDF)* in the western Arcadia Planitia region of Mars, possesses hundreds of small domical structures (diameters approx. 0.5 - 6 km). [1] presented a brief review of the area, observing that the structures possess a 'strong resemblance' to the rhyolite domes of Mono Craters, California. Using shadow-length measurements derived from Viking orbital imagery, [1] estimated height to basal diameter (H/D) ratios of selected domes to be on the order of 0.04 and observed that this value is comparable to the range of H/D ratios of the Glass Mountain and Little Glass Mountain, California, obsidian flows (0.04 to 0.13). Additionally, [1] noted the existence of a series of crescentic 'ridges' on the surface of a lobate flow body, presumably a lava flow, near the area in which the domical structures occur. These are spaced 700 - 800 m apart, with a ridge/trough relief of approx. 100 m. [1] remarked that the crescentic ridge pattern resembles that seen on terrestrial felsic lava flows, such as those associated with the Medicine Lake Highlands caldera in California, USA and that of the Chao dacite flow in Peru.
Derived from text
*Fluid Flow; Lava; Mars Surface; Calderas; Highlands*

**20050175714** Arizona Univ., Tucson, AZ, USA
**A Stochastic Cratering Model for Asteroid Surfaces**
Richardson, J. E.; Melosh, H. J.; Greenberg, R. J.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations
Contract(s)/Grant(s): NAG5-12619; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The observed cratering records on asteroid surfaces (four so far: Gaspra, Ida, Mathilde, and Eros [1-4]) provide us with important clues to their past bombardment histories. Previous efforts toward interpreting these records have led to two basic modeling styles for reproducing the statistics of the observed crater populations. The first, and most direct, method is to use Monte Carlo techniques [5] to stochastically populate a matrix-model test surface with craters as a function of time [6,7]. The second method is to use a more general, parameterized approach to duplicate the statistics of the observed crater population [8,9]. In both methods, several factors must be included beyond the simple superposing of circular features: (1) crater erosion by subsequent impacts, (2) infilling of craters by impact ejecta, and (3) crater degradation and era- sure due to the seismic effects of subsequent impacts. Here we present an updated Monte Carlo (stochastic) modeling approach, designed specifically with small- to medium-sized asteroids in mind.
Derived from text
*Asteroids; Cratering; Stochastic Processes; Monte Carlo Method; Time Dependence*

**20050175715** George Washington Univ., Washington, DC, USA
**Spectroscopic Study of Interactions Between Nitrogen and Silicate Melts Under High Pressure and Temperature: Insights into the Evolution of Geochemical Reservoirs**
Roskosz, M.; Mysen, B. O.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The early history of the Earth was a time of profound differentiation. After the main sequence of accretion, it is generally supposed that a transient magma ocean formed. Therefore, the main features of the planet was acquired during the differentiation of a volatile-bearing magma ocean. A number of chemical, physical and structural studies have been dedicated to volatiles in magmas, especially to noble gases and H2O solubility. Somewhat surprisingly, the behavior of nitrogen is poorly

characterized in spite of its high concentration in the present atmosphere and in some meteoritic materials. Nitrogen elemental and isotopic budgets are also used to model the evolution of atmospheric and deep geochemical reservoirs [1-2]. It is thus essential for such approach to accurately understand its behavior in melts, metals and minerals as a function of compositions, structures and intensive. In this respect, some studies recently addressed this question in silicate melts under ambient pressure and different oxygen fugacity [3-4]. These mainly confirm previous but scarce results reported in material and metallurgical literature. The solubility of nitrogen follows a Henry s law and dissolves in liquids as an inert species, as do noble gases. Under very reducing conditions however, nitrogen is chemically bonded to the silicate network via a partial nitridation of the melt as observed in nitride glasses.
Derived from text
*Nitrogen; Silicates; Melts (Crystal Growth); Spectroscopy; High Pressure; Chemical Bonds*

**20050175729** NASA Johnson Space Center, Houston, TX, USA
**Highly Siderophile Elements and Osmium Isotope Systematics in Ureilites: Are the Carbonaceous Veins Primary Components?**
Rankenburg, K.; Brandon, A. D.; Humayun, M.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ureilites are an enigmatic group of primitive carbon-bearing achondrites of ultramafic composition. The majority of the ~143 ureilite meteorites consist primarily of olivine and pyroxene (and occasionally chromite) [1]. They are coarse-grained, slowly cooled, and depleted in incompatible lithophile elements. Minor amounts of dark interstitial material consisting of carbon, metal, sulfides, and fine-grained silicates occur primarily along silicate grain boundaries, but also intrude the silicates along fractures and cleavage planes. Variable degrees of impact shock features have also been imparted on ureilites. The prevailing two origins proposed for these rocks are either as melting residues of carbonaceous chondritic material [2], [3], or alternatively, derivation as mineral cumulates from such melts [4], [5], [6]. It has recently been proposed that ureilites are the residues of a smelting event, i.e. residues of a partial melting event under highly reducing conditions, where a solid Fe-bearing phase reacts with a melt and carbon to form Fe metal and carbon monoxide [7]. Rapid, localized extraction and loss of the basaltic component into space resulting from high eruption velocities could preserve unequilibrated oxygen isotopes and produce the observed olivine-pyroxene residues via 25-30% partial melting of chondritic-like precursor material.
Derived from text
*Ureilites; Achondrites; Carbonaceous Materials; Chondrites; Silicates; Osmium Isotopes; Mineralogy; Grain Size*

**20050175730** Lockheed Martin Corp., Houston, TX, USA
**Evaporative Evolution of Martian Brines Based on Halogens in Nakhlites and MER Samples**
Rao, M. N.; Sutton, S. R.; McKay, D. S.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: We have recently reported the Cl and Br abundances determined by APS X-ray Microprobe and EMPA analyses of secondary aqueous minerals in Nakhla veins and discussed the significance of Cl Br correlations with respect to the evolution of brine solutions on Mars [1,2]. In that study [2], we suggested that the low Br concentration (~10 ppm) in Lafayette Iddingsite [3] is indicative of early stage of evaporation during progressive evolution of Martian brine solutions, which is, in turn, consistent with the petrographic evidence of early deposition of salt sequence of carbonate-sulfate- and no halite [4,5] in Lafayette. We showed that the high Br concentrations of approx.240 ppm in secondary salts in Nakhla veins similarly indicate late stages of evaporation in evolving Martian brine solutions which is again consistent with petrographic evidence of late stage deposition of salt sequence i.e. carbonate-sulfate-halite in Nakhla [4,5]. When sea water evaporates under equilibrium conditions, the most insoluble carbonates (siderite and calcite) deposit first, followed by sulfates (gypsum and anhydrite) and finally the water-soluble halides are precipitated when the water content is sufficiently low [6]. In the present study, we make a detailed comparison of Cl/Br ratios in secondary minerals in nakhlites with those in MER soils and rocks at Gusev and Meridiani and show that the compositions of solutions that inundated Lafayette iddingsite (early stage) and Nakhla veins (late stage) include the range of solutioncompositions that gave rise to a variety of secondary salts at Gusev and Meridiani sites. Further, the results obtained here suggest that two kinds of brine solutions (one, late and the other, early or intermediate stage) seem to have inundated most of the rocks and soils to varying degrees and precipitated the secondary salts at Meridiani and Gusev sites.
Derived from text
*Mars Surface; Brines; Halogens; Nakhlites; Abundance; Deposits*

**20050175731** Oulu Univ., Finland

**Mars Express HRSC Colors of White Rock, Arabia, Mars**

Raitala, J.; Basilevsky, A. T.; Neukum, G.; Werner, S. C.; Denk, T.; McCord, T., et al.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

White Rock is an enigmatic landform discovered in Mariner 9 images [1]. The 12 x 15 km exposure of relatively bright material on the floor of 90-km crater Pollack (8degS/25degE). Albedo and the position on the crater floor led to suggestion that it is an erosional remnant of ancient lacustrine evaporite deposit [2-4]. No obvious evidences of carbonates or sulfates were found when using TES data [5] leading into the conclusion that White Rock is not an evaporite but rather an eroded accumulation of compacted or weakly cemented aeolian sediment. Since that two important scientific finds were made: 1) Kirkland et al. [6] found that 'substantial, well-crystalline, regional mineral deposits, including rock outcrops, can be 100% exposed and remain undetected at the sensitivity of TES/THEMIS'. 2) The Opportunity Mars rover found in Meridiani Planum (approx.1.95degS, 354.5degE, approx.1,800 km WNW from White Rock) outcrops of essentially sulfate rocks interpreted to be shallow water evaporates [7,8]. Interesting that TES/THEMIS orbital observations do not detect sulfates in this locality. This makes worthwhile to reconsider if White Rock can be evaporite deposit. We do this through measuring colors of White Rock and neighboring deposits using the MEX HRSC images taken on orbit 330 and comparing these results with colors of the Opportunity sulfate and some other deposits [9].

Derived from text

*Mars Express; Mars Surface; Planetary Geology; Mineral Deposits; Rocks; Sulfates; Crystallinity*

**20050175736** Massachusetts Inst. of Tech., Cambridge, MA, USA

**Investigating the Impact Evolution of Hydrated Asteroids**

Rivkin, A. S.; Pierazzo, E.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The volatile inventory of asteroids is of great interest for the origin of volatiles on all terrestrial planets. Water- and OH-bearing minerals are seen at the surfaces of some asteroids, and in many carbonaceous chondrites, but not all bodies where they may have been expected (e.g., Mathilde and the martian satellites). Some of these bodies may have lost their surface volatiles through low-velocity collisions which could have heated up and destroyed relatively fragile hydrated minerals without producing significant melting of the asteroid. We are testing this hypothesis through hydrocode simulations to investigate the shock dehydration in low-velocity impacts from which we can extract the relative proportions of dehydrated and still-hydrated material in the impact ejecta.

Derived from text

*Asteroids; Carbonaceous Chondrites; Extraction; Melting; Dehydration*

**20050175738** Centre National de la Recherche Scientifique, Paris, France

**NanoSims Images of Precambrian Fossil Cells**

Robert, F.; Selo, M.; Hillion, F.; Skrzypczak, A.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Judging from the occurrence of micro-fossils in sedimentary rocks, life was dominated by prokaryotic microbes during the early Precambrian [1]. Fossils of such microorganisms are rare, incompletely preserved in geological materials and show morphologies that can be mimicked by a variety of non biological structures such as inorganic minerals, ore deposits or simple local chemical heterogeneities of the host matrix. Discriminating between true microbial fossils and 'pseudo-fossils' is thus, a central issue for the study of the appearance and evolution of life on Earth. The simple morphology is not considered as a valid criterion for the identification of a microfossil and several additional conditions has been defined to confidently ascribe a visual structure to remains of life. Considered alone, none of these conditions is a definitive proof and several of them are required in the same sample to establish the presence of life in sedimentary rocks before their compactions and solidifications.

Derived from text

*Precambrian Period; Fossils; Biological Evolution; Geology; Mineral Deposits; Prokaryotes; Sedimentary Rocks*

**20050175741** Arizona Univ., Tucson, AZ, USA

**Europa's South Polar Region: Reconstruction of the Sequential Resurfacing History**

Riley, J.; Greenberg, R.; Sarid, A. R.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Europa appears to be extremely active geologically, to the extent that the surface that existed several tens of millions of years ago has been entirely reprocessed since then [1]. Some studies have suggested that the character of the resurfacing has changed during this time, reflecting long-term changes in the geophysics of Europa [2]. According to such interpretations the ice crust of Europa, which overlies a global ocean, has undergone a systematic global thickening, perhaps caused by long-term orbital evolution. A trend toward a thicker crust would be consistent with work by Greenberg [3] that suggested the Galilean satellites are currently evolving away from orbital resonance, so that their orbital eccentricities, and hence tidal heating are decreasing. The timescale for such orbital change is consistent with the period over which the present surface of Europa has formed. The geological evidence cited for systematic change is a perceived evolution in the style of active resurfacing processes. Resurfacing has been dominated by two major categories of processing (ref Greenberg reviews): tectonics and formation of chaotic terrain. According to those who argue for systematic change, tectonic effects dominated earlier, while formation of chaotic terrain did not become important until more recently [e.g. 2], and the perceived trend is interpreted as evidence for a thickening of the crust.

Derived from text

*Europa; Geology; Geophysics; Tectonics; Terrain*

**20050175746** Pomona Coll., Claremont, CA, USA

**Classification of Geological Material Units in the Ganiki Planitia Quadrangle (V14) of Venus Using Statistical Clustering Methods**

Richards, J.; Hardin, J.; Grosfils, E. B.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In an ongoing attempt to analyze volcanic and tectonic activity in the Ganiki Planitia quadrangle (V14) of Venus and to construct an accurate stratigraphy of the region, researchers have created a geologic map of the region [e.g., 1]. This geologic map is based on qualitative interpretation of V14 from the Magellan FMAP radar images (75m/pixel) and topography data. The mappers did not explicitly use the numerical information encoded in these images to guide their mapping, nor did they use the available physical property data sets of emissivity, reflectivity, and RMS slope quantitatively. Here we use statistical clustering techniques to analyze the existing map of V14 in order to (a) test whether the map is consistent with the numerical data and (b) identify units whose classification might be incorrect.

Derived from text

*Geology; Maps; Radar Imagery; Volcanoes; Tectonics; Statistical Analysis; Stratigraphy*

**20050175747** New Mexico Univ., Albuquerque, NM, USA

**Revisiting C60 Fullerene in Carbonaceous Chondrites and Interplanetary Dust Particles: HRTEM and Raman Microspectroscopy**

Rietmeijer, Frans J. M.; Borg, Janet; Rotundi, A.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

When getting ready for comet Wild-2 STARDUST samples the true nature of the carrier of the astronomical 217.5nm UV extinction feature is yet again of interest. Amorphous carbon, hydrogenated amorphous carbon, quenched carbonaceous condensates , nanodiamonds, fullerenes and soot are viable candidates [1,2] although fullerenic carbons such as the famous onions found in the Allende meteorite [3] are missing from this list. The returned dust from comet Wild-2 could finally show the true nature of the carbon carrier. Here, we assess the detection of minor amounts of C60 in natural and analog samples. High-resolution transmission electron microscope (HRTEM) studies of carbons in the Allende, Leoville and Vigarano meteorites found multiple- and single-wall fullerenic (closed) carbons structures [4,5]. The single-wall ring structures of ca. 2-5 nm in diameter in the Allende meteorite might be higher fullerenes, suggesting that C60 could also have been present [5]. Meteorites and interplanetary dust particles (IDPs) are complex samples and when searching for a minor constituent, e.g. fullerene, it would be expedient to know the unique fullerene signature in HRTEM images or in Raman spectra of carbon-rich

material obtained by vapor-vapor condensation experiments wherein fullerene is present among many different carbon forms in such analog samples.
Derived from text
*Carbonaceous Chondrites; Amorphous Materials; Hydrogenation; Trace Elements; Meteorites; Interplanetary Dust; Fullerenes*

**20050175748** Colorado Univ., Boulder, CO, USA
**Crustal Relaxation and Its Implications for the Martian Crustal Dichotomy**
Roberts, James H.; Zhong, Shi-Jie; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The crustal dichotomy is one of the oldest features on Mars [1,2]. Both exogenic [3,4] and endogenic models [5] have been proposed to explain the origin of this feature. We propose that regardless of the formation mechanism, convective forces may be required to maintain the dichotomy over geologic time. Studies from MGS topography and gravity data suggest that the crust must be at least 50 km thick on average [6]. The crustal dichotomy appears to have formed during the early Noachian [2], when the planet was still relatively hot and the elastic layer was substantially thinner [7,8]. The warm lower crust would have been able to flow. Stress relaxation studies suggest that the topography may relax relatively quickly in the absence of a degree1 mantle convective force [9-11], and would remove the poletopole variation seen on Mars.
Derived from text
*Crusts; Geochronology; Planetary Geology; Mars Surface; Dichotomies; Landforms*

**20050175751** Tokyo Univ., Hongo, Japan
**Basement Topographic Control on the Chasmata Initial Growth and Distribution in the Martian Southern Polar Cap**
Rodriguez, J. A. P.; Sasaki, S.; Fairen, A.; Miyamoto, H.; Schulze-Makuch, D.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the greatest puzzles in martian geology is the history of formation and modification of the polar deposits. The geologic complexity of the polar landforms and the relatively young age of the caps have been attributed to various mechanisms of deposition and removal of the their geologic materials [e.g. 1,2,3]. Polar chasmata comprise geomorphic evidence that large-scale removal of polar materials has taken place on Mars. In this work we examine the geomorphic and topographic characteristics of the chasmata systems in the southern polar cap and discuss how the irregular topography of the underlying basement may have played a significant role in the initiation and subsequent growth of chasmata and radial trough systems.
Derived from text
*Polar Caps; Mars Surface; Geomorphology; Deposits; Topography; Planetary Geology*

**20050175753** Tokyo Univ., Hongo, Japan
**Outflow Channel Floor Collapse and the Formation of the Simud and Tiu Valles, Mars**
Rodriguez, J. A. P.; Sasaki, S.; Tanaka, K. L.; Skinner, J. A., Jr.; Dohm, J. M.; Miyamoto, H.; Fairen, A.; Kuzmin, R.; Schulze-Makuch, D.; Baker, V. R.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Catastrophic and non-catastrophic flooding related to the episodic release of highly pressurized groundwater confined within the Martian cryolithosphere in various types of aquifers [e.g. 1-3], resulted in the excavation of the eastern circum-Chryse outflow channels, which display the most striking dissectional signature on Mars. Other proposed mechanisms for the formation of outflow channels, include debris flows and glacial erosion [e.g., 4-5]. Chaotic terrains are commonly located at the source regions and along the margins of the outflow channels. These irregular depressions lined with chaotic blocks, are mostly attributed to the undermining and collapse of the of cratered highland [e.g., 6-8], basin [9], and outflow channel floor materials [3]. The morphogenetic association between the chaotic terrains and the outflow channels remains controversial. For example, chaotic terrain may form strictly by catastrophic discharges of water and debris and attendant surface collapse [e.g. 1, 7].. On the other hand, Rodriguez et al. [3] propose that much of the chaotic terrain formation post-dates outflow activity in the region and that chaos formation may not have involved significant groundwater emanations. In this work, we investigate the geologic history of the Simud and Tiu Valles. Based on geologic mapping and geomorphic

assessment using Viking-, Mars Global Surveyor-, and Mars Odyssey-based information we discuss significant surface collapse in the region.
Derived from text
*Terrain; Collapse; Erosion; Geomorphology; Mars Surface; Paleontology; Aquifers; Excavation*

**20050175760** Carnegie Institution of Washington, Washington, DC, USA
**Experimental Determination of Iron Isotope Fractionation During High Temperature Segregation of Metal from Silicate Liquids: Evaporation or Diffusion?**
Roskosz, M.; Luais, B.; Toplis, M. J.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent advances in mass spectrometry make it possible to measure isotopic variations of transition metals (Cu, Fe, Zn ...) in materials of interest to the Earth sciences. This rapidly developing field has given rise to several ground breaking studies, concentrated primarily on the characterization of natural materials, including extraterrestrial, igneous, biogenic and abiogenic sedimentary rocks [e.g.1]. In the case of Fe, these results have generated considerable interest because it has been inferred that isotopic ratios of this element might be a tracer of microbial activity, a conclusion supported by experimental studies of biological systems [2]. Iron isotopes may then be a powerful tool in the quest for signs of early life [2-3]. However, measurements on materials which are clearly abiogenic in origin, for example metal and silicate fractions of pallasite meteorites [4-6], demonstrate that Fe isotopic variability also occurs in this context. Similarly Fe isotope fractionation has been observed between clinopyroxenes and olivines in mantle xenolith nodules [4, 7]. Nevertheless, no experimental studies have been reported which quantify the degree of isotopic fractionation in high-temperature magmatic systems. The dependence of Fe isotope fractionation on thermodynamic properties such as temperature, pressure and oxygen fugacity has to be addressed.
Derived from text
*Iron Isotopes; Fractionation; High Temperature; Silicates; Evaporation; Diffusion; Sedimentary Rocks; Transition Metals*

**20050175900** Arizona Univ., Tucson, AZ, USA
**Why Moldavites are Reduced**
Sheffer, A.; Melosh, H. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations
Contract(s)/Grant(s): NAG5-11493; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Moldavite tektites are colored a bright bottle green by reduced Fe, despite the originating sediments being completely oxidized. The high temperature processing of silicates often results in very reduced products, such as Si-bearing Fe metal in type-1 chondrules [1], lunar regolith agglutinates [2], and multiple Si-Fe metal phases in fulgurites [3,4]. Previous work on silicate reduction has often focused on the need for reducing agents such as carbon or hydrogen; we show that for a moldavite composition these are not necessary. The isentropic cooling path is inherently reducing.
Derived from text
*Moldavite; Tektites; Lunar Rocks; High Temperature; Silicates*

**20050175902** Argonne National Lab., IL, USA
**A Search for Live (Pu-244) in Deep-Sea Sediments: Preliminary Results of Method Development**
Savina, M. R.; Paul, M.; Ofan, A.; Barzyk, J. G.; Pellin, J. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report on the initial stages of a search for live Pu-244 from interstellar grains in deep sea sediments using Resonant Ionization Mass Spectrometry (RIMS). The study of interstellar grains has attracted considerable attention in recent years with the detection of ISM grains in the inner solar system by the Galileo [1] and Ulysses [2, 3] missions. Interstellar dust grains incident on Earth have been detected by the AMOR radar array [4-6]. Based on these data, estimates can be made of the amount of ISM material accreting as dust on Earth.
Derived from text
*Cosmic Dust; Sediments; Interstellar Matter; Mass Spectroscopy*

**20050175905** Rutgers Univ., Piscataway, NJ, USA

**Beryllium-10 in Ivory Coast Tektites**

Serefiddin, F.; Herzog, G. F.; Koeberl, C.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Previous studies of Australasian tektites used 10Be concentrations to constrain the location and characteristics of the source material [1]. The average value of Be-10 (corrected to time of formation (TOF) 0.77 My ago) in Australasian tektites is 143+/-50 10(exp 6) atoms/g. This average is comparable to values measured in near surface source materials, such as soils (terrestrial) or sediments (marine and terrestrial). The Ivory Coast tektites are regular (splash-form) tektites formed as a result of the impact event that created the Bosumtwi Crater 1.07 My ago (Figure 1) [2]. The land-based tektite strewn field is an area 40 km in radius approximately 125 km north of Abidjan. The entire tektite strewn field including microtektites extends off the coast of West Africa. If Ivory Coast tektites also formed from surficial materials as did the Australasian tektites, then we would expect them to contain similar concentrations of Be-10.

Derived from text

*Beryllium Isotopes; Surface Properties; Tektites; Soils; Craters; Sediments*

**20050175907** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**An Approach to In-Situ Observations of Volcanic Plumes**

Smythe, W. D.; Lopes, M. C.; Pieri, D. C.; Hall, J. L.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Volcanoes have long been recognized as playing a dominant role in the birth, and possibly the death, of biological populations. They are possible sources of primordial gases, provide conditions sufficient for creating amino acids, strongly affect the heat balance in the atmosphere, and have been shown to sustain life (in oceanic vents.) Eruptions can have profound effects on local flora and fauna, and for very large eruptions, may alter global weather patterns and cause entire species to fail. Measurements of particulates, gases, and dynamics within a volcanic plume are critical to understanding both how volcanoes work and how plumes affect populations, environment, and aviation. Volcanic plumes and associated eruption columns are a miasma of toxic gases, corrosive condensates, and abrasive particulates that makes them hazardous to nearby populations and poses a significant risk to all forms of aviation. Plumes also provide a mechanism for sampling the volcanic interior, which, for hydrothermal environments, may host unique biological populations.

Derived from text

*Plumes; Volcanoes; Heat Balance; Condensates; Amino Acids*

**20050175916** Moscow State Univ., Russia

**Some Peculiarities of Quartz, Biotite and Garnet Transformation in Conditions of Step-like Shock Compression of Crystal Slate**

Sazonova, L. V.; Feldman, V. I.; Miljavskij, V. V.; Borodina, T. I.; Sokolov, S. N.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A character investigated of changes of the crystal slate, which consists of a garnet (40-45 %), biotite (20-25 %), quartz (5-10 %) and plagioclase (25-30 %), has been studied using of recovery assemblies of planar geometry. The assemblies were loaded by impact of Al plates up to pressures 19, 23.5, 26, 36 and 52 GPa. In the sample, the peak pressure was achieved after several reverberations of the waves between the walls of the steel sample container. Quartz. Planar elements develop in quartz at shock loading 19 - 36 GPa, at the same time this mineral already at 19 GPa begins to transform to amorphous phase. By the X-ray data at shock pressure 52 GP about 96 % of quartz grains transform to amorphous phase. The quartz transformations from crystal slates are the same on the whole as in experiments with monomineral samples [1].

Derived from text

*Quartz; Biotite; Garnets; Shock Loads; Amorphous Materials; Plagioclase*

**20050175918** Humboldt Univ., Berlin, German Democratic Republic

**Geology of Southern Quintana Roo (Mexico) and the Chicxulub Ejecta Blanket**

Schoenian, F.; Tagle, R.; Stoeffler, D.; Kenkmann, T.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Chicxulub ejecta blanket was first discovered on Albion Island in NW-Belize [1, 2]. This region has been considered as being completely covered by platform carbonates of a continuously retreating lower Tertiary (Paleogene) sea [3]. The discovery of KT rocks, the finding of further localities of the ejecta blanket in adjacent Quintana Roo (Mexico) and central Belize and the presence of Karst features atop the underlying Cretaceous [2, 4] question the traditional geological model of the Yucat n peninsula.
Derived from text
*Ejecta; Lithology; Petrography; Bedrock; Carbonates*

**20050175921** Hawaii Univ., Honolulu, HI, USA
**Thermal Processing and Accretion of Silicate Dust into Chondrites and Comets**
Scott, Edward R. D.; Krot, Alexander N.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The most abundant matrix minerals in chondritic meteorites.hydrated phyllosilicates and ferrous olivine.formed predominantly in asteroids by fluid-assisted metamorphism. These minerals probably formed from materials like the matrix minerals in three less altered carbonaceous chondrites (Acfer 094, ALHA77307, and Adelaide), viz., micron and nm sized grains of forsterite and enstatite, and amorphous, ferromagnesian silicate [1-2]. The matrix of K chondrite, Kakangari, also contains enstatite and forsterite but has albite and anorthite rather than amorphous silicate [3]. Compositional and structural features of enstatite (ortho-clino intergrowths) and forsterite (high Mn, as in some AOA olivine) suggest that they formed as condensates that cooled below 1300 K at approx.1000 K/h. Most amorphous silicates are likely to be solar nebula condensates also, as matrix, which is nearly solar in composition, is unlikely to be a mixture of genetically unrelated materials with different compositions. Here we focus on matrix-chondrule relationships, clues to accretion from chondritic components, and comparisons between matrix, chondritic IDPs and cometary silicates.
Derived from text
*Silicates; Dust; Chondrites; Comets; Metamorphism (Geology); Carbonaceous Chondrites; Chondrule; Condensates*

**20050175925** Smithsonian Institution, Washington, DC, USA
**A Long Lava Flow in the Tharsis Region of Mars as Mapped Using THEMIS Data**
Shockey, K. M.; Zimbelman, J. R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A long lava flow to the west of Ascraeus Mons [1], the northernmost volcano of the Tharsis Montes volcanoes, was previously examined [2] using Mars Orbiter Laser Altimeter (MOLA) data. The same flow is now being mapped using the Mars Odyssey Spacecraft Thermal Emission Imaging System (THEMIS) data, under a grant from the Planetary Geology and Geophysics program of NASA. The daytime infrared (IR) THEMIS data, at 100 m/pixel, reveal a much more detailed picture of the flow then could be inferred from MOLA shaded relief images.
Derived from text
*Thermal Emission; Mars Volcanoes; Fluid Flow; Lava*

**20050175927** Geological Survey, Flagstaff, AZ, USA
**Alphonsus-type Dark-Halo Craters: Morphometry and Volume Reassessments and Implications for Eruptive Style**
Skinner, J. A., Jr.; Gaddis, L. R.; Keszthelyi, L.; Hare, T. M.; Howington-Kraus, E.; Rosiek, M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dark-halo craters located along floor-fractures in Alphonsus crater (108 km diameter; approx.13degS/357degE) are considered type localities of small lunar pyroclastic deposits. Much of our understanding of the processes involved in smaller pyroclastic eruptions comes from morphometric analysis and deposit volumes in Alphonsus crater performed by Head and Wilson [1]. These authors used high-resolution photographs and topographic data to map the distribution and estimate the volume of materials in the pyroclastic cones. They concluded that juvenile materials were present in nearly all of the dark-halo crater deposits. Additional information on the nature of the magmatic or juvenile components at Alphonsus has come from Earth-based spectral data, which indicated that these deposits were compositionally diverse and that several of the pyroclastic cones may have olivine components [2, 3]. Recent results based on Clementine UVVIS data were less conclusive, supporting

the existence of compositional diversity among the Alphonsus and other pyroclastic deposits but not clearly identifying an olivine component [4-7].
Derived from text
*Craters; Halos; Topography; Fractures (Materials); Deposits; Emission Spectra*

**20050175944** Neba Elementary School, Neba, Japan
**Mt. Oikeyama Structure: First Impact Structure in Japan?**
Sakamoto, M.; Gucsik, A.; Ninagawa, K.; Nishido, H.; Shichi, R.; Toyoda, S.; Bidlo, A.; Brezsnyanszky, K.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The origin of the Mt. Oikeyama structure in Central Japan has been debated for many decades. The purpose of this study is to provide new information about scanning electron microscopecathodoluminescence (SEM-CL) data of planar microdeformations in quartz samples to determine whether this area was formed by tectonic, regular geological processes or shock metamorphic events. the optical microscope plane-polarized, SEI and backscattered electron (BSE) images of (obtained at same area) (Figs. 3a-c), SEM-CL photomicrographs of the quartz grains in the chert show two or more sets of planar microstructures presumably referred to planar deformation features, PDFs (Fig. 3b). This image of the same sample exhibits the contrast with dark streaks
Derived from text
*Metamorphism (Geology); Tectonics; Microstructure; Backscattering; Deformation; Geology*

**20050175963** Cologne Univ., Germany
**SIMS Analysis of Moderately Lithophile Elements in CR and CB Chondrite Metal: Characteristic Properties of Pristine and Processed Metal**
Schoenbeck, T. W.; Huss, G. R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899
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CR and CB chondrites are unusual carbonaceous chondrites because of their high contents of FeNi metal grains. The origin of metal in these meteorites is still a matter of debate. Several authors claimed that all metals in CR chondrites are processed, either by metalsilicate equilibration during formation of chondrules [1], by reduction of FeO-rich silicates [2,3] and/or evaporation and recondensation [4,5] or by desulphurization of troilite [6]. On the other hand it has been proposed that at least some metal grains in CH and CB chondrites formed by condensation in a gas of solar composition and have preserved primary compositional characteristics [7,8,9] . The positive correlation of Ni with Co observed in many metal grains in CR, CH and CB chondrites is predicted by condensation calculations. Unfortunately, equilibration of metal with silicate melt at various temperatures or oxygen fugacities during chondrule formation is also capable of producing positive NiCo correlations [10]. Thus, further distinguishing features are needed to establish the origin of these metals.
Derived from text
*Carbonaceous Chondrites; Melts (Crystal Growth); Chondrites; Chondrule; Evaporation; Metals; Gas Composition*

**20050175965** NASA Johnson Space Center, Houston, TX, USA
**Weathering of Basaltic Rocks from the Gusev Plains up into the Columbia Hills from the Perspective of the MER Mossbauer Spectrometer**
Schroeder, C.; Klingelhoefer, G.; Morris, R. V.; Rodionov, D. S.; deSouza, P. A.; Ming, D. W.; Yen, A. S.; Gellert, R.; Bell, J. F., III, et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations
Contract(s)/Grant(s): DLR-50QM99022; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Rocks on the ejecta blanket of Bonneville crater and along Spirit s traverse over the Gusev plains towards the Columbia Hills are angular and strewn across the surface. They have a basaltic composition [1,2], and their Mossbauer spectra are dominated by an olivine doublet [1]. The ubiquitous presence of abundant olivine in rocks and in surrounding soil suggests that physical rather than chemical weathering processes currently dominate the plains at Gusev crater [1]. However, MB spectra of rocks and outcrops in the Columbia Hills suggest more aggressive alteration processes have occurred. Ascending

into the hills, Spirit encountered outcrop and rocks exhibiting layered structures. Some scattered rocks at the foot of the Columbia Hills appeared 'rotten' or highly altered by physical and/or chemical processes (fig. 1). Mossbauer spectra of those rocks show a decrease in olivine accompanied by an increase in the Fe-oxides magnetite, hematite, and nanophase Fe3+ -oxides (fig. 2), suggesting that chemical weathering processes in the presence of water have altered these rocks and outcrops.
Derived from text
*Basalt; Weathering; Rocks; Soils; Craters; Ejecta; Chemical Reactions; Mossbauer Effect*

**20050175970** Nagoya Univ., Aichi, Japan
**Estimation of Ion Escape Rates from Non-Magnetic Earth: On Contribution of Terrestrial Ion Flows to Non-Solar Components Implantated in Lunar Soils**
Seki, K.; Terada, N.; Shinagawa, H.; Ozima, M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Physical and chemical mechanisms responsible for the atmospheric escape from a planet dramatically change with the strength of its intrinsic magnetic field [1,2]. When the planet has substantial global intrinsic magnetic field as in the case of the present Earth, the planetary magnetic field provides a barrier against the solar wind (continuous and dynamic supersonic plasma flow from the Sun) and the solar wind cannot blow directly into the upper atmosphere. In the present Earth, the solar wind approaching to the Earth is stopped by the terrestrial magnetic field at the magnetopause (at about 10 Earth radii), where the magnetic pressure balances the kinetic pressure of the solar wind.
Derived from text
*Geomagnetism; Magnetohydrodynamic Flow; Planetary Magnetic Fields; Reaction Kinetics; Upper Atmosphere; Magnetopause*

**20050175991** Concordia Univ., Montreal, Quebec, Canada
**Possible Pingos and Periglacial Landscapes in Northwest Utopia Planitia, Mars, Part 2**
Soare, R. J.; Burr, D. M.; Tseung, J. M. Wan Ban; Peloquin, C.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hydrostatic (closed-system) pingos are elongate to circular, ice-cored mounds that are perennial features of some periglacial landscapes. These perennial mounds range in size from a few to approx. 60 m in height; they may reach approx. 300 m in diameter [1]. The origin and growth of a hydrostatic pingo are contingent upon the availability of surface water, the work of freezing processes and the presence of deep, continuous permafrost [2]. As a hydrostatic pingo evolves and matures, mound cracks and crosses begin to appear. The final stage of pingo development is marked by summit collapse, leaving an annular rim behind. The processes responsible for the formation of thermal contraction polygons - sharp, sub-zero losses of temperature - and of thermokarst - changes in the thermal equilibrium of ice-rich permafrost - differ from those associated with the formation of hydrostatic pingos. Despite these differences, the three landforms are frequent companions in periglacial landscapes on Earth
Derived from text
*Hydrostatics; Landforms; Mars Surface; Thermodynamic Equilibrium; Ice*

**20050175992** Concordia Univ., Montreal, Quebec, Canada
**Possible Thermokarst and Alas Formation in Utopia Planitia, Mars**
Soare, Richard J.; Tseung, J. M. Wan Bun; Peloquin, Claude; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Pits, depressions and collapse features that are consistent with the morphology of terrestrial thermokarst have been identified in five mid- to high-latitudinal areas of Mars: 1. the circum-Chryse outflow channels [1][2][3][4]; 2. Chryse Planitia itself [5][6]; 3. the volcanic fields around Olympus Mons [7] and those to the west of Elysium Mons; 4. the southern margin of the Vastitas Borealis formation [8]; and, 5. two of the great northern plains - Acidalia [9] and - Utopia Planitiae (UP) [10][11][12]. These are areas where water may have flowed in the past and near-surface ground ice could be present today. Our research evaluates the plausibility of thermokarst formation in an area of UP where thermokarst-like features are highly concentrated: - 260deg - 281deg longitude and 40deg - 50deg latitude.
Derived from text
*Morphology; Mars Surface; Ice; Mars Volcanoes*

**20050176024** Tennessee Univ., Knoxville, TN, USA

**THEMIS Multipsectral Analysis of Proposed Paleolake Basins in the Aeolis Quadrangle of Mars**

Stockstill, K. R.; Moersch, J. E.; McSween, H. Y., Jr.; Christensen, P. R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Several geomorphic studies have proposed the existence of paleolake basins on Mars [e.g., 1,2]. A list of 179 proposed paleolake basins in impact craters was compiled with corresponding geomorphic evidence for each basin [1]. Previously, we conducted a TES study [3] to search for small (approx.5 kmscale) exposures of evaporite minerals within the 80 largest putative paleolake basins from this list [1]. In that study, seven basins displayed one or more surface spectral units distinct from their surroundings. Linear deconvolution and newly-developed spectral indices methods were used to analyze spectral units from these basins. The deconvolution routine never used evaporite spectral endmembers in credible amounts (i.e., not \g 10-15% [4]) and the spectral indices methods did not detect evaporite minerals for any spectra of identified spectral units [3].

Derived from text

*Mineral Deposits; Craters; Geomorphology; Spectral Methods; Sedimentary Rocks*

**20050176051** Washington Univ., Seattle, WA, USA

**Water-soluble Organic Components in Aerosols Associated with Savanna Fires in Southern Africa: Identification, Evolution and Distribution**

Gao, Song; Hegg, Dean A.; Hobbs, Peter V.; Kirchstetter, Thomas W.; Magi, Brian I.; Sadilek, Martin; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 8491; In English

Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

During the SAFARI 2000 field campaign, both smoke aerosols from savanna fires and haze aerosols in the boundary layer and in the free troposphere were collected from an aircraft in southern Africa. These aerosol samples were analyzed for their water-soluble chemical components, particularly the organic species. A novel technique, electrospray ionization-ion trap mass spectrometry, was used concurrently with an ion chromatography system to analyze for carbohydrate species. Seven carbohydrates, seven organic acids, five metallic elements, and three inorganic anions were identified and quantified. On the average, these 22 species comprised 36% and 27% of the total aerosol mass in haze and smoke aerosols, respectively. For the smoke aerosols, levoglucosan was the most abundant carbohydrate species, while gluconic acid was tentatively identified as the most abundant organic acid. The mass abundance and possible source of each class of identified species are discussed, along with their possible formation pathways. The combustion phase of a fire had an impact on the chemical composition of the emitted aerosols. Secondary formation of sulfate, nitrate, levoglucosan, and several organic acids occurred during the initial aging of smoke aerosols. It is likely that under certain conditions, some carbohydrate species in smoke aerosols, such as levoglucosan, were converted to organic acids during upward transport.

Author

*Aerosols; Africa; Fires; Water; Solubility; Organic Materials; Geophysics*

**20050176057** Brigham Young Univ., Provo, UT, USA

**Semivolatile Particulate Organic Material Southern Africa during SAFARI 2000**

Eatough, D. J.; Eatough, N. L.; Pang, Y.; Sizemore, S.; Kirchstetter, T. W.; Novakov, T.; Journal of Geophysical Research; [2005]; Volume 108, No. D13, pp. 15-1; In English

Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

During August and September 2000, the University of Washington's Cloud and Aerosol Research Group (CARG) with its Convair-580 research aircraft participated in the Southern African Fire-Atmosphere Research Initiative (SAFARI) 2000 field study in southern Africa. Aboard this aircraft was a Particle Concentrator-Brigham Young University Organic Sampling System (PC-BOSS), which was used to determine semivolatile particulate material with a diffusion denuder sampler. Denuded quartz filters and sorbent beds in series were used to measure nonvolatile and semivolatile materials, respectively. Results obtained with the PC-BOSS are compared to those obtained with conventional quartz-quartz and Teflon-quartz filter pack samplers. Various 10-120 min integrated samples were collected during flights through the h e troposphere, in the atmospheric boundary layer, and in plumes from savanna fires. Significant fine particulate semivolatile organic compounds (SVOC) were found in all samples. The SVOC was not collected by conventional filter pack samplers and therefore would not have been determined in previous studies that used only filter pack samplers. The SVOC averaged 24% of the fine particulate mass in emissions from the fires and 36% of the fine particulate mass in boundary layer samples heavily impacted by aged emissions from savanna fires. Concentrations of fine particulate material in the atmospheric mixed layer heavily impacted by aged

savanna frre emissions averaged 130 micrograms per cubic meter. This aerosol was 85% carbonaceous mated.
Author
*Africa; Fires; Organic Materials; Particulates; Volatility; Atmospheric Composition*

**20050176417** Oulu Univ., Finland
**Distribution and Classification of Multiple Coronae on Venus**
Tormanen, T.; Aittola, M.; Kostama, V.-P.; Raitala, J.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Coronae are large volcano-tectonic structures with concentric and/or radial structures and associated volcanic features [e.g. 1-4]. Coronae are thought to form as a result of buoyant mantle diapirs deforming overlying lithosphere [e.g. 3-8]. We have conducted a survey of multiple coronae (coronae with at least 2 linked structures with a common annulus [3,5]) based on the existing catalogues of coronae and related volcano-tectonic features [9-12] as well as identifying additional coronae from Magellan images and topographic data. Double-type coronae were earlier studied based on Magellan data [13-16]. In this new survey we studied all multiple-type features and identified 70 multiple coronae including 12 multiple arachnoids. Of the multiple coronae 48 are Type 1 and 22 Type 2 coronae (Type 1 and 2 as defined in [10]). Multiple coronae may thus be more common in the Type 2 corona population.
Derived from text
*Coronas; Deformation; Classifications; Tectonics; Volcanoes; Lithosphere; Catalogs (Publications)*

**20050176420** Cornell Univ., Ithaca, NY, USA
**Seismic Shaking Removal of Craters 0.2-0.5 km in Diameter on Asteroid 433 Eros**
Thomas, P. C.; Robinson, M. S.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact cratering acts in a variety of ways to create a surprising range of scenery on small satellites and asteroids. The visible crater population is a self-modifying characteristic of these airless objects, and determining the various ways younger craters can add or subtract from the population is an important aspect of small body 'geology.' Asteroid 433 Eros, the most closely studied of any small body, has two aspects of its crater population that have attracted attention: a fall-off of crater densities below approx.100 m diameter relative to an expected equilibrium population [1] and regions of substantially lower large crater densities [2, 3, 4]. In this work we examine the global variation of the density of craters on Eros larger than 0.177 km, a size range above that involved in small crater depletion hypotheses [1, 5]. We counted all craters on Eros to a size range somewhat below 0.177 km diameter (and different from data used in [3]). The primary metric for this study is the number of craters between 0.177 and 1.0 km within a set radius of each grid point on the 2deg x 2deg shape model of Eros. This number can be expressed as an R-value [6], provided that it is remembered that the large bin size makes individual R values slightly different from those obtained in the usual root-2 bins.
Derived from text
*Asteroids; Size Distribution; Shaking; Cratering*

**20050176427** California Univ., Los Angeles, CA, USA
**High Resolution Al-26 Chronology: Resolved Time Interval Between Rim and Interior of a Highly Fractionated Compact Type a CAI from Efremovka**
Taylor, D. J.; McKeegan, K. D.; Krot, A. N.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Al-Mg chronometer (decay of Al-26 to Mg-26 with a half-life of approx.0.73 Ma) has proven to be extremely useful in establishing the relative ages of the earliest-forming solar system objects [1], if one can safely assume that Al-26 was homogeneously distributed throughout the early solar system. Given the proper set of conditions, this short-lived radionuclide can also be used to establish an internal relative chronology of a single object by investigating the initial Al-26/Al-27 in different petrographic components within that object. CAIs that formed early enough to contain live Al-26 and then later experienced high-temperature event(s) leading to Wark-Lovering rim formation before the complete decay of Al-26 may meet this requirement. As reported previously in [2], we have identified an unusual compact type A CAI from Efremovka that contains highly fractionated Mg in the interior, in the same range as FUN inclusions, and unfractionated Mg in the rim. Two

separate well-correlated internal Al-Mg evolution isochrons have been obtained for the interior and the rim, yielding a high-resolution chronology for the formation of the interior followed by the later formation of the Wark-Lovering rim.
Derived from text
*Aluminum Isotopes; Magnesium Isotopes; Chronology; Radioactive Isotopes; High Temperature; Inclusions; Petrography*

**20050176434** Tennessee Univ., Knoxville, TN, USA
**FeNi Metal Grains in LaPaz Mare Basalt Meteorites and Apollo 12 Basalts**
Taylor, Lawrence A.; Day, James M. D.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The LaPaz mare basalt meteorites and Apollo 12 basalts contain FeNi metal grains with anomalously high Ni and Co abundances, unlike those found in typical achondrites, chondrites, or iron meteorites. In Apollo 12 basalts, FeNi metal grains are associated with the earliest formed minerals (chromite and olivine) and are often at the boundaries between the phenocrysts and the matrix. Conversely in the LaPaz mare basalts, the FeNi metal grains are sited within the Fe-rich rims of pyroxene, or at the boundaries of pyroxene, plagioclase, or ulvospinel, indicating late-stage formation. The disparate FeNi metal crystallization sequence of the Apollo 12 and LaPaz basalts, all of which formed at low oxygen activities, probably represents the control of phases with relatively high partition coefficients for Ni and Co, such as olivine and chromite. Formation of metal grains may be the direct result of the crystallization of olivine and chromite in Apollo 12 basalts, whereas lack of olivine and chromite in LaPaz basaltic melts may force crystallization of FeNi metals due to their relative incompatibility.
Derived from text
*Iron Meteorites; Minerals; Spinel; Petrology; Basalt; Chondrites; Crystallization*

**20050176435** Hiroshima Univ., Japan
**U-Pb Systematics of Phosphates in Nakhlites**
Terada, K.; Sano, Y.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Studies of the SNC (Shergottite, Nakhlite, Chassignite) meteorites, which are thought to be impact ejecta from the planet Mars, have contributed significantly to understanding of the igneous history of the planet. Nakhlites, which are fine-grained clinopyroxenites, have not been subjected to severe shock metamorphism like shergottites. Their original igneous textures are well preserved. So far, an enormous amount of work on radiometric dating of nakhlites (mainly Nakhla, Lafayette and Governador Valadares) has been reported. The results of the Ar-40/Ar-39 ages, Rb-Sr ages and Sm-Nd ages clearly indicate a formation age of approx.1.3 Ga for Nakhlites (for recent review, [1]). On the other hand, U-Pb work also has been carried out only for Nakhla, however the interpretations of the U-Pb isotopic system are debatable [2-6]. On the whole, Pb-Pb isochron plots of leach-residue fractions show considerable scatter, indicating that Pb-207-Pb-206 ages are \g2 Ga. Nakamura et al. [4] reported a U-Pb Concordia plot after common lead correction and subtraction of contaminant of Pb, which showed the data intersecting the Concordia curve at 4.33+/-0.08 Ga and 1.28+/-0.05 Ga. Taking into account the REE measurement and Rb-Sr age of 1.26 Ga, and assuming appropriate common lead correction, Nakamura et al. [4] concluded that the age of the light REE-depleted Nakhla source is \h 4.33 Ga. Thus, a U-Pb age of 1.3 Ga age has not yet been reported for Nakhlite, and a consensus has not been attained to the U-Pb systematics in Nakhlites.
Derived from text
*Nakhlites; Shergottites; Isotopes; Phosphates; SNC Meteorites; Metamorphism (Geology); Chronology; Chassignites*

**20050176437** Bayreuth Univ., Germany
**The Effects of Oxygen, Sulphur and Silicon on the Dihedral Angles Between Fe-rich Liquid Metal and Olivine, Ringwoodite and Silicate Perovskite: Implications for Planetary Core Formation**
Terasaki, H.; Rubie, D. C.; Mann, U.; Frost, D. J.; Langenhorst, Falko; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The separation of the Earth s core by porous flow through the solid silicate mantle has been considered improbable on grounds of the high dihedral angles measured between Fe-rich liquids and silicate minerals [1]. At the low Fe metal melt fractions that are relevant to efficient core/mantle separation, the occurrence of melt interconnectivity requires that the dihedral angle between metal and crystals is less than 60deg. There is evidence, however, that the solution of light elements, such as

O and S, into Fe-rich liquids can lower dihedral angles significantly [2,3]. In comparison to the Earth, the Martian mantle is more FeOrich (approx. 18 wt %) and the Martian core is believed to contain more sulphur (approx. 14 wt %), differences that might have made core formation by porous flow more feasible on Mars. In addition to O and S, Si is also often proposed as a plausible light element in the Earth s core [4]. Fe-Si alloying is particularly relevant to models of core formation that propose a stepwise increase in the redox state of the accreting material over time [5]. In order to investigate the effects of these light elements on the dihedral angles between Fe-rich liquid and silicate minerals, we have performed a series of high-pressure experiments between 3 and 26 GPa, conditions which encompass those of almost the entire Martian mantle. Olivine, ringwoodite and silicate perovskite have been studied over a range of silicate FeO concentrations relevant to core formation on both the Earth and Mars.
Derived from text
*Oxygen; Sulfur; Silicon; Dihedral Angle; Liquid Metals; Olivine; Silicates; Perovskites; Planetary Cores; Core Flow; Earth Core; Earth Mantle*

**20050176454** Arizona State Univ., Tempe, AZ, USA
**Minor Element Behavior of Pallasite Olivine: Understanding Pallasite Thermal History and Chronology**
Tomiyama, T.; Huss, G. R.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Pallasites are highly differentiated meteorites composed mainly of olivines and Fe-Ni metal with comparable volumes. A standard view is that pallasites originated from the core-mantle boundary in differentiated parent bodies [e.g., 1, 2]. Fe-Ni metal in pallasites exhibits Widmanst tten structure indicative of slow cooling, and cooling rates inferred from zoning profiles in metal are ~1 oC/Myr [3]. However, pallasite olivines show chemical diffusion profiles that suggest cooling rates of a few to tens of degrees per year, roughly a million times faster [4, 5]. Metal and olivine do not seem to be telling the same story. Manganese-chromium isotopic systematics are also confusing. Ion probe measurements of olivines and phosphates appear to show initial 55Mn/53Mn ratios ((55Mn/53Mn)0) on the order of 1x10-5 [6, 7], but thermal ionization measurements made on bulk olivines that have had the surfaces removed by abrasion give (55Mn/53Mn)0 values of 1-2x10-6 [8, 9]. This discrepancy has never been adequately explained. Clearly, there is a need for a better understanding of the thermal history and isotope systematics of pallasites.
Derived from text
*Ion Probes; Manganese; Meteorites; Olivine; Phosphates; Stony-Iron Meteorites; Chromium*

**20050176455** California Univ., Los Angeles, CA, USA
**Canonical Anorthite in a Grosnaja Forsterite-bearing CAI**
Tonui, E. K.; Russell, S. S.; Simon, J. I.; Young, E. D.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Forsterite-bearing Ca,Al-rich inclusions (FoB's) are a small subset of CAIs most notable for the fact that more than half of reported examples are FUN inclusions with significant mass dependent fractionation effects [1,2]. Recent petrographic studies of 10 FoB s in a CV chondrite confirmed that many of them experienced extensive evaporation of Mg and Si during crystallization [3]. However, very limited Mg isotopic studies have been carried out on FoB s in general. We report oxygen isotopic ratios and UV laser ablation MC-ICPMS measurements of Mg isotope ratios in a Grosnaja FoB (63624-1) that was initially thought to be a FUN inclusion. Studies of rare inclusions like FoB s affords precise tests of models predicting correlations between mineral or whole-rock chemistry, isotopic fractionation and chronologies [e.g. 4, this meeting].
Derived from text
*Forsterite; Chondrites; Crystallization; Fractionation; Magnesium Isotopes; Isotope Ratios*

**20050176493** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Multiple X Line Reconnection in the Near Earth Magnetotail: Cluster Multipoint Plasma and Field Observations**
Eastwood, J. P.; Sibeck, D. G.; Slavin, J. A.; Goldstein, M. L.; Keith, W.; Hesse, M.; Lavraud, B.; Sitnov, M.; Licek, E. A.; Balogh, A.; [2005]; 2 pp.; In English; 2005 Joint Assembly, 23-27 May 2005, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

Eastwood et al. [2004, manuscript submitted to CRL], have recently reported observations of multiple X line reconnection proceeding in the near Earth (approximately 18Re) magnetotail, leading to the formation and growth of an Earthward moving flux rope. Here we present the associated ion and electron measurements that indicate significant structuring to the magnetic

field; in particular, an absence of counterstreaming electrons in the center of the flux rope. The observations, made on October 2, 2003, are put into a wider context by examining the surrounding plasma conditions, which indicate that after the event, the plasma sheet was highly dynamic. We also consider how common these observations are in the Cluster dataset, and discuss the implications for previous single spacecraft studies.
Author
*Plasmas (Physics); Magnetic Field Reconnection; Geomagnetic Tail*

**20050176495** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Three-Dimensional Modeling of Guide-Field Magnetic Reconnection**
Hesse, Michael; 2005; 1 pp.; In English; 2005 Joint Assembly, 23-27 May 2005, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

The dissipation mechanism of guide field magnetic reconnection remains a subject of intense scientific interest. On one hand, one set of recent studies have shown that particle inertia-based processes, which include thermal and bulk inertial effects, provide the reconnection electric field in the diffusion region. On the other hand, a second set of studies emphasizes the role of wave-particle interactions in providing anomalous resistivity in the diffusion region. In this presentation, we analyze three-dimensional PIC simulations of guide-field magnetic reconnection. Specific emphasis will be on the question whether thermal-inertia processes, mediated by the electron pressure tensor, remain a viable dissipation mechanism in fully three-dimensional systems.
Author
*Magnetic Field Reconnection; Three Dimensional Models*

**20050176504** NASA, Washington, DC, USA
**The Case of Ozone Depletion**
Lambright, W. Henry; May 2005; 61 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/SP-2005-4538; LC-2005001712; No Copyright; Avail: CASI; A04, Hardcopy

While the National Aeronautics and Space Administration (NASA) is widely perceived as a space agency, since its inception NASA has had a mission dedicated to the home planet. Initially, this mission involved using space to better observe and predict weather and to enable worldwide communication. Meteorological and communication satellites showed the value of space for earthly endeavors in the 1960s. In 1972, NASA launched Landsat, and the era of earth-resource monitoring began. At the same time, in the late 1960s and early 1970s, the environmental movement swept throughout the USA and most industrialized countries. The first Earth Day event took place in 1970, and the government generally began to pay much more attention to issues of environmental quality. Mitigating pollution became an overriding objective for many agencies. NASA's existing mission to observe planet Earth was augmented in these years and directed more toward environmental quality. In the 1980s, NASA sought to plan and establish a new environmental effort that eventuated in the 1990s with the Earth Observing System (EOS). The Agency was able to make its initial mark via atmospheric monitoring, specifically ozone depletion. An important policy stimulus in many respects, ozone depletion spawned the Montreal Protocol of 1987 (the most significant international environmental treaty then in existence). It also was an issue critical to NASA's history that served as a bridge linking NASA's weather and land-resource satellites to NASA s concern for the global changes affecting the home planet. Significantly, as a global environmental problem, ozone depletion underscored the importance of NASA's ability to observe Earth from space. Moreover, the NASA management team's ability to apply large-scale research efforts and mobilize the talents of other agencies and the private sector illuminated its role as a lead agency capable of crossing organizational boundaries as well as the science-policy divide.
Derived from text
*Mission to Planet Earth; NASA Programs; Ozone Depletion; Environmental Monitoring*

**20050176511** Veszprem Univ., Veszprem, Hungary
**Individual Aerosol Particles from Biomass Burning in Southern Africa, 1, Compositions and Size Distributions of Carbonaceous Particles**
Posfai, Mihaly; Simonics, Renata; Li, Jia; Hobbs, Peter V.; Buseck, Peter R.; Journal of Geophysical Research; March 8, 2003; ISSN 0148-0227; Volume 18, No. D13, pp. 19-1; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Individual aerosol particles in smoke plumes from biomass fires and in regional hazes in southern Africa were studied using analytical transmission electron microscopy (TEM), which allowed detailed characterization of carbonaceous particle

types in smoke and determination of changes in particle properties and concentrations during smoke aging. Based on composition, morphology, and microstructure, three distinct types of carbonaceous particles were present in the smoke: organic particles with inorganic (K-salt) inclusions, tar ball particles, and soot. The relative number concentrations of organic particles were largest in young smoke, whereas tar balls were dominant in a slightly aged (1 hour) smoke from a smoldering fire. Flaming fires emitted relatively more soot particles than smoldering fires, but soot was a minor constituent of all studied plumes. Further aging caused the accumulation of sulfate on organic and soot particles, as indicated by the large number of internally mixed organic/sulfate and soot/sulfate particles in the regional haze. Externally mixed ammonium sulfate particles dominated in the boundary layer hazes, whereas organic/sulfate particles were the most abundant type in the upper hazes. Apparently, elevated haze layers were more strongly affected by biomass smoke than those within the boundary layer. Based on size distributions and the observed patterns of internal mixing, we hypothesize that organic and soot particles are the cloud-nucleating constituents of biomass smoke aerosols. Sea-salt particles dominated in the samples taken in stratus clouds over the Atlantic Ocean, off the coast of Namibia, whereas a distinct haze layer above the clouds consisted of aged biomass smoke particles.
Author
*Aerosols; Africa; Biomass Burning; Carbonaceous Materials; Size Distribution; Atmospheric Composition*

**20050176515** Arizona State Univ., Tempe, AZ, USA
**Individual Aerosol Particles from Biomass Burning in Southern Africa Compositions and Aging of Inorganic Particles, 2, Compositions and Aging of Inorganic Particles**
Li, Jia; Posfai, Mihaly; Hobbs, Peter V.; Buseck, Peter R.; Journal of Geophysical Research; March 8, 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 20-1; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Individual aerosol particles collected over southern Africa during the SAFARI 2000 field study were studied using transmission electron microscopy and field-emission scanning electron microscopy. The sizes, shapes, compositions, mixing states, surface coatings, and relative abundances of aerosol particles from biomass burning, in boundary layer hazes, and in the free troposphere were compared, with emphasis on aging and reactions of inorganic smoke particles. Potassium salts and organic particles were the predominant species in the smoke, and most were internally mixed. More KCl particles occur in young smoke, whereas more K2SO4 and KNO3 particles were present in aged smoke. This change indicates that with the aging of the smoke, KCl particles from the fires were converted to K2SO4 and KNO3 through reactions with sulfur- and nitrogen- bearing species from biomass burning as well as other sources. More soot was present in smoke from flaming grass fires than bush and wood fires, probably due to the predominance of flaming combustion in grass fires. The high abundance of organic particles and soluble salts can affect the hygroscopic properties of biomass-burning aerosols and therefore influence their role as cloud condensation nuclei. Particles from biomass burning were important constituents of the regional hazes.
Author
*Aerosols; Africa; Biomass Burning; Inorganic Materials; Particles; Atmospheric Composition*

**20050176519** NASA Ames Research Center, Moffett Field, CA, USA
**Solar Spectral Radiative Forcing During the Southern African Regional Science Initiative**
Pilewskie, P.; Pommier, J.; Bergstrom, R.; Gore, W.; Howard, S.; Rabbette, M.; Schmid, B.; Hobbs, P. V.; Tsay, S. C.; Journal of Geophysical Research; March 13, 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 22-1; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

During the dry season component of the Southern African Regional Science Initiative (SAFARI) in late winter 2000, the net solar spectral irradiance was measured at flight levels throughout biomass burning haze layers. From these measurements, the flux divergence, fractional absorption, instantaneous heating rate, and absorption efficiency were derived. Two cases are examined: on 24 August 2000 off the coast of Mozambique in the vicinity of Inhaca Island and on 6 September 2000 in a very thick continental haze layer over Mongu, Zambia. The measured absolute absorption was substantially higher for the case over Mongu where the measured midvisible optical depth exceeded unity. Instantaneous heating from aerosol absorption was 4 K d(sup -1) over Mongu, Zambia and 1.5 K d(sup -1) near Inhaca Island, Mozambique. However, the spectral absorption efficiency was nearly identical for both cases. Although the observations over Inhaca Island preceded the river of smoke from the southern African continent by nearly 2 weeks, the evidence here suggests a continental influence in the lower tropospheric aerosol far from source regions of burning.
Author
*Africa; Solar Spectra; Solar Radiation; Biomass Burning*

**20050176525** NASA Ames Research Center, Moffett Field, CA, USA

**Coordinated Airborne, Spaceborne and Ground-based Measurements of Massive Thick Aerosol Layers during the Dry Season in Southern Africa**

Schmid, B.; Redemann, J.; Russell, P. B.; Hobbs, P. V.; Hlavka, D. L.; McGill, M. J.; Holben, B. N.; Welton, E. J.; Campbell, J. R.; Torres, O., et al.; Journal of Geophysical Research; April 3, 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 32-1; In English

Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

During the dry season airborne campaign of the Southern African Regional Science Initiative (SAFARI 2000), coordinated observations were made of massive thick aerosol layers. These layers were often dominated by aerosols from biomass burning. We report on airborne Sun photometer measurements of aerosol optical depth (lambda = 0.354- 1.557 microns), columnar water vapor, and vertical profiles of aerosol extinction and water vapor density that were obtained aboard the University of Washington's Convair-580 research aircraft. We compare these with ground-based AERONET Sun/sky radiometer results, with ground based lidar data (MPL-Net), and with measurements from a downward pointing lidar aboard the high-flying NASA ER-2 aircraft. Finally, we show comparisons between aerosol optical depths fiom the Sun photometer and those retrieved over land and over water using four spaceborne sensors (TOMS, MODIS, MISR, and ATSR-2).

Author

*Aerosols; Africa; Airborne Equipment; Spacecraft Instruments*

**20050176529** Washington Univ., Seattle, WA, USA

**Clean Air Slots Amid Dense Atmospheric Pollution in Southern Africa**

Hobbs, Peter V.; Journal of Geophysical Research; March 28, 2003; ISSN 0148-0227; Volume 108, No. D13; 2 pp.; In English

Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

During the flights of the University of Washington's Convair-580 in the Southern African Regional Science Initiative (SAFARI 2000) in southern Africa, a phenomenon was observed that has not been reported previously. This was the occurrence of thin layers of remarkably clean air, sandwiched between heavily polluted air, which persisted for many hours during the day. Photographs are shown of these clean air slots (CAS), and particle concentrations and light scattering coefficients in and around such slot are presented. An explanation is proposed for the propensity of CAS to form in southern Africa during the dry season.

Author

*Air Pollution; Republic of South Africa; Atmospheric Composition; Air Quality*

**20050176532** Veszprem Univ., Veszprem, Hungary

**Atmospheric Tar Balls: Particles from Biomass and Biofuel Burning**

Posfai, Mihaly; Gelencser, Andras; Simonics, Renata; Arato, Krisztina; Li, Jia; Hobbs, Peter V.; Buseck, Peter R.; Journal of Geophysical Research; 2004; ISSN 0148-0227; Volume 109, pp. D06213; In English

Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Tar balls are amorphous, carbonaceous spherules that occur in the tropospheric aerosol as a result of biomass and biofuel burning. They form a distinct group of particles with diameters typically between 30 and 500 nm and readily identifiable with electron microscopy. Their lack of a turbostratic microstructure distinguishes them from soot, and their morphology and composition (approximately 90 mol% carbon) renders them distinct from other carbonaceous particles. Tar balls are particularly abundant in slightly aged (minutes to hours old) biomass smoke, indicating that they likely form by gas-to-particle conversion within smoke plumes. The material of tar balls is initially hygroscopic; however, the particles become largely insoluble as a result of free radical polymerization of their organic molecules. Consequently, tar balls are primarily externally mixed with other particle types, and they do not appreciably increase in size during aging. When tar balls coagulate with water-bearing particles, their material may partly dissolve and no longer be recognizable as distinct particles. Tar balls may contain organic compounds that absorb sunlight. They are an important, previously unrecognized type of carbonaceous (organic) atmospheric particle.

Author

*Biomass Burning; Tars; Atmospheric Composition; Carbonaceous Materials*

**20050176536** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**A Mechanism for the Loading-Unloading Substorm Cycle Missing in MHD Global Magnetospheric Simulation Models**

Klimas, A. J.; Uritsky, V.; Vassiliadis, D.; Baker, D. N.; [2005]; 1 pp.; In English; 2005 Joint Assembly Meeting, 23-27 Jun. 2005, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

Loading and consequent unloading of magnetic flux is an essential element of the substorm cycle in Earth's magnetotail. We are unaware of an available global MHD magnetospheric simulation model that includes a loading- unloading cycle in its behavior. Given the central role that MHD models presently play in the development of our understanding of magnetospheric dynamics, and given the present plans for the central role that these models will play in ongoing space weather prediction programs, it is clear that this failure must be corrected. A 2-dimensional numerical driven current-sheet model has been developed that incorporates an idealized current- driven instability with a resistive MHD system. Under steady loading, the model exhibits a global loading- unloading cycle. The specific mechanism for producing the loading-unloading cycle will be discussed. It will be shown that scale-free avalanching of electromagnetic energy through the model, from loading to unloading, is carried by repetitive bursts of localized reconnection. Each burst leads, somewhat later, to a field configuration that is capable of exciting a reconnection burst again. This process repeats itself in an intermittent manner while the total field energy in the system falls. At the end of an unloading interval, the total field energy is reduced to well below that necessary to initiate the next unloading event and, thus, a loading-unloading cycle results. It will be shown that, in this model, it is the topology of bursty localized reconnection that is responsible for the appearance of the loading-unloading cycle.
Author
*Magnetohydrodynamics; Simulation; Two Dimensional Models; Earth Magnetosphere*

**20050176539** Maryland Univ. Baltimore County, Catonsville, MD, USA
**Tropospheric Carbon Monoxide Measurements from the Scanning High-resolution Interferometer Sounder on 7 September 2000 in Southern Africa during SAFARI 2000**
McMillan, W. W.; McCourt, M. L.; Revercomb, H. E.; Knuteson, R. O.; Christian, T. J.; Doddridge, B. G.; Hobbs, P. V.; Lukovich, P. C.; Novelli, P. C.; Piketh, S. J., et al.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, Bo. D13, pp. 8492; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Retrieved tropospheric carbon monoxide (CO) column densities are presented for more than 9000 spectra obtained by the University of Wisconsin-Madison (UWis) Scanning High-Resolution Interferometer Sounder (SHIS) during a flight on the NASA ER-2 on 7 September 2000 as part of the Southern African Regional Science Initiative (SAFARI 2000) dry season field campaign. Enhancements in tropospheric column CO were detected in the vicinity of a controlled biomass burn in the Timbavati Game Reserve in northeastern South Africa and over the edge of the river of smoke in south central Mozambique. Relatively clean air was observed over the far southern coast of Mozambique. Quantitative comparisons are presented with in situ measurements from five different instruments flying on two other aircraft: the University of Washington Convair-580 (CV) and the South African Aerocommander JRB in the vicinity of the Timbavati fire. Measured tropospheric CO columns (extrapolated from 337 to 100 mb) of 2.1 x 10(exp 18) per square centimeter in background air and up to 1.5 x 10(exp 19) per square centimeter in the smoke plume agree well with SHIS retrieved tropospheric CO columns of (2.3 plus or minus 0.25) x 10(exp 18) per square centimeter over background air near the fire and (1.5 plus or minus 0.35) x 10(exp 19) per square centimeter over the smoke plume. Qualitative comparisons are presented with three other in situ CO profiles obtained by the South African JRA aircraft over Mozambique and northern South Africa showing the influence of the river of smoke.
Author
*Carbon Monoxide; High Resolution; Interferometers; Republic of South Africa; Troposphere; Atmospheric Sounding*

**20050177039** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Intermittent Turbulence and SOC Dynamics in a 2-D Driven Current-Sheet Model**
Klimas, A. J.; Uritsky, V.; Vinas, A. F.; Vassiliasdis, D.; Baker, D. N.; [2005]; 1 pp.; In English; 2005 Joint Assembly Meeting, 23-27 Jun. 2005, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

Borovsky et al. have shown that Earth's magnetotail plasma sheet is strongly turbulent. More recently, Borovsky and Funsten have shown that eddy turbulence dominates and have suggested that the eddy turbulence is driven by fast flows that act as jets in the plasma. Through basic considerations of energy and magnetic flux conservation, these fast flows are thought to be localized to small portions of the total plasma sheet and to be generated by magnetic flux reconnection that is similarly localized. Angelopoulos et al., using single spacecraft Geotail data, have shown that the plasma sheet turbulence exhibits signs of intermittence and Weygand et al., using four spacecraft Cluster data, have confirmed and expanded on this conclusion. Uritsky et al., using Polar UVI image data, have shown that the evolution of bright, nightside, UV auroral emission regions is consistent with many of the properties of systems in self-organized criticality (SOC). Klimas et al. have suggested that the auroral dynamics is a reflection of the dynamics of the fast flows in the plasma. sheet. Their hypothesis is that the transport of magnetic fludenergy through the magnetotail is enabled by scale-free avalanches of localized reconnection whose SOC dynamics are reflected in the auroral UV emission dynamics. A corollary of this hypothesis is that the strong, intermittent, eddy

turbulence of the plasma sheet is closely related to its critical dynamics. The question then arises: Can in situ evidence for the SOC dynamics be found in the properties of the plasma sheet turbulence? A 2-dimensional numerical driven current-sheet model of the central plasma sheet has been developed that incorporates an idealized current-driven instability with a resistive MHD system. It has been shown that the model can evolve into SOC in a physically relevant parameter regime. Initial results from a study of intermittent turbulence in this model and the relationship of this turbulence to the model's known SOC dynamics will be discussed.
Author (revised)
*Magnetohydrodynamic Simulation; Magnetohydrodynamic Turbulence; Geomagnetic Tail; Plasma Layers; Current Sheets*

**20050177232** Washington Univ., Seattle, WA, USA
**Emissions of Trace Gases and Particles from Savanna Fires in Southern Africa**
Sinha, Parikhit; Hobbs, Peter V.; Yokelson, Robert J.; Bertschi, Isaac T.; Blake, Donald R.; Simpson, Isobel J.; Gao, Song; Kirchstetter, Thomas W.; Novakov, Tica; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D13, pp. 8487; In English
Contract(s)/Grant(s): NAG5-9022; Copyright; Avail: Other Sources; Abstract Only

Airborne measurements made on initial smoke from 10 savanna fires in southern Africa provide quantitative data on emissions of 50 gaseous and particulate species, including carbon dioxide, carbon monoxide, sulfur dioxide, nitrogen oxides, methane, ammonia, dimethyl sulfide, nonmethane organic compounds, halocarbons, gaseous organic acids, aerosol ionic components, carbonaceous aerosols, and condensation nuclei (CN). Measurements of several of the gaseous species by gas chromatography and Fourier transform infrared spectroscopy are compared. Emission ratios and emission factors are given for eight species that have not been reported previously for biomass burning of savanna in southern Africa (namely, dimethyl sulfide, methyl nitrate, five hydrocarbons, and particles with diameters from 0.1 to 3 microns). The emission factor that we measured for ammonia is lower by a factor of 4, and the emission factors for formaldehyde, hydrogen cyanide, and CN are greater by factors of about 3, 20, and 3 - 15, respectively, than previously reported values. The new emission factors are used to estimate annual emissions of these species from savanna fires in Africa and worldwide.
Author
*Fires; Trace Elements; Republic of South Africa; Exhaust Emission; Particles*

## 47
## METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

**20050173840** Army War Coll., Carlisle Barracks, PA USA
**Disaster Preparedness: Anticipating the Worst Case Scenario Issue Paper Volume 05-05, March 2005**
Mar. 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432445; No Copyright; Avail: Defense Technical Information Center (DTIC)

South Asia, geologically speaking, is a very dynamic region. Its northern boundaries follow the convergence of the Indian and Eurasian Plates, while its southern edge is contained within the Ring of Fire. Although the major collision of continents that began the formation of the Himalayas and the Tibetan Plateau occurred 50 million years ago, South Asia is still a seismically active area. Over the last century it has experienced eighteen earthquakes with a magnitude greater than 6.0. Approximately every 70 years the Katmandu Valley in Nepal experiences such a seismic event. More immediately, it is estimated that 350,000 lives were lost and potentially millions left homeless in Bangladesh, India, Indonesia, Sri Lanka, and Thailand from the 9.0 earthquake and resulting tsunami that occurred off Indonesia on December 26, 2004. With recurring major earthquakes predicted for this seismically unstable region, effective disaster preparedness planning at the national and regional levels is a 'high payoff' investment that governments can make in anticipation of large-scale natural or man-made disasters. Such preparedness planning both speeds the national and regional reaction time, and assists international organizations and other countries in sizing appropriate response support.
DTIC
*Disasters; Earthquakes; Maintainability*

**20050174522** Nebraska Univ., Lincoln, NE, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Carnegie Institution of Washington, Stanford, CA, USA

**Highly Portable, Rapidly Deployable System for Eddy Covariance Measurements of CO(sub 2) Fluxes**

Billesbach, D. P.; Fischer, M. L.; Torn, M. S.; Berry, J. A.; 2005; 34 pp.; In English

Report No.(s): DE2005-836224; No Copyright; Avail: Department of Energy Information Bridge

To facilitate the study of flux heterogeneity within a region, the authors have designed, built, and field-tested a highly portable, rapidly deployable, eddy covariance CO2 flux measurement system. The system is built from off-the-shelf parts and was assembled at a minimal cost. The unique combination of features of this system allow for a very rapid deployment with a minimal number of field personnel. The system is capable of making high precision, unattended measurements of turbulent CO2 fluxes, latent heat (LE) fluxes, sensible heat fluxes (H), and momentum transfer fluxes. In addition, many of the meteorological and ecosystem variables necessary for quality control of the fluxes and for running ecosystem models are measured.

NTIS

*Carbon Dioxide; Heat Flux; Vortices*

**20050175768** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Critical Climate-Sensitive and Important Grain-Producing Regions: Grain Production/Yield Variations Due to Climate Fluctuations, Volume 1**

Welker, J. E.; December 2004; 25 pp.; In English

Report No.(s): NASA/TM-2004-212252/VOL1; Rept- 2005-00563-0/VOL1; No Copyright; Avail: CASI; A03, Hardcopy

Ideally, the Crop Country Inventory, CCI, is a methodology for the pre-harvest prediction of large variations in a country s crop production. This is accomplished by monitoring the historical climatic fluctuations, especially during the crop calendar period, in a climate sensitive large crop production region or sub-country, rather than the entire country. The argument can be made that the climatic fluctuations in the climatic sensitive region are responsible for the major annual crop country variations and that the remainder of the country, without major climatic fluctuations for a given year, can be assumed to be a steady-state crop producer. The principal data set that has been used is the Global Climate Mode (GCM) data from the National Center for Environmental Prediction (NCEP), taken over the last half century. As a test of its accuracy, GCM data can and has been correlated with the actual meteorological station data at the station site.

Author

*Annual Variations; Climate; Crop Calendars; Crop Growth*

**20050176492** Meteorological Satellite Center, Kiyose, Japan

**Monthly Report of the Meteorological Satellite Center: February 2005**

February 2005; In English; In Japanese; Copyright; Avail: Other Sources

The CD-ROM concerning the February 2005 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.

Derived from text

*Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan*

**20050176497** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**CDEP Consortium on Ocean Data Assimilation for Seasonal-to-Interannual Prediction (ODASI)**

Rienecker, Michele; Zebiak, Stephen; Kinter, James; Behringer, David; Rosati, Antonio; Kaplan, Alexey; [2005]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The ODASI consortium is focused activity of the NOAA/OGP/Climate Diagnostics and Experimental Prediction Program with the goal of improving ocean data assimilation methods and their implementations in support of seasonal forecasts with coupled general circulation models. The consortium is undertaking coordinated assimilation experiments, with common forcing data sets and common input data streams. With different assimilation systems and different models, we aim to understand what approach works best in improving forecast skill in the equatorial Pacific. The presentation will provide an

overview of the consortium goals and plans and recent results focused towards evaluating data impacts.
Author
*Oceans; Annual Variations; Data Acquisition*

**20050177031** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Transport of Trace Gases**
Schoeberl, Mark R.; [2005]; 1 pp.; In English; RAL Spring School in Quantitative Earth Observation, 21-24 Mar. 2005, Oxford, UK; No Copyright; Avail: Other Sources; Abstract Only

Trace gases measurements are used to diagnose both the chemistry and transport of the atmosphere. These lectures emphasize the interpretation of trace gases measurements and techniques used to untangle chemistry and transport effects. I will discuss PV transform, trajectory techniques, and age-of-air as far as the circulation of the stratosphere.
Author
*Gas Transport; Atmospheric Chemistry; Trace Elements*

**20050177033** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Studying the Diurnal Cycle of Convection Using a TRMM-Calibrated Infrared Rain Algorithm**
Negri, Andrew J.; [2005]; 1 pp.; In English
Report No.(s): Rept-68711; No Copyright; Avail: Other Sources; Abstract Only

The development of a satellite infrared (IR) technique for estimating convective and stratiform rainfall and its application in studying the diurnal variability of rainfall on a global scale is presented. The Convective-Stratiform Technique (CST), calibrated by coincident, physically retrieved rain rates from the Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR), is applied over the global tropics. The technique makes use of the IR data from the TRMM Visible/Infrared Scanner (VIRS) before application to global geosynchronous satellite data. The calibrated CST technique has the advantages of high spatial resolution (4 km), filtering of nonraining cirrus clouds, and the stratification of the rainfall into its convective and stratiform components, the last being important for the calculation of vertical profiles of latent heating. The diurnal cycle of rainfall, as well as the division between convective and Stratiform rainfall will be presented. The technique is validated using available data sets and compared to other global rainfall products such as Global Precipitation Climatology Project (GPCP) IR product, calibrated with TRMM Microwave Imager (TMI) data. Results from five years of PR data will show the global-tropical partitioning of convective and stratiform rainfall.
Author
*Diurnal Variations; TRMM Satellite; Infrared Scanners; Convection; Atmospheric Circulation*

**20050177045** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**The CRYSTAL-FACE Mission**
Newman, P.; [2005]; 1 pp.; In English; SCOUT-03 Meeting, 7-11 Mar. 2005, Zurich, Switzerland; No Copyright; Avail: Other Sources; Abstract Only

The Cirrus Regional Study of Tropical Anvils and Cirrus Layers - Florida Area Cirrus Experiment (CRYSTAL-FACE) was a measurement campaign designed to investigate tropical cirrus cloud physical properties and formation processes. Understanding the production of upper tropospheric cirrus clouds is essential for the successful modeling of the Earth's climate. The mission was staged in July 2002 with flights of 6 aircraft from Key West, Florida. Several aircraft were used for in situ and remote sensing of aerosols, ice crystals, meteorological fields, radiative fluxes, and gas concentrations. The NASA ER-2 and WB-57, the Proteus aircraft, owned by Northrop Grumman and operated by Scaled Composites, CIRPAS provided the DeHavilland UV-l8A, 'Twin Otter' aircraft, the University of North Dakota provided a Cessna Citation II aircraft , and NSF supported the ELDORA radar onboard the Naval Research Laboratory P-3 aircraft. In this presentation, I will describe some of the flights, the conditions, and some of the results from the mission.
Author
*Tropical Meteorology; Cirrus Clouds; Research Aircraft*

**20050177052** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Aerosol-Cloud-Precipitation Interactions over Indo-Gangetic Basin**
Tsay, S.-C.; Lau, K. .; Holben, B. N.; Hsu, N. C.; Bhartia, P. K.; [2005]; 2 pp.; In English; United Nations, Environmental Protection Atmospheric Brown Clouds Meeting, 2-6 Apr. 2005, Shanghai, China; No Copyright; Avail: Other Sources; Abstract Only

About 60% of world population reside in Asia, in term of which sheer population density presents a major environmental stress. Economic expansion in this region is, in fact, accompanied by increases in bio-fuel burning, industrial pollution, and land cover and land use changes. With a growth rate of approx. 8%/yr for Indian economy, more than 600 million people from Lahore, Pakistan to Calcutta, India over the Indo-Gangetic Basin have particularly witnessed increased frequencies of floods and droughts as well as a dramatic increase in atmospheric loading of aerosols (i.e., anthropogenic and natural aerosol) in recent decades. This regional change (e.g., aerosol, cloud, precipitation, etc.) will constitute a vital part of the global change in the 21st century. Better understanding of the impacts of aerosols in affecting monsoon climate and water cycles is crucial in providing the physical basis to improve monsoon climate prediction and for disaster mitigation. Based on climate model simulations, absorbing aerosols (dust and black carbon) play a critical role in affecting interannual and intraseasonal variability of the Indian monsoon. An initiative on the integrated (aerosols, clouds, and precipitation) measurements approach over the Indo-Gangetic Basin will be discussed. An array of ground-based (e.g., AERONET, MPLNET, SMART-COMMIT, etc.) and satellite (e.g., Terra, A-Train, etc.) sensors will be utilized to acquire aerosol characteristics, sources/sinks, and transport processes during the pre-monsoon (April-May, aerosol forcing) season, and to obtain cloud and precipitation properties during the monsoon (May-June, water cycle response) season. Close collaboration with other international programs, such as ABC, CLIVAR, GEWEX, and CEOP in the region is anticipated.
Author
*Aerosols; Clouds (Meteorology); Precipitation (Meteorology); India; River Basins*

**20050177065** National Ocean Service, Rockville, MD
**Barometer Calibration Guidelines. Updated February 2002**
Feb. 2002; 10 pp.; In English
Report No.(s): PB2005-106713; No Copyright; Avail: CASI; A02, Hardcopy
The report contains a step by step guide for doing the calculations and deriving the new barometer coefficient 2 using Solomons Island as an example. The report also contains a step by step guide for doing the calculations and deriving the new barometer coefficient 2 for stations that have the barometer installed and coefficient 2 stored correctly in the past, again using Solomons Island as an example.
NTIS
*Barometers; Calibrating*

**20050177096** Bureau of Reclamation, Denver, CO
**Variability of Wet and Dry Periods in the Upper Colorado River Basin and Possible Effects of Climate Change. Sensitivity of Probable Maximum Precipitation Estimates to Climate Change. Global Climate Change Response Program**
Eddy, R. L.; Jan. 1996; 100 pp.; In English
Report No.(s): PB2005-105184; No Copyright; Avail: CASI; A05, Hardcopy
This study had two objectives: to identify periods of precipitation well above and well below normal and to assess the effects of an increase of 10 percent and a decrease of 10 percent in precipitation on the duration of these extreme periods. The Upper Colorado River Basin (the drainage area above Glen Canyon Dam) was chosen for the study because of its topographic variability and the importance of its water resources to large populations beyond the region. Data for the study were limited to those available in the Surface Water Branch, Earth Sciences Division, of the Bureau of Reclamation's Denver Office. No change in the number of events was assumed. Increasing or decreasing the average precipitation by 10 percent usually would not change the number of consecutive wet or dry years by more than 1 year. This would usually have a minor impact on water resource systems because the natural variability would still result in a mix of wet, normal, and dry years. However, about once every 20 years, some grouping of stations would experience a rather dramatic change in the number of consecutive wet or dry years. An episode of crisis proportions could occur if several portions of the Upper Colorado River Basin experienced these major wet or dry periods at the same time.
NTIS
*Climate Change; Precipitation (Meteorology); Earth Sciences; Climatology*

**20050177180** Comite Consultatif International de Radiocommunications, Geneva, Switzerland
**13th Plenary Assembly, Volume 6, Ionospheric Propagation (Study Group 6)**
1975; 270 pp.; In English; 13th Plenary Assembly, 1974, Geneva, Switzerland; No Copyright; Avail: CASI; A12, Hardcopy
Study Group 6 is concerned with the acquisition of knowledge of the propagation of radio waves through the ionosphere

and its application to telecommunication problems. Since the Study Group does not deal directly with telecommunication systems, its main efforts are to codify experience and knowledge of the properties of the ionosphere and of background radio noise in forms as widely applicable as possible, with respect to geographical position, season, time of day, and solar-terrestrial relations. Moreover, the Study Group takes active account of special features of ionospherically propagated radio waves. Finally, it proposes actions intended to stimulate the collection of essential ionospheric and solar-terrestrial data, so that the basis for the required predictions associated with ionospheric propagation can be maintained and improved. The topics of this 13th Plenary Assembly include: 1) Ionospheric and solar indices; 2) Prediction of MUF; 3) Field strengths between about 1.5 and 40 MHz; 4) Atmospheric and man-made radio noise; 5) Ionospheric mapping; 6) Problems of interference; 7) Field strengths below about 1.5 MHz; 8) Fading of signals received via the ionosphere; and 9) Topics related to space systems
Derived from text
*Ionospheric Propagation; Radio Waves; Telecommunication*

**20050177223** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Regression Analysis of Long-Term Profile Ozone Data Set from BUV Instruments**
Stolarski, Richard S.; [2005]; 1 pp.; In English; Spring 2005 AGU Meeting, 23-27 May 2005, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

We have produced a profile merged ozone data set (MOD) based on the SBUV/SBUV2 series of nadir-viewing satellite backscatter instruments, covering the period from November 1978 - December 2003. In 2004, data from the Nimbus 7 SBUV and NOAA 9, ll, and 16 SBUV/2 instruments were reprocessed using the Version 8 (V8) algorithm and most recent calibrations. More recently, data from the Nimbus 4 BUT instrument, which was operational from 1970 - 1977, were also reprocessed using the V8 algorithm. As part of the V8 profile calibration, the Nimbus 7 and NOAA 9 (1993-1997 only) instrument calibrations have been adjusted to match the NOAA 11 calibration, which was established based on comparisons with SSBUV shuttle flight data. Differences between NOAA 11, Nimbus 7 and NOAA 9 profile zonal means are within plus or minus 5% at all levels when averaged over the respective periods of data overlap. NOAA 16 SBUV/2 data have insufficient overlap with NOAA 11, so its calibration is based on pre-flight information. Mean differences over 4 months of overlap are within plus or minus 7%. Given the level of agreement between the data sets, we simply average the ozone values during periods of instrument overlap to produce the MOD profile data set. Initial comparisons of coincident matches of N4 BUV and Arosa Umkehr data show mean differences of 0.5 (0.5)% at 30km; 7.5 (0.5)% at 35 km; and 11 (0.7)% at 40 km, where the number in parentheses is the standard error of the mean. In this study, we use the MOD profile data set (1978-2003) to estimate the change in profile ozone due to changing stratospheric chlorine levels. We use a standard linear regression model with proxies for the seasonal cycle, solar cycle, QBO, and ozone trend. To account for the non-linearity of stratospheric chlorine levels since the late 1990s, we use a time series of Effective Chlorine, defined as the global average of Chlorine + 50 * Bromine at 1 hPa, as the trend proxy. The Effective Chlorine data are taken from the 3-D Goddard CTM. We will show the latest trend results using this statistical model. In addition, the Nimbus 4 BUV data offer an opportunity to test the physical properties of our statistical model. From ground-based comparisons we will establish an uncertainty range for the Nimbus 4 data. We then extrapolate our statistical model fit backwards in time and compare to the Nimbus 4 data. We compare the characteristics of the residual, defined as the difference between the data and statistical regression fit, during the Nimbus 4 time period and the 1978-2003 period over which the statistical model coefficients were estimated, and present these results.
Author
*Ozone; Regression Analysis; Solar Backscatter UV Spectrometer; Satellite-Borne Instruments*

**20050177236** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**GLACE: The Global Land-Atmosphere Coupling Experiment Part 2: Analysis**
Guo, Zhichang; Dirmeyer, Paul A.; Koster, Randal D.; Bonan, Gordon; Chan, Edmond; Cox, Peter; Gordon, C. T.; Kanae, Shinjiro; Kowalczyk, Eva; Lawrence, David; April 2005; 40 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The twelve weather and climate models participating in the Global Land-Atmosphere Coupling Experiment (GLACE) show both a wide variation in the strength of land-atmosphere coupling and some intriguing commonalities. In this paper, we address the causes of variations in coupling strength - both the geographic variations within a given model and the model-to-model differences. The ability of soil moisture to affect precipitation is examined in two stages, namely, the ability of the soil moisture to affect evaporation, and the ability of evaporation to affect precipitation. Most of the differences between the models and within a given model are found to be associated with the first stage - an evaporation rate that varies strongly and consistently with soil moisture tends to lead to a higher coupling strength. The first stage differences reflect identifiable

differences in model parameterization and model climate. Intermodel differences in the evaporation-precipitation connection, however, also play a key role.
Author
*Air Land Interactions; Coupling; Atmospheric General Circulation Models; Precipitation (Meteorology)*

## 54
## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

**20050174533** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**Ergonomics Considerations for Reducing Cumulative Trauma Exposure in Underground Mining**
Cornelius, K. M.; Turin, F. C.; 2005; 8 pp.; In English
Report No.(s): PB2005-105977; No Copyright; Avail: CASI; A02, Hardcopy

Many of the job activities associated with underground mining tend to be labor intensive and repetitive in nature. These tasks, over time, take a toll on the soft tissue and joints. Considering that the mean age of a miner is 45 years, and the median total experience around 20 years, mining companies are becoming more aware of cumulative effects to the worker, especially as worker reports on such injuries rise. The report describes a job analysis evaluation of roof-bolting tasks performed at an underground coal mine concerned about the early warning signs of cumulative trauma.
NTIS
*Coal; Human Factors Engineering; Early Warning Systems; Mining*

**20050174542** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**Progress Toward a Reduced Exposure Mining System**
Schnakenberg, G. H.; 2005; 12 pp.; In English
Report No.(s): PB2005-106032; No Copyright; Avail: CASI; A03, Hardcopy

This reduced exposure mining system (REMS) research effort enhances the USBM ongoing health and safety research efforts to reduce and control dust and noise and to reduce accidents through training and better mining practices. This paper reports progress of the research that is developing and will demonstrate the technologies required for the computer-assisted tele-remote operation of continuous mining machines, haulage systems, and roof bolting machines.
NTIS
*Exposure; Mining; Health*

**20050174545** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**Random Motion Capture Model for Studying Events Between a Machine and Its Operator**
Ambrose, D. H.; 2005; 12 pp.; In English
Report No.(s): PB2005-106038; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a technique for representing and analyzing random motions and hazardous events in a computer simulated three-dimensional workplace, providing machine designers and safety analysis with a new technique to evaluate ways to reduce operator-machine interaction hazards. Technical data is this paper is based upon a project striving to reduce workers' risks from being hit by underground mining machinery in a confined space.
NTIS
*Human Factors Engineering; Coal; Mining*

**20050177049** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**Verification and Validation of Roof Bolter Simulation Models for Studying Events Between a Machine and Its Operator**
Bartels, J. R.; Ambrose, D. H.; Wang, R. C.; 2001; 18 pp.; In English
Report No.(s): PB2005-106058; REPT-2001-01-2088; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents the results of a study to verify and validate a computer model that represents and analyzes motions and hazardous events in a simulated three dimensional workplace. The purpose of the computer model is to support research that is investigating the safe speed range for the vertical movement of roof bolter boom arms to reduce worker injuries in underground coal mines. The information obtained for this paper is based upon a project that is investigating means to reduce workers risks of injury from exposure to mining machinery. The methodology being employed by the project includes human

factors design considerations, anthropometric modeling and simulation tools, laboratory validation, engineering interventions, and collaboration with industry and an equipment manufacturer. The results of this study were used to (1) determine the input parameters that are unique to the mining environment and needed to develop a credible, computer-based, human-machine interactive model, (2) develop test methods to measure the required parameters, and (3) to refine the human-machine interactive computer model.
NTIS
*Computerized Simulation; Human Factors Engineering; Man Machine Systems*

**20050177053** Westat Research, Inc., Rockville, MD, USA, Transportation Research Corp., Markham, VA, USA
**Comprehensive Human Factors Guidelines for Road Systems**
Lerner, N.; Llaneras, R.; Smiley, A.; Hanscom, F.; Mar. 2005; 138 pp.; In English
Report No.(s): PB2005-106589; No Copyright; Avail: CASI; A07, Hardcopy

The National Cooperative Highway Research Program (NCHRP) Project 17-18(8), Comprehensive Human Factors Guidelines for Road Systems, concerned the initial development of a new resource document for highway designers, traffic engineers, and other practitioners. The purpose of the planned Human Factors Guidelines (HFG) document, as stated in the project Statement of Work, is to provide the best factual information and insight on road users characteristics, in a useful CD-ROM format, to facilitate safe roadway design and operational decisions. The impetus behind this project was the recognition that current design references have limitations in providing the practitioner with adequate guidance for incorporating road user needs and capabilities when dealing with design and operational issues. These limitations may be of various sorts. Design guidelines may represent minimum requirements that are not always appropriate over the full range of roadway users or applications. Guidance may not be based on adequate human factors data.
NTIS
*Human Factors Engineering; Highways; Systems Engineering*

**20050177110** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**Method for Evaluating System Interactions in a Dynamic Work Environment**
Steiner, L.; Turin, F.; Cornelius, K.; 2005; 8 pp.; In English
Report No.(s): PB2005-106017; No Copyright; Avail: CASI; A02, Hardcopy

As technology evolves, accidents may occur becasue human-system interactions were and considered adquately in the process. A systematic methodology can be used to evaluate the causes of mishaps and to develop recommendations that will enhance safety. A recent trend observed in underground coal mining is used to illustrate this principle because an underground mine is a dynamic work environment. Mining is characterized not only by frequent geologic changes but by technological evolution that can seriously degrade human performance and compromise worker health and safety.
NTIS
*Mining; Human Factors Engineering; Human Performance*

**20050177130** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**International Encyclopedia of Ergonomics and Human Factors, Volume 1**
Karwowski, W.; 2005; 10 pp.; In English
Report No.(s): PB2005-105996; No Copyright; Avail: CASI; A02, Hardcopy

If we consider ergonomics to be an exercise in matching job demands to worker capabilities, one of the principal capabilities we must be concerned with is that of human strength. The report presents: an analysis of isometric strength; a strength aptitude test using the iso-inertial method; a technique dealing with the measurement of isokinetic strength; and a discussion of how these mesh with ergonomics.
NTIS
*Human Factors Engineering; Psychological Tests*

**20050177135** California Univ., Davis, CA, USA
**Effects of an Ergonomic Intervention for Computer Work**
Rempel, D. M.; Krause, N.; Goldberg, R.; Benner, D.; Hudes, M.; 2004; 44 pp.; In English
Report No.(s): PB2005-105196; No Copyright; Avail: CASI; A03, Hardcopy

Customer service work at computers is associated with elevated rates of upper body musculoskeletal disorders. This randomized controlled intervention trial evaluated the effects of a wide forearm support surface and a trackball on upper body

pain severity and incident musculoskeletal disorders among 182 customer service operators at a large HMO who were randomized to receive (1) ergonomics training only, (2) training plus a trackball, (3) training plus a forearm support, or (4) training plus a trackball and forearm support. If the participant's weekly pain severity or medication usage exceeded a priori criteria an upper body physical examination was performed. Analyses using Cox proportional hazard models and linear regression models adjusted for demographic factors, baseline pain levels, and psychosocial job factors. Within 12 months post-intervention 63 participants were diagnosed with a musculoskeletal disorder in the upper extremities or the neck-shoulder region. Adjusted hazard rate ratios show a protective effect of the armboard for neck-shoulder disorders (HR = 0.49, 95% C.I. = 0.24 to 0.97). The armboard also significantly reduced neck-shoulder pain and right upper extremity pain in comparison to the control group. The findings of the trackball intervention were mixed. A return-on-investment model predicted a full return of armboard and installation costs within 2.4 months. Providing a large forearm support combined with ergonomic training is an intervention that can prevent upper body musculoskeletal disorders and reduce upper body pain associated with computer work.
NTIS
*Human Factors Engineering; Musculoskeletal System*

## 55
## 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 Sciences*.

**20050174628** Carnegie Institution of Washington, Washington, DC, USA
**An Integrated System for Labeling and Detection of Biological Molecules in Mars Analog Regolith Using an Antibody Microarray**
Maule, J.; Toporski, J.; Wainwright, N.; Steele, A.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Protein microarray analysis has had a major impact in modern biology and medicine by enabling detection of hundreds of proteins (and other molecules) using extremely small sample volumes. Protein microarrays are printed on a glass slide using a robot and are only a few millimeters in diameter. Each consists of a grid of several hundred spots (100-200 m-diameter) of protein. Protein microarrays can be divided into two categories: target protein arrays and antibody (Ab) microarrays. Target protein microarrays have been used to study protein interactions with pharmaceutical drugs, enzyme substrates and antibodies; the latter are examples of antigen (Ag) microarrays . Ab microarrays are arrays printed with antibodies, each of which binds to and recognizes a specific molecule termed the antigen . Some antibodies printed in a microarray format can detect antigens at concentrations below 1ng/ml. Used most extensively for the analysis of human proteins in biomedical applications, this type of array has not been used for the detection of microbial or viral antigens in environmental samples [although microbial/viral antigen microarrays have been used for serodiagnosis]. We have proposed that such a microbe-specific Ab microarray would provide a useful tool for in situ detection of biological molecules in space (due to its low mass, broad search capability and small sample required).
Derived from text
*Microorganisms; Mars Surface; Planetary Geology; Systems Integration; Molecules*

## 59
## MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

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

**20050175884** NASA Glenn Research Center, Cleveland, OH, USA
**Foundations of Tensor Analysis for Students of Physics and Engineering With an Introduction to the Theory of Relativity**
Kolecki, Joseph C.; April 2005; 92 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-332-41
Report No.(s): NASA/TP-2005-213115; E-14609; No Copyright; Avail: CASI; A05, Hardcopy

Tensor analysis is one of the more abstruse, even if one of the more useful, higher math subjects enjoined by students of physics and engineering. It is abstruse because of the intellectual gap that exists between where most physics and engineering mathematics leave off and where tensor analysis traditionally begins. It is useful because of its great generality, computational power, and compact, easy to use, notation. This paper bridges the intellectual gap. It is divided into three parts: algebra, calculus, and relativity. Algebra: In tensor analysis, coordinate independent quantities are sought for applications in physics and engineering. Coordinate independence means that the quantities have such coordinate transformations as to leave them invariant relative to a particular observer s coordinate system. Calculus: Non-zero base vector derivatives contribute terms to dynamical equations that correspond to pseudoaccelerations in accelerated coordinate systems and to curvature or gravity in relativity. These derivatives have a specific general form in tensor analysis. Relativity: Spacetime has an intrinsic geometry. Light is the tool for investigating that geometry. Since the observed geometry of spacetime cannot be made to match the classical geometry of Euclid, Einstein applied another more general geometry differential geometry. The merger of differential geometry and cosmology was accomplished in the theory of relativity. In relativity, gravity is equivalent to curvature.
Author
*Coordinate Transformations; Relativity; Tensor Analysis*

**20050177120** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
**Motion Editing and Reuse Techniques and Their Role in Studying Events Between a Machine and Its Operator**
Volberg, O.; Ambrose, D. H.; 2005; 10 pp.; In English
Report No.(s): PB2005-106015; No Copyright; Avail: CASI; A02, Hardcopy

Motion capture involves recording the position and global orientation of joint sensors of a real object, in most cases a real person performing some human activities. This information is usually recorded at uniformly spaced instances of time, or as it is often called frame-by-frame. Then the recorded motion data sets are processed and mapped into a skeleton hierarchy of a virtual, computer simulated human figure to control the motion of the virtual human in the computer simulation. In the first part of the paper we review several new techniques developed to facilitate the manipulation, noise reduction, storage and reuse of captured data, which have a potential to reduce the overall cost of motion simulation and improve its realism.
NTIS
*Computerized Simulation; Control Simulation; Manual Control; Noise Reduction; Motion Simulation*

**20050177241** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Towards an Automated Development Methodology for Dependable Systems with Application to Sensor Networks**
Hinchey, Michael G.; Rash, James L.; Rouff, Christopher A.; [2005]; 7 pp.; In English; WSNIA: IEEE Workshop on Information Assurance in Wireless Sensors Networks, 7-9 Apr. 2005, Phoenix, AZ, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A general-purpose method to mechanically transform system requirements into a probably equivalent model has yet to appeal: Such a method represents a necessary step toward high-dependability system engineering for numerous possible application domains, including sensor networks and autonomous systems. Currently available tools and methods that start with a formal model of a system and mechanically produce a probably equivalent implementation are valuable but not su8cient. The 'gap' unfilled by such tools and methods is that their. formal models cannot be proven to be equivalent to the system requirements as originated by the customel: For the classes of systems whose behavior can be described as a finite (but significant) set of scenarios, we offer a method for mechanically transforming requirements (expressed in restricted natural language, or in other appropriate graphical notations) into a probably equivalent formal model that can be used as the basis for code generation and other transformations.
Author
*Autonomy; Domains; Natural Language (Computers); Systems Engineering; Proving*

## 60
## COMPUTER OPERATIONS AND HARDWARE

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

**20050173880** Defence Research and Development Canada, Valcartier, Quebec Canada
**Toward a Capability Engineering Process**
Lizotte, M.; Bernier, F.; Mokhtari, M.; Couture, M.; Dussault, G.; Lalancette, C.; Lemieux, F.; Lam, S.; Dec. 2004; 3 pp.; In English
Report No.(s): AD-A432358; No Copyright; Avail: Defense Technical Information Center (DTIC)

Defence R&D Canada is currently developing the Capability Engineering (CE) concept in order to close the gap between the Capability Based Planning (CBP) and the acquisition processes. This paper summarises results of initial investigations, which have created a good understanding of the problem, while raising many questions needing to be answered in developing a Capability Engineering Process (CEP).
DTIC
*Acquisition; Systems Engineering*

**20050177140** NASA Lewis Research Center, Cleveland, OH, USA
**Testing Efficiency Improved by Addition of Remote Access Control Room**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center's Remote Access Control Room (RACR) uses off-the-shelf video conferencing software integrated with existing facility data systems to provide access to the test data by networking from virtually anywhere in the country. The system allows research engineers in remote locations to participate in tests and monitor data in real time just as if they were present in the control room.
Derived from text
*Ground Based Control; Real Time Operation; Remote Control; Video Communication*

**20050177220** NASA Lewis Research Center, Cleveland, OH, USA, Syracuse Univ., NY, USA
**Wavelet Techniques Applied to Modeling Transitional/Turbulent Flows in Turbomachinery**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Computer simulation is an essential part of the design and development of jet engines for the aeropropulsion industry. Engineers concerned with calculating the flow in jet engine components, such as compressors and turbines, need simple engineering models that accurately describe the complex flow of air and gases and that allow them to quickly estimate loads, losses, temperatures, and other design parameters. In this ongoing collaborative project, advanced wavelet analysis techniques are being used to gain insight into the complex flow phenomena. These insights, which cannot be achieved by commonly used methods, are being used to develop innovative new flow models and to improve existing ones. Wavelet techniques are very suitable for analyzing the complex turbulent and transitional flows pervasive in jet engines. These flows are characterized by intermittency and a multitude of scales. Wavelet analysis results in information about these scales and their locations. The distribution of scales is equivalent to the frequency spectrum provided by commonly used Fourier analysis techniques; however, no localization information is provided by Fourier analysis. In addition, wavelet techniques allow conditional sampling analyses of the individual scales, which is not possible by Fourier methods.
Derived from text
*Computerized Simulation; Design Analysis; Engine Parts; Turbomachinery; Wavelet Analysis; Turbulent Flow*

## 61
## COMPUTER PROGRAMMING AND SOFTWARE

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

**20050173852** Massachusetts Inst. of Tech., Lexington, MA USA
**Supercomputing: HPCMP, Performance Measures and Opportunities**
Henry, Cray J.; Feb. 2005; 52 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432951; No Copyright; Avail: Defense Technical Information Center (DTIC)

Briefing charts only.
DTIC
*Computer Programming; Signal Processing; Software Engineering*

**20050173863** Massachusetts Inst. of Tech., Lexington, MA USA
**PMatlab Takes the HPCchallenge**
Haney, Ryan; Kim, Hahn; Funk, Andrew; Kepner, Jeremy; Rader, Charles; Reuther, Albert; Travinin, Nadya; Feb. 2005; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A432946; No Copyright; Avail: Defense Technical Information Center (DTIC)

The HPCchallenge benchmark suite has been released by the DARPA HPCS program to help define the performance boundaries of future Petascale computing systems. The suite is composed of several well known computational kernels (STREAM, Top500, FFT, and RandomAccess) that span high and low spatial and temporal locality. These kernels also encompass key aspects of embedded signal processing: vector computations, matrix multiplies, corner turns and random selection operations. MATLAB 2 is the primary high level language used within the signal processing community and is increasingly used for large system simulations and quickly processing data in the field. The pMatlab parallel MATLAB toolbox provides the necessary global array semantics to allow HPCchallenge to be implemented. The results provide a unique opportunity to probe both the relative (pMatlab vs. MATLAB) and absolute (pMatlab vs. C/ fortran+MPI) merits of pMatlab. Specifically, for each kernel in HPCchallenge we examine code size, maximum problem size, and performance. We find pMatlab code to be approximately 10x smaller than the equivalent C/MPI code. The problem sizes possible using pMatlab scale linearly with the number of processors (e.g. we are able to FFT a 2(exp 28) complex vector on 16 CPUS), and are comparable to the corresponding C/Fortran+MPI code. Finally, the scalability of the kernels approaches that of the C/Fortran+MPI code.
DTIC
*Computer Programs; Kernel Functions; Computer Programming*

**20050173865** Integrated Sensors, Inc., Utica, NY USA
**Parallel Matlab: RTExpress on 64-bit SGI Altix with SCSL and MPT**
Castellano, Cosmo; Feb. 2005; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A433010; No Copyright; Avail: Defense Technical Information Center (DTIC)
By late 2004 RTExpress(Trademark), a compiler and runtime environment that provides the capability for MATLAB (Registered) script files to be directly compiled and then executed on parallel high performance computers (HPC), will be released for the SGI platform, including the new Altix Itanium systems. 1 This new version of RTExpress(TradeMark) will take advantage of the SGI hardware and software package. specifically 64- bit operation, the SGI MPT (Message Passing Toolkit), the SGI SCSL (Scientific Computing Software Library), and is the first version of RTExpress(TradeMark) to utilize the advantages of a global shared-memory system. This paper presents the first test results using this new release. Improvement in corner-turn timing is anticipated due to the SGI numalink interconnect fabric. as compared to other interconnect technology common in Linux clusters, such as Ethernet. Up to an order of magnitude improvement in corner turn performance, and overall 2D FFT performance is expected.
DTIC
*Computer Programs; Unix (Operating System); Memory (Computers); Applications Programs (Computers)*

**20050173876** Army Research Lab., Aberdeen Proving Ground, MD USA
**Catching the Cyber Spy: ARL's Interrogator**
Long, Kerry S.; Dec. 2004; 3 pp.; In English
Report No.(s): AD-A432198; No Copyright; Avail: Defense Technical Information Center (DTIC)
The U.S. Army Research Laboratory has designed a network-based intrusion detection framework, Interrogator, which addresses the constantly changing threat environment that Department of Defense networks are already facing, while providing a frame work that encourages, further innovation in intrusion detection. In Interrogator, intrusion detection systems sensors, or Gators, are essentially dumb devices that monitor a network segment and transfer a subset of raw network traffic back to a central repository. Relevant network raw data can now easily be made available to both intrusion analysis and researchers for examination, experimentation, and development of better detection methods decoupled from the complexities of collecting the data.
DTIC
*Computer Networks; Data Acquisition; Warning Systems; Detection; Intrusion*

**20050173884** Naval Postgraduate School, Monterey, CA USA
**An Analysis of Disc Carving Techniques**
Mikus, Nicholas; Mar. 2005; 159 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432468; No Copyright; Avail: Defense Technical Information Center (DTIC)
Disc carving is an essential element of computer forensic analysis. However the high cost of commercial solutions coupled with the lack of availability of open source tools to perform disc analysis has become a hindrance to those performing analysis on UNIX computers. In addition even expensive commercial products offer only a fairly limited ability to 'carve' for

various files. In this thesis, an open source tool known as Foremost is modified in such a way as to address the need for such a carving tool in a UNIX environment. An implementation of various heuristics for recognizing file formats will be demonstrated as well as the ability to provide some file system specific support. As a result of these implementations a revision of Foremost will be provided that will be made available as an open source tool to aid analysts in their forensic investigations. DTIC

*Computer Techniques; Applications Programs (Computers); Unix (Operating System)*

**20050175750** Lunar and Planetary Inst., Houston, TX, USA

**Composition Determined by Linear Mixture Modeling Varies with the Lab Spectra Used**

Rodricks, N.; Greenhagen, B.; Kirkland, L.; Herr, K. C.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Linear mixture modeling is an analytical technique often used to determine the composition of materials measured using infrared spectroscopy. Concentrations of pure minerals can be estimated by comparing the observed spectral signature band depth to that of laboratory spectra of the same mineral. The method as used for Mars typically uses spectra measured of coarse particles. The abundance modeling then uses the assumption that the band depth measured of the field sample will be the same as the laboratory sample if the field target fills the field of view (100% coverage of the pixel). However, abundance is not the only variable in observed band depth: (1) abundance, (2) surface roughness, and (3) particle size all cause spectral band contrast variation. Here we illustrate the impact of ignoring effects 2 and 3 above on abundance models that are currently used for Mars. We use MiniTES analog data measured in the field at Mars spectral analog test sites.

Author

*Estimating; Field of View; Minerals; Spectral Signatures; Analog Data*

**20050177163** NASA Lewis Research Center, Cleveland, OH, USA

**pV3-Gold Visualization Environment for Computer Simulations**

Babrauckas, Theresa L.; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A new visualization environment, pV3-Gold, can be used during and after a computer simulation to extract and visualize the physical features in the results. This environment, which is an extension of the pV3 visualization environment developed at the Massachusetts Institute of Technology with guidance and support by researchers at the NASA Lewis Research Center, features many tools that allow users to display data in various ways.

Author

*Programming Environments; Scientific Visualization; Computerized Simulation*

**20050177197** NASA Lewis Research Center, Cleveland, OH, USA, Centric Engineering Systems, CA, USA, Allied-Signal Engines and Systems, Phoenix, AZ, USA

**Multiphysics Code Demonstrated for Propulsion Applications**

Lawrence, Charles; Melis, Matthew E.; Research and Technology 1997; April 1998; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The utility of multidisciplinary analysis tools for aeropropulsion applications is being investigated at the NASA Lewis Research Center. The goal of this project is to apply Spectrum, a multiphysics code developed by Centric Engineering Systems, Inc., to simulate multidisciplinary effects in turbomachinery components. Many engineering problems today involve detailed computer analyses to predict the thermal, aerodynamic, and structural response of a mechanical system as it undergoes service loading. Analysis of aerospace structures generally requires attention in all three disciplinary areas to adequately predict component service behavior, and in many cases, the results from one discipline substantially affect the outcome of the other two. There are numerous computer codes currently available in the engineering community to perform such analyses in each of these disciplines. Many of these codes are developed and used in-house by a given organization, and many are commercially available. However, few, if any, of these codes are designed specifically for multidisciplinary analyses. The Spectrum code has been developed for performing fully coupled fluid, thermal, and structural analyses on a mechanical system with a single simulation that accounts for all simultaneous interactions, thus eliminating the requirement for running a large number of sequential, separate, disciplinary analyses. The Spectrum code has a true multiphysics analysis capability, which improves analysis efficiency as well as accuracy. Centric Engineering, Inc., working with a team of Lewis and AlliedSignal Engines engineers, has been evaluating Spectrum for a variety of propulsion applications including disk quenching, drum

cavity flow, aeromechanical simulations, and a centrifugal compressor flow simulation.
Author
*Computer Programs; Turbomachinery; Computerized Simulation; Temperature Effects; Structural Analysis; Propulsion*

## 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.

**20050173841** Army War Coll., Carlisle Barracks, PA USA
**Network Enabled Operations in Operation Iraqi Freedom: Initial Impressions Issue Paper Volume 06-05, March 2005**
Murphy, Dennis; Mar. 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432457; No Copyright; Avail: Defense Technical Information Center (DTIC)

The first Gulf War was conducted with legacy systems straddling the industrial and emergent information age. The major combat operations phase of Operation Iraqi Freedom (OIF) on the other hand, put into practice information age constructs and theory for the first time in warfare and was an impressive success in its speed and lethality. The impact of that network enabled campaign (often referred to as Network Centric Warfare) is the topic of a study conducted by the Center for Strategic Leadership, U.S. Army War College and commissioned by the Office of Force Transformation, U.S. Department of Defense. The study will be completed by the fall of 2005, but first drafts of the study hint at valuable operational and strategic insights.
DTIC
*Electronic Warfare; Military Operations; Warfare*

**20050173878** Maryland Univ., College Park, MD USA
**Dynamic and Distributed Trust for Mobile Ad-Hoc Networks**
Baras, John S.; Jiang, Tao; Dec. 2004; 3 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0011
Report No.(s): AD-A432324; No Copyright; Avail: Defense Technical Information Center (DTIC)

Future battlefield networks will involve thousands of heterogeneous nodes operating under rapidly changing connectivity, and resource (bandwidth, energy, computation, etc.) constraints. Mobile Ad-hoc networks (MANET) form the basis for current and future military networks. Trust and trust establishment among communicating nodes (soldiers, vehicles, UAVs, satellites) and sensor nodes is the absolutely starting point for establishing any such network. The network management system needs to frequently validate trust, frequently defend against attacks, quickly isolate compromised nodes, and quickly establish trust in dynamically collaborating group (topology changes). In this paper we provide our solution to the problem of establishing and maintaining trust relations within a MANET, in a manner that satisfies both the dynamic and distributed constraints of the problem.
DTIC
*Communication Networks; Management Systems; Communicating*

**20050173882** Naval Postgraduate School, Monterey, CA USA
**Architectures for Device Aware Network**
Seah, Peng L.; Chung, Wai K.; Mar. 2005; 101 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432440; No Copyright; Avail: Defense Technical Information Center (DTIC)

In today's heterogeneous computing environment, a wide variety of computing devices with varying capabilities need to access information in the network. Existing network is not able to differentiate the different device capabilities, and indiscriminatingly send information to the end-devices, without regard to the ability of the end-devices to use the information. The goal of a device-aware network is to match the capability of the end-devices to the information delivered, thereby optimizing the network resource usage. In the battlefield, all resources-including time, network bandwidth and battery capacity are very limited. A device-aware network avoids the waste that happens in current, device-ignorant networks. By eliminating unusable traffic, a device-aware network reduces the time the end-devices spend receiving extraneous information, and thus saves time and conserves battery-life. In this thesis, we evaluated two potential DAN architectures, Proxy-based and Router-based approaches, based on the key requirements we identified. To demonstrate the viability of DAN, we built a prototype using a hybrid of the two architectures. The key elements of our prototype include a DAN browser, a DAN Lookup

Server and DAN Processing Unit (DPU). We have demonstrated how our architecture can enhance the overall network utility by ensuring that only appropriate content is delivered to the end-devices.
DTIC
*Display Devices; Architecture (Computers); Prototypes; Viability*

**20050173883** Naval Postgraduate School, Monterey, CA USA
**Remote Application Support in a Multilevel Environment**
Cooper, Robert C.; Mar. 2005; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432661; No Copyright; Avail: Defense Technical Information Center (DTIC)

The use of specialized single-level networks in current military operations is inadequate to meet the need to share information envisioned by the Global Information Grid (GIG). Multilevel security (MLS) is a key Information Assurance enabler for the GIG vision. The Monterey Security Architecture (MYSEA), a distributed MLS network, eliminates the need to use separate equipment to connect to many networks at different classification levels. It allows users to view data at different sensitivities simultaneously. MYSEA also allows commercial software and hardware to be used at clients. To address the threat of residual data on the client after a user session change in security state, the MYSEA clients are required to be 'stateless', i.e., there is no non-volatile writable memory. Hence the MYSEA server must provide the clients with the ability to execute server-resident client-side applications to access data at different security levels over the MLS Local Area Network (LAN). The MYSEA server currently does not support such capability. This thesis addresses this limitation. A new trusted process family is introduced to provide a pseudo-socket interface for the single level remote application to access the MLS LAN interface. Detailed design specifications were created to facilitate implementation of the remote application support.
DTIC
*Computer Information Security; Design Analysis; Classifications*

**20050175863** NASA Lewis Research Center, Cleveland, OH, USA
**Thermomechanical Property Data Base Developed for Ceramic Fibers**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A key to the successful application of metal and ceramic composite materials in advanced propulsion and power systems is the judicious selection of continuous-length fiber reinforcement. Appropriate fibers can provide these composites with the required thermomechanical performance. To aid in this selection, researchers at the NASA Lewis Research Center, using in-house state-of-the-art test facilities, developed an extensive data base of the deformation and fracture properties of commercial and developmental ceramic fibers at elevated temperatures. Lewis' experimental focus was primarily on fiber compositions based on silicon carbide or alumina because of their oxidation resistance, low density, and high modulus. Test approaches typically included tensile and flexural measurements on single fibers or on multifilament tow fibers in controlled environments of air or argon at temperatures from 800 to 1400 C. Some fiber specimens were pretreated at composite fabrication temperatures to simulate in situ composite conditions, whereas others were precoated with potential interphase and matrix materials.
Derived from text
*Ceramic Fibers; Composite Materials; Data Bases; High Temperature; Matrix Materials; Thermodynamics*

**20050176063** NASA Lewis Research Center, Cleveland, OH, USA
**NASA Lewis' IITA K-12 Program**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center's Information Infrastructure Technology and Applications for Kindergarten to 12th Grade (IITA K-12) Program is designed to introduce into school systems computing and communications technology that benefits math and science studies. By incorporating this technology into K-12 curriculums, we hope to increase the proficiency and interest in math and science subjects by K-12 students so that they continue to study technical subjects after their high school careers are over.
Author
*Technology Utilization; Computer Networks; Educational Resources; Internet Resources; Schools*

**20050176494** NASA Lewis Research Center, Cleveland, OH, USA, Akron Univ., Akron, OH, USA
**User Interface Developed for Controls/CFD Interdisciplinary Research**
Research and Technology 1995; March 1996; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Lewis Research Center, in conjunction with the University of Akron, is developing analytical methods and software tools to create a cross-discipline 'bridge' between controls and computational fluid dynamics (CFD) technologies. Traditionally, the controls analyst has used simulations based on large lumping techniques to generate low-order linear models convenient for designing propulsion system controls. For complex, high-speed vehicles such as the High Speed Civil Transport (HSCT), simulations based on CFD methods are required to capture the relevant flow physics. The use of CFD should also help reduce the development time and costs associated with experimentally tuning the control system. The initial application for this research is the High Speed Civil Transport inlet control problem. A major aspect of this research is the development of a controls/CFD interface for non-CFD experts, to facilitate the interactive operation of CFD simulations and the extraction of reduced-order, time-accurate models from CFD results. A distributed computing approach for implementing the interface is being explored. Software being developed as part of the Integrated CFD and Experiments (ICE) project provides the basis for the operating environment, including run-time displays and information (data base) management. Message-passing software is used to communicate between the ICE system and the CFD simulation, which can reside on distributed, parallel computing systems. Initially, the one-dimensional Large-Perturbation Inlet (LAPIN) code is being used to simulate a High Speed Civil Transport type inlet. LAPIN can model real supersonic inlet features, including bleeds, bypasses, and variable geometry, such as translating or variable-ramp-angle centerbodies. Work is in progress to use parallel versions of the multidimensional NPARC code.

Derived from text

*Computational Fluid Dynamics; Computer Programs; Control Theory; Human-Computer Interface*

## 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*.

**20050173839** Space and Naval Warfare Systems Command, San Diego, CA USA

**ThrowBot: Design Considerations for a Man-Portable Throwable Robot**

Barnes, Mitch; Everett, H. R.; Rudakevych, Pavlo; Jan. 2005; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A432380; No Copyright; Avail: Defense Technical Information Center (DTIC)

The pocket-sized ThrowBot is a sub-kilogram-class robot that provides short-range remote eyes and ears for urban combat. This paper provides an overview of lessons learned from experience testing and evaluation of the iRobot ThrowBot developed under the Defense Advanced Research Projects Agency (DARPA) Tactical Mobile Robots (TMR) program. Emphasis has been placed on investigating requirements for the next generation of ThrowBots to be developed by iRobot Corporation and SPAWAR Systems Center San Diego (SSC San Diego) Unmanned Systems Branch. Details on recent evaluation activities performed at the Military Operations in Urban Terrain (MOUT) test site at Fort Benning, GA, are included, along with insights obtained throughout the development of the ThrowBot since its inception in 1999 as part of the TMR program.

DTIC

*Portable Equipment; Robotics; Robots; Warfare*

## 64
## NUMERICAL ANALYSIS

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

**20050175858** NASA Glenn Research Center, Cleveland, OH, USA

**Explicit Von Neumann Stability Conditions for the c-tau Scheme: A Basic Scheme in the Development of the CE-SE Courant Number Insensitive Schemes**

Chang, Sin-Chung; April 2005; 84 pp.; In English

Contract(s)/Grant(s): WBS 22-781-30-69

Report No.(s): NASA/TM-2005-213627; E-14371; No Copyright; Avail: CASI; A05, Hardcopy

As part of the continuous development of the space-time conservation element and solution element (CE-SE) method, recently a set of so called 'Courant number insensitive schemes' has been proposed. The key advantage of these new schemes is that the numerical dissipation associated with them generally does not increase as the Courant number decreases. As such,

they can be applied to problems with large Courant number disparities (such as what commonly occurs in Navier-Stokes problems) without incurring excessive numerical dissipation.
NASA
*Dimensionless Numbers; Neumann Problem; Space-Time Ce/Se Method; Computational Fluid Dynamics*

## 65
## STATISTICS AND PROBABILITY

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

**20050175804** Ohio State Univ., Columbus, OH, USA
**Visualizing Time-Varying Distribution Data in EOS Application**
Shen, Han-Wei; Data Science Journal; December 02, 2004; Volume 3, pp. 135-144; In English
Contract(s)/Grant(s): NCC2-1261; Copyright; Avail: CASI; A02, Hardcopy

In this research, we have developed several novel visualization methods for spatial probability density function data. Our focus has been on 2D spatial datasets, where each pixel is a random variable, and has multiple samples which are the results of experiments on that random variable. We developed novel clustering algorithms as a means to reduce the information contained in these datasets; and investigated different ways of interpreting and clustering the data.
Derived from text
*Algorithms; Cluster Analysis; Time; Variations; Probability Density Functions*

**20050177237** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**A Posteriori Correction of Forecast and Observation Error Variances**
Rukhovets, Leonid; [2005]; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-00167; No Copyright; Avail: CASI; A02, Hardcopy

Proposed method of total observation and forecast error variance correction is based on the assumption about normal distribution of 'observed-minus-forecast' residuals (O-F), where O is an observed value and F is usually a short-term model forecast. This assumption can be accepted for several types of observations (except humidity) which are not grossly in error. Degree of nearness to normal distribution can be estimated by the symmetry or skewness (luck of symmetry) a(sub 3) = mu(sub 3)/sigma(sup 3) and kurtosis a(sub 4) = mu(sub 4)/sigma(sup 4) - 3 Here mu(sub i) = i-order moment, sigma is a standard deviation. It is well known that for normal distribution a(sub 3) = a(sub 4) = 0.
Author
*Error Analysis; Forecasting; Variance (Statistics); Normal Density Functions; Data Products*

## 66
## SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

**20050174535** Department of Energy, Pittsburgh, PA, USA
**Guidance Sensor for Continuous Mine Haulage**
Sammarco, J. J.; 1996; 12 pp.; In English
Report No.(s): PB2005-105980; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Bureau of Labor Statistics reports that the mining industry has the highest average annual fatality rate (31.9 per 100,000 workers) among all major American industry. To address this, a major research program to reduce hazard exposure of miners with computer-assisted mining equipment was initiated by the U.S. Bureau of Mines. One application involves the manual process of extracting and hauling coal where operators, in the tight confines of a mine, can be struck or caught by mobile machinery. The approach to remedy this problem uses a guidance system on the haulage equipment so that it follows the machine that extracts coal. This, in essence, involves sensor-based docking of the machines. Sensors that can survive the hostile mine environment of dust, methane gas, and water, play the key role. Computer analysis of the mining machine's movements and empirical machine characterizations were conducted to establish operating requirements and spatial limitations to ensure proper loading of coal into the haulage equipment. These data served in the selection of a sensing system.
NTIS
*Automatic Control; Sensors; Detection*

## 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*.

**20050174524** Rutherford Appleton Lab., Chilton

**Use of Fluorinated Mica as a Crystal Analyser on IRIS**

Adams, M. A.; Fernandez-Alonso, F.; Maxwell, D. T.; Vine, J.; Abbley, D. D.; Dec. 13, 2004; 32 pp.; In English

Report No.(s): PB2005-103030; RAL-TR-2004-022; Copyright; Avail: National Technical Information Service (NTIS)

The potential use of a synthetic fluorinated mica, fluorophlogopite, as an analyzer crystal on the high resolution inelastic neutron scattering spectrometer IRIS has been investigated. In-situ measurements on IRIS and single crystal diffraction measurements at the Paul Scherrer Institute in Switzerland have been made in order to charactetrize this material. A direct comparison with the muscovite mica currently in use on IRIS shows that the fluorophlogopite is superior both in terms of reflected intensity and signal-background.

NTIS

*Mica; Inelastic Scattering; Single Crystals*

**20050174525** Rutherford Appleton Lab., Chilton

**Prototype 2-D GMSD Based Imaging Detector for X-rays**

Bateman, J. E.; Derbyshire, D. E.; Duxbury, D. M.; Rhodes, N. J.; Nov. 19, 2004; 22 pp.; In English

Report No.(s): PB2005-103031; RAL-TR-2004-027; Copyright; Avail: National Technical Information Service (NTIS)

The development and testing of a 2-D prototype detector based on a gas micro strip detector (GMSD) is reported. The second spatial co-ordinate is obtained by utilizing a plane of orthogonal wires as pick up electrodes. The detector is operated with the wire plane at such a potential so as not to induce any gain around the wires. This means that the high tolerances normally associated with wire planes in Multi-Wire Proportional Counters are not necessary, making the manufacture and repair of such a device relatively easier. The detector comprises of 48 individually instrumented channels in both X (GMSD strips) and Y (transverse wire plane). A specially designed encoding module has been constructed which feeds digital addresses for each event to the ISIS data taking electronics system (DAE). An intrinsic detector resolution of approximately 0.5 mm FWHM has been measured for both dimensions which is degraded slightly by the digital resolution for the overall system. This readout method is shown to be very tolerant of a poor signal to noise ratio in the readout channels (unlike traditional analogue wire chamber readout systems) and permits the operation of the GMSD at moderate avalanche gains (approximately 1,000). This helps to maximize the rate and lifetime performance of the detector as well as permitting data capture rates in the MHz range.

NTIS

*X Rays; Gas Detectors; Imaging Techniques*

**20050174526** Rutherford Appleton Lab., Chilton

**Prototype 2-D GMSD Based Imaging Detector for Neutrons**

Bateman, J. E.; Derbyshire, G. E.; Duxbury, D. M.; Marsh, A. S.; Rhodes, N. J.; Dec. 09, 2004; 22 pp.; In English

Report No.(s): PB2005-103032; RAL-TR-2004-028; Copyright; Avail: National Technical Information Service (NTIS)

The development and testing of a 2-D prototype detector based on a gas micro strip detector (GMSD) is reported. The second spatial co-ordinate is obtained by utilizing a plane of orthogonal wires as pick up electrodes. The detector is operated with the wire plane at such a potential so as not to induce any gain around the wires. This means that the high tolerances normally associated with wire planes in Multi-Wire Proportional Counters are not necessary, making the manufacture and repair of such a device relatively easier. The detector comprises of 48 individually instrumented channels in both X (GMSD strips) and Y (transverse wire plane). A specially designed encoding module has been constructed which feeds digital addresses for each event to the ISIS data taking electronics system (DAE). An intrinsic detector resolution of approximately 0.5 mm FWHM has been measured for both dimensions which is degraded slightly by the digital resolution for the overall system. This readout method is shown to be very tolerant of a poor signal to noise ratio in the readout channels (unlike traditional analogue wire chamber readout systems) and permits the operation of the GMSD at moderate avalanche gains (approximately 1,000).

This helps to maximize the rate and lifetime performance of the detector as well as permitting data capture rates in the MHz range.
NTIS
*Neutrons; Imaging Techniques; Gas Detectors*

**20050174553** STI Optronics, Inc., Bellevue, WA, USA, Brookhaven National Lab., Upton, NY, California Univ., Los Angeles, CA, USA, Stanford Univ., Stanford, CA
**Model Comparisons with STELLA Experimental Results**
Kimura, W. D.; Babzien, M.; Ben-Zvi, I.; Campbell, L. C.; Cline, D. B.; Sep. 2004; 14 pp.; In English
Report No.(s): DE2004-15009930; BNL-73205-2004; No Copyright; Avail: Department of Energy Information Bridge

High-trapping efficiency and narrow energy spread in a staged laser acceleration system was demonstrated during the Staged Electron Laser Acceleration (STELLA) experiment. The experiment used inverse free electron lasers (IFEL) driven by the Brookhaven National Laboratory Accelerator Test Facility (ATF) CO(sub 2) laser. The 1st IFEL modulated the electron beam energy. A subsequent chicane created a train of (approx.) 3 fs-long microbunches separated by 10.6 microns. These microbunches are trapped and accelerated in a 2nd IFEL where up to 80% trapping efficiencies and energy spreads down to 0.36% (1-(delta)) were measured. This paper presents additional model comparisons with the data, and discusses the strengths and limitations of the model.
NTIS
*Electron Acceleration; Electron Beams; Free Electron Lasers*

**20050174554** Brookhaven National Lab., Upton, NY, USA, Tokyo Metropolitan Univ., Tokyo, Japan, Hebrew Univ. of Jerusalem, Rehovot, Israel
**Experiments on Laser and e-Beam Transport and Interaction in a Plasma Channel**
Pogorelsky, I. V.; Pavlishin, I. V.; Ben-Zvi, I.; Yakimenko, V.; Kumita, T.; Sep. 2004; 14 pp.; In English
Report No.(s): DE2004-15009932; BNL-73207-2004-CP; No Copyright; Avail: Department of Energy Information Bridge

An ablative capillary discharge is installed into a linac beamline and serves as a plasma source for generating and characterizing wakefields. Simultaneously, the electron beam is used as a tool for plasma diagnostics. A high-energy picosecond CO(sub 2) laser channeled within the same capillary strongly affects a counterpropagating electron beam. These observations, supported with simulations, suggest the possibility of manipulating relativistic electron beams by steep plasma channels ponderomotively produced by a laser.
NTIS
*Linear Accelerators; Lasers*

**20050174556** STI Optronics, Inc., Bellevue, WA, USA, Brookhaven National Lab., Upton, NY, California Univ., Los Angeles, CA, USA, Academy of Sciences (Russia), Moscow, Russia
**Laser Wakefield Acceleration Driven by ATF CO(sub 2) Laser (STELLA-LW)**
Kimura, W. D.; Andreev, N. E.; Babzien, M.; Ben-Zvi, I.; Cline, D. B.; 2004; 14 pp.; In English
Report No.(s): DE2004-15009933; BNL-73208; No Copyright; Avail: Department of Energy Information Bridge

A new experiment has begun that builds upon the successful Staged Electron Laser Acceleration (STELLA) experiment, which demonstrated high-trapping efficiency and narrow energy spread in a staged laser-driven accelerator. STELLA was based upon inverse free electron lasers (IFEL); the new experiment, called STELLA-LW, is based upon laser wakefield acceleration (LWFA). The first phase of STELLA-LW will be to demonstrate LWFA in a capillary discharge driven by the Brookhaven National Laboratory Accelerator Test Facility (ATF) terawatt CO(sub 2) laser beam. This will be the first time LWFA is conducted at 10.6-(micro)m laser wavelength. It will also be operating in an interesting pseudo-resonant regime where the laser pulse length is too long for resonant LWFA, but too short for self-modulated LWFA. Analysis has shown that in pseudo-resonant LWFA, pulse-steepening effects occur on the laser pulse that permits generation of strong wakefields. Various approaches are being explored for the capillary discharge including polypropylene and hydrogen-filled capillaries. Planned diagnostics for the experiment include coherent Thomson scattering (CTS) to detect the wakefield generation.
NTIS
*Electron Acceleration; Lasers*

**20050174557** Brookhaven National Lab., Upton, NY

**Scientific Presentations 10th Meeting of the Management Steering Committee of the RIKEN BNL Collaboration**

2004; 324 pp.; In English; Scientific Presentations 10th Meeting of the Management Steering Committee of the RIKEN BNL Collaboration, March 25 - 26, 2004, Wako, Japan

Report No.(s): DE2004-15009951; BNL-73171-2004; No Copyright; Avail: Department of Energy Information Bridge

This program documents the scientific presentations on the 10th meeting of the management steering committee of the Ripken Brookhaven National Laboratory collaboration.

NTIS

*Accelerators; Conferences*

**20050174725** Los Alamos National Lab., NM

**Fission Spectrum**

Bloch, F.; Staub, H.; Aug. 18, 1943; 80 pp.; In English

Report No.(s): DE2004-4408656; No Copyright; Avail: Department of Energy Information Bridge

Measurements of the spectrum of the fission neutrons of 25 are described, in which the energy of the neutrons is determined from the ionization produced by individual hydrogen recoils. The slow neutrons producing fission are obtained by slowing down the fast neutrons from the Be-D reaction of the Stanford cyclotron. In order to distinguish between fission neutrons and the remaining fast cyclotron neutrons both the cyclotron current and the pulse amplifier are modulated. A hollow neutron container, in which slow neutrons have a lifetime of about 2 milliseconds, avoids the use of large distances. This method results in much higher intensities than the usual modulation arrangement. The results show a continuous distribution of neutrons with a rather wide maximum at about 0.8 MV falling off to half of its maximum value at 2.0 MV. The total number of neutrons is determined by comparison with the number of fission fragments. The result seems to indicate that only about 30% of the neutrons have energies below .8 MV. Various tests are described which were performed in order to rule out modification of the spectrum by inelastic scattering.

NTIS

*Fission; Neutron Spectra*

**20050175619** Brookhaven National Lab., Upton, NY

**Search for the Dirac Monopole with 30-Bev Protons**

Purcell, E. M.; Collins, G. B.; Fujii, T.; Hornbostel, J.; Turkot, F.; 2004; 46 pp.; In English

Report No.(s): DE2004-4737493; BNL-6506; No Copyright; Avail: Department of Energy Information Bridge

A search was made at the Brookhaven alternating gradient synchrotron for magnetic monopoles produced either in collisions of 30-Bev protons with light nuclei, or produced by gamma rays secondary to these protons in the Coulomb field of protons or of carbon nuclei. In runs using 5 7 x 10/sup 15/ circulating protons, no monopole-like event was found. This implies an upper limit for production in protonnucleon interactions of about 2 x 10/sup -40/ cm/sup 2/. Experimental limits are also derived for the photoproduction of pole pairs.

NTIS

*Protons; Monopoles; Synchrotrons; Magnetic Monopoles*

**20050175622** Brookhaven National Lab., Upton, NY

**Acceleration of Polarized Protons to High Energy**

Roser, T.; Apr. 1999; 11 pp.; In English

Report No.(s): DE2004-770761; BNL-65932; No Copyright; Avail: Department of Energy Information Bridge

High energy polarized beam collisions will open up the unique physics opportunities of studying spin effects in hard processes. However, the acceleration of polarized beams in circular accelerators is complicated by the numerous depolarizing spin resonances. Using a partial Siberian Snake and a rf dipole that ensure stable adiabatic spin motion during acceleration has made it possible to accelerate polarized protons to 25 GeV at the Brookhaven AGS. Full Siberian Snakes and polarimeters are being developed for RHIC to make the acceleration of polarized protons to 250 GeV possible. A similar scheme is being studied for the 800 GeV HERA proton accelerator.

NTIS

*Polarized Radiation; Radio Frequencies; Collisions; Polarimeters*

**20050175623** Brookhaven National Lab., Upton, NY, Kyoto Univ., Japan
**Barrier Cavities in the Brookhaven AGS**
Blaskiewicz, M.; Spitz, R.; Brennan, J. M.; Roser, T.; 2004; 10 pp.; In English
Report No.(s): DE2004-770763; BNL-65934; No Copyright; Avail: Department of Energy Information Bridge
In collaboration with KEK two barrier cavities, each generating 40 kV per turn have been installed in the Brookhaven AGS. Machine studies are described and their implications for high intensity operations are discussed.
NTIS
*Cavities; Computers*

**20050175625** Brookhaven National Lab., Upton, NY, FMC Corp., Princeton, NJ, USA
**Studies on Relationship Between Structure of Over-Charge State and Thermal Stability for LiNiO(sub 2) Based Cathode Materials**
Sun, X.; Yang, X.; McBreen, J.; Gao, Y.; 2000; 18 pp.; In English
Report No.(s): DE2004-770786; BNL-66573; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
*X Ray Diffraction; Cathodes; Charged Particles; Cathodic Coatings*

**20050175626** Brookhaven National Lab., Upton, NY, Kyoto Univ., Japan, New Mexico Univ., Albuquerque, NM, USA, Argonne National Lab., IL
**P-Carbon CNI Polarimeter for RHIC**
Huang, H.; Bai, M.; Bunce, G.; Makdisi, Y.; Roser, T.; 2000; 10 pp.; In English
Report No.(s): DE2004-770757; BNL-65922; No Copyright; Avail: Department of Energy Information Bridge
The RHIC spin program requires excellent polarimetry so that the knowledge of the beam polarization does not limit the errors on the experimental measurements. However, polarimetry of proton beams with energies higher than about 30 GeV poses a difficult challenge. For polarization monitoring during operation, a fast and reliable polarimeter is required that produces a polarization measurement with a 10% relative error within a few minutes. The p-Carbon elastic scattering in the Coulomb-Nuclear-Scattering (CNI) region has a calculable and large analyzing power, but detecting the recoil carbon needs sophisticated detector system and a very thin target. Experiment has been planned in the AGS. This paper describes the experimental setup in the AGS.
NTIS
*Polarimetry; Polarization; Measurement*

**20050175629** Brookhaven National Lab., Upton, NY, California Univ., Davis, CA, USA
**Charge Transport in Synthetic Metals**
Emery, V. J.; Kivelson, S. A.; Muthukumar, V. N.; 1999; 14 pp.; In English
Report No.(s): DE2004-770792; BNL-66179; No Copyright; Avail: Department of Energy Information Bridge
The phenomenology of charge transport in synthetic metals is reviewed. It is argued that the conventional quasiparticle picture and Boltzmann transport theory do not apply to these materials. The central ideas of Fermi liquid theory are reviewed, and the significant corrections produced by quasiparticle scattering from ferromagnetic spin fluctuations in liquid (sup 3)He are described. It is shown that Sr(sub 2)RuO(sub 4) does not display the symptoms of a nearly-ferromagnetic Fermi liquid, so the source of its odd angular momentum pairing remains to be understood. The solution of an assisted-tunneling model of charge transport in quasi-one dimensional materials is described. This model has a quantum critical point and gives a resistivity that is linear in temperature or frequency, whichever is greater.
NTIS
*Synthetic Metals; Charge Transfer; Phenomenology*

**20050175632** Brookhaven National Lab., Upton, NY, California Univ., Los Angeles, CA, USA
**Local Electronic Structure and High Temperature Superconductivity**
Emergy, V. J.; Kivelson, S. A.; 2004; 14 pp.; In English
Report No.(s): DE2004-770808; BNL-66291; No Copyright; Avail: Department of Energy Information Bridge
It is argued that a new mechanism and many-body theory of superconductivity are required for doped correlated

insulators. Here they review the essential features of and the experimental support for such a theory, in which the physics is driven by the kinetic energy.
NTIS
*Electronic Structure; High Temperature; Superconductivity*

**20050175633** Brookhaven National Lab., Upton, NY, California Univ., Los Angeles, CA, USA, Stanford Univ., Stanford, CA
**STELLA Experiment: Design and Model Predictions**
Kimura, W. D.; Fiorito, R. B.; Babzien, M.; Gallardo, J. C.; Robinson, K. E.; Jul. 1998; 18 pp.; In English
Report No.(s): DE2004-770809; BNL-66297; No Copyright; Avail: Department of Energy Information Bridge

The STaged ELectron Laser Acceleration (STELLA) experiment will be one of the first to examine the critical issue of staging the laser acceleration process. The BNL inverse free electron laser (EEL) will serve as a prebuncher to generate (approx) 1 (micro)m long microbunches. These microbunches will be accelerated by an inverse Cerenkov acceleration (ICA) stage. A comprehensive model of the STELLA experiment is described. This model includes the EEL prebunching, drift and focusing of the microbunches into the ICA stage, and their subsequent acceleration. The model predictions will be presented including the results of a system error study to determine the sensitivity to uncertainties in various system parameters.
NTIS
*Electron Acceleration; Free Electron Lasers; Electron Bunching*

**20050175634** Brookhaven National Lab., Upton, NY, USA
**Solenoid Capture System for Neutrino Production**
Diwan, M.; Kahn, S.; Palmer, R. B.; Jan. 1999; 10 pp.; In English
Report No.(s): DE2004-770906; BNL-66303; No Copyright; Avail: Department of Energy Information Bridge

This paper describes the use of a high field solenoidal magnet to capture secondary pions from the production target. The captured pions subsequentially decay to produce the neutrino beam. A pion capture system using a high field solenoid magnet has been proposed for the muon collider. This technology would also be available for neutrino beam production. It will be shown that a high field solenoid would produce a larger flux of neutrinos with energy, E(sub (nu)) \h 1.3 GeV, than a neutrino beam produced with a horn system. (nu)(sub e), (bar (nu))(sub e) flux contamination in the solenoid neutrino beam is only 0.15%.
NTIS
*Neutrino Beams; Solenoids*

**20050175635** Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
**Review of Alignment Activities at Jefferson Lab**
Curtis, C. J.; 2004; 12 pp.; In English
Report No.(s): DE2004-834539; No Copyright; Avail: Department of Energy Information Bridge

The Thomas Jefferson National Accelerator Facility (Jefferson Lab) comprises a 5 GeV continuous electron beam accelerator (CEBAF) delivering beam to three experimental halls, and a kilowatt range tunable free electron laser (FEL), currently being upgraded to a 10 kW machine. The progression into steady state experimental runs at the facility has allowed the alignment group the opportunity to incorporate new developments into the alignment system. Two of these are discussed, together with some of the more unusual (e.g. gyrotheodolite survey) and the more routine surveys performed at the lab over the last three years.
NTIS
*Linear Accelerators; Steady State; Tunable Lasers; Alignment*

**20050177227** NASA Lewis Research Center, Cleveland, OH, USA
**Physics of Hard Spheres Experiment (PhaSE) or 'Making Jello in Space'**
Ling, Jerri S.; Doherty, Michael P.; Research and Technology 1997; April 1998; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Physics of Hard Spheres Experiment (PHaSE) is a highly successful experiment that flew aboard two shuttle missions to study the transitions involved in the formation of jellolike colloidal crystals in a microgravity environment. A colloidal suspension, or colloid, consists of fine particles, often having complex interactions, suspended in a liquid. Paint, ink, and milk are examples of colloids found in everyday life. In low Earth orbit, the effective force of gravity is thousands of times less

than at the Earth's surface. This provides researchers a way to conduct experiments that cannot be adequately performed in an Earth-gravity environment. In microgravity, colloidal particles freely interact without the complications of settling that occur in normal gravity on Earth. If the particle interactions within these colloidal suspensions could be predicted and accurately modeled, they could provide the key to understanding fundamental problems in condensed matter physics and could help make possible the development of wonderful new 'designer' materials. Industries that make semiconductors, electro-optics, ceramics, and composites are just a few that may benefit from this knowledge. Atomic interactions determine the physical properties (e.g., weight, color, and hardness) of ordinary matter. PHaSE uses colloidal suspensions of microscopic solid plastic spheres to model the behavior of atomic interactions. When uniformly sized hard spheres suspended in a fluid reach a certain concentration (volume fraction), the particle-fluid mixture changes from a disordered fluid state, in which the spheres are randomly organized, to an ordered 'crystalline' state, in which they are structured periodically. The thermal energy of the spheres causes them to form ordered arrays, analogous to crystals. Seven of the eight PHaSE samples ranged in volume fraction from 0.483 to 0.624 to cover the range of interest, while one sample, having a concentration of 0.019, was included for instrument calibration.

Author

*Spheres; Space Shuttle Missions; Colloids; Crystals; Condensed Matter Physics; Particle Interactions; Atomic Interactions*

## 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 and Power*.

**20050177152** NASA Lewis Research Center, Cleveland, OH, USA

**Manipulating Liquids with Acoustic Radiation Pressure**

Oeftering, Richard C.; Research and Technology 1996; March 1997; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

At the NASA Lewis Research Center, high-intensity ultrasound is being used to create acoustic radiation pressure (ARP) on objects in liquids. It is also being used to create liquid currents or jets called acoustic streaming. NASA's interest in ARP includes remote-control agitation of liquid systems in space, such as in liquid space experiments and liquid propellant tanks. It can be used to eject or deploy droplets for droplet physics or droplet combustion experiments. It can also be used to manipulate bubbles, drops, and surfaces suspended in liquid experiments and propellant systems.

Author

*Sound Pressure; Liquids; Ultrasonic Processing; Agitation*

**20050177168** NASA Lewis Research Center, Cleveland, OH, USA

**Minimum Climb to Cruise Noise Trajectories Modeled for the High Speed Civil Transport**

Berton, Jeffrey J.; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The proposed U.S. High Speed Civil Transport (HSCT) will revolutionize commercial air travel by providing economical supersonic passenger service to destinations worldwide. Unlike the high-bypass turbofan engines that propel today's subsonic airliners, HSCT engines will have much higher jet exhaust speeds. Jet noise, caused by the turbulent mixing of high-speed exhaust with the surrounding air, poses a significant challenge for HSCT engine designers. To resolve this challenge, engineers have designed advanced mixer rejector nozzles that reduce HSCT jet noise to airport noise certification levels by entraining and mixing large quantities of ambient air with the engines' jet streams. Although this works well during the first several minutes of flight, far away from the airport, as the HSCT gains speed and climbs, poor ejector inlet recovery and ejector ram drag contribute to poor thrust, making it advantageous to turn off the ejector. Doing so prematurely, however, can cause unacceptable noise levels to propagate to the ground, even when the aircraft is many miles from the airport. This situation lends itself ideally to optimization, where the aircraft trajectory, throttle setting, and ejector setting can be varied (subject to practical aircraft constraints) to minimize the noise propagated to the ground. A method was developed at the NASA Lewis Research Center that employs a variation of the classic energy state approximation: a trajectory analysis technique historically used to minimize climb time or fuel burned in many aircraft problems. To minimize the noise on the ground at any given throttle setting, high aircraft altitudes are desirable; but the HSCT may either climb quickly to high altitudes using a high, noisy throttle setting or climb more slowly at a lower, quieter throttle setting. An optimizer has been programmed into NASA's existing aircraft and noise analysis codes to balance these options by dynamically choosing the best altitude-velocity path and throttle setting history. The noise level standard, or metric, used in the optimizer should be one that accurately reflects the

subjective annoyance levels of ground-based observers under the flight path. A variety of noise metrics are available, many of which are practical for airport-vicinity noise certification. Unlike airport noise, however, the HSCT's climb noise will be characterized by relatively low noise levels, long durations, and low-frequency spectra. The noise metrics used in these calculations are based on the recommendations of researchers at the NASA Langley Research Center, who have correlated the flyover noise annoyance levels of actual laboratory subjects with a variety of measurements. Analysis of data from this optimizer has shown that significant reductions in noise may be obtained with trajectory optimization. And since throttling operations are performed in the subsonic portion of the climb path (where thrust is plentiful), only small penalties in HSCT range or fuel performance occur.
Author
*Civil Aviation; Climbing Flight; High Speed; Jet Aircraft Noise; Cruising Flight; Models; Trajectory Optimization*

**20050177229** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Thermal Noise Limit in Frequency Stabilization of Lasers with Rigid Cavities**
Numata, Kenji; Kemery, Amy; Camp, Jordan; [2005]; 1 pp.; In English; 6th Edoardo Amaldi Conference on Gravitational Waves, 20-24 Jun. 2005, Okinawa, Japan; No Copyright; Avail: Other Sources; Abstract Only

We evaluated thermal noise (Brownian motion) in a rigid reference cavity Used for frequency stabilization of lasers, based on the mechanical loss of cavity materials and the numerical analysis of the mirror-spacer mechanics with the direct application of the fluctuation dissipation theorem. This noise sets a fundamental limit for the frequency stability achieved with a rigid frequency-reference cavity of order 1 Hz/rtHz at 10mHz at room temperature. This level coincides with the world-highest level stabilization results.
Author
*Cavities; Frequency Stability; Lasers; Thermal Noise; Rigidity*

## 74
## OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

**20050173962** Hamilton Sundstrand Sensor Systems, Pomona, CA, USA
**Wide Field Imaging Spectrometer (WFIS): Instrument Design and First Field Tests**
Pollock, H. R.; Haring, R. E.; Sutin, B.; Mustard, J.; Boardman, J.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

WFIS is a new instrument concept that provides hyperspectral images with a compact system. WFIS is an all-reflective, wide-field-of-view imaging spectrometer [1]. WFIS was originally developed for high spectral resolution Earth science applications associated with atmospheric monitoring, but also works will in near-field applications (e.g. planetary landers). A flight-like opto-mechanical WFIS engineering model was constructed and has been used to demonstrate data collection techniques and to provide representative data for simulations for future applications.
Derived from text
*Field of View; Imaging Spectrometers; Spectral Resolution; Environmental Monitoring; Data Acquisition; Data Simulation*

**20050176503** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Seven Experiments to Test the Local Lorentz Invariance of c**
Gezari, Daniel Y.; [2005]; 16 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

The speed of light has never been measured directly with a moving detector to test the fundamental assertion of special relativity that c is invariant to motion of the observer. Seven simple experiments are proposed, four of which could test the invariance of c to motion of the detector. Three other observations of moving sources could test Einstein s second postulate and the relativity of stellar aberration. There are lingering concerns that the speed of light may depend on the motion of the observer, after all. This issue can now be resolved by experiment.
Author
*Lorentz Transformations; Relativity; Light (Visible Radiation)*

**20050177119** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA

**Laser Ignition of Flammable Gas**

Dubaniewicz, T. H.; Cashdollar, K. L.; Monaghan, W. D.; 2005; 14 pp.; In English; International Laser Safety Conference (ILSC'99), Orlando, FL, March 8-11, 1999

Report No.(s): PB2005-106010; No Copyright; Avail: CASI; A03, Hardcopy

In underground coal mines, lasers are being considered for remote measurement of explosive methane gas. Current federal safety regulations for underground mines contain no specific guidelines for evaluating the safety of optoelectronic components such as diode lasers. The National Institute for Occupational Safety and Health (NIOSH) is conducting research to help provide a scientific basis for developing appropriate safety guidelines for optical equipment in the presence of flammable methane gas and/ or coal dust. One phase of the study is an experimental evaluation of methane-air ignition by laser heated small particles. Minimum observed igniting powers for energy delivered by 200, 400, and 800 micrometer core diameter fiber-optic cables and directed onto selected targets in methane-air atmospheres were 0.6. 1.1, and 2.2 W., respectively. Comparisons are made with other ignition phenomena, including heated wires.

NTIS

*Lasers; Ignition; Flammable Gases; Laser Heating; Mines (Excavations)*

**20050177129** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA, Bureau of Mines, Pittsburgh, PA, USA

**Ignition Tests with a Fiber-Optic Powered Instrument**

Dubaniewicz, T. H.; Cashdollar, K. L.; Cucci, G. R.; 2005; 14 pp.; In English

Report No.(s): PB2005-106003; No Copyright; Avail: CASI; A03, Hardcopy

New types of industrial instruments use fiber-coupled laser energy to power remote sensors. Fiber-optic based instruments are used in classified (hazardous) locations found in many industrial plants because the fiber provides a natural barrier against accidental electrical discharge into potentially explosive atmospheres. However, current safety standards do not cover the use of laser-powered fiber optic instruments in potentially explosive environments such as found in coal mines. The U.S. Bureau of Mines began an invesitgation of laser-powered fiber-optic instruments in explosive atmospheres in support of the standards-making process. A commercial fiber-optic interface system, modified to simulate several worst-case operating conditions, ignited explosive hydrogen-air mixtures. Worst-case simulations consisted of disabling a safety shutoff feature, operating the laser at significantly higher powers than intended for normal operations, and cleaving fiber-optic connections to direct laser energy onto selected absorptive materials. At the highest level available, the fiber-optic interface system did not ignite selected methane-air mixtures. The obtained data should prove useful in establishing appropriate safety standards.

NTIS

*Fiber Optics; Ignition; Laser Outputs*

**20050177192** NASA Lewis Research Center, Cleveland, OH, USA

**Time-Resolved Optical Measurements of Fuel-Air Mixedness in Windowless High Speed Research Combustors**

Nguyen, Quang-Viet; Research and Technology 1997; April 1998; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Fuel distribution measurements in gas turbine combustors are needed from both pollution and fuel-efficiency standpoints. In addition to providing valuable data for performance testing and engine development, measurements of fuel distributions uniquely complement predictive numerical simulations. Although equally important as spatial distribution, the temporal distribution of the fuel is an often overlooked aspect of combustor design and development. This is due partly to the difficulties in applying time-resolved diagnostic techniques to the high-pressure, high-temperature environments inside gas turbine engines. Time-resolved measurements of the fuel-to-air ratio (F/A) can give researchers critical insights into combustor dynamics and acoustics. Beginning in early 1998, a windowless technique that uses fiber-optic, line-of-sight, infrared laser light absorption to measure the time-resolved fluctuations of the F/A (refs. 1 and 2) will be used within the premixer section of a lean-premixed, prevaporized (LPP) combustor in NASA Lewis Research Center's CE-5 facility. The fiber-optic F/A sensor will permit optical access while eliminating the need for film-cooled windows, which perturb the flow. More importantly, the real-time data from the fiber-optic F/A sensor will provide unique information for the active feedback control of combustor dynamics. This will be a prototype for an airborne sensor control system.

Derived from text

*Gas Turbine Engines; Fuel-Air Ratio; Real Time Operation; Active Control; Combustion Chambers; Optical Measurement*

## 75
## PLASMA PHYSICS

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

**20050173853** Naval Postgraduate School, Monterey, CA USA
**Investigation of Transient Plasma Ignition for a Pulse Detonation Engine**
Rodriguez, Joel; Mar. 2005; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432979; No Copyright; Avail: Defense Technical Information Center (DTIC)

Elimination or reduction of auxiliary oxygen use in Pulse Detonation Engines (PDEs) is necessary if the technology is to compete with existing Ramjet systems. This thesis investigated a Transient Plasma Ignition (TPI) system and found that the technology can at least reduce and may be able to completely remove the auxiliary oxygen requirement of current PDE systems. TPI was tested and compared with a traditional capacitive discharge spark plug system in a dynamic flow, ethylene/air mixture combustor. Ignition delay time, Deflagration-to-Detonation transition (DDT) distance and time, detonation wave speed and fire success rate performance were analyzed for various mass flow rates and stoichiometric ratios. A transient plasma dualelectrode concept was also employed and analyzed. Results show that TPI is more effective and reliable than the spark plug ignition with considerable improvements to DDT performance. The TPI dual-electrode concept was proven to be the most effective configuration with average reductions in DDT distance and time of 17% and 41% respectively when compared to the capacitive discharge spark plug system configuration.
DTIC
*Detonation Waves; Ignition; Internal Combustion Engines; Plasma Engines; Plasmas (Physics); Pulse Detonation Engines; Spark Ignition*

**20050174521** Oak Ridge National Lab., TN
**Workshop on Advanced Computational Materials Science: Application to Fusion and Generation IV Fission Reactors**
Jun. 30, 2004; 72 pp.; In English
Report No.(s): DE2005-836171; No Copyright; Avail: Department of Energy Information Bridge

This program was convened to determine the degree to which an increased effort in modeling and simulation could help bridge the gap between the data that is needed to support the implementation of these advanced nuclear technologies and the data that can be obtained in available experimental facilities. The need to develop materials capable of performing in the severe operating environments expected in fusion and fission (Generation IV) reactors represents a significant challenge in materials science. There is a range of potential Gen-IV fission reactor design concepts and each concept has its own unique demands. Improved economic performance is a major goal of the Gen-IV designs. As a result, most designs call for significantly higher operating temperatures than the current generation of LWRs to obtain higher thermal efficiency. In many cases, the desired operating temperatures rule out the use of the structural alloys employed today.
NTIS
*Accelerators; Alloys*

**20050177086** Princeton Univ., NJ
**Approximate Integrals of rf-driven Particle Motion in Magnetic Field**
Dodin, I. Y.; Fisch, N. J.; Apr. 2004; 20 pp.; In English
Report No.(s): DE2004-827917; PPPL-3945; No Copyright; Avail: Department of Energy Information Bridge

For a particle moving in nonuniform magnetic field under the action of an rf wave, ponderomotive effects result from rf-driven oscillations nonlinearly coupled with Larmor rotation. Using Lagrangian and Hamiltonian formalism, we show how, despite this coupling, two independent integrals of the particle motion are approximately conserved. Those are the magnetic moment of free Larmor rotation and the quasi-energy of the guiding center motion parallel to the magnetic field. Under the assumption of non-resonant interaction of the particle with the rf field, these integrals represent adiabatic invariants of the particle motion.
NTIS
*Particle Motion; Integrals; Magnetic Fields*

## 80
## SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

**20050176472** Texas Univ., Dallas, TX, USA
**Impacting Classroom Teachers Through Long-Term Professional Development**
Urquhart, M. L.; Bober, K. M.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Education and Public Outreach (E/PO) provides an important outlet for bringing the science to the public that funds research. NASA's commitment to E/PO is reflected in the agency's requirement that 1-2% of the cost of flight missions and instruments be dedicated to E/PO, and by opportunities for individual researchers to apply for supplemental support. For pre-college students, undergraduates, teachers, and members of the general public, NASA E/PO can provide a wealth of excitement and real scientific data that can inspire interest and learning in science, mathematics, and technology. The true challenge comes in creating and delivering E/PO that has a positive, significant and lasting impact on our target audiences. Derived from text
*Education; Instructors; Universities; Students*

## 82
## DOCUMENTATION AND INFORMATION SCIENCE

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

**20050173854** Army Command and Control Directorate, Fort Monmouth, NJ USA
**Battle Command On The Move**
Young, Rodney; Morley, Rebecca; Dec. 2004; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A432738; No Copyright; Avail: Defense Technical Information Center (DTIC)

Modern combined arms conflicts demand an accelerated tempo of operations requiring the rapid processing and transfer of information to the relevant location on the battlefield. A means to gain timely and useful information quickly while on-the-move will enable the tactical commander to make informed decisions in a manner consistently faster than the enemy. The mission of Battle Command on the Move (BCOTM) systems is to provide the tactical commander with the same level of Situational Awareness (SA) enabling. Situational Understanding (SU) at the decisive point on the battlefield. This allows his units to see first, understand first, act first and finish decisively. Designed for On-the-Move missions, BCOTM enables commander centric operations versus command post centric operations by bringing unprecedented SA and SU to the commander. Previously this type of information was only available in a fixed command post, far removed from the decisive point on the battlefield.
DTIC
*Information Transfer; Warfare*

**20050173862** Defense Acquisition Univ., Fort Belvoir, VA USA
**Supporting Communities of Interest in a Net-Centric Investment Environment (Defense Acquisition Review Journal)**
Dickover, Noel; Jan. 2005; 21 pp.; In English
Report No.(s): AD-A432885; No Copyright; Avail: Defense Technical Information Center (DTIC)

In the Department of Defense (DoD), significant effort has been devoted to conceptualizing a net-centric environment, particularly with respect to network-centric operations and warfare. In accordance, the DoD Chief Information Officer has issued a Net-Centric Operations and Warfare Reference Model and a Net-Centric Checklist. In addition, the Net-Centric Functional Capabilities Board is developing a draft Net-Centric Environment Joint Functional Concept. While the focus of the aforementioned products is largely oriented to the warfighter, DoD senior management, through various management initiative decisions, has embraced a movement toward a net-centric environment in an effort to effect net-centric business transformation and e-Government.
DTIC
*Information Systems; Commerce*

**20050173885** Army War Coll., Carlisle Barracks, PA USA

**DOD Public Affairs Strategies and Means During OIF: Were They Effective?**

Johnson, Rivers J., Jr; Mar. 2005; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A432666; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Department of Defense (DoD) conducted a public affairs campaign during Operation Iraqi Freedom (OIF) that included a variety of strategies and means to communicate to the American public and the international community the U.S. intentions concerning military operations in Iraq. Did DoD employ the appropriate strategies and means to meet the communication goals and how did DoD measure the effectiveness of its communications strategies and means? This paper will examine DoD's effectiveness in communicating its strategies goals objectives about military operations during OIF and the means by which DoD executed the strategies and means.

DTIC

*Public Relations; Communicating*

**20050173888** Infologic, Inc., Newport Beach, CA USA

**TechIP: A Methodology for Emerging Information Technology Insertion & Integration**

Patel, Has; Dec. 2004; 3 pp.; In English; Original contains color illustrations

Report No.(s): AD-A432587; No Copyright; Avail: Defense Technical Information Center (DTIC)

A number of current and planned government information system projects are mission critical, network-centric, complex and have long life cycles. In addition, they incorporate a number of requirements that need the application of emerging technologies, such as multimedia (data, voice, image) processing and software agents. To implement these requirements, the system designers are required to insert, integrate and manage proven advances in Emerging Information Technology (EIT) in to the system. This paper discusses a methodology, called TechIP (Technology Insertion Plan).

DTIC

*Information Systems; Data Processing; Image Processing; Multimedia*

**20050173889** National Defense Univ., Washington, DC USA

**Threat Warning for America's Critical Infrastructures**

Thrasher, Paul W.; Jan. 2000; 16 pp.; In English

Report No.(s): AD-A432658; No Copyright; Avail: Defense Technical Information Center (DTIC)

The President's Commission on Critical Infrastructure Protection, Critical Foundations, was a report of a multi-agency effort to 'study the critical infrastructures that constitute the life support systems of (the USA), determine their vulnerabilities, and propose a strategy for protecting them in the future'.2 Spurred by this report, the President signed Presidential Decision Directive 63 which built upon the PCCIP's recommendations. In signing PDD-63, the President's intent was for the USA to 'take all necessary measures to swiftly eliminate any significant vulnerability to both physical and cyber attacks on our critical infrastructures, including especially our cyber systems'.3 One of the goals of PDD-63 was to create a national center to warn of significant infrastructure attacks, to include the detection and analysis of such attacks, with maximum participation from the private sector. This task fell to the FBI's National Infrastructure Protection Center (NIPC) to provide threat assessment, warning, vulnerability assessment, and law enforcement investigation and response.4 Now, nearly two years hence, these encompassing tasks are largely going undone while the NIPC focuses nearly all its resources on law enforcement investigation and response, with only minor Information Sharing and Analysis Center (ISAC) coordination. It is the purpose of this paper to show that national cyber threat warning measuresare important for protecting critical infrastructures. Further, this paper asserts that tactical and strategic cyber threat warning is inadequate and needs to be reassessed vis- -vis the role of the Department of Defense, the Intelligence Community, and the Justice Department.

DTIC

*Information Systems; Warning Systems; Defense Program; Information Transfer*

**20050174583** Clemson Univ., SC, USA

**Online Tools for Astronomy and Cosmochemistry**

Meyer, B. S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558

Contract(s)/Grant(s): DE-FC02-01ER-41189; NAG5-10454; NSF AST-98-19877; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Over the past year, the Webnucleo Group at Clemson University has been developing a web site with a number of interactive online tools for astronomy and cosmochemistry applications. The site uses SHP (Simplified Hypertext

Preprocessor), which, because of its flexibility, allows us to embed almost any computer language into our web pages. For a description of SHP, please see http://www.joeldenny.com/ At our web site, an internet user may mine large and complex data sets, such as our stellar evolution models, and make graphs or tables of the results. The user may also run some of our detailed nuclear physics and astrophysics codes, such as our nuclear statistical equilibrium code, which is written in fortran and C. Again, the user may make graphs and tables and download the results.
Derived from text
*Websites; Astrophysics; Cosmochemistry; Stellar Evolution*

**20050175737** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Topography Analysis and Visualization Software Supports a Guided Comparative Planetology Education Exhibit at the Smithsonian's Air and Space Museum**
Roark, J. H.; Masuoka, C. M.; Frey, H. V.; Keller, J.; Williams, S.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Planetary Geodynamics Laboratory (http://geodynamics.gsfc.nasa.gov) of NASA s Goddard Space Flight Center designed, produced and recently delivered a 'museum-friendly' version of GRIDVIEW, a grid visualization and analysis application, to the Smithsonian's National Air and Space Museum where it will be used in a guided comparative planetology education exhibit. The software was designed to enable museum visitors to interact with the same Earth and Mars topographic data and tools typically used by planetary scientists, and experience the thrill of discovery while learning about the geologic differences between Earth and Mars.
Author
*Topography; Computer Programs; Planetology*

## 85
## TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

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.

**20050175857** Kirby Co., Cleveland, OH, USA
**Technology Transferred to the Kirby Company**
Research and Technology 1995; March 1996; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

NASA Lewis Research Center's Propulsion Systems Branch, evaluated the structural and vibration characteristics of the Kirby Model G-4 fan. Modes of vibration and resonance potential were evaluated in the Holography Test Lab at Lewis. As a result of the Lewis tests and rotor structural evaluation, Kirby engineers gained new insights into their existing design, enabling them to develop a more robust fan for use in their vacuum cleaners.
Derived from text
*Cleaners; Rotors; Suction; Technology Transfer; Technology Utilization*

## 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*.

**20050175990** California Univ., Berkeley, CA, USA
**Extracting Hypervelocity Impact Track Events in Aerogel in Cross-section Wafers**
Snead, C. J.; Butterworth, A. L.; Westphal, A. J.; Grant, P. G.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Stardust spacecraft successfully passed through the trail of Comet Wild-2 in January 2004 and, for the first time, collected cometary particles. These particles, in addition to the contemporary interstellar grains captured during the spacecraft s journey to Wild-2, will be returned to Earth in January 2006 [1]. We have been developing techniques for the extraction and

analysis of these particles by working with aerogel collectors from NASA s Orbital Debris Collection Experiment (ODCE), which was exposed on the Mir space station. minimizing the amount of aerogel affecting measurements. a
Derived from text
*Hypervelocity Impact; Wafers; Wild 2 Comet*

**20050176498** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**The Living With a Star (LWS) Sentinels Mission**
Szabo, A.; [2005]; 1 pp.; In English; 2005 Joint Assembly, 23-27 May 2005, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Sentinels Mission, the heliospheric element of the NASA Living With a Star (LWS) program, is still rapidly evolving, especially as the Sentinels Science and Technology Definition Team is progressing with its work. With the Solar Dynamics Observatory, the solar component, and the Geospace elements taking a more finalized form, it becomes clearer what scientific and measurement objectives will be necessary to establish the solar-geospace connection in order to achieve the goals of the LWS program. Possible, early formulation designs of the Sentinels mission will be presented that includes the Inner Heliospheric Mappers, a four spacecraft mission to observe the inner heliosphere between 0.25 and 1.0 AUs along with a Far Side Sentinel that will perform remote solar observations from nearly the opposite side of the Sun. Moreover, the complementarity of the various planned international missions (e.g., ESA Solar Orbiter, and Beppi Colombo) along with NASA planetary projects (e.g., Mars program and MESSENGER) will be discussed and how they can form a coherent system. Finally, the importance of already available heliospheric data will be emphasized.
Author
*NASA Space Programs; Space Missions; Helioseismology*

**20050177058** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Supporting the GLAST User Community**
Band, David L.; [2004]; 6 pp.; In English; 22nd Texas Symposium, 13-17 Dec. 2004, Stanford, CA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Gamma-ray Large Area Space Telescope (GLAST) Science Support Center (GSSC) is the scientific community's interface with GLAST. The GSSC will provide data, analysis software and documentation. In addition, the GSSC will administer the guest investigator program for NASA HQ. Consequently, the GSSC will provide proposal preparation tools to assist proposers in assessing the feasibility of observing sources of interest.
Author
*Gamma Ray Telescopes; Spaceborne Telescopes; Space Missions*

**20050177167** NASA Lewis Research Center, Cleveland, OH, USA, NYMA, Inc., USA, Aerospace Design and Fabrication, Inc., USA, California Univ., Berkeley, CA, USA
**Smoldering News From STS-77 Endeavour**
Koudelka, John M.; Fernandez-Pello, A. Carlos; Research and Technology 1996; March 1997; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Microgravity Smoldering Combustion (MSC) experiment lifted off aboard the Space Shuttle Endeavour for its second flight in May 1996, as part of the STS-77 mission. This experiment is part of a series of studies focused on the smolder characteristics of porous combustible materials in a microgravity environment. Smoldering is a nonflaming form of combustion that takes place in the interior of combustible materials. Common examples of smoldering are nonflaming embers, charcoal briquettes, and cigarettes. The objective of this study is to provide a better understanding of the controlling mechanisms of smoldering in microgravity and normal Earth gravity (1g). As with other forms of combustion, gravity affects the availability of air and transport of heat, and therefore, the rate of combustion. The results of the microgravity experiments will be compared with identical ones carried out in 1g. In addition, they will be used to verify present theories of smolder combustion and will provide new insights into the process of smoldering combustion, enhancing our fundamental understanding of this frequently encountered combustion process and guiding improvements in fire safety practices. Two smoldering combustion tests with polyurethane foam were successfully accomplished during the STS-77 mission. The tests investigated smoldering combustion in a quiescent (no-flow) enriched oxygen environment, and in an air environment with a 2-mm/sec airflow through the fuel sample. The primary data from the tests are the ignition characteristics, spread rate, smolder reaction temperature, and products of combustion (solid and gas). On both the first mission on STS-69 and the second mission on STS-77, a smolder front propagated the length of the forced-flow samples, with the spread rate between the

corresponding upward and downward 1g smolder rates. Neither of the quiescent cases propagated combustion (the first case was due in part to a problem with the experiment electronics). These results show a dramatic difference from the normal gravity results, where smolder propagation is very rapid and complete for both of these conditions. The experiment was conceived by Prof. A. Carlos Fernandez-Pello at the University of California-Berkeley. The MSC hardware was designed and built at the NASA Lewis Research Center by a team of civil servants and contractors from NYMA, Inc., and Aerospace Design & Fabrication, Inc. (ADF). The hardware consists of two sealed aluminum combustion chambers (each being a half a cylinder). The chambers hold the MSC test section, data acquisition electronics, power distribution electronics, and instrumentation. The hardware is fitted into a 5-ft(sup 3) Get-Away-Special (GAS) canister that is mounted in the shuttle cargo bay. The test section consists of a quartz cylinder that contains the polyurethane foam sample and an igniter. This igniter, which is an electrically heated wire sandwiched between two porous ceramic disks, is mounted in contact with the end of the foam sample. An array of 12 thermocouples placed axially and radially along the foam sample provide temperature histories, which are used to determine the rate of smolder propagation, and the characteristics of the reaction.
Author
*Smoldering; Space Missions; Microgravity; Space Transportation System; Endeavour (Orbiter)*

## 89
## ASTRONOMY

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

**20050173946** Yaroslavl State Pedagogical Univ., Yaroslavl, Russia
**On Origin of Sedna**
Perov, N. I.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 1 pp.; In English; See also 20050173912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Sedna (2003 VB12), announced in March 15, 2004, - probably is the first observing object of the Oort s Cloud. Elements of the orbit of Sedna are following: M=357 deg.8148, n = 0.0008040 deg/day, a = 531.6576335 AU, e = 0.8574338, omega = 311 deg .82711, Omega = 144 deg.49288, i = 11 deg.93041 (for the Epoch 2004, July, 14). Brown, Morbidelli, Levison maintain that only scattering by so-far-unobserved Planet X could produce such a high-perihelion orbit. A celestial mechanics model of origin of Sedna is presented below.
Author
*Hypothetical Planets; Oort Cloud; Perihelions*

**20050174561** Padua Univ., Italy
**Stability of the 3:1 Resonance Locking in the 55 Cancri Planetary System**
Marzari, F.; Scholl, H.; Tricarico, P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The most crowded extrasolar planetary system discovered so far is the one around main sequence star 55 Cancri(= rho(sup 1) Cancri). Four planets are known to orbit the star with semi-major axes ranging from 0.038 to 5.26 AU while the nominal orbital eccentricities range from approx. 0 to 0.44. The innerplanet, 55 Cnc e, is the lowest mass extra-solar planet yet found around a Sun-like star being a Neptune-mass planet. The central star is a solar-type star with an age of 5 Gyr. This suggests that the planetary orbits have already undergone evolutionary processes like migration due to interaction of the planets with an early disk and/or scattering of planetesimals and planetary embryos, and tidal interaction with the central star.
Derived from text
*Extrasolar Planets; Protoplanets; Planetary Orbits*

**20050174594** NASA Ames Research Center, Moffett Field, CA, USA
**On the Origin of the Saturnian Satellite System: Did Iapetus Form In-Situ?**
Mosqueira, I.; Estrada, P. R.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Current models of planet and satellite formation are marred by our lack of understanding regarding the turbulent state of accretion disks. According to the Rayleigh criterion, Keplerian disks are hydrodynamically stable. Indeed, it has been argued that a carefully designed Taylor Couette experiment shows stability in the case of positive radial gradients in specific angular

momentum even for high Reynolds numbers [1], in agreement with numerical simulations which consistently show turbulence decay [2]. Other possible sources of turbulence may fail due to low ionization, may decay as the optical depth decreases due to dust coagulation, may involve unrealistic boundary conditions, or result in limited transport. The difficulty stems not only from the degree of turbulence, but also from the kind of turbulence, and whether it may be characterized by an alpha parameter.
Derived from text
*Angular Momentum; Natural Satellites; Boundary Conditions; Couette Flow; Dust; Accretion Disks*

**20050174622** Impact, Bloomfield, IN, USA
**The Cosmic Clock, the Cycle of Terrestrial Mass Extinctions**
Marusek, J. A.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Over the past 500 million years, great terrestrial cataclysms forced global mass extinctions. A detailed study of postulated extinction mechanisms has lead to insight on both timing and cause. Two primary mechanisms, Oort cloud comet impacts and nearby supernova events, are believed responsible. A dual cycle of extinctions is observed and well ordered in geological time. Both mechanisms are synchronized to the passage of the solar system through the spiral arms of the Milky Way galaxy.
Author
*Oort Cloud; Geochronology; Cometary Collisions; Clocks*

**20050174626** Toronto Univ., Ontario, Canada
**Rotational Stability of Dynamic Planets with Lithospheres**
Matsuyama, I.; Mitrovica, J. X.; Perron, J. T.; Richards, M. A.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The secular rotational stability of terrestrial planets subject to surface mass loading and internal convective dynamics is a longstanding problem in geophysics framed by a series of seminal studies. Gold, for example, discussed the stability of a hydrostatic planet subject to an anomalous (i.e., nonhydrostatic or imperfectly compensated) load. The uncompensated load would act to push the rotation pole away or, alternatively, would migrate toward the equator. In the short term, the hydrostatic bulge would act to stabilize the pole (i.e., retard polar motion). However, since the hydrostatic rotational bulge of the planet would, in time, relax to any new orientation of the rotation pole, all memory of this previous orientation would ultimately vanish. That is, a hydrostatic bulge provides no longterm rotational stability and the reorientation of the pole, or so-called true polar wander (TPW), would be governed solely by the location of the uncompensated surface mass load. In particular, a mass excess of any size (indeed, as small as Gold s beetle) would drive t would eventually reorient the load to the equator.
Derived from text
*Terrestrial Planets; Rotation; Stability; Lithosphere*

**20050175933** Muenster Univ., Germany
**TOF-SIMS, NanoSIMS, and TEM Analysis of Interplanetary Dust Particle Sections**
Stephan, T.; Weber, I.; Hoppe, P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Before in 2006 the Stardust mission will bring material from comet Wild 2 under controlled conditions to Earth [1], anhydrous IDPs represent probably the only source for cometary matter that is available for analysis in terrestrial laboratories. Like meteorites, IDPs have their own individual history that links them to their respective parent bodies and that can be revealed with modern analytical techniques. In most previous studies, only one analytical technique has been applied to individual particles and averaged properties from different sub-sets of the IDP collection were compared. Major technical developments during recent years provide the opportunity to study individual particles with a great variety of analytical techniques. In continuation of a comprehensive consortium study of IDPs from stratospheric dust collector U2071 [2], three particles were selected for TOF-SIMS, NanoSIMS, and TEM analysis. This suite of analytical techniques allows to obtain information on the elemental, isotopic, and mineralogical composition of IDPs on a sub-micrometer scale. Since 1994, when the consortium study was initiated, technical improvements in both SIMS variants [3,4], especially in achievable lateral

resolution and sensitivity have significantly enhanced the abilities to study these tiny, extremely finegrained, complex particles.
Derived from text
*Interplanetary Dust; Meteorites; Isotopes; Dust Collectors; Chemical Composition; Comets; Mineralogy*

**20050175983** Shemakha Astrophysical Observatory, Azerbaijan, USSR
**Optimal Smoothing of Asteroid Reflectance Spectra: The Search for Faint Absorption Bands**
Shestopalov, D.; Golubeva, L.; McFadden, L.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Faint absorption bands (FABs) arise in the visual range of mineral and rock spectra due to petrologically important transition elements (Fe2+, Fe3+, Ti2+, Ti3+, Cr3+, Ni2+, etc) situated in a crystal lattice of minerals. The intensity of these bands is small for the following reasons. First, abundance of these elements is low in the rock-forming minerals and, second, the electron transfers in envelopes of cations, situated in electrostatic field of ligands, are spin forbidden. At the same time FABs bear important information about crystallographic, chemical and physical properties of minerals and, consequently, about their origin and evolution [1,2]. Lately spectrophotometric surveys, including thousands of asteroids from different optical types and dynamical groups, have been obtained [3-5]. Large telescopes and modern CCD-spectrometers produced spectra with good signal-to-noise ratios even for faint asteroids. After dividing the observed asteroid spectrum by the observed solar analog spectrum the resulting spectrum displays high-frequency oscillations of the reflectance coefficients and looks like a fine-tooth comb. This effect is conditioned, in particular, by photometric errors of the measurement of low light levels from an asteroid and a star. Just these oscillations contain information about FABs. We suppose that the measured asteroid reflectance spectrum is the sum of three components: low-changing regular trend, low-amplitude modulation (useful signal) of the trend and a random noise (see Fig.1a as an example). The trend is easily approximated by the classic least square estimation. The task, consequently, is to separate the useful signal from the noise.
Derived from text
*Absorption Spectra; Smoothing; Asteroids; Reflectance; Rocks; Minerals*

**20050176029** Naval Research Lab., Washington, DC, USA
**Surface and Internal Structure of Pristine Presolar Silicon Carbide**
Stroud, Rhonda, M.; Bernatowicz, Thomas J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-4328; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Silicon carbide is the most well-studied type of presolar grain. Isotope measurements of thousands [1,2] and structural data from over 500 individual grains have been reported [3]. The isotope data indicate that approximately 98% originated in asymptotic giant branch stars and 2% in supernovae. Although tens of different polytypes of SiC are known to form synthetically, only two polytypes have been reported for presolar grains. Daulton et al. [3] found that for SiC grains isolated from Murchison by acid treatments, 79.4% are 3C cubic beta-SiC, 2.7% are 2H hexagonal alpha-SiC, 17.1% are intergrowths of and , and 0.9% are heavily disordered. They report that the occurrence of only the and polytypes is consistent with the observed range of condensation temperatures of circumstellar dust for carbon stars. Further constraint on the formation and subsequent alteration of the grains can be obtained from studies of the surfaces and interior structure of grains in pristine form, i.e., prepared without acid treatments [4,5]. The acid treatments remove surface coatings, produce etch pits around defect sites and could remove some subgrains. Surface oxides have been predicted by theoretical modeling as a survival mechanism for SiC grains exposed to the hot oxidizing solar nebula [6]. Scanning electron microscopy studies of pristine SiC shows some evidence for the existence of oxide and organic coatings [4]. We report herein on transmission electron microscopy studies of the surface and internal structure of two pristine SiC grains, including definitive evidence of an oxide rim on one grain, and the presence of internal TiC and AlN grains.
Derived from text
*Silicon Carbides; Asymptotic Giant Branch Stars; Stellar Envelopes; Solar Nebula; Order-Disorder Transformations*

**20050176458** Laboratoire de Geochimie et Cosmochimie, Paris, France
**Cr-54 Anomalies in the Solar System: Their Extent and Origin**
Trinquier, A.; Birck, J. L.; Allegre, C. J.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chromium isotopic anomalies (defined non-mass dependent isotopic variations) at 1-10% level have first been found in Allende s Inclusions with the most striking variations on Cr-54. Cr-53 effects have also been found first in Inclusions and later in various planetary objects. They are almost always correlated to the Mn/Cr ratio which therefrom indicate that they relate to past 53Mn decay and will not be discussed here. With experimental resolution of c.a. 0,5-1 epsilon units, both Cr-54 excesses and deficits have been evidenced in CV3 inclusions. Similar variations of comparable amplitude in Ca-48-Ti-50Fe58-Ni-63-64 are present within the same samples. A nucleosynthetic origin is favored that is associated with a component produced in a neutron-rich statistical equilibrium which can be reached in the final stages of evolution of massive stars in a type 1 supernova event [1]. Besides the inclusion scale, large Cr-54 isotopic heterogeneity of up to several % is present at the micro scale in the matrix of carbonaceous chondrites [2]. With the higher precision obtained in the last few years [3], bulk carbonaceous chondrites display clearly resolved and variable Cr-54 excesses relative to the terrestrial composition. Derived from text

*Chromium Isotopes; Stellar Evolution; Massive Stars; Carbonaceous Chondrites; Supernovae*

**20050177038** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**First Results from the Swift Gamma Ray Burst Mission**

Gehreis, Neil; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Swift is now in orbit after a beautiful launch on November 20, 2004. It is a multiwavelength observatory designed specifically to study the fascinating gamma-ray bursts. The goals are to determine the origin of bursts and use them to probe the early Universe. A new-technology wide-field gamma-ray camera detects more than a hundred bursts per year. Sensitive narrow-field X-ray and UV/optical telescopes are pointed at the burst location in 20 to 70 sec by an autonomously controlled 'swift' spacecraft. For each burst, arcsec positions are determined and optical/UV/X-ray/gamma-ray spectrophotometry performed. Information is also rapidly sent to the ground to a team of more than 50 observers at telescopes around the world. First results from the mission will be presented, including observations of bright GRBs, faint GRBs, short GRBs and a super-giant flare from the soft gamma repeater SGRl806-20.

Author

*Gamma Ray Spectrometers; NASA Space Programs; Spaceborne Astronomy; Spaceborne Telescopes; Astronomical Observatories*

**20050177040** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Bulk Velocities, Chemical Composition and Ionization Structure of the X-ray Shocks in WR140 near Periastron as Revealed by the Chandra Gratings**

Pollock, A. M. T.; Corcoran, Michael F.; Stevens, Ian R.; Williams, P. M.; [2005]; 46 pp.; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

The Wolf-Rayet WC7+O4.5 binary WR140 went through the periastron passage of its 8-year eccentric binary orbit in early 2001 as the two stars made their closest approach. Both stars have powerful supersonic stellar winds which crash into each other between the stars to produce X-rays. Chandra grating observations were made when the X-rays were at their brightest making WR140 the brightest hot-star X-ray source in the sky and giving the opportunity to study the velocity profiles of lines, all of which were resolved and blue-shifted. In the general context of shock physics, the measurements constrain the flow of hot gas and where different ions were made. The lower velocity widths of cool ions imply a plasma that was not in equilibrium. The brightness of lines relative to the strong continuum in conjunction with plasma models gives interim abundance estimates for eight different elements in WC-type material including an Ne/S ratio in good agreement with earlier long-wavelength measurements.

Author

*Chemical Composition; Ionization; Wolf-Rayet Stars; X Ray Astrophysics Facility; Velocity Distribution*

**20050177076** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Atomic Processes in X-ray Photoioinzed Gas**

Kallman, Timothy; [2005]; 1 pp.; In English; AAS Conference, 31 May - 1 Jun. 2005, Minneapolis, MN, USA; No Copyright; Avail: Other Sources; Abstract Only

It has long been known that photoionization and photoabsorption play a dominant role in determining the state of gas in nebulae surrounding hot stars and in active galaxies. Recent observations of X-ray spectra demonstrate that these processes are also dominant in highly ionized gas near compact objects, and also affect the transmission of X-rays from the majority of astronomical sources. This has led to new insights into the understanding of what is going on in these sources. It has also

pointed out the need for accurate atomic cross sections for photoionization and absorption, notably for processes involving inner shells. The xstar code can be used for calculating the heating, ionization and reprocessing of X-rays by gas in a range of ionization states and temperatures. It has recently been updated to include an improved treatment of inner shell transitions in iron. I will review the capabilities of xstar, the atomic data, and illustrate some applications to recent X-ray spectral observations.
Author
*Ionized Gases; Photoionization; X Rays; Photoabsorption; Atomic Physics; Active Galaxies*

**20050177083** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**XMM-Newton Archival Study of the ULX Population in Nearby Galaxies**
Winter, Lisa M.; Mushotzky, Richard; Reynolds, Christopher S.; [2005]; 44 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

We have conducted an archival XMM-Newton study of the bright X-ray point sources in 32 nearby galaxies. From our list of approximately 100 point sources, we attempt to determine if there is a low-state counterpart to the Ultraluminous X-ray (ULX) population. Indeed, 16 sources in our sample match the criteria we set for a low-state ULX, namely, L(sub X) greater than 10(exp 38 ergs per second) and a spectrum best fit with an absorbed power law. Further, we find evidence for 26 high-state ULXs which are best fit by a combined blackbody and a power law. As in Galactic black hole systems, the spectral indices, GAMMA, of the low-state objects, as well a s the luminosities, tend to be lower than those of the high-state objects. The observed range of blackbody temperatures is 0.1-1 keV with the most luminous systems tending toward the lowest temperatures. We also find a class of object whose properties (luminosity, blackbody temperature, and power law slopes) are very similar to those of galactic stellar mass black holes. In addition, we find a subset of these objects that can be best fit by a Comptonized spectrum similar to that used for Galactic black holes in the very high state, when they are radiating near the Eddington limit.
Author
*XMM-Newton Telescope; Galaxies; Luminosity; Populations*

**20050177225** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Initial Results from the Swift Mission**
Marshall, Frank E.; [2005]; 1 pp.; In English; AAS Meeting, 30 May - 2 Jun. 2005, Minneapolis, MN, USA; No Copyright; Avail: Other Sources; Abstract Only

Swift is a new observatory to study gamma-ray bursts and their afterglows. Launched in November, 2004, Swift has now completed its activation phase and is detecting about two bursts per week with the Burst Alert Telescope. Swift's other two instruments, X-ray Telescope and Ultra-Violet and Optical Telescope, typically start observing the burst within a few minutes. We report the initial results from the wide range of burst and afterglow characteristics that have been found.
Author
*Afterglows; Gamma Ray Bursts; X Ray Astronomy; Ultraviolet Astronomy*

**20050177230** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Star Formation Rates in Cooling Flow Clusters: A UV Pilot Study with Archival XMM-Newton Optical Monitor Data**
Hicks, A. K.; Mushotzky, R.; [2005]; 16 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NGT5-140; No Copyright; Avail: CASI; A03, Hardcopy

We have analyzed XMM-Newton Optical Monitor (OM) UV (180-400 nm) data for a sample of 33 galaxies. 30 are cluster member galaxies, and nine of these are central cluster galaxies (CCGs) in cooling flow clusters having mass deposition rates which span a range of 8 - 525 solar mass per year. By comparing the ratio of UV to 2MASS J band fluxes, we find a significant UV excess in many, but not all, cooling flow CCGs, a finding consistent with the outcome of previous studies based on optical imaging data (McNamara & O Connell 1989; Cardiel, Gorgas, & Aragon-Salamanca 1998; Crawford et al. 1999). This UV excess is a direct indication of the presence of young massive stars, and therefore recent star formation, in these galaxies. Using the Starburst99 spectral energy distribution (SED) model of continuous star formation over a 900 Myr period, we derive star formation rates of 0.2 - 219 solar mass per year for the cooling flow sample. For 2/3 of this sample it is possible to equate Chandra/XMM cooling flow mass deposition rates with UV inferred star formation rates, for a combination of starburst lifetime and IMF slope. This is a pilot study of the well populated XMM UV cluster archive and a more extensive follow up study is currently underway.
Author
*Cooling Flows (Astrophysics); Star Formation Rate; XMM-Newton Telescope; Ultraviolet Radiation; Galactic Clusters*

## 90
## ASTROPHYSICS

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

**20050174576** Centre de Recherches Petrographiques et Geochimiques, Nancy, France

**Neon Isotope Heterogeneity in the Terrestrial Mantle: Implication for the Acquisition of Volatile Elements in Terrestrial Planets**

Marty, B.; Yokochi, R.; Ballentine, C. J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Neon in samples from the terrestrial mantle show isotopic variations representing mixing between air and a deep mantle component rich in Ne-20 and Ne-21 relative to Ne-22. Ne-21 enrichments are due to nuclear production within the mantle, but no known nuclear process can account for excess Ne-20. Thus Ne-20/Ne-22 ratios higher than air are interpreted as representing the occurrence of a solar-like neon component. There are two potential sources for this neon: 1) Solar Nebula gas; or 2) a mixture of solar wind and and solar energetic particle (SEP) neon, called Ne-B found in gas-rich meteorites. Identifying which of these sources provides the neon in the Earth has profound implications for the formation of the Earth. A solar nebula origin requires nebula gas to be present. Recently, Trieloff et al. argued that published data rather select Ne-B,. Although these authors proposed a 'planetary' origin for neon and presumably other terrestrial volatiles, others noted that the data sets investigated could not rule out a Solar nebula origin.

Author

*Neon Isotopes; Heterogeneity; Terrestrial Planets*

**20050174603** Max-Planck-Inst. fuer Chemie, Mainz, Germany

**Continued Study of Ba Isotopic Compositions of Presolar Silicon Carbide Grains from Supernovae**

Marhas, K. K.; Hoppe, P.; Ott, U.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Presolar grains condense in the winds or ejecta of evolved stars, thereby acquiring the characteristic isotopic compositions of the parent stars. Heavy elements such as Sr, Mo, Zr, and Ba in these grains have served as astrophysical diagnostic tools, which can be used to unravel the different nucleosynthesis and mixing processes taking place in the interior of the parent stars. In order to better understand the heavy element nucleosynthesis, we took up the project of Ba isotopic measurements in different types of presolar SiC grains.

Derived from text

*Astrophysics; Heavy Elements; Isotopes; Supernovae; Barium Isotopes*

**20050174667** Yale Univ., New Haven, CT, USA

**Low-Temperature Thermal History of Martian Meteorite ALH84001 from (U-Th)/He Thermochronometry**

Min, K.; Reiners, P. W.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The thermal history of Martian meteorite ALH84001 is controversial, and has been suggested to involve as many as two to five shock metamorphic events on Mars. It is generally agreed that a major shock event at approx. 4.0 Ga reset the Ar-40/Ar-39 and U-Th-Pb systems, but the timing and intensity of later, relatively low-temperature, event(s) is not well constrained. To better understand the thermal history after the primary shock at approx. 4.0 Ga, we applied single grain (U-Th)/He themrochronometry to merrillite and apatite crystals from ALH84001, 34. Results: With the exception of two analyses (57

Author

*Low Temperature; SNC Meteorites; Argon Isotopes; Uranium; Thorium; Lead (Metal)*

**20050174679** Museum of Natural History, London, UK

**Infrared Spectroscopy of Extraterrestrial Material: Comparison with Astronomical Spectra of Dust**

Morlok, A.; Koehler, M.; Grady, M. M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As part of our ongoing project to identify astronomical dust, we obtained infrared spectra of minerals and components from primitive meteorites. The aim is to produce a database of spectra for comparison with infrared spectra from dust in space, e.g. in circumstellar or protoplanetary disks. We think that minerals from primitive extraterrestrial material are well suited for this purpose, since these components formed in environments similar to that of the dust disks. In addition, most of the dust observed is also not pristine, but has also been processed. So it is safe to assume that such materials are a good approximation of the dust observed. Additional information is included in the original extended abstract.
Author (revised)
*Infrared Spectroscopy; Cosmic Dust; Astronomical Spectroscopy; Infrared Spectra; Minerals*

**20050174706** Physical Research Lab., Ahmedabad, India
**Noble Gases and Nuclear Tracks in the Nakhlite MIL 03346**
Murty, S. V. S.; Mahajan, R. R.; Goswami, J. N.; Sinha, N.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: MIL 03346 is collected during the 2003-2004 field season and is the 7th nakhlite known in world collection. We have analysed a set of near surface and interior samples from MIL 03346 for their noble gas and nuclear track records to delineate the cosmic ray exposure history of this meteorite and signatures of martian atmospheric and interior components in it.
Author
*Mars Atmosphere; Nuclear Astrophysics; Nakhlites; Particle Tracks; Rare Gases*

**20050175684** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Science with Constellation-X**
Hornschemeier, Ann, Editor; Garcia, Michael, Editor; May 23, 2005; 60 pp.; In English
Report No.(s): NASA/TP-2005-212784; Rept-2005-01561-0; No Copyright; Avail: CASI; A04, Hardcopy

NASA's upcoming Constellation-X mission, one of two flagship missions in the Beyond Einstein program, will have more than 100 times the collecting area of any previous spectroscopic mission operating in the 0.25-40 keV bandpass and will enable high-throughput, high spectral resolution studies of sources ranging from the most luminous accreting supermassive black holes in the Universe to the disks around young stars where planets form. This booklet, which was assembled during early 2005 using the contributions of a large team of Astrophysicists, outlines the important scientific questions for the decade following this one and describes the areas where Constellation-X is going to have a major impact. These areas include the exploration of the space-time geometry of black holes spanning nine orders of magnitude in mass and the nature of the dark energy and dark matter which govern the expansion and ultimate fate of the Universe. Constellation-X will also explore processes referred to as 'cosmic feedback' whereby mechanical energy, radiation, and chemical elements from star formation and black holes are returned to interstellar and intergalactic medium, profoundly affecting the development of structure in the Universe, and will also probe all the important life cycles of matter, from stellar and planetary birth to stellar death via supernova to stellar endpoints in the form of accreting binaries and supernova remnants.
Author
*Black Holes (Astronomy); Dark Energy; Dark Matter; Stars; NASA Space Programs; X Ray Astronomy*

**20050176542** Smithsonian Astrophysical Observatory, Cambridge, MA, USA
**Laboratory Astrophysics Using a Microcalorimeter and Bragg Crystal Spectrometer on an Electron Beam Ion Trap**
Brinton, John, Technical Monitor; Silver, Eric; May 2005; 10 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-5362; No Copyright; Avail: CASI; A02, Hardcopy

We completed modifications to the new microcalorimeter system dedicated for use on the EBIT at NIST, which included: 1) a redesign of the x-ray calibration source from a direct electron impact source to one that irradiates the microcalorimeter with fluorescent x-rays. The resulting calibration lines are free of bremsstrahlung background; 2) the microcalorimeter electronic circuit was significantly improved to ensure long-term stability for lengthy experimental runs
Author
*Calorimeters; Electron Beams; Laboratory Astrophysics; X Rays*

**20050177032** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**The Cycle of Cosmic Dust**
Dwek, Eliahu; [2005]; 1 pp.; In English; International Conference on Planetary Nebulae as Astronomical Tool, 26 Jun. - 2 Jul. 2005, Gdansk, Poland; No Copyright; Avail: Other Sources; Abstract Only

The presence of dust in the interstellar medium of galaxies dramatically affects their spectral appearance, and the interpretation of their underlying physical properties. Consequently, the diagnostic of galaxy spectra depends crucially on our understanding of the nature and properties of these dust particles. Models of interstellar dust particles must be able to reproduce a basic set of observational constraints, including the general interstellar extinction and infrared emission observed in the diffuse interstellar medium (ISM). Recent analysis of the solar spectrum have resulted in a convergence between the solar and B star abundances. This development, and the steadiness in the solar abundance determination of the primary refractory elements Mg, Si, and Fe, strongly suggest that any viable dust model must also obey interstellar abundances constraints. I will present fifteen dust models that differ in composition and size distribution and that simultaneously satisfy the local extinction, infrared emission, and abundances constraints have been shown to exist. This multitude of viable dust models provides us with an increased flexibility in understanding dust evolution and the many variations in dust properties in different phases of the ISM and stellar environments.
Author
*Abundance; Astronomical Models; Cosmic Dust; Interstellar Matter; Interstellar Gas*

**20050177035** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Hotspot or Heatwave? Getting to Grips with Neutron Star Burst Oscillations**
Watts, A.; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Many accreting neutron stars, including two of the millisecond pulsars, exhibit high frequency oscillations during Type I X-ray bursts. The properties of the burst oscillations reflect the nature of the thermal asymmetry on the stellar surface. The mechanism that gives rise to the aspzetry, however , remains unclear: possibilities include a hotspot due to uneven fuel distribution, modes of oscillation in the surface layers of the neutron star, or vortices driven by the Coriolis force. I will review some of the latest theory and observations, and present the results of a recent study of variability in the burst oscillations of the millisecond pulsar 51814-338.
Author
*Neutron Stars; Stellar Radiation; Bursts; X Rays; X Ray Astronomy*

**20050177036** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**A Complete Set of Radiative and Auger Rates for K-vacancy States in Fe XVIII-Fe-XXV**
Palmeri, P.; Mendoza, C.; Kallman, T. R.; Bautista, M. A.; Astronomy and Astrophysics; 2003; ISSN 0004-6361; Volume 10, pp. 1175-1184; In English; Original contains black and white illustrations
Contract(s)/Grant(s): FONACIT-S1-20011000912; Copyright; Avail: Other Sources

A complete set of level energies, wavelengths, A-values, and total and partial Auger rates have been computed for transitions involving the K-vacancy states within the n = 2 complex of Fe XVIII-Fe XXV. Three different standard numerical packages are used for this purpose, namely AUTOSTRUCTURE, the Breit-Pauli R-matrix suite (BPRM) and HFR, which allow reliable estimates of the physical effects involved and of the accuracy of the resulting data sets. The Breit interaction is taken into account because its contributions to the small A-values and partial Auger rates cannot be neglected with increasing electron occupancy. Semiempirical adjustments can also lead to large differences in both the radiative and Auger decay data of strongly mixed levels. Several experimental level energies and wavelengths are questioned, and significant discrepancies are found with previously computed decay rates that are attributed to numerical problems. The statistical accuracy of the present level energies and wavelengths is ranked at +/-3 eV and +/-2 mA, respectively, and that for A-values and partial Auger rates greater than lO(exp 13)/s at better than 20%.
Author
*Decay Rates; Atomic Interactions; Iron; X Ray Spectra; Spectrum Analysis*

**20050177037** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Atomic Data for the K-vacancy States of Fe XXIV**
Bautista, M. A.; Mendoza, C.; Kallman, T. R.; Palmeri, P.; [2003]; 18 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): FONACIT-S1-20011000912
Report No.(s): astro-ph/0207323; No Copyright; Avail: CASI; A03, Hardcopy

As part of a project to compute improved atomic data for the spectral modeling of iron K lines, we report extensive calculations and comparisons of atomic data for K-vacancy states in Fe XXIV. The data sets include: (i) energy levels, line wavelengths, radiative and Auger rates; (ii) inner-shell electron impact excitation rates and (iii) fine structure inner-shell

photoionization cross sections. The calculations of energy levels and radiative and Auger rates have involved a detailed study of orbital representations, core relaxation, configuration interaction, relativistic corrections, cancellation effects and semi-empirical corrections. It is shown that a formal treatment of the Breit interaction is essential to render the important magnetic correlations that take part in the decay pathways of this ion. As a result, the accuracy of the present A-values is firmly ranked at better than 10% while that of the Auger rates at only 15%. The calculations of collisional excitation and photoionization cross sections take into account the effects of radiation and spectator Auger dampings. In the former, these effects cause significant attenuation of resonances leading to a good agreement with a simpler method where resonances are excluded. In the latter, resonances converging to the K threshold display symmetric profiles of constant width that causes edge smearing.
Author
*Iron; K Lines; Mathematical Models; Atomic Excitations*

**20050177061** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Impact of LISA's Low Frequency Sensitivity on Observations of Massive Black Hole Mergers**
Baker, J.; Centrella, J.; [2005]; 10 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

LISA will be able to detect gravitational waves from inspiralling massive black hole (MBH) binaries out to redshifts z \g 10. If the binary masses and luminosity distances can be extracted from the Laser Interferometer Space Antenna (LISA) data stream, this information can be used to reveal the merger history of MBH binaries and their host galaxies in the evolving universe. Since this parameter extraction generally requires that LISA observe the inspiral for a significant fraction of its yearly orbit, carrying out this program requires adequate sensitivity at low frequencies, f \h 10(exp -4) Hz. Using several candidate low frequency sensitivities, we examine LISA's potential for characterizing MBH binary coalescences at redshifts z \g 1.
Author (revised)
*Low Frequencies; Sensitivity; Black Holes (Astronomy); LISA (Observatory)*

**20050177077** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Gravitational Wave Science: Challenges for Numerical Relativistic Astrophysics**
Cenrella, Joan; [2005]; 1 pp.; In English; PCA Workshop, 1-5 May 2005, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Gravitational wave detectors on earth and in space will open up a new observational window on the universe. The new information about astrophysics and fundamental physics these observations will bring is expected to pose exciting challenges. This talk will provide an overview of this emerging area of gravitational wave science, with a focus on the challenges it will bring for numerical relativistic astrophysics and a look at some recent results.
Author
*Astrophysics; Gravitational Waves; Relativity*

**20050177226** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**NASA Space Science and a Search for Ram-Pressure Stripping in the Hydra I Cluster**
Brown, Beth; [2005]; 1 pp.; In English; Bennett College NASA Space Science Week and Student Research Symposium, 21-23 Mar. 2005, Greensboro, NC, USA; No Copyright; Avail: Other Sources; Abstract Only

The NASA Goddard Space Flight Center's Sciences and Exploration Directorate seeks to expand scientific knowledge through observational and theoretical research in the study of the Earth-Sun system, the solar system and the origins of life, and the birth and evolution of the universe. This talk will discuss some of the cutting-edge space science research being conducted at Goddard. In addition, I will discuss my research on ram-pressure stripping in cluster elliptical galaxies. Ram-pressure stripping is a method by which hot interstellar gas can be removed from a galaxy moving through a group or cluster of galaxies. Indirect evidence of ram-pressure stripping includes lowered X-ray brightness in a galaxy due to less X-ray emitting gas remaining in the galaxy. Here we present the initial results of our program to determine whether cluster elliptical galaxies have lower hot gas masses than their counterparts in less rich environments. This test requires the use of the high-resolution imaging of the Chandra Observatory and we present our analysis of the galaxies in the nearby cluster Hydra I.
Author
*Elliptical Galaxies; Galactic Clusters; Galaxies; High Temperature Gases; Interstellar Gas; Stripping; X Ray Astronomy*

## 91
## LUNAR AND PLANETARY SCIENCE AND EXPLORATION

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

**20050173912** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXVI, Part 16**
[2005]; ISSN 1540-7845; In English; Lunar and Planetary Science XXXVI, 14-18 Mar. 2005, Houston, TX, USA; See also 20050173913 - 20050173973
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1234-Pt-16; Copyright; Avail: CASI; C01, CD-ROM

Contents include the folowing: Experimental Study of Fe-, Co- and Ni-partitioning Between Forsterite and low-Co Fe,Ni-Alloys: Implications for Formation of Olivine Condensates in Equilibrium with Primitive Metal. Channels and Fan-like Features on Titan Surface Imaged by the Cassini RADAR. The Oxygen Isotope Similarity of the Earth and Moon: Source Region or Formation Process? The Mn-53-Cr-53 System in CAIs: An Update. Comparative Planetary Mineralogy: Valence State Partitioning of Cr, Fe, Ti, and V Among Crystallographic Sites in Olivine, Pyroxene, and Spinel from Planetary Basalts. CAI Thermal History Constraints from Spinel: Ti Zoning Profiles and Melilite Boundary Clinopyroxenes. Noble Gas Study of New Enstatite SaU 290 with High Solar Gases. A Marine Origin for the Meridiani Planum Landing Site? A Mechanism for the Formation and Evolution of Tharsis as a Consequence of Mantle Overturn: Large Scale Lateral Heterogeneity in a Stably Stratified Mantle. Endolithic Colonization of Fluid Inclusion Trails in Mineral Grains. Microbial Preservation in Sulfates in the Haughton Impact Structure Suggests Target in Search for Life on Mars. Ascraeus Mons Fan-shaped Deposit, Mars: Geological History and Volcano-Ice Interactions of a Cold-based Glacier. Weathering Pits in the Antarctic Dry Valleys: Insolation-induced Heating and Melting, and Applications to Mars. Mineralogy and Petrography of Lunar Mare Regolith Breccia Meteorite MET 01-210. Geological Mapping of Ganymede. A Quantitative Analysis of Plate Motion on Europa: Implications for the Role of Rigid vs. Nonrigid Behavior of the Lithosphere. Comparison of Terrestrial Morphology, Ejecta, and Sediment Transport of Small Craters: Volcanic and Impact Analogs to Mars. An Integrated Study of OMEGA-Identified Mineral Deposits in Eastern Hebes Chasma, Mars. Global Spectral and Compositional Diversity of Mars: A Test of CRISM Global Mapping with Mars Express OMEGA Data. On Origin of Sedna. Processing ISS Images of Titan s Surface. LA-ICP-MS Study of Trace Elements in the Chaunskij Metal.
CASI
*Mars Volcanoes; Mars Surface; Lunar Topography; Extraterrestrial Life; Glaciers*

**20050173913** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Channels and Fan-like Features on Titan Surface Imaged by the Cassini RADAR**
Paganelli, F.; Elachi, C.; Lopes, R. M.; West, R.; Stiles, B.; Janssen, M. A.; Stofan, E. R.; Wood, C. A.; Lorenz, R. D.; Lunine, J. L., et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During two close flybys of Titan on October 26, 2004, and February 15, 2005, the Cassini s radar instrument acquired synthetic-aperture radar (SAR) data revealing Titan s complex surface and intriguing geological features. Fan-like and apparently flow-related features are connected to sinuous and linear features which resemble channels. The fan-like features and channels appear to be relatively SAR-bright and suggest surface roughness properties at the scale and bigger than the Ku-band, and possible volume scattering. A strong correlation between the SAR-bright and radiometric cold regions has been observed. The correlation is consistent with radiometric cold areas being caused by volume scattering at Ku as due to broken low-loss ice and resulting low emissivity as with the surfaces of Europa and Ganymede.
Author
*Titan; Low Temperature Environments; Surface Roughness; Geology*

**20050173916** Hawaii Univ., Honolulu, HI, USA
**The Aristarchus Plateau: The Next Step in Human Exploration of the Moon**
Peterson, C. A.; Smith, G. A.; Hawke, B. R.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NASA's Vision for Space Exploration includes the goal of returning humans to the Moon after an absence of more than

thirty years. NASA intends to use lunar exploration activities to further science, and to develop and test new approaches, technologies, and systems, including use of lunar and other space resources, to support sustained human space exploration to Mars and other destinations [1]. Many Americans have little idea of what such an endeavor would entail. The teaching of abstract ideas is often simplified and made more effective by the use of concrete examples. One way to educate students and the general public about what NASA will try to accomplish on the Moon is to model a future lunar base. The Aristarchus plateau has long been considered as a possible location for a lunar base [e.g., 2]. We have chosen it as a site for our model because it incorporates many features that can be used to illustrate the range of activities that must be undertaken in order to fulfill NASA's objectives.
Derived from text
*Lunar Exploration; Plateaus; Space Exploration; Extraterrestrial Resources; Moon*

**20050173917** Planetary Science Inst., Tucson, AZ, USA
**Assessing Atmospheric Water Injection from Oceanic Impacts**
Pierazzo, E.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations
Contract(s)/Grant(s): NAG5-12546; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Collisions of asteroids and comets with the Earth s surface are rare events that punctuate the geologic record. Due to the vastness of Earth s oceans, oceanic impacts of asteroids or comets are expected to be about 4 times more frequent than land impacts. The resulting injections of oceanic water into the upper atmosphere can have important repercussions on Earth s climate and atmospheric circulation. However, the duration and overall effect of these large injections are still unconstrained. This work addresses atmospheric injections of large amounts of water in oceanic impacts.
Author
*Collisions; Asteroids; Comets; Earth Surface; Water Injection*

**20050173918** Monash Univ., Victoria, Australia
**Saturn's Icy Moons: A Model for Their Origin and Bulk Chemical Composition**
Prentice, A. J. R.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

I report the preliminary results of a new model for the formation of Saturn s family of mid-sized icy moons, namely Mimas, Enceladus, Tethys, Dione, Rhea and Iapetus. It is proposed that these 6 moons condensed from a concentric family of orbiting gas rings that were shed equatorially by the contracting proto-Saturnian (hereafter p-Sat) cloud. Gas ring shedding is a central feature of the Modern Laplacian Theory of Solar system origin (hereafter MLT). In the case of the p-Sat cloud, the rings are shed at orbital radii Rn (n = 0,1,2,..) that lie close to the present mean orbital distances of the satellites, except for Iapetus. It is suggested that this moon initially formed close to the present mean distance of Titan, namely R(sub Ti) = 20.27R(sub Sat), where R(sub Sat) = 60,268 km is Saturn s equatorial radius. Iapetus was then displaced dynamically to its present orbit as a result of Titan s capture by the p-Sat cloud.
Derived from text
*Saturn (Planet); Ice; Chemical Composition; Mimas; Dione; Rhea (Astronomy); Enceladus; Tethys*

**20050173919** Kazan State Univ., USSR
**Modeling of the Free Lunar Libration**
Petrova, N.; Gusev, A.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Today the most interesting data on dynamics and internal structure of the Moon are already accumulated as a result of the different observations and space experiments. The Japanese space experiments Lunar_A and SELENE-missions, planed for 2006-2008 years, will contribute significantly to the information about the Moon: qualitative parameter Q, Love number k2, core s radius Rc, core s density etc. The searching for the free libration of the Moon and the study of this phenomenon may play an important role in determination of listed values in the Japanese experiments.
Author
*Data Structures; Libration; Moon; Radii*

**20050173920** Brown Univ., Providence, RI, USA

**The Lunar-wide Effects of the Formation of Basins on the Megaregolith**

Petro, . E.; Pieters, C. M.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG004GG11G; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The surface of the Moon underwent an intense bombardment during the first approx.700 my of it s history (e.g. [1]). During this time at least 43 basins [1,2] and countless smaller craters were formed across the entire surface [1,3]. A quantitative assessment of the regolith as formed and modified by basins is discussed here. The formation of the basins (craters \g300km in diameter) caused a significant amount of material to be excavated and redistributed across the surface of the Moon [4,5,6,7]. The material excavated by each individual basin was deposited and laterally mixed with the surrounding surface. This resulted in the development of a lunar-wide mixed zone of fragmented material, several kilometers thick [5,8,9]. This mixed zone was developed further by subsequent impacts resulting in a fragmental zone 1-2km thick called the megaregolith [10]. The initial zone of mixed material formed by the basins is not expected to be uniform across the surface of the Moon because of the varied size and random distribution of the basins. The main topographic ring of the 43 basins discussed by Wilhelms and Spudis [1,2] are illustrated in Figure 1.

Derived from text

*Lunar Effects; Craters; Regolith; Structural Basins; Size Distribution*

**20050173922** Planetary Science Inst., Tucson, AZ, USA

**Atmospheric Fragmentation of the Canyon Diablo Meteoroid**

Pierazzo, E.; Artemieva, N. A.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations

Contract(s)/Grant(s): NAG5-13429; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

About 50 kyr ago the impact of an iron meteoroid excavated Meteor Crater, Arizona, the first terrestrial structure widely recognized as a meteorite impact crater. Recent studies of ballistically dispersed impact melts from Meteor Crater indicate a compositionally unusually heterogeneous impact melt with high SiO2 and exceptionally high (10 to 25% on average) levels of projectile contamination. These are observations that must be explained by any theoretical modeling of the impact event. Simple atmospheric entry models for an iron meteorite similar to Canyon Diablo indicate that the surface impact speed should have been around 12 km/s [Melosh, personal comm.], not the 15-20 km/s generally assumed in previous impact models. This may help explaining the unusual characteristics of the impact melt at Meteor Crater. We present alternative initial estimates of the motion in the atmosphere of an iron projectile similar to Canyon Diablo, to constraint the initial conditions of the impact event that generated Meteor Crater.

Author

*Atmospheric Entry; Canyons; Contamination; Meteoroids; Meteorite Collisions*

**20050173923** Observatoire de Midi-Pyrenees, Toulouse, France

**Mars Express Imaging Photometry and Surface Geologic Processes at Mars: What Can be Monitored Within Gusev Crater?**

Pinet, P. C.; Cord, A.; Jehl, A.; Daydou, Y. D.; Chevrel, S. C.; Baratoux, D.; Greeley, R.; Williams, D. A.; Neukum, G., et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Access to the particle size and rock abundances from the sub-meter down to the microscale range is critical for the determination of geological processes that affect the planetary surfaces. Indeed, the geological processes controlling the size or being controlled by the size of particles include the volcanic processes, the surface features driven by the fluvial, aeolian or glacial activity, the landslides, the impact cratering and ejecta processes, and, last but not least, coating processes. Reflectance measurements of selected rocks and soils over a wide range of illumination geometries have been obtained by the Viking Lander, Mars Pathfinder and MER multispectral imaging facilities and provide local constraints on the interpretations of the physical and mineralogical nature of the Martian surface materials. A new investigation from orbit that can be addressed from Mars Express (MEx ) with the multi-angular High Resolution Stereo Camera (HRSC) dataset, generated with the nadir-looking, stereo and photometric channels, is to derive the surface photometric characteristics for mapping the variation

of the soil/bedrock physical properties of Mars, and to relate them to the spectroscopic and thermal observations produced by OMEGA, TES and THEMIS instruments.
Derived from text
*Imaging Techniques; Photometry; Planetary Surfaces; Mars Express; Surface Properties; Mars Surface*

**20050173924** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**Targeting Mars: The Mars Express Science Planning and Operations**
Pischel, R.; Zegers, T.; Hoffmann, H.; Hauber, E.; Mertens, V.; Roatsch, T.; Jaumann, R.; Matz, K.-D.; Companys, V.; Lauer, M.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 1 pp.; In English; See also 20050173912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The European Mars Express mission arrived at its elliptical orbit around Mars in January 2004. Since then the Red planet has been circled by the orbiter more than 1200 times and the 6 orbiter instruments have observed the Martian surface and atmosphere under various conditions. The paper describes the complex process of planning the science operations for Mars Express. This process is explained using the example of the High Resolution Stereo Camera (HRSC) and highlighting the question of how the accuracy of imaging specific targets is maintained from the planning step to the actual execution of spacecraft pointings.
Derived from text
*Mars Express; Imaging Techniques; Mars Surface; Elliptical Orbits; Mars Atmosphere*

**20050173925** Paris XI Univ., Orsay, France
**Spectral and Morphologic Properties of Nili Fossae**
Poulet, F.; Mangold, N.; Mustard, J.; Bibring, J.-P.; Gendrin, A.; Langevin, Y.; Gondet, B.; Masson, P.; Head, J.; Neukum, G., et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

OMEGA-MeX data has provided a new spatial distribution of localized concentrations of olivine on Mars [1,2,3]. The largest and the highest concentration of olivine is in Nili Fossae where [4] reported olivine detected with thermal infrared data. Of specific interest is the presence of hydrated minerals in this very rich olivine-bearing region. The identification of these hydrated minerals and their spatial distribution are discussed. We examine the geomorphology of this complex region with HRSC image. The combination of the spectral and geomorphic properties provides new insights on the conditions of formation of Nili Fossae.
Author
*Olivine; Mars Surface; Geomorphology*

**20050173927** Johns Hopkins Univ., Laurel, MD, USA
**A Shear Heating Origin for Ridges on Triton**
Prockter, L. M.; Nimmo, F.; Pappalardo, R. T.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Triton is believed to be a captured satellite based on its retrograde orbit around Neptune. Both Triton and Europa have relatively young surface ages, as evidenced by the small number of visible impact craters. Europa s global mean surface age has been estimated as approx. 60 Ma, while Triton s surface may only be approx. 100 Ma. Both moons are likely still geologically active and have similar surface compositions.
Author
*Triton; Retrograde Orbits; Craters*

**20050173928** Raytheon Information Technology and Scientific Services, Greenbelt, MD, USA
**A Martian Paleomagnetic Pole Estimate Made Using the Distribution and Intensity of Large Scale Magnetic Features**
Purucker, M. E.; Whaler, K. A.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Paleomagnetic pole estimates from Mars have used inversions of magnetic field observations over isolated dipoles, and inversions of magnetic field observations over multiple, overlapping sources. Utilizing our new, continuously varying

magnetization model, we estimate the paleomagnetic pole position based on the knowledge that an axially-centered dipolar magnetic field aligned with the rotation axis increases in strength with latitude.
Derived from text
*Magnetic Poles; Paleomagnetism; Magnetic Fields*

**20050173929** Observatoire de Midi-Pyrenees, Toulouse, France
**Derivation of Mars Surface Scattering Properties from OMEGA Spot Pointing Observations**
Pinet, P. C.; Daydou, Y.; Cord, A.; Chevrel, S.; Poulet, F.; Erard, S.; Bibring, J.-P.; Langevin, Y.; Melchiorri, R.; Bellucci, G. C., et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Emission phase function (EPF) observations have been carried out by Viking IRTM and Mars Global Surveyor TES instruments (e.g., [1,2]). With the generation of extensive angular coverage of emission phase function sequences, one can in principle assess and separate the contribution from surface and aerosol scattering phase functions. These observations, namely the TES EPF seasonal and spatial coverage, produced with large emission angles, have significantly improved the understanding of aerosols properties. Conversely, observations made under low to intermediate emission angles are most sensitive to the surface optical behavior, particularly when the atmosphere is experiencing low dust loading conditions. During Orbit 604 on July 10th 2004, the Mars Express spacecraft was rotated to allow the OMEGA instrument to obtain data at varying emission angles to derive an Emission Phase Function (EPF). We have explored the possibility of deriving surface photometric properties from these EPF observations, with the objective of comparing the outputs with thermophysical measurements from TES and THEMIS instruments, and from in situ data.
Derived from text
*Photometry; Mars Surface; Mars Express; Surface Properties; Scattering Functions*

**20050173931** California Inst. of Tech., Pasadena, CA, USA
**The Oxygen Isotope Similarity of the Earth and Moon: Source Region or Formation Process?**
Pahlevan, Kaveh; Stevenson, David J.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The oxygen isotope composition of lunar samples is indistinguishable from the terrestrial fractionation line on the three-isotope plot within analytical uncertainties [1]. By contrast, the oxygen isotope composition of Mars, as represented by the SNC meteorites, falls on a fractionation line clearly distinct from that of the Earth-Moon system (figure 1). The standard interpretation of these observations is that they reflect an isotopic similarity between the moon-forming impactor and the proto-Earth. Here we argue that such a scenario is unlikely and instead propose that mixing between the Earth and the circumterrestrial disk in the aftermath of the giant impact would homogenize the terrestrial and proto-lunar material, reducing the difference in oxygen isotope composition.
Derived from text
*Oxygen Isotopes; Earth-Moon System; SNC Meteorites; Fractionation; Lunar Geology*

**20050173934** Tokyo Univ., Hongo, Japan
**Noble Gas Study of New Enstatite SaU 290 with High Solar Gases**
Park, J.; Okazaki, R.; Nagao, K.; Bartoschewitz, R.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A new enstatite(E) chondrite, Sayh al Uhaymir 290 (SaU 290, nicknamed SaU 30R) was found in Adam County, Oman, by Rainer and Claudia Bartoschewitz, 2004, February 13th and November 6th. They found this new E chondrite on the gravel plateau of Miocene fresh-water limestone of Milddle Fars group, during the natural science expedition. SaU 290 was recovered as broken 64 pieces, the total mass of 1.796 kg, within a distance of 10 m approximately. SaU 290 will be officially named in the Meteorite Bulletin, 2005. It is classified as an E 3 anomaly enstatite chondrite, microbreccia, weathering grade W2.
Derived from text
*Chondrites; Meteorites; Rare Gases*

**20050173936** Brown Univ., Providence, RI, USA

**A Mechanism for the Formation and Evolution of Tharsis as a Consequence of Mantle Overturn: Large Scale Lateral Heterogeneity in a Stably Stratified Mantle**

Parmentier, E. M.; Zaranek, S. E.; Elkins-Tanton, L. T.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Tharsis volcanic center developed very early in the recorded geologic history of Mars and has remained active through most of the planet s evolution. The elevation of this global scale swell is due primarily to thickened crust. We present a model in which Tharsis originates from the melting of a large scale mantle heterogeneity resulting from mantle overturn following fractional magma ocean solidification. This explains the early development of Tharsis and the long-lived volcanism that has occurred in this region without requiring a heat flux from the core. In this model, the strong stable stratification following overturn prevents thermal convection. A frequently cited origin for Tharsis is decompression melting in a thermal plume originating by cooling of the core. Tharsis is the only volcanic feature of comparable scale on Mars. The existence of only a single thermal plume in a planet the size of Mars may be a consequence of a solid state phase transition near the core-mantle boundary. An internally generated magnetic field was present only during the very early evolution of Mars, so that if a plume exists, it must not have cooled the core sufficiently to sustain a magnetic field throughout most of the planet s evolution. A recent alternative proposal is that Tharsis originated as a large impact which determined the location of subsequent mantle upwelling and melting. However, no indication of upwelling and melting beneath other large impact structures can be seen.

Author

*Mars Volcanoes; Formations; Evolution (Development); Solidification; Upwelling Water*

**20050173938** Aberdeen Univ., UK

**Microbial Preservation in Sulfates in the Haughton Impact Structure Suggests Target in Search for Life on Mars**

Parnell, J.; Osinski, G. R.; Lee, P.; Cockell, C. S.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Microbes in Haughton Crater Sulfates: Impact craters are of high interest in planetary exploration because they are viewed as possible sites for evidence of life [1]. Hydrothermal systems in craters are particularly regarded as sites where primitive life could evolve. Evidence from the Miocene Haughton impact structure shows that crater hydrothermal deposits may also be a preferred site for subsequent colonization and hence possible extant life: Hydrothermal sulfates at Haughton are colonized by viable cyanobacteria [2]. The Haughton impact structure, Devon Island, Canadian High Arctic, is a 24 km-diameter crater of mid-Tertiary age. The structure preserves an exceptional record of impact-induced hydrothermal activity, including sulfide, and sulfate mineralization [3]. The target rocks excavated at the site included massive gypsum-bearing carbonate rocks of Ordovician age. Impact-remobilized sulfates occur as metre-scale masses of intergrown crystals of the clear form of gypsum selenite in veins and cavity fillings within the crater s impact melt breccia deposits [4]. The selenite is part of the hydrothermal assemblage as it was precipitated by cooling hot waters that were circulating as a result of the impact. Remobilization of the sulfate continues to the present day, such that it occurs in soil crusts (Fig. 1) including sandy beds with a gypsum cement. The sulfate-cemented beds make an interesting comparison with the sulfate-bearing sandy beds encountered by the Opportunity MER [5]. The selenite crystals are up to 0.3 m in width, of high purity, and transparent. They locally exhibit frayed margins where cleavage surfaces have separated. This exfoliation may be a response to freeze-thaw weathering. The selenite contains traces of rock detritus, newly precipitated gypsum, and microbial colonies. The rock detritus consists of sediment particles which penetrated the opened cleavages by up to 2cm from the crystal margins. Some of the detritus is cemented into place by gypsum, which must have been dissolved and reprecipitated from the host selenite.

Derived from text

*Microorganisms; Impact Melts; Deposits; Sulfates; Sulfides; Mars Craters; Sediments*

**20050173939** Brown Univ., Providence, RI, USA

**Ascraeus Mons Fan-shaped Deposit, Mars: Geological History and Volcano-Ice Interactions of a Cold-based Glacier**

Parsons, R. L.; Head, J. W., III; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ascraeus Mons is the northernmost of the three Tharsis Montes shield volcanoes (Arsia Mons, Pavonis Mons, and Ascraeus Mons), which are aligned along a N40 E trend on the crest of the broad Tharsis Rise. These three volcanoes, by virtue

of their great size and apparent similarity to terrestrial shield volcanoes such as Mauna Loa, Hawaii, have attracted considerable attention in the study of the geologic history of Mars. Previous studies have included investigations into their caldera morphologies as an indicator of late-stage summit activity, investigations into the evolutionary history of the volcanoes based on analyses of structural and morphologic features on and around them, and combined morphologic studies and crater counting to improve understanding of the overall stratigraphies of the volcanoes and the surrounding terrains. Several of these studies provide evidence to show that although Arsia, Pavonis, and Ascraeus Mons have had similar structural histories; differences between the three imply that each has a unique variation on the theme.
Derived from text
*Mars Surface; Mars Volcanoes; Terrain; Glaciers; Ice*

**20050173940** Brown Univ., Providence, RI, USA
**Weathering Pits in the Antarctic Dry Valleys: Insolation-induced Heating and Melting, and Applications to Mars**
Parsons, R. L.; Head, J. W., III; Marchant, D. R.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Coarsely pitted, 0.3 - 1 cm diameter, rocks have been observed on the surface of Mars since the observations made by the Viking Landers. These pits may be either vesicles formed by impact or volcanic processes, or the results of surface weathering processes. On Earth, weathering pits are common features on rocks throughout the Antarctic, where they have been attributed to both chemical and physical weathering processes. The hyper-arid, cold-polar desert environment of the Antarctic Dry Valleys (ADV) is commonly cited as the closest terrestrial analog to the Mars climate. It is hoped that further analysis of weathering pit morphologies in the ADV will provide a means to distinguish between the morphologies of vesicular rocks and non-vesicular rocks with weathering pits. The application of such a set of criteria to Mars could be important in furthering our understanding of the environment and processes occurring at its surface. The work presented here is a preliminary assessment of data collected from the Beacon Valley region of the ADV during November and December of 2004. The results highlight two end-members of weathering pit development, and offer support for pit formation resulting from mineral breakdown by insolation-induced melting of snow that accumulates preferentially in pits during periods of limited snowfall. Previous studies of weathering morphologies in Antarctica:
Author
*Mars Environment; Mars Surface; Weathering*

**20050173941** Brown Univ., Providence, RI, USA
**Geological Mapping of Ganymede**
Patterson, G. Wesley; Head, James W.; Collins, Geoffrey C.; Pappalardo, Robert T.; Procker, Louise M.; Lucchitta, Baerbel K.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Galilean satellites represent a series of bodies that contrast distinctly in their physical properties, surface geology, and thermal evolution. Their conditions of formation are very likely linked to the early history of the proto-Jovian nebula, with their disparate characteristics related to the radially varying conditions in the earliest period of their formation. The reasons for these differences in geological evolution represent one of the most fundamental problems in comparative planetology. Why are the surfaces of Ganymede and Callisto so strikingly different? What are the factors involved in their geological evolution? What roles do internal (e.g., possible presence of liquid water ocean at depth) and external forces (e.g., tidal interactions) play in explaining the differences between Ganymede and Callisto?
Derived from text
*Galilean Satellites; Ganymede; Water Depth; Thematic Mapping*

**20050173943** Pittsburgh Univ., Pittsburgh, PA, USA
**Comparison of Terrestrial Morphology, Ejecta, and Sediment Transport of Small Craters: Volcanic and Impact Analogs to Mars**
Peet, V. M.; Ramsey, M. S.; Crown, D. A.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Small craters, of both impact and volcanic origin, may represent some the most recent geologic activity on Mars [1].

Determining formational and erosional processes associated with these craters may have larger implications concerning the climate and surface evolution of Mars. The question of whether analysis of crater morphology, ejecta, and sediment transport can be ascertained through remote sensing data in a terrestrial analog and applied to Mars is the focus of this research. Research objectives include first field observation/ data collection coupled with a multi-wavelength remote sensing analysis. This methodology will be used to quantify formational and erosional processes that operate at smaller scales than previous studies. Ultimately, they will be applied to Mars datasets to determine the surface processes which operated on Mars at these small craters.
Author
*Terrestrial Radiation; Morphology; Ejecta; Sediment Transport; Mars Craters; Volcanoes*

**20050173944** Brown Univ., Providence, RI, USA
**An Integrated Study of OMEGA-Identified Mineral Deposits in Eastern Hebes Chasma, Mars**
Pelkey, S. M.; Gendrin, A.; Mustard, J. F.; Mangold, N.; Bibring, J.-P.; Langevin, Y.; Gondet, B., et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Incorporation of multiple remote sensing data sets allows us to better understand mineral deposits in Hebes Chasma identified from Mars Express OMEGA data. We focus on the geologic context of previously identified sulfate deposits [1]. from Viking and the Mars Orbiter Camera (MOC) as well as Thermal Emission Imaging System (THEMIS) visible and daytime thermal images. Thermal Emission Spectrometer (TES) albedos are used to estimate
Derived from text
*Mineral Deposits; Lunar Topography; Mars Express; Remote Sensing; Thermal Emission*

**20050173945** Brown Univ., Providence, RI, USA
**Global Spectral and Compositional Diversity of Mars: A Test of CRISM Global Mapping with Mars Express OMEGA Data**
Pelkey, S. M.; Mustard, J. F.; Bibring, J.-P.; Milliken, R.; Langevin, Y.; Gondet, B.; Gendrin, A.; Poulet, F.; Erard, S.; Murchie, S.; Arvidson, R., et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

After a year of mapping, the OMEGA instrument onboard the Mars Express has covered \g50% of the surface and revealed evidence for a wide diversity of materials, resulting in a new perception of the surface composition of Mars. This data set provides us with an ideal opportunity to evaluate and refine the multispectral mapping strategy set forth for operations of the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM). Based on the initial results from the OMEGA instrument, we have defined 36 parameters related to surface mineralogy that best match the known diversity of the martian surface. Thirteen atmospheric parameters have also been defined but lie beyond the scope of this presentation. To facilitate evaluation, gridded global maps of these parameters are produced at a resolution of 32
Derived from text
*Mars Express; Surface Layers; Photomapping; Multispectral Photography; Meteorological Parameters; Mars Surface; Imaging Spectrometers*

**20050173947** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Processing ISS Images of Titan's Surface**
Perry, Jason; McEwen, Alfred; Fussner, Stephanie; Turtle, Elizabeth; West, Robert; Porco, Carolyn; Knowles, Ben; Dawson, Doug, et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the primary goals of the Cassini-Huygens mission, in orbit around Saturn since July 2004, is to understand the surface and atmosphere of Titan. Surface investigations are primarily accomplished with RADAR, the Visual and Infrared Mapping Spectrometer (VIMS), and the Imaging Science Subsystem (ISS) [1]. The latter two use methane 'windows', regions in Titan's reflectance spectrum where its atmosphere is most transparent, to observe the surface. For VIMS, this produces clear views of the surface near 2 and 5 microns [2]. ISS uses a narrow continuum band filter (CB3) at 938 nanometers. While these methane windows provide our best views of the surface, the images produced are not as crisp as ISS images of satellites like

Dione and Iapetus [3] due to the atmosphere. Given a reasonable estimate of contrast (approx.30%), the apparent resolution of features is approximately 5 pixels due to the effects of the atmosphere and the Modulation Transfer Function of the camera [1,4]. The atmospheric haze also reduces contrast, especially with increasing emission angles [5].
Derived from text
*Atmospheric Effects; Infrared Spectrometers; Titan; Infrared Imagery; Imaging Techniques; Image Processing*

**20050173951** NASA Johnson Space Center, Houston, TX, USA, Curtin Univ. of Technology, Bentley, Australia
**A Further Investigation of the Exceptional Zircon Aggregate in Lunar Thin Section 73235,82**
Pidgeon, R. T.; Nemchin, a. A.; Meyer, C.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Smith et al. described an exceptional zircon assemblage in thin section 82 from lunar breccia 73235 which, in transmitted light, resembles a cluster of pomegranate seeds, situated in a clast dominated by bytownite (Fig.1). They reported that high-contrast back-scattered electron (BSE) images of the zircon assemblage clearly show an overgrowth around most of the crystals. Most significantly these authors reported that the age of the rims of ca 4.18Ga is 120 million years younger than age of the interiors, dated at ca 4.31Ga. Smith et al. concluded that ca 4.31 billion years ago a relatively large (500+micron) zircon crystallized within a clast of Ca rich plagioclase. The zircon was fractured into numerous smaller crystals and was subsequently overgrown by a second generation of zircon at approximately 4.18Ga.
Derived from text
*Breccia; Crystallization; Minerals; Lunar Crust*

**20050173952** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**A High-Sensitivity Broad-Band Seismic Sensor for Shallow Seismic Sounding of the Lunar Regolith**
Pike, W. Thomas; Standley, Ian M.; Banerdt, W. Bruce; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The recently undertaken Space Exploration Initiative has prompted a renewed interest in techniques for characterizing the surface and shallow subsurface (0-10s of meters depth) of the Moon. There are several reasons for this: First, there is an intrinsic scientific interest in the subsurface structure. For example the stratigraphy, depth to bedrock, density/porosity, and block size distribution all have implications for the formation of, and geological processes affecting the surface, such as sequential crater ejecta deposition, impact gardening, and seismic settling. In some permanently shadowed craters there may be ice deposits just below the surface. Second, the geotechnical properties of the lunar surface layers are of keen interest to future mission planners. Regolith thickness, strength, density, grain size and compaction will affect construction of exploration infrastructure in terms of foundation strength and stability, ease of excavation, radiation shielding effectiveness, as well as raw material handling and processing techniques for resource extraction.
Derived from text
*Lunar Surface; Surface Layers; Space Exploration; Moon; Geotechnical Engineering; Bedrock; Deposits; Ejecta*

**20050173953** Minnesota Univ., Minneapolis, MN, USA
**Classification of Mars Pathfinder Rocks Using Multispectral Data**
Pierre, N. M.; Yingst, R. A.; Johnson, J. R.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This study represents the first attempt at a systematic spectral classification of a significant percentage of rocks at the Mars Pathfinder (MPF) landing site. This work is part of a larger effort to correlate quantitative rock shape and roundness characteristics with spectral data, to better determine the geologic history of rocks at the site. Here, we use spectral analysis to reveal the composition of rock surfaces primarily in the MPF Rock Garden.
Author
*Classifications; Mars Pathfinder; Rocks; Spectrum Analysis*

**20050173954** Brown Univ., Providence, RI, USA

**Remote Sensing of Lunar Mineralogy: The Glass Conundrum**

Pieters, C. M.; Tompkins, S.; Pieters, C. M.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations

Contract(s)/Grant(s): NAG5-11763; NAG5-13609; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The term 'lunar glasses' provokes different connotations depending on the context. Common usages include a) pyroclastic deposits consisting of 'glass beads' derived from the deep interior, b) melt products created during impact events, and c) the ubiquitous and complex glass-welded weathering products, agglutinates. Each is distinct due to a specific geologic origin and composition, but all contain quench glass in some form. Spectral properties of a wide range of glass-bearing lunar materials is presented elsewhere [1], Discussed here are new spectra for a depth sequence of samples from Apollo 17 core 74002 collected at Shorty Crater. The data provide new insight into why Fe-Ti-rich quench glass is not directly observed remotely. Resolving this mystery allows the extensive glass-rich deposits at Aristarchus to be recognized as low-Ti pyroclastic glass. Derived from text

*Craters; Agglutination; Lunar Rocks; Glass; Remote Sensing; Deposits; Lunar Soil*

**20050173955** Centre d'Etude Spatiale des Rayonnements, Toulouse, France

**Performance Limits of New Generation Scintillators for Planetary Gamma-Ray Spectroscopy**

Pirard, B.; dUston, C.; Maurice, S.; Gasnault, O.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A lot of new scintillation materials have been developed in the last decade, especially for use in high energy physics and medical imaging (Positron Emission Tomography). Some of them, in particular LaBr3:Ce and LaCl3:Ce would present interesting properties for gamma-ray spectroscopy. Coupled with low noise readout devices and highly reflective coatings, these scintillators will in some cases compete with semiconductor detectors in the coming years. Although they have a poorer energy resolution than HPGe detectors, they do not require cooling systems (active or passive) and could be envisaged for future planetary missions where resources (mass, power) are limited. On the other hand, germanium-based detectors will still have the highest science return, making these new scintillators only attractive for the investigation of unexplored planetary bodies. The following presents perspectives of these new scintillators for a use in planetary exploration. Highlight is put on their spectral performances compared with conventional scintillators.

Derived from text

*Gamma Ray Spectrometers; Scintillation; High Energy Interactions; Imaging Techniques; Space Exploration; Tomography*

**20050173956** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**An Inventory of Impact Craters on the Martian South Polar Layered Deposits**

Plaut, J. J.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The polar layered deposits (PLD) of Mars continue to be a focus of study due to the possibility that these finely layered, volatile-rich deposits hold a record of recent eras in Martian climate history. Recently, the visible sensor on 2001 Mars Odyssey s Thermal Emission Imaging System (THEMIS) has acquired 36 meter/pixel contiguous single-band visible image data sets of both the north and the south polar layered deposits, during the local spring and summer seasons. In addition, significant coverage has been obtained at the THEMIS visible sensor s full resolution of 18 meters/pixel. This paper reports on the use of these data sets to further characterize the population of impact craters on the south polar layered deposits (SPLD), and the implications of the observed population for the age and evolution of the SPLD.

Derived from text

*Mars Exploration; Craters; Mars Surface; Thermal Emission; Planetary Geology; Deposits*

**20050173957** Johns Hopkins Univ., Laurel, MD, USA

**Haughton: A Peaked Ring Impact Structure**

Plescia, J. B.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Haughton Impact Structure on Devon Island in Canada (75 deg 22 min N, 80 deg 40 min W) is 23.4 +/- 1 Ma. The structure has been recognized since 1955; an impact origin was suggested by and confirmed by. A multidisciplinary study was conducted in 1984 to better define the geology and geophysics of the crater [5] and people have been mucking around the place ever since. Haughton s diameter is in the size range of complex craters, yet it lacks a recognized exposed topographic central uplift. It also has a relatively simple negative gravity anomaly. That anomaly (more characteristic of a simple than a complex crater) to first order suggests that the massexcess typical of a central uplift, is not present. To further explore the nature of a possible central uplift, gravity data were collected to supplement the data of.
Author
*Craters; Geology; Gravity Anomalies; Ring Structures; Impact Damage*

**20050173958** California Univ., Santa Cruz, CA, USA
**A Comparison of Automated and Manual Surveys of Small Craters in Elysium Planitia**
Plesko, C. S.; Brumby, S. P.; Asphaug, E.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Small impact craters are some of the most interesting, and most abundant features on Mars. There are now so many images of the surface of Mars that the dataset exceeds the Mars community s ability to analyze in detail by conventional manual methods. To overcome this bottleneck, we have developed an automated technique to rapidly survey images for interesting features, specifically small impact craters. We demonstrate that the accuracy of our automated crater counts are comparable to manual counts by human experts, and are useful in culling large datasets for images that merit expert examination.
Author
*Mars Surface; Mars Photographs; Manuals; Landforms; Craters*

**20050173959** Johns Hopkins Univ., Laurel, MD, USA
**Small-Diameter Martian Craters: Applicability for Chronology**
Plescia, J. B.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Crater counting has historically been used to establish relative and absolute chronologies on planetary surfaces and to develop global stratigraphies. Typically, craters in the size range \g1 km have been used. This diameter was chosen as a convenient balance between image resolution and a diameter that would indicate a formation age. Craters at larger diameters might be craters protruding from an underlying surface; smaller diameters might be affected by local resurfacing. A limitation of an approach that employs this size crater is that counts must be compiled for large areas in order to reduce the statistical uncertainties associated with comparison of counts. This results in an inability to detect small areas of variable age. The availability of high resolution MOC, THEMIS and HRSC images provides the ability to examine the population of craters in the \h\h1 km size range. Because the production function of craters follows a log distribution, the number of craters in the meters to hundred of meters diameter range is several orders of magnitude greater than in the km range. Thus, smaller areas can be counted, in principal, with low statistical uncertainties allowing the recognition of smaller differences in age and smaller areas of different age. [1, 2] proposed absolute chronologies for small scale craters to allow them to be used to establish not only the relative age, but the absolute age of a surface. Such chronologies are established by modifying the lunar chronology (based on returned samples) for martian conditions (e.g., impact velocities, gravity).
Derived from text
*Mars Craters; Planetary Surfaces; Lunar Geology; Gravitation; Chronology; Size Distribution; Impact Velocity*

**20050173960** Nevada Univ., Reno, NV, USA
**A Tale of Two Stratigraphies: From Alba Patera to the Northern Plains**
Polit, A. T.; Schultz, R. A.; Soliva, R.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We measure the along-strike throw of grabens on Alba Patera and compare their characteristics with those of the distal segments of the echelon grabens of Tantalus Fossae. Major differences exist in the fault populations and throw distributions

of the two areas studied, indicating a change in the Martian stratigraphy between these two regions.
Derived from text
*Geological Faults; Mars Surface; Stratigraphy; Planetary Geology; Length*

**20050173961** Moscow State Univ., Russia
**Evaluation of the Crystallization Temperatures and Pressures for Clinopyroxene in the Parental Bodies of Ordinary Chondrites**
Pletchov, P. Yu; Zinovieva, N. G.; Latyshev, N. P.; Granovsky, L. B.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912
Contract(s)/Grant(s): RFBR-04-05-64880; RFBR-UR.09.02.052; SS-130-2003.5; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Thermo- and barometry of clinopyroxene in ordinary chondrites indicates that, regardless of the chemical groups and petrological types of chondrites, they crystallized from chondritic melts at pressures of much greater than 0 kbar. McSween & Patcheon applied pyroxene thermometry to constrain the formation temperatures of LL chondrites and evaluated these temperatures at 900 - 1150 C for meteorites of different petrological types: LL3 and LL7. The pressures under which meteorites were produced were evaluated in by the Al concentrations in clino- and orthopyroxene. In this paper, the crystallization temperatures of chondrites were evaluated using a number of geothermometers, and the pressures were estimated by the clinopyroxene geo-barometer for the crystallization of the magmatic mineral assemblages in meteorites of each type.
Derived from text
*Crystallization; Temperature Measurement; Pressure Dependence; Chondrites; Barometers; Geotemperature*

**20050173963** Paris-Sud Univ., Orsay, France
**Mineralogy of the Northern High Latitude Regions of Mars**
Poulet, F.; Langevin, Y.; Bibring, J.-P.; Gondet, B.; Arvidson, R.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The northern high latitude regions of Mars have had a complex geologic history. Although they are some of the youngest units on Mars little is known about their composition, formation and deposition [1]. Neutron data acquired using the Neutron Spectrometer aboard 2001 Mars Odyssey indicates hydrogen-rich layers (\h1 meter) ranging up to 100% water-equivalent by mass are found at latitudes higher than 50-60degN latitude [2]. Recently, sedimentary minerals have been detected by OMEGA-MEx in some parts of the circumpolar dunes [3,4]. We have used OMEGA data to analyze the surface composition of the regions located between 50degN and the permanent polar cap. The surface properties of the northern terrains are discussed.
Derived from text
*Mars Surface; Mars Exploration; Mineralogy; Surface Properties; Surface Layers; Paleontology*

**20050173964** Arizona Univ., Tucson, AZ, USA
**Mapping Rays and Secondary Craters from Zunil, Mars**
Preblich, B.; McEwen, A.; Studer, D.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: A 10.1-km diameter crater named Zunil (7.7 deg N, 166 deg E) in the Cerberus Plains of Mars is the source for approx. 10(exp 7) secondary craters 10 m in diameter within 800 km of the impact site. The largest Zunil secondary found to date is only 230 m in diameter, whereas typically the largest secondary is 5% of the primary (500 m in this case). These secondaries are concentrated in asymmetric rays extending west up to 1600 km. Zunil is thought to be only a few Ma old, as it is younger than the Cerberus Plains, one of the youngest areas on Mars, and is a very plausible source crater for some of the basaltic shergottites. Further, its prominent rays and secondaries appear relatively fresh in both the visible and the infrared, and it is only the crater of its size or larger on Mars where rays are still present.
Derived from text
*Mars Surface; Mars Craters; Mapping*

**20050173965** Los Alamos National Lab., NM, USA

**Spatial Deconvolution of Mars Odyssey Neutron Spectroscopy Data: Analysis of Mars Southern Seasonal Cap**

Prettyman, T. H.; Elphic, R. C.; Feldman, W. C.; Murphy, J. R.; Nelli, S.; Titus, T. N.; Tokar, R. L.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During autumn and winter, CO2 gas condenses in the polar night forming an ice cap that extends from the pole to roughly 45 latitude. In the spring and summer, the ice sublimes, replenishing the atmosphere with CO2. Approximately 25% of the martian atmosphere is cycled into and out of the northern and southern seasonal caps. Consequently, the seasonal caps play a dominant role in atmospheric circulation. The main questions about the seasonal caps that remain unanswered concern the local energy balance, polar atmospheric dynamics, and CO2 condensation mechanisms. Mars general circulation models (GCM) can be calibrated by adjusting the emissivity and albedo of the seasonal caps to fit the model results to Viking pressure measurements [1,2]. The albedo and emissivity of the seasonal ice are generally assumed to be spatially uniform and constant with time. This calibration method enables accurate determination of the total amount of CO2 cycled through the northern and southern caps; however, the adjusted emissivity and albedo values are inconsistent with those observed by the Mars Global Surveyor Thermal Emission Spectrometer (TES). TES observations reveal a cap that is spatially heterogenous with time varying emissivity and albedo [3-5].

Derived from text

*Carbon Dioxide; Atmospheric Circulation; Atmospheric Physics; Mars Atmosphere; Polar Caps; Atmospheric General Circulation Models*

**20050173966** Instituto Nacional de Tecnica Aeroespacial, Madrid, Spain

**Searching for Clathrate Hydrates in the Europa Satellite**

Prieto-Ballesteros, O.; Kargel, J. S.; Selsis, F.; Fernandez-Sampedro, M.; Martinez, E. Sebastian; Hogenboom, D. L.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Several substances besides water ice, salts and/or acids have been detected on the surface of Europa, Ganymede and Callisto by spectroscopic sensors, including CO2, SO2 and H2S [1, 2, 3, 4]. The spectral signal of CO2 and SO2, from stronger bands on Callisto than in Europa, have been attributed to exist as confined molecules within or attached to a host material [2, 4], so these materials might exist as clathrate hydrates instead ordinary ices or gases. Clathrate hydrates are crystalline compounds in which an expanded water ice lattice forms cages that contain gas molecules.The specific phase of these substances will depend on the system conditions where they occur. Clathrate hydrates might be abundant in the solar system, as some authors have pointed out since the 1960's [5, 6, 7, 8, 9, 10, 11], but their volatility at low pressure usually restricts their present occurrence to below the surface for objects as warm as Europa or in the cold fringes of the Solar System as metastable surface condensates. If clathrate hydrates exist on Europa today, they have two possible origins: a) they might be primordial condensates from the Jovian sub-nebula, or b) they might be secondary minerals formed as a consequence of the geological evolution of the satellite. Primordial clathrate hydrates are not expected to have been preserved until now because of Europa s active geological history that is evidenced by many features on its surface. But dissociated gases from destroyed ancient clathrates may be added to volatiles from differentiation of both the chondritic rock precursor or reprocessing of cometary materials to make secondary clathrates that may be present today.

Derived from text

*Ganymede; Europa; Callisto; Carbon Dioxide; Sulfur Dioxides; Clathrates; Hydrates*

**20050173967** Lyon-1 Univ., Villeurbanne, France

**Sulfate Deposits Identified by OMEGA in Melas Chasma**

Quantin, C.; Gendrin, A.; Mangold, N.; Bibring, J.-P.; Poulet, F.; Allemand, P., et al.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: OMEGA, the VIS/NIR imaging spectrometer is onboard ESA/Mars Express spacecraft. Since one year, OMEGA has acquired many strips covering Valles Marineris. Melas Chasma, the central part of Valles Marineris is completely covered by OMEGA observations at low resolution with in addition some high resolution spots. The mineralogical informations given by OMEGA data are crucial to understand this complex area. Indeed, Melas Chasma displays many complex sedimentary landforms like interior layered deposits whose origin is not yet a consensus. The main point of the debate is the role of water in the formation or the erosion of the ILD. Here, we report the geological study of Melas Chasma mineralogy issue from OMEGA data. Especially, sulfates have been detected from OMEGA data set in Melas Chasma. Here,

we study their distribution. The mineralogy determined from OMEGA data provides new insights into the sedimentary history in Valles Marineris.
Author
*Sulfates; Deposits; Mars Surface; Mineralogy; Water*

**20050173968** NASA Ames Research Center, Moffett Field, CA, USA
**Dry Acid Deposition and Accumulation on the Surface of Mars and in the Atacama Desert, Chile**
Quinn, R. C.; Zent, A. P.; Ehrenfruend, P.; Taylor, C. L.; McKay, C. P.; Garry, J. R. C.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It has been discovered recently that soils from certain regions of the Chilean Atacama Desert have some characteristics that are similar to the surface materials tested by the Viking Landers. Navarro-Gonzalez et al. demonstrated that the quantity and diversity of heterotrophic bacteria increase as a function of local water availability in the Atacama, and that for some soil samples collected in the driest regions, no culturable bacteria could be isolated. Additionally, Navarro-Gonzalez et al. reported that pyrolysis-GCMS analysis of soils collected from these regions revealed extremely low levels of organic matter. Although the mechanism resulting in the low level of organics in these regions was not established by Navarro-Gonzalez, the condition of organic-depleted, near-sterile soil offers an interesting Earth analog of the martian surface material, as the Viking Gas Exchange (GEx) experiment and Labeled Release (LR) experiment were unable to demonstrate the presence of culturable bacteria, and the Viking pyrolysis- GCMS was unable to detect organic compounds.
Derived from text
*Acid Rain; Drying; Deposition; Accumulations; Mars Surface; Surface Properties; Soil Sampling*

**20050173969** Grenoble-1 Univ., France
**Maturation Grade of Coal Samples as Revealed by Raman Spectroscopy**
Quirico, E.; Rouzaud, J.-N.; Bonal, L.; Montagnac, G.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The accurate determination of the maturity of natural Organic Matter (OM) is a key problem in many fields, such as oil and coal research, or extraterrestrial matter for planetologic studies. Different physical or chemical tracers have been developed, and are generally efficient for dedicated studies (vitrine reflectance, elemental composition, etc.). However, research fields like the study of OM in meteorites and cometary grains require a characterization technique: 1) which does not depend on any biogenic materials as vitrinite is; 2) which is applicable to micrometric quantities and does not require sophisticated sample preparation for separating OM from minerals, like acid demineralization.
Derived from text
*Coal; Organic Materials; Minerals; Meteorites*

**20050173970** Maryland Univ., College Park, MD, USA
**Os-187/Os-188 and Highly Siderophile Element Systematics of Apollo 17 Aphanitic Melt Rocks**
Puchtel, I. S.; Walker, R. J.; James, O. B.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color illustrations
Contract(s)/Grant(s): NASA Order W-10252; NNG04GJ49A; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Generally chondritic relative abundances and high absolute abundances of the highly siderophile elements (HSE: Ru, Rh, Pd, Re, Os, Ir, Pt, Au) in Earth s upper mantle provide strong evidence that these elements were added to the Earth following the last major interaction between its metallic core and silicate fraction. So called ‘late accretion’ may have added materials comprising as much as 0.8% of the total mass of the Earth and possibly a similar proportion of mass to the Moon. We have begun to study the chemical nature of late accreted materials to the Earth - Moon system by examining the HSE contained in lunar impact-melt rocks. The HSE contained in melt rocks were largely added to the Moon during the period of time from the origin of the lunar highlands crust (4.4- 4.5 Ga) to the end of the late bombardment period (ca. 3.9 Ga). These materials provide the only direct chemical link to the late accretionary period. The chemical fingerprints of the HSE in late accreted materials may enable us to ascertain under what conditions and where in the solar system the late accreted materials formed. The Os-187/Os-188 ratios (reflecting long-term Re/Os), coupled with ratios of other HSE, can be diagnostic for

identifying the nature of the impactor. A critical issue, however, will be deconvolving the exogenous from indigenous components.
Derived from text
*Osmium Isotopes; Chondrites; Earth Mantle; Impact Melts*

**20050173971** Eidgenoessische Technische Hochschule, Zurich, Switzerland
**Iron-60 in the Eucrite Parent Body and the Initial Fe-60/Fe-56 of the Solar System**
Quitte, G.; Latkoczy, C.; Halliday, A. N.; Schoenbaechler, M.; Guenther, D.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Basaltic eucrites are differentiated meteorites that crystallized rapidly. Most of them have experienced thermal metamorphism and impact brecciation. The exact timescales of all these events is still a matter of debate. There is evidence that eucrites formed 8 to 10 Myrs after the start of the solar system and other evidence that has been used to argue for an earlier formation. The Fe-60 - Ni-60 chronometer (half-life = 1.49 +/- 0.27 Myrs) is well suited for constraining the age of the oldest basalts of our solar system. Nickel is more siderophile and more compatible in silicate melting than iron, so that both elements strongly fractionate during core formation and mantle differentiation. The resulting Fe/Ni ratio in eucrites is extremely high. Large excesses of Ni-60 are therefore expected in these meteorites. A first Ni isotopes study has been conducted for two eucrites using TIMS about ten years ago. It was shown that the Ni-60 excesses found in the samples result from the in situ decay of 60Fe which was extant at the time the eucrites formed and crystallized. To obtain a more comprehensive picture of Ni isotopes in eucrites, we have re-addressed the topic using MC-ICPMS. We here present data for whole rock samples from Bouvante and Juvinas, two non-cumulate eucrites, and for mineral separates from Juvinas.
Author
*Iron Isotopes; Solar System; Basalt; Meteoritic Composition; Crystallization*

**20050173972** Kingston Univ., Kingston-Upon-Thames, UK
**Addams Crater, Venus: Outflow Analogous with a Submarine Debris Flow?**
Purdie, Philip; Petford, Nick; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Magellan mission to Venus (1989 to 1994) recorded over 900 impact features on the surface of the planet. Due to the relative lack of erosion, recent volcanism and other tectonic activity, the mostly complete impact record allows for a detailed study of crater and outflow mechanics. From an initial vapour cloud formation scenario, the origin of the outflow as a cometary impact event sems unlikely. Vapour cloud modelling for iron and stony meteorite impacts correlate well with predicted source cloud emplacement and point to catastrophic emplacement of the distal outflow deposits. The extraordinary outflow length and morphology of Addams crater deposits are comparable to that of the Saharan submarine debris flow off Northwest Africa. Comparison of sonar data with radar images of the Addams crater outflow lead us to postulate that both flows were formed from a similar two-tiered flow regime.
Author
*Venus (Planet); Craters; Stony Meteorites; Meteorite Collisions*

**20050173973** Centre National de la Recherche Scientifique, Lyon, France
**Evidences for Fluvial and Lacustrine Activity on Interior Layered Deposits of Valles Marineris**
Quantin, C.; Allemand, P.; Mangold, N.; Dromart, G.; Delacourt, C.; Lunar and Planetary Science XXXVI, Part 16; [2005]; 2 pp.; In English; See also 20050173912; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the key questions of the study of Mars is the past or current presence of liquid water. The recent results from rover missions confirm the role of water at the surface of Mars at least during Noachian period. These results are in agreement with all the water-worn features reported until today on Noachian Highlands attesting that water cycle was different than today. However, neither results from rover missions neither geological evidences allow to constrain the duration of this water activity. The debate about a global warm and wet past climate or episodic conditions conducive to liquid water is still active. For the Hesperian period, the indices of water activity are more sporadic leading to exclude global climate conditions favourable to liquid water. However, a recent work reports the occurrence of dense valley networks dated at Hesperian period around and within Valles Marineris whose features could be consistent with warm and wet conditions. The study of this water activity

within Valles Marineris is crucial to understand the history of the canyon system. Indeed, Valles Marineris displays many enigmatic sedimentary figures whose formation under warm and wet conditions is controversial because of their age. Some canyons have thick Interior Layered Deposits (ILD). The hypotheses about their origin are so diverse as non-aqueous Aeolian or volcanic origin and aqueous sub-ice volcanism or lacustrine origin. Here, we report evidences of dense valley networks within Valles Marineris connected to a paleolake observed on possible ILD.
Author
*Water; Mars Surface; Climate; Geology*

**20050174558** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXVI, Part 13**
[2005]; ISSN 1540-7845; In English; Lunar and Planetary Science XXXVI, 14-18 Mar. 2005, Houston, TX, USA; See also 20050174559 - 20050174707
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1234-Pt-13; Copyright; Avail: CASI; C01, CD-ROM

Contents include the following: A Fast, Non-Destructive Method for Classifying Ordinary Chondrite Falls Using Density and Magnetic Susceptibility. An Update on Results from the Magnetic Properties Experiments on the Mars Exploration Rovers, Spirit and Opportunity. Measurement Protocols for In Situ Analysis of Organic Compounds at Mars and Comets. Piping Structures on Earth and Possibly Mars: Astrobiological Implications. Uranium and Lead in the Early Planetary Core Formation: New Insights Given by High Pressure and Temperature Experiments. The Mast Cameras and Mars Descent Imager (MARDI) for the 2009 Mars Science Laboratory. MGS MOC: First Views of Mars at Sub-Meter Resolution from Orbit. Analysis of Candor Chasma Interior Layered Deposits from OMEGA/MEX Spectra. Analysis of Valley Networks on Valles Marineris Plateau Using HRSC/MEX Data. Solar Abundance of Elements from Neutron-Capture Cross Sections. Preliminary Evaluation of the Secondary Ion/Accelerator Mass Spectrometer, MegaSIMS. Equilibrium Landforms in the Dry Valleys of Antarctica: Implications for Landscape Evolution and Climate Change on Mars. Continued Study of Ba Isotopic Compositions of Presolar Silicon Carbide Grains from Supernovae. Paleoenviromental Evolution of the Holden-Uzboi Area. Stability of Magnesium Sulfate Minerals in Martian Environments. Tungsten Isotopic Constraints on the Formation and Evolution of Iron Meteorite Parent Bodies. Migration of Dust Particles and Volatiles Delivery to the Inner Planets. On the Sitting of Trapped Noble Gases in Insoluble Organic Matter of Primitive Meteorites. Trapping of Xenon Upon Evaporation-Condensation of Organic Matter Under UV Irradiation: Isotopic Fractionation and Electron Paramagnetic Resonance Analysis. Stability of Water on Mars. A Didactic Activity. Analysis of Coronae in the Parga Chasma Region, Venus. Photometric and Compositional Surface Properties of the Gusev Crater Region, Mars, as Derived from Multi-Angle, Multi-Spectral Investigation of Mars Express HRSC Data. Mapping Compositional Diversity on Mars: Spatial Distribution and Geological Implications. A New Simulation Chamber for Studying Planetary Environments. Folded Structure in Terra Sirenum. Mars. Nitrogen-Noble Gas Static Mass Spectrometry of Genesis Collector Materials. Neon Isotope Heterogeneity in the Terrestrial Mantle: Implication for the Acquisition of Volatile Elements in Terrestrial Planets. The Cosmic Clock, the Cycle of Terrestrial Mass Extinctions.
CASI
*Capture Effect; Chondrites; Climate Change; Coronas; Craters; Deposits; Iron Meteorites; Magnetic Properties; Mars Environment*

**20050174559** Specola Vaticana, Vatican City State (Holy See)
**A Fast, Non-Destructive Method for Classifying Ordinary Chondrite Falls Using Density and Magnetic Susceptibility**
Macke, R. J.; Consolmagno, G. J.; Rochette, P.; Britt, D. T.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Magnetic susceptibility is the ratio of the induced magnetization of a material to the strength of an applied magnetic field (less than 1 mT). It depends on the capacity of the material to be affected by, or respond to, such a field and is a function of the abundance of the various magnetic phases in the sample, weighed by their specific susceptibility. Rochette et al. have demonstrated that the magnetic susceptibility of unweathered ordinary chondrites is correlated with the amount and oxidation state of the iron within those meteorites. Because these are the primary criteria for the classification of ordinary chondrites into H, L, and LL groups, they suggested that magnetic susceptibility measurements could be used as a fast and non-destructive tool for meteorite classification.
Derived from text
*Magnetic Permeability; Chondrites; Nondestructive Tests; Density (Mass/Volume)*

**20050174560** Cambridge Univ., Cambridge, UK

**Analysis of Coronae in the Parga Chasma Region, Venus**

Martin, P.; Stofan, E. R.; Glaze, L. S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Parga Chasma is a 10,000km long fracture and trough system extending from Atla Regio to Themis Regio in the southern hemisphere of Venus [1, 2]. The Parga system consists of a main NW-SE trending chasma with 14 branching segments, each of the segments having coronae along their length. The trough, fractures and coronae of the Parga system form a zone of deformation that ranges from approx.150 to \g400km wide. Parga and other chasmata systems are thought to result from regional extension accompanied by upwelling to form coronae [1-4]. As most coronae are located along rift systems [2], analysis of chasma coronae may further constrain the origin and evolution both of coronae and of the chasma systems. Following an earlier preliminary study [5, 6] we examine the variations in size, topography, annulus characteristics, associated volcanism, relative location and relative timing of corona formation with respect to rifting along the Parga system. We analyse 131 coronae, including coronae along the chasma as well as those up to 1,500km away from the rift.

Derived from text

*Coronas; Geological Faults; Venus Surface; Volcanology; Position (Location); Deformation; Planetary Geology*

**20050174563** Minnesota Univ., Duluth, MN, USA

**Circular Lows, a Genetically Distinct Subset of Coronae?**

McDaniel, K.; Hansen, V. L.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Venus hosts approx. 515 coronae with diameters ranging from approx. 60 - 2600 km. Coronae, circular to quasi-circular structures characterized by an annulus of fractures or ridges, variably display radial fractures, lava flows, and double ring structures. In plan view some coronae display elliptical forms with aspects ratios as much as 2:1.Coronae topographic profiles range from domical to plateau-shaped, rimmed depressions, to amphitheater-like depression, to no topographic expression; the range of topographic profiles has been attributed to developmental stage. Coronae have been interpreted as both exogenic products and endogenic products, including impact craters, caldera, and the surface expression of diapirs on the lithosphere diapiric structures, although most workers accept a diapiric origin. Given the wide range of coronae characteristics, coronae might form by more than one process. In this contribution we examine coronae marked by circular amphitheater-like depressions; we call these features circular lows in order to highlight them as a subset of coronae, with attention to description rather than possible mode of formation.

Author

*Coronas; Venus Atmosphere; Ring Structures; Radial Flow; Lava*

**20050174564** Tennessee Univ., Knoxville, TN, USA

**Comparison of Olivine-rich Martian Basalts and Olivine-Phyric Shergottites**

McSween, H. Y., Jr.; Milam, Keith A.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although initial deconvolutions of orbital thermal emission spectra of common Martian surface materials did not reveal the presence of magnesian olivine above the detection limit, recent deconvolutions that include more Fe-rich olivines in the spectral library suggest that this phase may be widespread and abundant in some locations. The occurrence of olivine in some Martian basaltic meteorites is obvious, but its origin remains controversial. Crystals in olivine-phyric shergottites have been suggested to represent phenocrysts, xenocrysts, or restites from impact melting. The occurrence of olivine-rich basalts (and olivine-bearing tephras) in Gusev Crater further confirms that this mineral is locally abundant on Mars. Compositional and textural comparison of Gusev basalts with olivine-phyric shergottites allows a more robust interpretation of the primitive character of these rocks and the nature of their mantle source region.

Author

*Mars Surface; Basalt; Olivine; Shergottites; Thermal Emission; Surface Properties*

**20050174565** Eotvos Lorand Univ., Budapest, Hungary

**Second Unusual Guidebook to Terrestrial Field Work Studies: Astronauts with Roving Vehicle, Robotic Rovers on Planetary Surfaces (Seventh Concise Atlas in the Solar System Series of Textbooks at Eoutvos University, Hungary)**

Meszaros, I.; Hargitai, H.; Horvath, A.; Kereszturi, A.; Sik, A.; Berczi, Sz.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558

Contract(s)/Grant(s): MUI-TP-154/2004; MUI-TP-190/2004; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The next new concise atlas we compiled in the series of the Solar System Research deals with Environmental Studies by Apollo astronauts with cars, and by rovers on Planetary Surfaces. The main chapters were a) Apollo field works in lunar rock deserts, b) Lunokhod Russian Rover field works, c) Pathfinder's Sojourner's works around the Sagan Station, and d) field works of MER rovers till summer of 2004 in the two landing sites. After works by landers This 7th member of our lecture note series gives background studies for works with rovers, a moving car of experiments on the basis till now 4 successful car and rover programs: Apollos and Lunokhods (on the Moon), and Pathfinder and MERs (on the Mars). When we overview the details of some of their main experiments we also focus on the main benefits to terrestrial geological and petrologic field work studies in this human size and the several days/months 'walking scale' robotics-helped activities.

Derived from text

*Textbooks; Landing Sites; Planetary Surfaces*

**20050174566** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Mars SEIS Experiment: A Mars Seismic Package**

Mimoun, D.; Lognonne, P.; Banerdt, W. B.; Schibler, P.; Giardini, D.; Pont, G.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars SEIS experiment. The SEIS experiment was first proposed by IPGP (and accepted) for the NetLander mission. It integrates two VBB (Very Broad Band) seismometers, a three axis Short Period seismometer and a series of environmental sensors for pressure, infra-sounds and temperature. IPGP (France) has the overall responsibility of the experiment and is responsible for the seismic and environmental sensors. ETHZ (Switzerland) is responsible for the electronics of the experiment and JPL (USA) for the SP (Short Period) sensors. As NetLander mission has been cancelled (while fortunately the development still goes on), this seismic package can be proposed for future Mars missions.

Author

*Seismographs; Mars Missions; Tidal Waves; Switzerland*

**20050174568** Lunar and Planetary Inst., Houston, TX, USA

**The Variation of Hydrocarbon Abundances with Latitude and Season in Saturn's Stratosphere**

Moses, J. I.; Greathouse, T. K.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC5-679; NNG05GA42G; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have developed a realistic, time-variable, one-dimensional, seasonal model for stratospheric photochemistry on Saturn using the Caltech/ JPL KINETICS code [1,2,3]. The model accounts for variations in ultraviolet flux due to orbital position, solar-cycle variations, and ring-shadowing effects. The results for two Saturnian years, starting at Ls = 0 in 1950 and running until the upcoming northern vernal equinox in 2009, are presented for numerous latitudes. The same two model years are run over and over again until the model convergences to make sure that high-altitude effects have had a chance to propagate down through the atmosphere. We use the SOLAR2000 model [4,5], in combination with the spectra presented in [6], to predict the ultraviolet flux at any wavelength and any point in time during the simulation. Saturn's orbital position during the simulation was taken from the ephemeris calculator at http://ssd.jpl.nasa.gov/horizons.html [7]. The photochemical model is derived from 'Model C' of [8] and uses a hydrocarbon reaction list that has been extensively updated from that presented in [3].

Derived from text

*Abundance; Hydrocarbons; Solar Cycles; Photochemical Reactions; Convergence; Latitude*

**20050174570** Geological Survey, Flagstaff, AZ, USA

**Mars Digital Dune Database: A Quantitative Look at the Geographic Distribution of Dunes on Mars**

Mullins, K. F\g; Hayward, R.; Titus, T. N.; Bourke, M. C.; Fenton, L. K.; Lunar and Planetary Science XXXVI, Part 13;

[2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Global Surveyor (MGS) Thermal Emission Imaging System (THEMIS) has acquired 100m resolution infrared (IR) daytime and nighttime images covering 75% and 98% of the surface Mars respectively. The combination of high-resolution and global coverage makes the THEMIS IR data set the logical choice for a planet wide inventory of moderate to large-scale dune deposits. Initial steps in developing a digital dune database in a global geographic context for Mars have been completed, resulting in a proto-type, ARC-based database. This database currently contains information delineating the dune fields between +/-65 degrees latitude, including numerous physical and image parameters [1]. While far from comprehensive, this database will provide the first quantitative dataset as well as a stable, centralized archive of pertinent information for global baseline analyses of Martian aeolian processes.

Derived from text

*Dunes; Mars Surface; Geographic Distribution; Imaging Techniques; Dust Storms*

**20050174573** Paris-Sud Univ., Orsay, France

**Analysis of Valley Networks on Valles Marineris Plateau Using HRSC/MEX Data**

Mangold, N.; Masson, P.; Ansan, V.; Quantin, C.; Neukum, G., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Valley networks on Mars have been the subject of considerable debates since three decades. They have been first attributed to fluvial processes under conditions 3.5 Gy ago that were warmer than the present cold climate. However, many other hypothesis like geothermal activity, subglacial melting or sapping processes have been proposed because valleys are often poorly dendritic. HRSC data give a wide range of tools to study fluvial valleys on Mars from high resolution images to DTM extracted from stereoscopic images.

Author

*Mars Surface; Plateaus; Climate*

**20050174575** Salamanca Univ., Salamanca, Spain

**Stability of Water on Mars. A Didactic Activity**

Martin, L.; Castilla, G.; dePablo, M. A.; Lopez, C.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Water is one of the oldest aims of the research about Mars and thanks of the gullies observed some years ago at the walls of impacts craters the search for signs that could reveal a part of the history of water on Mars is the goal of a lot of works developed by scientists around the world. Today, the public feel this same curiosity about what was the history of the martian water, why and how it disappeared, and if it is possible the existence of liquid water on Mars today. In order to show the physical reasons that could allow the existence of liquid water on the martian surface we develop a didactic activity (used with High School students and a general public) based on the temperature and pressure data obtained by different spacecrafts and landers on Mars.

Author

*Mars Surface; Water; Craters*

**20050174577** Centre National de la Recherche Scientifique, Orsay, France

**HRSC/MEX Analysis of Valley Networks in Echus Chasma Plateau and in Aeolis Region**

Masson, Ph.; Ansan, V.; Mangold, N.; Quantin, C.; Neukum, G.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Since visible images have been acquired by Viking orbiter in 1976, valley networks have been mainly identified in the heavily cratered uplands dated Noachian (\g3.5 Gyr). Valley networks on Mars have been the subject of considerable debates about their formation processes since three decades [1-5]. They have been first attributed to fluvial processes under conditions 3.5 Gyr ago that were warmer than the present cold climate. However, many other hypothesis like geothermal activity, subglacial melting or sapping processes have been proposed because of the low organisation. The Mars Express High Resolution Stereo Camera (HRSC) data give a wide range of tools to study fluvial valleys on Mars both using high resolution images and DTM extracted from stereoscopic images [6]. We determined the organisation of valleys in relationships with

regional topography and structural geology. We analysed quantitatively the valley morphology and the valley network morphometry in order to determine process(es) which is(are) at the origin of valleys. We focussed our study on two locations: Echus Chasma plateau and Aeolis region. Valley networks in Echus region:
Derived from text
*Craters; Valleys; Morphology; Mars Surface; Geology; Plateaus*

**20050174578** State Univ. of New York, Stony Brook, NY, USA
**Kaersutite (Ti-rich Amphibole) in the SNC Meteorites: Can It Crystallize at Low Pressure?**
McCubbin, F. M.; Whitaker, M. L.; Lindsley, D. H.; Nekvasil, H.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Kaersutite is a Ti-rich amphibole 5-10 wt% TiO2) that occurs in SNC meteorites in melt inclusions. Both the basaltic shergottites and the Chassigny dunite, of the SNC meteorites, contain kaersutite in melt inclusions. The shergottites contain ferro-kaersutite that is found within melt inclusions usually within cores of pyroxenes. These kaersutites are generally low in OH- content, and high in Fe . The Chassigny meteorite contains kaersutites found within melt inclusions in olivine. Chassigny kaersutites are oxy-kaersutites with the O(3) site summing to about 0.4 anions per formula unit (apfu), requiring 1.6 O2. Understanding the nature of the kaersutite within SNC meteorites may be essential for understanding the petrogenetic history of the SNC s.
Derived from text
*SNC Meteorites; Titanium Oxides; Crystallization; Low Pressure*

**20050174579** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Distant Secondary Craters and Age Constraints on Young Martian Terrains**
McEwen, A.; Preblich, B.; Turtle, E.; Studer, D.; Artemieva, N.; Golombek, M.; Hurst, M.; Kirk, R.; Burr, D.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Are small (less than approx. 1 km diameter) craters on Mars and the Moon dominated by primary impacts, by secondary impacts of much larger primary craters, or are both primaries and secondaries significant? This question is critical to age constraints for young terrains and for older terrains covering small areas, where only small craters are superimposed on the unit. If the martian rayed crater Zunil is representative of large impact events on Mars, then the density of secondaries should exceed the density of primaries at diameters a factor of ~1000 smaller than that of the largest contributing primary crater. On the basis of morphology and depth/diameter measurements, most small craters on Mars could be secondaries. Two additional observations (discussed below) suggest that the production functions of Hartmann and Neukum predict too many primary craters smaller than a few hundred meters in diameter. Fewer small, high-velocity impacts may explain why there appears to be little impact regolith over Amazonian terrains. Martian terrains dated by small craters could be older than reported in recent publications.
Derived from text
*Mars Surface; Mars Craters; Terrain; Age Factor*

**20050174580** Arizona State Univ., Tempe, AZ, USA
**Raman Imaging of Natural Coesite in Archived Petrographic Thin Sections: Vredefort Impact Structure**
McHone, John F.; Fries, Marc; Steele, Andrew; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Coesite and stishovite are minerals widely accepted as impact criteria when associated with suspected terrestrial impact structures. Both phases are pressure polymorphs of silica which form during shock metamorphism of quartz-rich target rocks. Their minute particle size and sparse distribution can make standard optical identification difficult for even the most skilled microscopist. The conventional method of detection requires partial HF digestion of whole rock samples, followed by X-ray diffraction analyses of successively concentrated acid residues. This procedure can be laborious and requires care with potentially dangerous reagents. Resulting data require skillful interpretation; diffraction lines can be masked by accessory minerals or by unexpected fluoride precipitates. In addition, bulk samples are usually completely destroyed.
Derived from text
*Coesite; Imaging Techniques; Metamorphism (Geology); Silicon Dioxide; X Ray Diffraction*

**20050174582** Laboratoire de Planetologie et Geodynamique, Nantes, France

**A Planetary Example of Tectonic Inversion: Folding and Thrusting in the Valles Marineris Graben System on Mars**

Mege, Daniel; Peulvast, Jean-Pierre; Masson, Philippe; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We used Themis, MOC, and MOLA data to reinterpret the floor of the southern Ius Chasma graben in Valles Marineris between 81 W and 82 W. We confirm earlier interpretations based on Viking imagery that this part of the graben has been inverted. Shortening is thought to result from the body forces exerted by the topography of Geryon Montes, the E-W horst between the two Ius Chasma grabens. Shortening is expected to balance Geryon Montes wall spreading through sackung. Based on the distribution of bifid crests in Valles Marineris, shortening is expected to have occurred in other areas in Valles Marineris as well.

Author

*Geological Faults; Mars Surface; Tectonics; Planetary Geology*

**20050174585** Arizona State Univ., Tempe, AZ, USA

**Palagonite-like Alteration Products on the Earth and Mars, I:, Spectroscopy (0.4-25 microns) of Weathered Basalts and Silicate Alteration Products**

Michalski, J. R.; Kraft, M. D.; Sharp, T. G.; Christensen, P. R.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Thermal infrared (TIR) spectra from the Thermal Emission Spectrometer (TES) and Mini-TES experiments suggest the presence of glasses and possibly clays and silica on the Martian surface, though visible/near infrared (VNIR) spectra show that clay minerals are not widespread and abundant on Mars. It is plausible that glass-like and clay-like materials identified with TES could also be interpreted as poorly crystalline silicate alteration products that formed from chemical weathering and aqueous sedimentary processes on Mars. Understanding the nature of amorphous and poorly crystalline materials on the Martian surface is critical for constraining alteration processes on Mars, including palagonitization.

Author

*Mars Surface; Silicon Dioxide; Silicates; Clays; Crystallinity; Basalt; Amorphous Materials*

**20050174587** NASA Johnson Space Center, Houston, TX, USA

**Geochemical and Mineralogical Indicators for Aqueous Processes on the West Spur of the Columbia Hills in Gusev Crater**

Ming, D. W.; Morris, R. V.; Gellert, R.; Yen, A.; Bell, J. F., III; Blaney, D.; Christensen, P. R.; Crumpler, L.; Chu, P.; Farrand, W. H.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The primary objective of the MER Spirit and Opportunity Rovers is to identify and investigate rocks, outcrops, and soils that have the highest possible chance of preserving evidence of water activity on Mars. The Athena Science Instrument Payload onboard the two rovers has provided geochemical and mineralogical information that indicates a variety of aqueous processes and various degrees of alteration at the two landing sites.

Derived from text

*Craters; Geochemistry; Mars Surface; Mineralogy*

**20050174588** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**A Global Map of Mars' Crustal Magnetic Field Based on Electron Reflectometry**

Mitchell, D. L.; Lillis, R. J.; Lin, R. P.; Connerney, J. E. P.; Acuna, M. H.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the great surprises of the Mars Global Surveyor mission was the discovery of intensely magnetized crust. Magnetic sources on Mars are at least ten times stronger than their terrestrial counterparts, probably requiring large volumes of coherently magnetized material, very strong remanence, or both. Although much of the attention so far has been placed on the strong crustal fields in the southern highlands, magnetic sources do exist in the younger low-lying plains. The strength and morphology of these sources could yield clues to the thermal and magnetic history of the northern plains. Low altitude

(approx. 100 km) Magnetometer (MAG) data obtained during aerobraking have the greatest spatial resolution and sensitivity for identifying crustal magnetic sources from orbit, but those data are sparse and therefore limit the ability to discern morphology. Fully sampled MAG data obtained in the 400-km altitude mapping orbit have been differenced with respect to latitude (Br/Lat) to minimize the influence of induced fields from the solar wind interaction and thus enhance the sensitivity to weak crustal sources. Here we describe independent results from the Electron Reflectometer (ER), which remotely measures the magnetic field intensity at approx. 170 km altitude, and is roughly seven times more sensitive to crustal magnetic sources than measurements of Br from the mapping orbit.
Author
*Maps; Mars Surface; Magnetic Fields; Reflectometers; Solar Wind; Plasma Interactions*

**20050174589** NASA Johnson Space Center, Houston, TX, USA
**Petrology, Geochemistry and Genesis of Ureilites**
Mittlefehldt, D. W.; Hudon, Pierre; Galindo, Charles, Jr.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ureilites are enigmatic achondrites that have some characteristics resulting from high temperature igneous processing, yet retain other characteristics inherited from the solar nebula. They are basalt-depleted ultramafic rocks containing 7-66 mg/g elemental C. They are rich in noble gases and display a correlation between mg# and Delta (17)O. This mishmash of properties has engendered various models for ureilite genesis, from those in which nebular processes dominate to those in which parent body igneous processes dominate. Characterization of new ureilites, especially of new subtypes, is an important part of attempts to unravel the history of the ureilite parent body or bodies. Here we report on the petrology and geochemistry of a suite of ureilites, mostly from Antarctica, and use these data to discuss ureilite petrogenesis. Additional information is included in the original extended abstract.
Author (revised)
*Petrology; Geochemistry; Ureilites; Petrogenesis*

**20050174590** Yamaguchi Univ., Japan
**Crater Variety with and without Volcanic Rocks between the Moon and Earth**
Miura, Y.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact crater on the Moon is defined by typical impact process on the highland. Mare basalt is filled to wide impact crater structure only front side of the Moon, mainly by large impact or tidal forces from Earth. The main purpose of this paper is 1) to elucidate large lunar craters with volcanic rocks compared with terrestrial crater, 2) to classify craters with volcanic rocks on Earth. Additional information is included in the original extended abstract.
Author (revised)
*Igneous Rocks; Lunar Craters; Meteorite Craters; Earth (Planet); Planetary Geology*

**20050174591** Tokyo Univ., Hongo, Japan
**Verification of a Model to Calculate Cooling Rates in Olivine by Consideration of Fe-Mg Diffusion and Olivine Crystal Growth**
Miyamoto, M.; Jones, R. H.; Koizumi, E.; Mikouchi, T.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We developed a model to analyze chemical zoning in olivine on the basis of Fe-Mg interdiffusion during olivine crystal growth to obtain the cooling rate (or burial depth) of parent rock. In this abstract, we verify this model by using Fe-Mg zoning in olivine produced by dynamic crystallization experiments of Jones and Lofgren. They reported Fe-Mg chemical zoning in olivine for the bulk chemical composition like a porphyritic chondrule of Semarkona (LL3.0) at 2 C/h, 5 C/h and 100 C/h cooling experiments. Additional information is included in the original extended abstract.
Author (revised)
*Olivine; Cooling; Crystal Growth; Chondrule*

**20050174595** Ecole Normale Superieure, Lyon, France

**Excesses of Ni-60 in Chondrites and Iron Meteorites**

Moynier, Frederic; Blichert-Toft, Janne; Ablarede, Telouk; Albarede, Francis; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The existence of Ni-60 excesses resulting from decay of the radioactive nuclide Fe-60(T(sob 1/2) = 1.5 My) has been known for almost two decades but the small number of data produced to date attests to the particularly difficult measurements by TIMS and SIMS . In contrast, MC-ICP-MS has a strong potential for Ni isotope analysis through this has not yet been fully explored. Here we report evidence of Ni isotope anomalies identified by MC-ICPMS in the metal phase and chondrules of chondrites, and in iron meteorites.

Author

*Nickel Isotopes; Iron Meteorites; Meteoritic Composition*

**20050174596** NASA Ames Research Center, Moffett Field, CA, USA

**Using Near Real-Time Mission Data for Education and Public Outreach: Strategies from the Life in the Atacama E/PO Effort**

Myers, E.; Coppin, P.; Wagner, M.; Fischer, K.; Lu, L.; McCloskey, R.; Seneker, D.; Cabrol, N.; Wettergreen, D.; Waggoner, A.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The EventScope educational telepresence project has been involved with education and public outreach for a number of NASA-sponsored missions including the Mars Exploration Rovers, the Odyssey Mission, and the Life in the Atacama project. However, during the second year of operations in the Atacama, a modified version of the EventScope public interface was used as the remote science operations interface. In addition, the EventScope lab hosted remote science operations. This intimate connection with the mission operations allowed the EventScope team to bring the experience of the mission to the public in near real-time. Playing to this strength, the lab developed strategies for releasing E/PO content as close to real-time as possible.

Author

*Real Time Operation; Mars Exploration; Teleoperators*

**20050174597** Missouri Univ., Rolla, MO, USA

**Solar Abundance of Elements from Neutron-Capture Cross Sections**

Manuel, O.; Myers, W. A.; Singh, Y.; Pleess, M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Light elements, H and He, covering the solar surface are widely believed to be dominant inside the Sun [1]. Noting that gaseous envelopes may not reflect the Sun s internal composition, Harkins [2] used analyses on 443 meteorites to conclude that Fe, O, Ni and Si are more abundant. B2FH [3] explained element synthesis in stars; decades later Fowler said laboratory and theoretical calculations cannot explain why O/C = 2 [4]. Solar-wind-implanted elements in lunar soils showed a mass-dependent excess of lighter isotopes [5]. This empirical fractionation also yielded Fe, O, Ni and Si as the most abundant elements in the Sun [5, 6]. Neutron-capture cross-sections and the photospheric abundance [1] of s-process nuclides [3] offer another test for mass separation in the Sun.

Derived from text

*Solar Wind; Chemical Elements; Light Elements; Neutrons; Meteorites; Nuclides; Absorption Cross Sections; Isotopes*

**20050174598** Aizu Univ., Japan

**Automatic Crater Recognition on Digital Terrain Model**

Matsumoto, N.; Asada, N.; Demura, H.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ESA, SMART-1 has orbited around the Moon [1], Space Agencies of Japan, China, and India have expressed subsequent moon missions, and USA announced a return to the moon in New Vision for Space Exploration Program [2]. We have a Moon Rush. Japanese SELENE mission [3] has 14 instruments, and is going to provide a dataset more than 20TB. These massive and diverse data raise awareness about the need for automatically extracting/dictating geologic information. Here we remark

'crater' on digital terrain models, this is just preparation for analysis of SELENE DTM products.
Derived from text
*Space Exploration; Geology; Craters; Terrain*

**20050174599** Centre d'Etude Spatiale des Rayonnements, Toulouse, France
**ChemCam Instrument for the Mars Science Laboratory (MSL) Rover**
Maurice, S.; Wiens, R.; Manhes, G.; Cremers, D.; Barraclough, B.; Bernardin, J.; Bouye, M.; Cros, A.; Dubois, B.; Durand, E., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ChemCam is a new type of active remote sensing instrument to investigate details of the Martian geochemistry. It is one of the experiments recently selected for the mobile Mars Science Laboratory (MSL) rover, scheduled for launch in 2009. The ChemCam science objectives are described in a companion paper by Wiens et al. [1]. ChemCam uses laser interrogation to remove dust layers and to depth profile through weathering layers. The same laser pulse is used to perform an elemental analysis, based on the Laser Induced Breakdown Spectroscopy (LIBS) technique [2-4], at distances from 2 m to 13 m from the rover. Simultaneously, a remote micro-imager (RMI) provides context imaging, with resolution better than 80 microradians.
Derived from text
*Chemical Analysis; Geochemistry; Roving Vehicles; Remote Sensing; Mars Surface; Mars (Planet); Laser-Induced Breakdown Spectroscopy*

**20050174600** NASA Johnson Space Center, Houston, TX, USA
**Porphyritic Olivine-Pyroxene Clast in Kaidun: First Discovery of an Ordinary Chondrite Clast?**
Mikouchi, T.; Makishima, J.; Koizumi, E.; Zolensky, M. E.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Kaidun is an enigmatic meteorite showing a micro-brecciated texture composed of variable kinds of lithic clasts and mineral fragments. The constituent components range from primitive chondritic materials to differentiated achondritic materials, and thus believed to have originated from a large parent body accumulating materials from many different bodies in the asteroid belt. One of the interesting observations is that no ordinary chondrite component has been found yet, although C and E chondrites components are abundant. In this abstract, we report mineralogy of the clast (Kaidun #15415- 01.3.13a) showing a porphyritic olivine-pyroxene chondrule-like texture similar to those found in unequilibrated ordinary chondrites.
Author
*Rocks; Textures; Meteoritic Composition; Chondrites; Olivine*

**20050174601** Museum of Planetary Sciences, Prato, Italy
**NWA 1052 and NWA 1054: Two New Primitive Achondrites from North West Africa**
Moggi-Cecchi, V.; Pratesi, G.; Mancini, L.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NWA 1052 and NWA 1054 are two meteorites bought in 2001 at the Bologna Mineral Fair from a Moroccan dealer by Matteo Chinellato. The main masses weigh 22 and 86 g, respectively, and are both slightly weathered. One of them (NWA 1052) presents a small portion of fusion crust. The cut surfaces of both hand samples show a texture similar to that of an equilibrated chondrite, with small metal grains set in a dark brown matrix but without visible chondrules. The Museum of Planetary Sciences of Prato (MSP) owns both the type specimens (MSP2365 and 2366) and the corresponding thin sections.
Instruments and methods
Author
*Meteoritic Composition; Minerals; Achondrites*

**20050174602** Boston Univ., Boston, MA, USA
**Equilibrium Landforms in the Dry Valleys of Antarctica: Implications for Landscape Evolution and Climate Change on Mars**
Marchant, David R.; Head, James W.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The very low atmospheric temperatures and limited availability of liquid water in parts of the Antarctic Dry Valleys (ADV) makes them compelling analogs for current martian environments. Although classified as a single, hyperarid, cold-polar desert, the ADV region is more appropriately divided into a series of narrow climatological zones. Each zone fosters a unique suite of equilibrium landforms; in this context, equilibrium landforms are those unconsolidated features produced solely by geomorphic processes operating within a given microclimate zone. Of course some landforms in the ADV evolved over a range of climatic conditions, but many formed from processes operating at uniform rates and under non-changing climate conditions. In this tectonically stable region then, evidence for partial dissection and/or unstable modification of equilibrium landforms may suggest variation in geomorphic processes brought on by interval(s) of climate change. Our study of the origin, evolution, and temporal migration of equilibrium landforms throughout the ADV may help shed light on the origin and evolution of similar-appearing landforms on Mars and may also help discern the magnitude and direction of recent climate change on Mars.
Author
*Antarctic Regions; Climate Change; Mars Environment; Mars Atmosphere*

**20050174604** International Research School of Planetary Sciences, Pescara, Italy
**Paleoenviromental Evolution of the Holden-Uzboi Area**
Marinangeli, L.; Rossi, A. P.; Pondrelli, M.; Baliva, A.; DiLorenzo, S.; Ori, G. G.; Hauber, E.; Neukum, G.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Uzboi Vallis is part of a large network of outflow channels of the Margaritifer Sinus Region, located on the easternmost side of Valles Marineris. The Noachian Holden crater appears to have modified a preexisting fluvial system, likely no very active at the impact time. A variety of younger fluvio-lacustrine environments and glacial morphologies have been recognized in the Holden crater, suggesting variations of the water cycle trough time. The aim of this work is to define the context on which the Holden lacustrine system was active. The work is focused on the two basins surrounding Holden crater: the 'Holden NE' crater (as named by where fan-shaped deposits confirm the presence of water and the northern Uzboi Vallis, the channel debouching into the Holden crater which was probably acting as lacustrine basin. We have performed a geological survey of the two sites based on HRSC images and stereo-derived topography and MOC images for close view of the deposits. We also compared the observed stratigraphic sequences with the one reconstructed in the Holden crater to understand the overall evolution of the water-related environments.
Author
*Paleobiology; Craters; Geological Surveys; Mars Surface*

**20050174605** Desert Research Inst., Reno, NV, USA
**Stability of Magnesium Sulfate Minerals in Martian Environments**
Marion, G. M.; Kargel, J. S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Viking Lander, Pathfinder, and Mars Exploration Rover missions to Mars have found abundant sulfur in surface soils and rocks, and the best indications are that magnesium sulfates are among the key hosts. At Meridiani Planum, MgSO4 salts constitute 15 to 40 wt.% of sedimentary rocks. Additional S is hosted by gypsum and jarosite. Reflectance and thermal emission spectroscopy is consistent with the presence of kieserite (MgSO4 H2O) and epsomite (MgSO4*7H2O). Theoretically, the dodecahydrate (MgSO4*12H2O) should also have precipitated. We first examine theoretically which MgSO4 minerals should have precipitated on Mars, and then how dehydration might have altered these minerals.
Author
*Magnesium Sulfates; Mars Environment; Mars Surface*

**20050174606** Academy of Sciences (Russia), Moscow, Russia
**Migration of Dust Particles and Volatiles Delivery to the Inner Planets**
Marov, M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558
Contract(s)/Grant(s): RFBR-01-02-17540; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Delivery of volatiles by small bodies to the terrestrial planets in terms of formation and evolution of their atmospheres/hydrospheres was earlier discussed by us. We shall now address the role of dust particles in such a delivery.

Particulate matter is produced by comets, trans-Neptunian objects, and asteroids. These interplanetary dust particles (IDPs) migrate in the Solar System and can collide with terrestrial planets, some trans-Neptunian objects getting first Jupiter-crossing orbits. Our results of computer simulations showed that a small fraction of Jupiter crossing objects (JCOs) can transit to the orbits typical for near-Earth objects and even to typical asteroid orbits, and some of them reside such orbits for tens or even hundreds of millions years. One may thus assume that many former comets composed mainly of late condensates and carbonaceous chondrites and closely related to trans-Neptunian objects, disintegrated inside Jupiter s orbit during this long period of time giving rise to enormous amount of dust particles of primordial origin. In pursuit of these basic ideas, migration of dust particles from different regions of the solar system was numerically integrated.
Derived from text
*Carbonaceous Chondrites; Interplanetary Dust; Terrestrial Planets; Migration*

**20050174607** Centre de Recherches Petrographiques et Geochimiques, Nancy, France
**On the Sitting of Trapped Noble Gases in Insoluble Organic Matter of Primitive Meteorites**
Marrocchi, Y.; Derenne, S.; Marty, B.; Robert, F.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Meteoritic noble gases are mainly hosted by two carbon-rich phases that are left after demineralization of bulk meteorite by HF and HCl : nanodiamonds and an enigmatic phase labeled phase Q. The latter is the carrier of primordial Ar, Kr and Xe, referred hereafter as P1 noble gases, which represent the majority of heavy noble gases trapped in primitive meteorites. P1 noble gases are readily released from HF/HCl residue by chemical oxidation (HNO3). Because HNO3 etching induces little mass loss of the HF/HCl residue but triggers important degassing of noble gases, it has been proposed that P1 noble gases are located at, or near, the very surface of carbonaceous grains. However, stepped combustion experiments of acid residues have revealed that some carbon, nitrogen, and P1 noble gases are released in a common temperature range. As carbon and nitrogen are structural constituents of organic macromolecular material, these results suggest that P1 noble gases are trapped in the volume of the insoluble organic matter IOM) rather than bound to its surface.
Derived from text
*Organic Materials; Meteoritic Composition; Rare Gases*

**20050174609** NASA Johnson Space Center, Houston, TX, USA
**An Update on Results from the Magnetic Properties Experiments on the Mars Exploration Rovers, Spirit and Opportunity**
Madsen, M. B.; Arneson, H. M.; Bertelsen, P.; Bell, J. F., III; Binau, C. S.; Gellert, R.; Goetz, W.; Gunnlaugsson, H. P.; Herkenhoff, K. E.; Hviid, S. F., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Magnetic Properties Experiments were designed to investigate the properties of the airborne dust in the Martian atmosphere. A preferred interpretation of previous experiments (Viking and Pathfinder) was that the airborne dust is primarily composed by composite silicate particles containing as a minor constituent the mineral maghemite (gamma-Fe2O3). In this abstract we show how the magnetic properties experiments on Spirit and Opportunity provide information on the distribution of magnetic mineral(s) in the dust on Mars, with emphasis on results from Opportunity.
Derived from text
*Magnetic Properties; Roving Vehicles; Mars Exploration; Dust; Trace Elements*

**20050174610** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Measurement Protocols for In Situ Analysis of Organic Compounds at Mars and Comets**
Mahaffy, P. R.; Brinckerhoff, W. B.; Buch, A.; Cabane, M.; Coll, P.; Demick, J.; Glavin, D. P.; Navarro-Gonzalez, R.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The determination of the abundance and chemical and isotopic composition of organic molecules in comets and those that might be found in protected environments at Mars is a first step toward understanding prebiotic chemistries on these solar system bodies. While future sample return missions from Mars and comets will enable detailed chemical and isotopic analysis with a wide range of analytical techniques, precursor insitu investigations can complement these missions and facilitate the identification of optimal sites for sample return. Robust automated experiments that make efficient use of limited spacecraft

power, mass, and data volume resources are required for use by insitu missions. Within these constraints we continue to explore a range of instrument techniques and measurement protocols that can maximize the return from such insitu investigations.
Derived from text
*Chemical Analysis; Abundance; Organic Compounds; Isotopes; Molecules; Chemical Composition*

**20050174612** York Univ., Ontario, Canada
**Piping Structures on Earth and Possibly Mars: Astrobiological Implications**
Mahaney, W. C.; Milner, M. W.; Dohm, J. M.; Baker, V. R.; Netoff, D.; Malloch, D.; Miyamoto, H.; Hare, T. M.; Komatsu, G.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Terrestrial surface and subsurface environments are linked to specific biologic habitats with variable compositions of microorganisms. Many of these environments are similar to water-enriched environments on Mars that have dynamic geologic and hydrologic histories. Many researchers have hypothesized that Mars may contain fossilized or extant microbial life in similar surface or subsurface settings where water may support life now or have supported it in the past. A primary goal of astrobiology is to find suitable deposits on Mars that may support extant life or have supported life in the past.
Derived from text
*Exobiology; Mars Surface; Microorganisms; Planetary Geology*

**20050174614** Malin Space Science Systems, San Diego, CA, USA
**MGS MOC: First Views of Mars at Sub-Meter Resolution from Orbit**
Malin, M. C.; Edgett, K. S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) is now capable of obtaining images with sub-meter per pixel spatial resolution. In such images, the two Mars Exploration Rovers (MER) can be seen from orbit, 380 400 km away. These images also permit testing of hypotheses regarding a variety of martian landforms and geologic materials. MOC was designed to obtain images with spatial resolution as high as approx. 1.5 m/pixel from its nominal altitude orbit, using spacecraft motion to sweep a single line detector array across a target area. In 2003 and 2004, operators of MOC and MGS pioneered an approach that allows MOC to obtain images with approx. 50 cm/pixel spatial resolution in the downtrack dimension. Images acquired using the cPROTO (compensated Pitch and Roll Targeted Observation) approach, effectively, provide submeter resolution views of Mars.
Author
*Mars Global Surveyor; Mars Surface; Planetary Geology; Landforms*

**20050174615** Centre National de la Recherche Scientifique, Orsay, France
**Analysis of Candor Chasma Interior Layered Deposits from OMEGA/MEX Spectra**
FROM; Mangold, N.; Gendrin, A.; Quantin, C.; Gondet, B.; Langevin, Y.; Bibring, J.-P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Sedimentary deposits are high priority targets for missions to Mars because they recorded the chemical conditions of these past environments. Images interpretation of potential sedimentary layers led to controversial conclusions about their origins. Layered deposits identified by the Mariner 9 and Viking spacecrafts were interpreted as sediments, possibly formed by lacustrine deposition involving stable liquid water, but other origins like volcanic or wind blown material were also proposed. The images of the Mars Observer Camera (MOC) of Mars Global Surveyor (MGS) show details of such deposits in the ancient highlands or the Interior Layered Deposits (ILD) of Valles Marineris canyons. They are interpreted as evidence of active sedimentary processes likely involving liquid water in the early Mars. However, no spectral data like TES (Thermal Emission Spectrometer) data have confirmed these interpretations yet8. Only the analysis of martian meteorites shown the possibility of evaporite mineral assemblages in fractures of
Author
*Sedimentary Rocks; Mineral Deposits; Mars Photographs; Thermal Emission; Fractures (Materials)*

**20050174617** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
**Photometric and Compositional Surface Properties of the Gusev Crater Region, Mars, as Derived from Multi-Angle, Multi-Spectral Investigation of Mars Express HRSC Data**
Martin, P. D.; Cord, A.; Foing, B.; Zegers, T.; vanKan, M.; Pinet, P.; Daydou-Y.; Hoffmann, H.; Hoffmann, H.; Hauber, E.; Jaumann, R., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

High-resolution stereo and color images of the Gusev crater (176 deg E, 14 deg S) and surroundings were acquired by the High Resolution Stereo Camera (HRSC) during several early orbits of the ESA Mars Express mission. The multi-angular aspect of the HRSC data sets can be used to determine the photometric and physical properties (e.g., surface roughness) of the observed Martian surface. From the multi-spectral aspect of the data can be derived an evaluation of the composition and distribution of the surface materials, which in turn provides important information about surface processes and regional or local stratigraphy. The focus of this investigation is to use the potential of the HRSC multi-angular and multi-spectral data sets for identifying photometric, color and compositional units and their heterogeneity, for assessing the relationships with regional geological units, and for providing further insight into the geologic, climatic history of this region of Mars.
Author
*Photometry; Mars Surface; Surface Roughness; Climatology*

**20050174618** Colorado Univ., Boulder, CO, USA
**Mapping Compositional Diversity on Mars: Spatial Distribution and Geological Implications**
Martinez-Alonso, Sara; Mellon, Michael T.; Jakosky, Bruce M.; Kindel, Bruce C.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Visible and infrared spectrometers of high spatial resolution (e.g., Mars Express OMEGA, Mars Reconnaissance Orbiter CRISM) on board Mars orbiting missions will allow for detailed surface composition mapping of critical regions, necessary for the identification of future landing sites. Determining from existing global datasets the critical regions to be surveyed in detail with such instruments is essential to optimize the scientific return of those missions. The Spectral Variance Index (SVI) method identifies, from statistical analysis of the Mars Global Surveyor Thermal Emission Spectrometer (TES) global dataset, regions on the surface of Mars characterized by higher-than-average spectral variance, and therefore dominated by the presence of diverse materials, rather than by a spectrally homogeneous cover.
Derived from text
*Mars Express; Mars Surface; Spatial Distribution; Geology; Surface Layers*

**20050174619** Consejo Superior de Investigaciones Cientificas, Madrid, Spain
**A New Simulation Chamber for Studying Planetary Environments**
Martin-Gago, J. A.; Mateo-Marti, E.; Prieto-Ballesteros, O.; Atienza, C.; Sobrado, J. M.; Gomez-Elvira, J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Nowadays, the study of planetary environments with astrobiological interest has become a major challenge. Planetary objects like Mars and the Europa satellite are among the priority targets for searching biosignatures in our solar system. This is mainly due to the presence of water in any of their phases during the past or present of their geological histories [1,2,3,4]. However, the effect of the environmental parameters at the planet surface, such as radiation, gas pressure or temperature, is critical either for microorganism survival or the preservation of biosignatures [4, 5].
Derived from text
*Europa; Planetary Environments; Radiation Pressure; Exobiology; Gas Pressure; Geology; Microorganisms*

**20050174620** Universidad Rey Juan Carlos, Madrid, Spain
**Folded Structure in Terra Sirenum. Mars**
Martin-Gonzalez, F.; dePablo, M.; Marquez, A.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Located in Terra Sirenum, at 37 deg S, 178.5 deg W, at the Southern highlands of Mars, there is a WNW-ESE elongated relief previously mapped as a volcanic relief with uncertain age situated between two depressions located at the West of

Gorgonum basin. This elongated relief has an altitude of more than 1600 meters and a short axis of around 100 kilometers. The age of the younger materials filling these two basins was calculated like Hesperian and it is concurrent with the age established for the Eridania Lake, a possible extensive lake that could cover the depressions of Cimmeria and Sirenum Terrae until the Middle Hesperian. This relief intersects a WSW-ENE graben of the radial-Tharsis Sirenum Fossae system; tectonic structures previously interpreted as simple graben.
Derived from text
*Geological Faults; Mars Surface; Tectonics*

**20050174623** Consejo Superior de Investigaciones Cientificas, Madrid, Spain
**An Experimental Set-Up for Studying the Chemical Effect of Irradiation on Different Planets**
Mateo-Marti, e.; Martin-Gago, J. A.; Prieto-Ballesteros, O.; Atienza, C.; Sobrado, J. M.; Gomez-Elvira, J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Earth, Mars, Europa, Triton, and other bodies in our solar system are continually exposed to the effects of different types of irradiation. This radiation results in breaking and rearrangement of chemical bonds within ices and minerals, causing the destruction of some species and the creation of others (HCO, H2CO, CH4, CO2, etc.). Furthermore, many of these species are of biological interest to understand the origin of life. For example, photochemical reactions, driven by solar UV, are believed to be the principal source of complex molecules observed in the most planetary and lunar atmospheres (1). The knowledge of the photochemical routes by which organics are formed in other planetary atmospheres could provide insights into photoproducts that were formed in the atmosphere of the primitive Earth.
Derived from text
*Irradiation; Planetary Atmospheres; Photochemical Reactions; Biological Evolution; Carbon Dioxide; Earth Atmosphere; Lunar Atmosphere; Methane*

**20050174624** Northwestern Univ., Evanston, IL, USA
**Study of a 15 km Crater with Diverse Morphology, Elysium Planitia, Mars**
Matias, Audeliz; Jurdy, Donna M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The recent missions to Mars with diverse instruments have provided a new perspective for the study of Martian surface landforms. They have permitted the characterization of over 40,000 impact craters 5 km in diameter [1], showing a diverse cratering record with some quite unusual morphologies. Changes in crater morphology are thought to reflect the impact energy and target properties involved in the crater formation [2]. We examine the nature of the approx.15 km diameter crater (28.3deg N, 116.7deg E), part of an assessment of rampart craters on northwestern Elysium Planitia (20-30deg N, 110-120deg E) (Figure 1). This crater is of particular interest due to the presence of a massive lobe in the southwestern side of the rim (Figure 2a). Significantly, the Elysium region has been found to contain evidence of widespread ground ice [3]. In addition, lobate ejecta morphology, like that here, has been shown to correlate with evidence of near-surface volatile reservoirs [4]. Perhaps, this feature formed as a result of interaction with ground ice during impact.
Derived from text
*Craters; Impact Strength; Morphology; Mars Surface; Ejecta*

**20050174625** Washington Univ., Seattle, WA, USA
**Atmospheric Entry Heating Effects on Organic Carbonaceous Phases of IDPs and Polar Micrometeorites: An EELS Study**
Matrajt, G.; Brownlee, D.; Joswiak, D.; Taylor, S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Electron Energy Loss Spectroscopy (EELS) is a technique currently used to study carbonaceous phases in small particles such as IDPs [1]. Very ordered carbon such as graphite presents a particular EELS spectrum, which is different from the EELS spectrum of poorly ordered carbon such as amorphous or organic carbon [2,3]. Among the differences that exist between these two types of EELS spectra, the two most visible are the presence or absence of a well defined sigma peak with a maximum between 292-293 eV, and the presence or absence of a small peak near 6 eV (that we called gamma peak) in the loss region [4], between the ZLP (zero loss peak) and the plasmon peak (see Figs. 1 and 2). Heated carbon presents some order in its

structure that is usually distinguished in the EELS spectrum by the presence of a small peak [4]. IDPs and micrometeorites contain pristine and thermally processed carbonaceous phases. To distinguish these two different phases we combined EELS with high resolution imaging methods to study the carbonaceous phases of 3 IDPs and one polar micrometeorite. To determine the nature and temperature at which the thermally processed phases were formed we studied a range of different carbonaceous materials that we pulse heated to different temperatures.
Derived from text
*Aerodynamic Heating; Carbonaceous Materials; Micrometeorites; Temperature Effects; Energy Dissipation; Electron Energy*

**20050174627** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**Emissivity Spectral Measurements of Particulate Planetary Analog Materials**
Maturilli, A.; Witzke, A.; Helbert, J.; Moroz, L.; Arnold, G.; Wagner, C.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Reflection and emission spectra of planetary surfaces contain extensive information on the surface properties and in particular on mineralogical composition. The compositional information is provided by diagnostic mineral absorption features affected by their composition and structure. To interpret features of planetary spectra in a right way, it is essential to study the spectral behavior of terrestrial analog materials using laboratory measurements.
Derived from text
*Planetary Surfaces; Emissivity; Reflection; Surface Properties; Mineralogy; Emission Spectra*

**20050174629** MDS Research, Saint Petersburg, FL, USA
**Crustal Sources of Atmospheric Methane on Mars: The Association with Ground Ice and the Potential Role of Local Thermal Anomalies**
Max, M. D.; Clifford, S. M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The recent detection of methane in the Martian atmosphere (Muma et al., 2004; Krasnopolsky et al., 2004; Formisano and Cottini, 2004) has led to considerable speculation regarding the nature of its source. Methane can originate from both biotic and abiotic processes, the most plausible sources being emissions from subsurface methanogens or recent volcanic activity (Fisk and Giovannoni, 1999; Wallendahl and Treiman, 1999; Max and Clifford, 2000; Krasnopolsky et al., 2004). The need for recent activity is because the photodissociation of atmospheric methane by solar UV limits its lifetime to only 340 yrs. Thus, for methane to be detectable today, some process for its active replenishment must exist (Krasnopolsky et al., 2004).
Derived from text
*Mars Atmosphere; Methane; Photodissociation; Crusts; Air Pollution*

**20050174631** Tennessee Univ., Knoxville, TN, USA
**Unbrecciated Eucrite MAC 02522: Petrology of a 'Typical' Eucrite and Implications for Spectroscopy**
Mayne, R. G.; McCoy, T. J.; McSween, H. Y., Jr.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have begun a project to petrologically and spectrally characterize a suite of unbrecciated eucrites with the aim of understanding if correlations exist that will allow us to extract mineralogical, chemical or genetic information from visible and near-infrared spectra collected by the DAWN mission at Vesta.
Derived from text
*Chemical Analysis; Petrology; Visible Spectrum; Mineralogy; Extraction*

**20050174632** Arizona State Univ., Tempe, AZ, USA
**Investigation of Weathering Products of Martian Meteorite Analog Materials and Implications for the Formation of Martian Surface Fines**
McAdam, A. C.; Leshin, L. A.; Sharp, T. G.; Harvey, R. P.; Hoffman, E. J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Terrestrial analogs to martian surface materials can be used to gain insight into potential martian weathering processes and the role of water in the near-surface environment. We are investigating the mineralogy and chemical properties of fine size

fractions of a soil weathered from the Ferrar Dolerite. The soil was collected near Lewis Cliff in the Transantarctic Mountains. The Ferrar exhibits mineralogical similarities to martian basaltic lithologies, as represented by the shergottites [1]. Production of fines from this protolith in the cold, arid Antarctic makes the fines a promising Mars analog material. Also, these materials were altered in a colder, drier environment than other well-studied Mars analogs, such as Hawaiian palagonitic tehpras (e.g. JSC Mars-1) [2]. Our detailed studies of Ferrar fines are focused on addressing several questions. What is the relative significance of inherited, primary phases and chemical weathering products? What are the spatial, structural, and chemical relationships between minerals? What is the nature of any chemical weathering products? Have such products 'ripened' into well crystalline phases or are they poorly crystalline? Progress to date on addressing these questions is discussed below.
Derived from text
*Mars Surface; Chemical Properties; Mineralogy; Surface Properties; Lithology; Earth Analogs; Basalt*

**20050174633** NASA Johnson Space Center, Houston, TX, USA
**Curation and Allocation of the New Antarctic Nakhlite, MIL03346**
McBride, K. M.; Righter, K.; Satterwhite, C. E.; Schwarz, C.; Robinson, P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In January 2004, the ANSMET reconnaissance field team (Fig. 1) working in the Miller Range of the Transantarctic Mountains discovered a 715 g achondrite that was instantly recognized as unique. Named MIL03346, initial processing (NASA Johnson Space Center or JSC) and classification (Smithsonian Institution or SI) revealed this achondrite to be a nakhlite (Fig. 2). MIL03346 is the seventh nakhlite recognized in world collections [2], the third nakhlite returned from Antartica, and the first nakhlite in the US Antarctic collection (Table 1). The following is a summary of the steps taken in the processing and allocating of MIL 03346 and some comparisons to some other lunar and martian meteorites processed and allocated at JSC.
Derived from text
*Achondrites; SNC Meteorites; Classifications; Nakhlites*

**20050174634** NASA Johnson Space Center, Houston, TX, USA
**Prospecting for Martian Ice**
McBride, S. A.; Allen, C. C.; Bell, M. S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During high Martian obliquity, ice is stable to lower latitudes than predicted by models of present conditions and observed by the Gamma Ray Spectrometer (approx. 60 deg N). An ice-rich layer deposited at mid-latitudes could persist to the present day; ablation of the top 1 m of ice leaving a thin insulating cover could account for lack of its detection by GRS. The presence of an ice-layer in the mid-latitudes is suggested by a network of polygons, interpreted as ice-wedge cracks. This study focuses on an exceptional concentration of polygons in Western Utopia (section of Casius quadrangle, roughly 40 deg - 50 deg N, 255 deg - 300 deg W). We attempt to determine the thickness and age of this ice layer through crater-polygons relations.
Derived from text
*Mars Surface; Ice; Craters*

**20050174637** Brown Univ., Providence, RI, USA
**The Medusae Fossae Formation: Geological Characteristics and Topographic and Stratigraphic Relationships of the Lower Member Along Southeastern Elysium Planitia**
McColley, S. M.; Head, J. W., III.; Neukum, G.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Medusae Fossae Formation (MFF) is a long-standing enigma in the equatorial region of Mars. Mechanisms of formation for this unit are numerous and include: ignimbrite flows, aeolian deposition, ancient polar deposits formed by polar wander, air fall from explosive volcanic eruptions, and deposition of ice, snow, and dust during periods of high obliquity or outflow channel formation. The HRSC, MOC, THEMIS, and MOLA data sets provide the means to characterize all members (Aml, Amm, and Amu) included in the MFF at a variety of scales and to test the formational mechanisms listed above and to assess new ones. Specifically, quantitative and qualitative comparisons of features within the MFF will provide insight into the behavior of each member post-deposition. These observations coupled with past interpretations may provide an avenue to

place tighter constraints on formational mechanisms. To this end, we are currently analyzing stratigraphic relationships and characterizing the variable terrain types within the lower member (Aml) of the MFF and its relationships to adjacent units. Author

*Geology; Topography; Stratigraphy; Mars Surface*

**20050174638** Smithsonian Institution, Washington, DC, USA

**Metal-Sulfide-cemented Agglutinates: What's Really Happening with Sulfur on Asteroidal Surfaces?**

McCoy, T. J.; Brown, M. R. M.; Nittler, L. R.; Rost, D.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Near Earth Asteroid Rendezvous mission to 433 Eros addressed fundamental issues in asteroid and meteorite science, including the composition (both chemical and mineralogical) and physical state of asteroids. However, NEAR highlighted our still incomplete understanding of the nature of asteroidal regolith and the processes that operate at the asteroid-space boundary. This dearth is in strong contrast to studies of lunar regolith. In particular, lunar agglutinates provide a physical record of the effects of micrometeorite bombardment in lunar regolith, but similar asteroidal agglutinates remain unknown from asteroidal regolith breccias.

Derived from text

*Asteroids; Sulfides; Physical Chemistry; Regolith; Cementation*

**20050174639** Hawaii Univ., Honolulu, HI, USA

**Characteristics of Intracrater Thermal Anomalies in Southwestern Margaritifer Terra**

McDowell, M. L.; Hamilton, V. E.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

An investigation of nighttime thermal infrared images recorded by the Thermal Emission Imaging System (THEMIS) onboard Mars Odyssey reveals numerous craters in the region of southwestern Margaritifer Terra, Mars with anomalously warm floor deposits relative to the surrounding materials. These deposits differ from classic intracrater deposits, e.g., in that they appear to be coherent units rather than aeolian sand deposits. We have analyzed the spectral, thermal, topographic, and geomorphic characteristics of these anomalous deposits using THEMIS, Mars Global Surveyor Thermal Emission Spectrometer (TES), Mars Orbiter Laser Altimeter (MOLA), and Mars Orbiter Camera (MOC) data to understand their composition and origin.

Author

*Mars Surface; Craters; Deposits; Geomorphology; Thermal Emission*

**20050174640** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Cassini Imaging Results at Titan**

McEwen, A.; Turtle, E.; Perry J.; Fussner, S.; Porco, C.; West, R.; Johnson, T.; Collins, G.; DelGenio, T.; Barbara, J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cassini Imaging Science Subsystem (ISS) images show striking albedo markings on the surface of Titan. In equatorial regions the albedo patterns have high contrast and exhibit prominent lineaments and linear/angular boundaries suggestive of tectonic influences or fracturing of brittle surficial materials. There are intriguing dark curving lines near the south pole. Here we present several working hypotheses to explain these patterns. We also briefly summarize atmospheric science results.

Author

*Titan; Albedo; Atmospheric Chemistry; Atmospheric Physics; Structural Properties (Geology)*

**20050174641** Maryland Univ., College Park, MD, USA

**Evidence for Partial Melting in Reflectance Spectra of 433 Eros**

McFadden, L. A.; Goldman, Noah; Gaffey, M. J.; Izenberg, N. R.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations

Contract(s)/Grant(s): NAGW-0004; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The NEAR Shoemaker spacecraft returned near-IR spectra of asteroid 433 Eros at spatial resolutions ranging from 2.5 to 100's km during its year-long orbital mission in 2000. Assuming modified Gaussian absorption bands represent the reflectance spectrum between 0.8-2.5 m we fit the average of all geometrically corrected spectra acquired by the near-IR spectrometer (NIS) with seven absorption bands. Interpretation of the absorption bands in terms of olivine and pyroxene minerals indicates that the surface of Eros contains olivine and two pyroxenes with compositions that are indicative of a partially melted assemblage. This partial melting must have occurred when the asteroid was part of a larger minor planet, prior to break up into its current elongated and irregular shape.
Author
*Absorption Spectra; Eros Asteroid; Near Infrared Radiation; Melting*

**20050174642** Lunar and Planetary Inst., Houston, TX, USA
**Spreading of the Olympus Mons Volcanic Edifice, Mars**
McGovern, P. J.; Morgan, J. K.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Olympus Mons on Mars is the tallest known volcano in the solar system, with height about 23 km above base and a diameter about 600 km. Recent topography and image data are consistent with suggestions that Olympus Mons has undergone the process of volcanic spreading, in which the flanks of the volcano move outward to accommodate intrusive and extrusive growth. However, this process appears to have different manifestations in different sectors of the edifice. Here, topographic profiles of Olympus Mons are compared to profiles generated by Distinct Element Method (DEM) models of volcanic spreading. Our goal is to evaluate the relative contributions of spreading to the volcano s structure and to infer the boundary conditions (i.e., high- or low friction) at the base of the edifice.
Author
*Mars Surface; Mars Volcanoes; Topography*

**20050174644** Washington Univ., Saint Louis, MO, USA
**On Convection in Ice I Shells of Outer Solar System Bodies: Application to Callisto and Titan**
McKinnon, William B.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It has been argued that the dominant non-Newtonian creep mechanisms of water ice make the ice shell above Callisto s ocean, and by inference all radiogenically heated ice I shells in the outer solar system, stable against solid-state convective overturn. Conductive heat transport and internal melting (oceans) are therefore predicted to be, or have been, widespread among midsize and larger icy satellites and Kuiper Belt objects. Alternatively, at low stresses (where non-Newtonian viscosities can be arbitrarily large), convective instabilities may arise in the diffusional creep regime for arbitrarily small temperature perturbations. For Callisto, ice viscosities are low enough that convection is expected over most of geologic time above the internal liquid layer for plausible ice grain sizes.
Derived from text
*Callisto; Titan; Convection; Ice; Creep Properties*

**20050174645** State Univ. of New York, Stony Brook, NY, USA
**Provenance and Diagenesis of Impure Evaporitic Sedimentary Rocks on Meridiani Planum, Mars**
McLennan, Scott M.; Bell, J. F., III; Calvin, W. M.; Christensen, P. R.; Clark, B. C.; deSouza, P. A.; Farrand, W. H.; Fike, D.; Gellert, R.; Ghosh, A., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Preserved on the plains of Merinidani Planum, in the vicinity of the Opportunity landing site, is a succession of impure evaporitic sandstones. Stratigraphic and sedimentological relationships indicate mixed clastic and chemical depositional environments involving a combination of aeolian and shallow water conditions such as those found in terrestrial playa lakes, sabkhas or shallow marine embayments. These rocks also contain abundant textural and mineralogical evidence for a complex and protracted diagenetic history.
Author
*Mars Surface; Sedimentary Rocks; Planetary Geology; Geochemistry*

**20050174646** Massachusetts Univ., Amherst, MA, USA

**Processes Involved in the Formation of Martian Fan-shaped Deposits**

McMenamin, D. S.; McGill, G. E.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Martian fan-shaped deposits have varied origins. As on Earth, they can be classified as subaerial fans, true deltas, or lava deltas. True deltas (deposited where a river debouches into standing water) on Mars are either fluvial- or wave-dominated; fluvial-dominated deltas are influenced by inertia, buoyancy, and friction processes at their distributary mouths. Fan deltas, kame deltas, and grounding line wedges may also be present. To understand depositional environments and hydrologic and paleoclimatic conditions, it is important to distinguish between them. With the availability of high-resolution imagery, we can re-evaluate earlier classifications, and distinguish between several types of deltas and fan-shaped deposits.

Author

*Mars Surface; Deposits; Imagery; Planetary Geology*

**20050174648** NASA Johnson Space Center, Houston, TX, USA

**Analysis of Molecular Contamination on Genesis Collectors Through Spectroscopic Ellipsometry**

McNamara, K. M.; Stansbery, Eileen K.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Before the spacecraft returned to Earth in September, the Genesis mission had a preliminary assessment plan in place for the purpose of providing information on the condition and availability of collector materials to the science community as a basis for allocation requests. One important component of that plan was the evaluation of collector surfaces for molecular contamination. Sources of molecular contamination might be the on-orbit outgassing of spacecraft and science canister components, the condensation of thruster by-products during spacecraft maneuvers, or the condensation of volatile species associated with reentry. Although the non-nominal return of the Genesis spacecraft introduced particulate contamination to the collectors, such as dust and heatshield carbon-carbon, it is unlikely to have caused any molecular deposition. The contingency team's quick action in returning the damaged payload the UTTR cleanroom by 6 PM the evening of recovery help to ensure that exposure to weather conditions and the environment were kept to a minimum.

Derived from text

*Contamination; Ellipsometry; Genesis Mission; Particulates; Spectroscopy; Aerosols*

**20050174650** Massachusetts Inst. of Tech., Cambridge, MA, USA

**Early Irreversible Hydrous Melting and Degassing of the Martian Interior: An Experimental Study**

Medard, E.; Grove, T. L.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

According to current models of the solar system formation, the concentration of volatile elements in a given planet is expected to increase with distance from the Sun. It is thus probable that the chondritic mix from which Mars accreted is richer in volatiles than that of the Earth. Actually, evidence from Martian meteorites show that Mars is not as depleted in volatile elements as are other terrestrial planets. The most volatile element, H, is of particular importance, because of the tremendous effect H2O has on melting temperatures. Carbonaceous chondrites, containing up to 10 wt% H2O, can bring fairly large amounts of water in an accreting planet. The actual H2O content of the Martian mantle may be quite low (down to 36 p.p.m.), and evidence from noble gas isotopes strongly points towards an early degassing process, that has stripped the planet of most volatile gases. Before this degassing event, primordial Mars may have been quite wet. Radiogenic isotope data for Martian meteorites (e.g., evidence for live Nd-142 and Hf-182 in their source) all provide evidence that Mars accreted rapidly and at an early stage differentiated into atmosphere, mantle and core. Furthermore, the preservation of 4.5 Ga old isotopic heterogeneities points toward the absence of subsequent widescale homogenization processes, as observed on the Earth. It thus appeared that most of Martian characteristics have been acquired during very early differentiation processes. We investigated the melting behaviour of an undegassed Martian mantle composition, in order to explore the potential influence of water on these early differentiation processes. Experimental studies show that water has a strong effect on melting temperatures, and the presence of water may profoundly modify the timing of differentiation in a growing planet. We propose that an early hydrous melting event occurred during the accretion process. This melting event profoundly differentiated the Martian mantle and removed H2O from the planet's interior.

Derived from text

*Mars (Planet); Melting; Planetary Structure; Mars Surface; Degassing*

**20050174651** Lunar and Planetary Inst., Houston, TX, USA

**Understanding the Olympus Mons and Valles Marineris Using THEMIS Imagery**

Mena-Fernandez, S.; Xie, H.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

To better understand Mars geological features, water resources, possible life, and climate aspects, several spacecrafts such as the Mars Global Survey, Mars Express and Mars Odyssey had been launch into space. The latter, carries a sensor called Thermal Emission Imaging System (THEMIS), which combines a 5-band visible subsystem (VIS) and a 10- band infrared (IR) subsystem with 19m, 100m pixel resolution, respectively. This study aims at developing methods to eventually assess Mars mineral and rock composition through the case study of the Olympus Mons and Valles Marineris from THEMIS image analysis. ISIS 3.0 software was utilized to transform individual THEMIS QUEB files to Cub and from Cub to Tiff files. Then, these Tiff images were brought to ENVI for further processing and analyses. All analyses will be based on three geophysical parameters of the two study areas: temperature, radiance, and emissivity. The spectral emissivity of materials in the two areas will be compared with the Earth s mineral library. This will allow us to finally understand the rock and mineral composition of the Mars surface and the geological and tectonic processes that Mars experienced. Initial results indicate that the temperatures are slightly different between the Olympus Mons (-27 F to 4 F) and the Valles Marineris (-28 to 9 F), while the spectral radiance of materials in the two areas are obviously different. Further data processing and analyses are still in progress. Author

*Imaging Techniques; Mars Volcanoes; Planetary Geology; Thermal Emission; Tectonics; Geophysics*

**20050174652** NASA Johnson Space Center, Houston, TX, USA

**Isolation and Identification of Microorganisms in JSC Mars-1 Simulant Soil**

Mendez, Claudia; Garza, Elizabeth; Gulati, Poonam; Morris, Penny A.; Allen, Carlton C.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558

Contract(s)/Grant(s): NNG04GD68G; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Microorganisms were isolated and identified in samples of JSC Mars-1, a Mars simulant soil. JSC Mars-1 is an altered volcanic ash from a cinder cone south of Mauna Kea, Hawaii. This material was chosen because of its similarity to the Martian soil in physical and chemical composition. The soil was obtained by excavating 40 cm deep in a vegetated area to prevent contamination. In previous studies, bacteria from this soil has been isolated by culturing on different types of media, including minimal media, and using biochemical techniques for identification. Isolation by culturing is successful only for a small percentage of the population. As a result, molecular techniques are being employed to identify microorganisms directly from the soil without culturing. In this study, bacteria were identified by purifying and sequencing the DNA encoding the 16s ribosomal RNA (16s rDNA). This gene is well conserved in species and demonstrates species specificity. In addition, biofilm formation, an indicator of microbial life, was studied with this soil. Biofilms are microbial communities consisting of microbes and exopolysaccharides secreted by them. This is a protective way of life for the microbes as they are more resistant to environmental pressures.

Author

*Mars 1 Spacecraft; Microorganisms; Soils; Biochemistry; Mars Surface*

**20050174653** Paris-Sud Univ., Orsay, France

**Evidence for Removal Episode on Northern Plains from the Martian Fluidized Ejecta Volume**

Meresse, S.; Costard, F.; Mangold, N.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lobate ejecta blankets surrounding impact craters constitute a singular and widespread morphology of Martian craters. Their formation involves subsurface volatiles (water or ice) in the permafrost. Till then, in order to estimate the proportion of groundwater in the substrate at the time of crater formation, researchers used the maximal extension of the ejecta layer. It is defined by the ejecta mobility ratio (E.M.). However, this method does not take into account the exact volume of the ejecta blanket. The measurement of ejecta volume seems to be more appropriate and will also give new information about the morphometry and the characteristic of Martian craters. Here, we have used MOLA altimetry data for the determination of ejecta volume. Our research is limited to specific regions including the most numerous and fresh craters: Lunae Planum on the one hand and the Northern lowlands with Utopia and Acidalia Planitia on the other hand.

Derived from text

*Ejecta; Mars Craters; Mars Surface; Plains*

**20050174654** NASA Johnson Space Center, Houston, TX, USA

**Association of Presolar Grains with Molecular Cloud Material in IDPs**

Messenger, S.; Keller, L. P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Anhydrous interplanetary dust particles (IDPs) collected in the stratosphere appear chemically, mineralogically, and texturally primitive in comparison to meteorites. Particles that escape significant atmospheric entry heating have highly unequilibrated mineralogy, are volatile element rich, and, overall, appear to have escaped significant parent body hydrothermal alteration. These IDPs are comprised of the building blocks of the solar system. The strongest evidence that anhydrous IDPs are primitive is that they contain abundant stardust and molecular cloud material. In particular, presolar silicates were first identified in IDPs and are present in abundances (450-5,500 ppm) that are well above that observed in primitive meteorites (less than 170 ppm). The most fragile (cluster) IDPs also commonly exhibit large H and N isotopic anomalies that likely originated by isotopic fractionation during extremely low temperature chemical reactions in a presolar cold molecular cloud. The D/H ratios exceed that of most primitive meteorites, and in rare cases reach values directly observed from simple gas phase molecules in cold molecular clouds. The most extreme D- and N-15-enrichments are usually observed at the finest spatial scales (0.5-2 microns) that can be measured. These observations suggest that D and N-15 hotspots are in fact preserved nuggets of molecular cloud material, and that the materials within them also have presolar origins. The advanced capabilities of the NanoSIMS ion microprobe now enable us to test this hypothesis. Here, we report two recent examples of presolar silicates found to be directly associated with molecular cloud material.

Author

*Interplanetary Dust; Particles; Mineralogy; Molecular Clouds; Granular Materials*

**20050174655** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Impact Crater Deposits in the Martian Highlands**

Mest, S. C.; Crown, D. a.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The martian highlands of Noachis Terra (20-30 deg S, 20-50 deg E), Tyrrhena Terra (0-30 deg S, 50- 100 deg E) and Terra Cimmeria (0-60 deg S, 120-170 deg E) preserve long and complex histories of degradation, but the relative effects of such factors as fluvial, eolian, and mass wasting processes have not been well constrained. The effects of this degradation are best observed on large (D greater than 10 km) impact craters that characterize the ancient highlands. Some craters exhibit distinct interior deposits, but precise origins of these deposits are enigmatic; infilling may occur by sedimentary (e.g., fluvial, lacustrine, eolian), mass wasting and (or) volcanic processes.

Derived from text

*Mars Surface; Craters; Deposits*

**20050174656** Metzger Geoscience, Reno, NV, USA

**Evidence of Dust Devil Scour at the MER Spirit Gusev Site**

Metzger, S. M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Using MOC orbital images and several image sets from MER Spirit (Pancam, Navcam and MI), it has now become possible to study at substantially different scales the effects of dust devil vortices as they pass over the surface of the planet Mars. Prior to the January 2004, landing of the Mars Exploration Rover Spirit in Gusev crater, MOC images indicated a number of dust devil tracks in the immediate area. This report will make the case for (1) a limited number of days when vortex formation could proceed, (2) dust devil scour evidence on a rock examined by the Microscopic Imager (MI), and (3) calculate dust removal rates during one season in Gusev.

Derived from text

*Dust; Vortices; Planetary Surfaces; Mars Exploration; Craters*

**20050174657** Fukushima National Coll. of Tech., Iwaki, Japan

**Application to Large Blocks on Asteroid 25143 Itokawa: Ejecta Mass Distribution with Low Velocity for Impact Cratering Experiment on Porous Target**

Michikami, T.; Moriguchi, K.; Nakamura, R.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Hayabusa spacecraft will arrive at the asteroid 25143Itokawa in summer 2005. One of the biggest challenges at the arrival of Itokawa will be collecting the samples from the asteroid surface. However we do not know how many blocks there are on the surface. If there are many blocks larger than 1m, a minor collision might occur when the spacecraft touch down the asteroid surface. The blocks are produced during impact cratering, and only low velocity blocks can settle on the surface, because escape velocity from Itokawa is sub-meter per second. In order to examine the hazard that Hayabusa spacecraft collides with large blocks (\g1m), it is necessary to estimate the number of large blocks, which have been ejected with low velocity during impact cratering. There are very few experiments measuring the ejecta mass distributions with low velocity, because almost all ejecta are faster than 1m/s (e.g., [1], [2]). However, according to [3], there are many ejecta with lower velocities as long as the material strength of the target is small. As an example, in the case of one specific target (compressive strength 0.5MPa and porosity 43%), amount of ejecta with velocity lower than 1m/s is about 40% to the total ejecta mass. Recent observations demonstrated that asteroids have low densities and porous bodies. Therefore, if the result of the laboratory impact experiments is applied to the impact cratering on asteroid surface, many large blocks are likely to exist on the surface of Itokawa. In order to investigate the large blocks on Itokawa, impact cratering experiment was carried out and the ejecta mass distribution with low velocity was estimated.
Derived from text
*Asteroids; Compressive Strength; Mass Distribution; Mechanical Properties; Targets*

**20050174660** Tennessee Univ., Knoxville, TN, USA
**Accuracy of Derived Plagioclase Compositions from Thermal Emissivity Spectra of Multi-Component Mixtures of Pure Plagioclase**
Milam, K. A.; McSween, H. Y., Jr.; Moersch, J. E.; Christensen, P. R.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Remote sensing studies indicate that plagioclase feldspar is the dominant mineral phase in the martian crust, present in both surface types 1 and 2 identified by the Mars Global Surveyor Thermal Emission Spectrometer (TES). Martian meteorites, commonly thought to have sampled isolated areas on Mars, contain plagioclase in abundances secondary only to pyroxene. Terrestrial basalts and andesites are comprised of primary plagioclase feldspar that is calcic-intermediate (An50-75) in composition. Primary plagioclase with sodic (less than An-30) compositions is found in felsic and alkali- rich volcanic rocks and as an alteration phase in metamorphic and hydrothermally altered rocks. Primary plagioclase compositions vary with the extent and type of crystallization processes and with a variety of emplacement mechanisms. In low-temperature (less than 200 C) aqueous environments, plagioclase is commonly converted to clay minerals through hydrolysis. At hydrothermal temperatures, calcic plagioclase converts to more sodic compositions (less than An-30) through a process known as albitization.
Derived from text
*Plagioclase; Thermal Emission; Spectral Emission; Basalt; Crystallization*

**20050174662** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Mars ROCKS! in North Dakota, Solar System Ambassador Program in North Dakota**
Milford, C. R.; Marek, M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars is Rock'n in the Midwest! With a total of 5 currently running space missions exploring the red planet, what can teachers locally do to bring Mars into the classroom and capitalize on free and low-cost resources to teach Earth Science in terms of Mars? The NASA/JPL Solar System Ambassador is one such resource that Earth science teachers in the region can utilize. Currently only one Solar System Ambassador exists in the whole state of North Dakota. North Dakota is a rural state with the majority of its population concentrated on the eastern frindges which include the cities of Grand Forks and Fargo. The ruralness of the rest of the state provide a interesting challenge for any outreach program especially the solar system ambassador program.
Derived from text
*Mars Surface; Rocks; Planetary Geology*

**20050174663** Brown Univ., Providence, RI, USA
**Stratigraphic Analysis of the North Polar Cap of Mars: Recent Climate History**
Milkovih, Sarah M.; Head, James W.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The northern polar cap of Mars is characterized by spiraling troughs cutting through the cap surface. Horizontal and sub-horizontal layers exposed on the walls of these troughs are thought to contain varying ratios of water ice and dust. These polar layered deposits (PLD), first observed in Mariner 9 images and later studied in detail with the Viking orbiters, extend throughout the cap.. Recent images from Mars Global Surveyor (MGS) show that the layers have a range of thicknesses and albedos. Formation theories regard the layers as products of climate change due to orbital cycles, similar to climate changes caused by Milankovitch cycles on Earth, although the details of the formation processes remain unknown.
Derived from text
*Mars Photographs; Mars Surface; Polar Caps; Stratigraphy; Climate Change*

**20050174664** Brown Univ., Providence, RI, USA
**Evidence for Internal Deformation and Flow in the Northern Polar Cap of Mars**
Milkovich, S. M.; Head, J. W., III; Marchant, David R.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Within the northern residual polar cap of Mars are dark lanes or troughs; on the walls of these exposures are extensive lateral layers of ice and dust found throughout the polar cap. The polar layered deposits were first identified in Mariner 9 images [1, 2] and later studied in detail with the Viking orbiters [e. g. 3, 4, 5, 6, 7] and with the Mars Orbiter Camera (MOC) onboard the Mars Global Surveyor (MGS) [e. g., 8, 9, 10, 11]. These layers are thought to contain the record of recent climate change and polar history [e.g., 5, 7, 10, 11]. An understanding of the processes at work shaping the cap can help to interpret the climate record. It is well-documented that terrestrial ice of sufficient thickness can flow [e.g., 12, 13, 14]; if the martian polar cap is thick enough and the geothermal gradient at the base of the cap is high enough, it should flow as well [15, 16, 17, 18, 19, 20]. However, the strength of the cap material is unknown due to the unknown proportion of dust in the polar layered deposits within the cap; the presence of dust can strengthen or weaken the cap material, depending on the amount of dust [21, 22]. The presence of layers deformed by flow would provide insight into the strength and behavior of the cap.
Derived from text
*Polar Caps; Deformation; Exposure; Internal Flow; Mars Surface*

**20050174665** Brown Univ., Providence, RI, USA
**A Laboratory-based Model for Estimating Absolute H2O Content of Minerals Using VIS-NIR Spectroscopy**
Milliken, R. E.; Mustard, J. F.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The OMEGA and CRISM VIS-NIR spectrometers (on ESA s Mars Express and NASA a MRO, respectively) will provide high-resolution data that covers both the 3.0 and 1.9 micron water absorptions. The 3.0 micron band is present in all spectra acquired by OMEGA thus far, and a 1.9 micron band is visible in localized regions. Our goal is to use this data to estimate the absolute and/or relative H2O content of the martian surface both spatially and temporally. Previous studies have used laboratory data to find relationships between water content, mineralogy, and various spectral parameters. Building on our previous work, we use laboratory-derived spectra to calculate and compare several absorption band parameters to total H2O content in an attempt to find a relationship between water absorption strength and water content. Our proposed model is applicable to laboratory data as well as spectra of Mars, lunar deposits, asteroids, or other hydrated planetary surfaces.
Author
*Water; Mars Express; Mars Surface; Mineralogy*

**20050174666** Brown Univ., Providence, RI, USA
**Mapping the Water Content of the Martian Surface Using Mars Express OMEGA Data**
Milliken, R. E.; Mustard, J. F.; Poulet, F.; Bibring, M.-P.; Langevin, Y.; Gondet, B.; Pelkey, S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The detection of sulfates on the surface of Mars by the Mars Exploration Rovers [1] has shown that liquid water once interacted with the near-surface to produce hydrated minerals. Data from previous Mars missions, including the Mariner 6 IRS [2], Phobos 2 ISM [3,4], Mars Odyssey GRS [5] and MGS TES instruments [6], have been used to estimate the water content of the surface at relatively low spatial resolutions. Current and upcoming instruments (ESA s Mars Express OMEGA and NASA MRO's CRISM, respectively) will provide unprecedented high spatial and spectral resolution VIS-NIR data that will

cover the 3.0 m fundamental H2O stretching absorptions as well as the 1.9 m H2O combination overtone absorption, which are due to adsorbed or bound water. To date, most estimates of surface hydration rely partly on the ground-truth observations of soil water content as measured by the Viking landers (approx.1-2 wt.%), which have large uncertainties [7]. In this study, we apply our laboratory-derived models relating water absorption strengths and absolute water content [8] to the 3.0 m water absorption in the OMEGA VIS-NIR data. This model requires no a priori knowledge of surface composition [8] and provides an estimate of the absolute H2O content of the martian surface, independent of the Viking lander observations.
Derived from text
*Sulfates; Absorption Spectra; Mars Express; Soils*

**20050174668** Colorado Univ., Boulder, CO, USA
**Thermophysical Properties of the Surface of Isidis Basin, Mars**
Murphy, N. W.; Jakosky, B. M.; Rafkin, S. C. R.; Larsen, K.; Putzig, N. E.; Mellon, M. T.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Isidis Planitia contains some of the highest values of bulk thermal inertia (\g450 J/sq m/K/1/2s) on the surface of Mars (Fig. 1) [1]. There has been very little investigation of the surfaces of high thermal inertia observed in remote-sensing datasets since the Viking era. Of the current and past missions to the Martian surface, the Mars Pathfinder landing site contains the highest values of thermal inertia values derived from TES, with a mean value of 390 J/sq m/K/1/2s. The higher values of thermal inertia in the Isidis basin describe a surface with more extreme thermophysical properties than those observed at mission landing sites on Mars. Two questions were at the focus of this study: (1) what types of surfaces are responsible for the high-values of thermal inertia and (2) what geologic mechanisms gave rise to the complex pattern of high thermal inertia now observed in the Isidis basin?
Derived from text
*Thermophysical Properties; Structural Basins; Landing Sites; Mars Surface; Remote Sensing; Thermal Emission*

**20050174669** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Galileo SSI Observations of Volcanic Activity at Tvashtar Catena, Io**
Milazzo, M. P.; Keszthely, L. P.; Radebaugh, J.; Davies, A. G.; Turtle, E. P.; Geissler, P.; Klaasen, K. P.; McEwen, A. S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 1 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: We report on the analysis of the Galileo SSI's observations of the volcanic activity at Tvashtar Catena, Io as discussed by Milazzo et al. Galileo's Solid State Imager (SSI) observed Tvashtar Catena (63 deg N, 120 deg W) four times between November 1999 and October 2001, providing a unique look at the distinctive high latitude volcanism on Io. The November 1999 observation spatially resolved, for the first time, an active extraterrestrial fissure eruption. The brightness temperature of the lavas at the November 1999 fissure eruption was 1300 K. The second observation (orbit I27, February 2000) showed a large (approx. 500 sq km) region with many, small spots of hot, active lava. The third observation was taken in conjunction with a Cassini observation in December 2000 and showed a Pele-like plume deposition ring, while the Cassini images revealed a 400 km high Pele-type plume above the Catena. The final Galileo SSI observation of Tvashtar was acquired in October 2001, and all obvious (to SSI) activity had ceased, although data from Galileo's Near Infrared Mapping Spectrometer (NIMS) indicated that there was still significant thermal emission from the Tvashtar region. We have concentrated on analyzing the style of eruption during orbit I27 (February 2000). Comparison with a lava flow cooling model indicates that the behavior of the Tvashtar eruption during I27 does not match that of 'simple' advancing lava flows. Instead, it may be an active lava lake or a complex set of lava flows with episodic, overlapping (in time and space) eruptions.
Derived from text
*Volcanoes; Io; Infrared Imagery; Thermal Emission; Brightness Temperature*

**20050174671** Woods Hole Oceanographic Inst., MA, USA
**On the Mechanical Origin of Two-Wavelength Tectonics on Ganymede**
Montesi, Laurent G. J.; Collins, Geoffrey C.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Deformation of bright terrain on Ganymede occurs at two wavelengths: Fault spacing of order 1-2 km, and topographic undulations of order 10 km. Necking has been invoked to explain the longer wavelength but may be questionable if the

strength of brittle ice increases significantly with depth. The short wavelength can be explained through localization instability. Numerical models show that long-distance fault interaction can produce regularly-spaced zones of enhanced deformation that may an alternative origin for the long wavelength deformation on Ganymede, especially in low strain areas. Additional information is included in the original extended abstract.
Author (revised)
*Ganymede; Tectonics; Crustal Fractures; Planetary Geology*

**20050174672** NASA Ames Research Center, Moffett Field, CA, USA
**Mars-Analog Evaporite Experiment: Initial Results**
Moore, J. M.; Bullock, M. A.; Sharp, T.G.; Quinn, R.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This research is part of a multiyear experimental investigation to understand the nature and evolution brines and evaporates on Mars. The spectacular discoveries of the MER rovers, particularly those of Opportunity at Meridiani, both illustrate the relevance, as well as guide the future direction, of this work. Here we report the initial results from our just-completed and tested evaporites apparatus, using a synthetic brine analog to our brine experiment simulating a modern Mars environment in which the brine was subjected to rapid evaporation under modern Martian conditions. Additional information is included in the original extended abstract.
Author (revised)
*Mars Environment; Environment Simulation; Evaporation; Brines; Mineral Deposits*

**20050174673** NASA Ames Research Center, Moffett Field, CA, USA
**Layered Deposits and Pitted Terrain in the Circum Hellas Region**
Moore, J. M.; Howard, A. D.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Much of the southern highlands has been mantled since the Noachian, including a general blanket of possibly airfall-derived sediment that softens the landscape, the Electris mantle including knobby chaos in several basins, and a variety of deposits that are the subject of this study that share the common characteristics of being generally confined to basins and crater floors and that manifest irregular interior depressions. Many of these features occur in a zone surrounding Hellas. These deposits share the general characteristics of having fairly smooth, nearly planar surfaces and abrupt scarps bordering interior and marginal depressions. Despite these common characteristics, a wide range of morphologies occurs. Several end-members are discussed below. Additional information is included in the original extended abstract.
Author (revised)
*Mineral Deposits; Terrain; Structural Basins; Mars Surface; Planetary Geology; Strata; Sediments*

**20050174674** Arizona State Univ., Tempe, AZ, USA
**Rock Coatings from Vulcano, a Martian Analog Environment**
Minitti, M. E.; Weitz, C. M.; Bishop, J. L.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Previous studies have shown weathering environments in Martian analog sites on Earth can lead to coatings or rinds that alter the chemistry and spectral properties of original lithologies. Understanding such coatings is important for interpreting chemical and spectral data from Martian lithologies given suggestions and observations of the presence of coatings on Mars. We previously demonstrated that leaching of glass-rich Hawaiian basalts, sometimes in the presence of fumarolic gases, leads to formation of opaline coatings with minor amounts of Fe, Ti and S. The basalts illustrated that coatings as thin as 3 micron were sufficient to mask the substrate spectral character at both visible and near-infrared (VNIR) and thermal infrared wavelengths. Because coating formation processes and products can vary depending on substrate rock and weathering environment, we initialized a study of coated rocks from another analog Martian weathering environment, Vulcano (Aeolian Islands, Italy). Relative to Hawaii, Vulcano rocks have a different composition, experience less rainfall (25 in - 9 in per year; G. Capasso, pers. comm.) and are subjected to a different balance of fumarolic gases. Vulcano, like Hawaii, serves as a reasonable analog to Martian weathering given the periodic availability of water and the presence of fumarolic gases, which

are hypothesized to influence Martian lithologies through acid fog weathering.
Author
*Rocks; Coatings; Mars Surface; Weathering; Wind Effects*

**20050174675** Arizona Univ., Tucson, AZ, USA
**Preliminary Results of Sublimation Fractionation in Dusty Disaggregated Samples**
Moores, J. E.; Brown, R. H.; Lauretta, D. S.; Smith, P. H.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Using a cryostat, the behavior of particulate rich ice as an analogue for the ice-rich polar regolith of Mars is investigated. In particular, we examine the isotopic enrichment of this ice in deuterium and its role as a sink for the heavier isotope. We have chosen an appropriate concentration and size (1.6 microns in radius) for these particles based on the assumption that martian ices could be emplaced by precipitation from the atmosphere under near-current conditions. A 25wt% mixture of this size of TiO2 dust in a 5vol% deuterium D2O/H2O solution was used as a regolith simulant and was found to undergo significant deuterium fractionation. Unlike previous crystalline samples, the fractionation did not end rapidly - typical of solid samples with limited molecule mobility within the bulk. Instead, the hydrogen content of the sublimed gas continued to increase with time possibly as a result of preferential movement of deuterium away from the surface towards the colder part of the sample. Using a petrographic microscope ice grain sizes were confirmed to be consistent with snows seen by Viking Lander 2 in 1979. Additional information is included in the original extended abstract.
Author (revised)
*Sublimation; Fractionation; Dust; Mars Environment; Environment Simulation; Regolith; Isotopic Enrichment; Deuterium; Ice*

**20050174676** Academy of Sciences (Russia), Moscow, Russia
**Thermodynamic Models for Aqueous Alteration Coupled with Volume and Pressure Changes in Asteroids**
Mironenko, M. V.; Zolotov, M. Y.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

All major classes of chondrites show signs of alteration on their parent bodies (asteroids). The prevalence of oxidation and hydration in alteration pathways implies that water was the major reactant. Sublimation and melting of water ice, generation of gases, formation of aqueous solutions, alteration of primary minerals and glasses and formation of secondary solids in interior parts of asteroids was likely to be driven by heat from the radioactive decay of short-lived radionuclides. Progress of alteration reactions should have affected masses and volumes of solids, and aqueous and gas phases. In turn, pressure evolution should have been controlled by changes in volumes and temperatures, escape processes, and production/consumption of gases.
Derived from text
*Thermodynamics; Aqueous Solutions; Asteroids; Pressure Dependence; Volumetric Analysis; Chondrites*

**20050174678** NASA Johnson Space Center, Houston, TX, USA
**Crystallization Age and Source Signature of Chassigny**
Misawa, K.; Shih, C.-Y.; Reese, Y.; Nyquist, L. E.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chassigny is the Martian dunite composed of cumulate olivine (92%), chromite (1.4%), pyroxene (5%) and interstitial feldspar (1.7%). Although nakhlites (clinopyroxenite) are less intensely affected by shock metamorphism, Chassigny has been subjected to a peak shock pressure of about 35 GPa. The cosmic-ray exposure age of Chassigny (11.3 +/- 0.6 Ma) is comparable to those of nakhlites, suggesting launch pairing of these meteorites. Prior chemical and isotopic studies of Chassigny suggest that the meteorite crystallized approx. 1.3 Ga ago and is closely related to nakhlites. Nevertheless, compared to other Martian meteorites there are limited isotopic data for Chassigny. To examine the relationship of Chassigny to nakhlites, we have undertaken new Rb-Sr and Sm-Nd isotopic studies. Here we present the new Sm-Nd isotopic data for Chassigny and discuss the nature of its source materials.
Author
*Crystallization; Age Factor; Olivine; Chromites; Pyroxenes; Nakhlites; Mars (Planet)*

**20050174680** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**GCM Simulations of the Tropical Hydrogen Distribution Observed by Mars Odyssey**

Mischna, M. A.; Richardson, M. I.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The age and nature of the tropical hydrogen deposits on Mars remain uncertain. Competing theories suggest that the deposits are composed of either ancient, hydrated minerals or recently emplaced water ice. We use the GFDL Mars GCM with a fully coupled atmosphere-regolith water cycle to explore which of these hypotheses is best supported by model results. Such a conclusion can be drawn from the resultant trends in subsurface ice evolution during various obliquity and polar cap conditions. Our results suggest that the tropical hydrogen distribution is best explained by recent emplacement of ice through either exposure of the south polar ice cap or by burial of tropical surface ice from the most recent high obliquity excursions. Author

*Mars Surface; Hydrogen; Deposits; Tropical Regions; Simulation*

**20050174683** Lancaster Univ., UK

**Uncertainties in Water Discharge Rates at the Athabasca Valles Paleochannel System, Mars**

Mitchell, K. L.; Leesch, F.; Wilson, L.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations

Contract(s)/Grant(s): PPARC-PPA/G/S/2000/00521; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Athabasca Valles, in Cerberus Plainum, Mars, form a network of outflow channels that are among the youngest on Mars. We interpret the origin to be the result volcano-tectonic fracturing of the cryosphere which released a pressurised aquifer system at a flux rate estimated to be in the range 1-2 x 10exp 6) cc/s. We previously used this estimate to demonstrate that the water must have been in the liquid state before eruption, as dykecryosphere thermal interactions would be insufficient to melt the required volume at the required rate. However, our suspicion, during and following this initial study, and based on research into other channel systems on Mars, was that previously quoted uncertainty ranges were much smaller than can reliably be derived based on palaeochannel measurements when taking into account all uncertainties. The aim of this study, therefore, is to re-analyse the palaeohydrology of Athabasca Valles, in order to reassess previous water discharge estimates. The main element of this work is the inclusion of all obtainable error and uncertainty estimates.
Author

*Mars Atmosphere; Water; Ice Environments; Tectonics; Volcanoes*

**20050174684** Lancaster Univ., UK

**Recent and Future Volcanism on Dormant Mars**

Mitchell, K. L.; Wilson, L.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Evidence for geologically very recent volcanism on Mars, in some cases within the past 0.1% of Mars' 4.5 Ga history, seems to be at odds with the lack of observation of on-going activity. We suggest that Mars is dormant rather than extinct, in a cycle characterized by approx. 100 Ma epochs of inactivity, punctuated with approx. 1 Ma, single-centre, eruptive epochs. Our predictions of erupted volumes and eruption rates are consistent with the volumes and lengths of the youngest lava flows on Olympus Mons, and suggest that, even if an eruptive epoch is on-going, it may be 10s of years before the next approx. 2 year-long eruption.
Author

*Mars Volcanoes; Mars Surface; Time Measurement*

**20050174686** Arizona Univ., Tucson, AZ, USA

**Conductive-Convective Switches of the Ice Shell of Europa: Implications for the Surfaces Structures**

Mitri, G.; Showman, A. P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We investigate the response of a conductive and convective ice shell to changes of heat production in the silicate mantle and in the ice shell of Jupiter s satellite Europa. This abstract is a summary of Mitri and Showman, recently submitted to Icarus. Estimates of Europa s ice shell thickness range from approx. 3 - 50 km. This uncertainty in thickness translates directly into an uncertainty in the heart-transfer mechanism: if the shell is thick, the rigid surface could be underlain by a layer of

convecting water ice, whereas a thin shell would instead transport the heat by conduction. Interestingly, most estimates of the shell thickness (10 - 40 km) imply that the ice-shell Rayleigh number is near the critical Rayleigh number, which is approx. 10(exp 6) for realistic temperature-dependent viscosities.
Derived from text
*Conductive Heat Transfer; Convection; Switches; Ice; Europa*

**20050174687** Hawaii Univ., Honolulu, HI, USA
**Thermally Distinct Craters Near Hrad Vallis, Mars**
Morris, A. R.; Mouginis-Mark, P. J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The terrain surrounding Hrad Vallis, NW Elysium Planitia at 34degN, 218degW, is geologically distinct from the surrounding landscape. The area is characterized by unusual flow-like deposits and channel systems that extend radially from the slopes of Elysium Mons [1] (Fig. 1). Various formation mechanisms have been proposed for Hrad Vallis using Viking Orbiter [1] and Mars Orbiter Camera (MOC) images [2]. Previous workers noted the presence of depressions within the flow deposit that appear to have been formed by processes other than impact cratering [2-4]. Presently, no rigorous models exist to explain the formation of these distinct craters. The primary goal of the current study is to assess possible formation mechanisms for the craters by way of a geomorphologic and topographic examination utilizing a variety of data available.
Derived from text
*Craters; Geomorphology; Deposits; Planetary Geology; Terrain; Mars Surface*

**20050174689** NASA Johnson Space Center, Houston, TX, USA
**Abundance and Speciation of Water and Sulfate at Gusev Crater and Meridiani Planum**
Ming, D. W.; Clark, B. C.; Klingelhoefer, G.; Gellert, R.; Rodionov, D.; Schroeder, C.; deSouza, P.; Yen, A.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A major science goal of the Mars Exploration Rover (MER) mission is to search for evidence of water activity, and direct mineralogical evidence for aqueous activity has been reported for Meridiani Planum in the form of the iron sulfate hydroxide mineral jarosite and at Gusev crater in the form of goethite. The Spirit and Opportunity rovers have each collected 110+ Moessbauer (MB) and 75+ Alpha Particle X-Ray Spectrometer (APXS) spectra from Gusev crater and Meridiani Planum [1 - 4]. In this abstract, we use mineralogical and elemental data, primarily from the Moessbauer and APXS instruments, to infer the speciation and estimate the abundance of sulfate and water (as either the H2O molecule or the hydroxyl anion) at Gusev crater and Meridiani Planum. Throughout the abstract, we adopt a format for mineral formulas that shows water explicitly rather than the usual practice of structure-based formulas (e.g., for goethite we write Fe2O3xH2O instead of FeOOH).
Derived from text
*Mars Exploration; Water; Roving Vehicles; Mineralogy; Iron Oxides; X Ray Spectrometers; Sulfates; Craters*

**20050174690** Tsukuba Univ., Japan
**Appropriate Shock Waves for Chondrule Formation: Heating Rate and Cooling Rate Constraints**
Miura, H.; Nakamoto, T.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The absence of isotopic fractionation in chondrules suggests that chondrules have to be heated rapidly (\g10(exp 4) K/hr) at a temperature range of 1273-1573 K. Dust aggregates that have never melted before are thought to be fluffy. When such aggregates are heated, the isotopic fractionation should occur associated the evaporation from inside of fluffy aggregates. If the heating rate is slow, it is impossible to suppress the isotopic fractionation. On the contrary, since once molten dust particles are not fluffy, there is no need to heat them rapidly. On the other hand, chondrules have to cool at an appropriate speed (approx. 10-3000 K/hr) in order to reproduce their texture (e.g., porphyritic, barred olivine, and so forth). The shock-wave heating model taking into account the radiation transfer can explain the appropriate cooling rate. However, it is unclear whether or not the heating rate of chondrules in those models is rapid enough to suppress the isotopic fractionation. In this study, we numerically simulate the shockwave heating model taking into account the radiation transfer (both the dust thermal continuum emission and the line emission of gas molecules) and discuss the chondrule formation scenario which satisfies both constraints:

the rapid heating rate and the appropriate cooling rate. Additional information is included in the original extended abstract. Author (revised)
*Petrogenesis; Chondrule; Shock Waves; Solar Nebula*

**20050174693** Observatoire de Besancon, France
**Volatiles Enrichments in Saturn: Predictions for Cassini**
Mousis, O.; Alibert, Y.; Benz, W.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We use the giant planets extended core-accretion model [1] and the clathrate hydrate trapping theory [2] to calculate the enrichments in O, C, N, S, Xe, Ar and Kr with respect to their solar abundances in Saturn s atmosphere. In the past years, abundances of C and N have been determined from ground-based observations [3] [4]. Thus, C and N were estimated to be enhanced by factors of approx. 2.85+/-0.95 and 2+/-0.5 in Saturn s atmosphere compared to their solar value, respectively. However, recent Cassini spacecraft measurements have led to a revision of C abundance in Saturn s atmosphere, which is now estimated to be 7+/-2 times the solar value [5]. As a result, this unexpected high C enhancement may lead to important changes in the calculations of the volatiles enrichments in Saturn s atmosphere, if we compare them with those calculated with the former value. In the present work, we discuss the implications of both ground-based and Cassini measurements on the amount of ices accreted by proto-Saturn during its formation. In addition, from the calibration on the two existing measurements of C enhancement in Saturn, we derive the corresponding enrichments values of other volatile species with respect to their solar abundances. Some of these predictions may be tested by the Cassini spacecraft mission in a near future.
Derived from text
*Gas Giant Planets; Saturn Atmosphere; Abundance; Clathrates; Enrichment*

**20050174695** Tokyo Univ., Japan
**Flow-like Features on Europa: Geometric Patterns and Relation to Topography Collectively Constrain Material Properties and Effusion Rates**
Miyamoto, H.; Mitri, G.; Dohm, J. M.; Showman, A. P.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Processes that result in the formation of a variety of surface features on Europa may involve surface flows of viscous materials, including both ice and slurry flows. Theoretical investigations of cryovolcanism suggest that an eruption of ice/water is a viable, though not unequivocal, explanation for these features. Although most of these flow-like features can also be explained by other processes, such as thermal or compositional diapirism or melt-through of a thin ice shell, even in these cases, surface flows may be involved; for example, ascending diapirs may fracture the surface and discharge materials that flow onto the surface. Here, we present numerical simulations of surface-ice flows on Europa to better illuminate whether putative flow-like features actually resulted from flows and, for probable flow candidates, to constrain the eruption conditions and flow rheology during emplacement. The primary constraint on the modeling is the relationship between the flow-like features and surrounding topography, which affords a unique opportunity to test the flow hypothesis. Overall, our results support the view of Fagents that, while cryovolcanic flows appear to be present on Europa, they are not a dominating factor in shaping the surface. Putative flow-like features: Several types of features
Author
*Europa; Topography; Water; Ice; Rheology*

**20050174696** Hawaii Univ., Honolulu, HI, USA
**The Unique Attributes of Martian Double Layered Ejecta Craters**
Mouginis-Mark, Peter J.; Boyce, Joseph M.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ejecta deposits surrounding many impact craters on Mars have been enigmatic since the first Viking Orbiter images illustrated their non-lunar character [1]. Unlike on the Moon and Mercury, Martian impact craters typically possess lobate deposits that appear to have been fluidized at the time of emplacement [2 - 5]. Typically this has been attributed to the presence of volatiles (water or ice) within the target material at the time of crater formation, although alternative models that include atmospheric effects have also been proposed [6, 7]. The Mars Crater Consortium produced a consistent set of nomenclature

for most of the fresh impact craters that can be identified on Mars using Viking Orbiter images [8], which we adopt for this study. The three major crater types defined by the Consortium are single layer ejecta (SLE), double layer ejecta (DLE), and multi-layer ejecta (MLE). Here we use THEMIS VIS data collected and released up until October, 2004, to identify some of the unique attributes of DLE craters that serve to place constraints on future numerical models of ejecta emplacement.
Derived from text
*Ejecta; Mars Craters; Planetary Craters; Mars Surface; Atmospheric Effects; Deposits*

**20050174697** Tennessee Univ., Knoxville, TN, USA
**Comparison of Orbital Infrared Observations and Surface Measurements by the Mars Exploration Rover Spirit at Gusev Crater**
Moersch, J. E.; Crumpler, L.; Arvidson, R.; Blaney, D.; Christensen, P.; Fergason, R.; Golombek, M.; Knudson, A.; Piatek, J.; Ruff, S., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Exploration Rovers are the first robotic vehicles to traverse a distance across the surface of another planet that is greater than the size of a single resolution element in remote sensing data collected from orbit. This mobility affords new opportunities in making comparisons between what is seen from above and what is seen on the ground. Rover measurements can be used to ground-truth a priori predictions made from orbital data, and to make empirical calibrations of orbital data. Orbital data that have been calibrated in this way can then be used to extrapolate predictions regarding the nature of the terrain yet to be traversed. Thermal infrared observations have featured prominently in orbital remote sensing of Mars. The Thermal Emission Spectrometer (TES) on Mars Global Surveyor has mapped the composition and thermophysical properties of the surface at moderate (approx. 3km) spatial resolution and high (5-10/cm) spectral resolution, and the Thermal Emission Imaging System (THEMIS) on Mars Odyssey is mapping the same properties at a much higher spatial resolution (100m) and moderate spectral resolution (approx. .1 m). Both instruments played key roles in selection of the landing sites for the Mars Exploration Rovers. Here we present initial results from our efforts to compare these orbital thermal infrared observations with measurements made by the rover Spirit at Gusev crater. THEMIS thermal inertias: Past comparisons of
Author
*Infrared Astronomy; Imaging Techniques; Mars Exploration; Planetary Surfaces; Thermophysical Properties; Thermal Emission*

**20050174698** Ecole Normale Superieure, Lyon, France
**Isotopic Fractionation of Copper and Zinc in Lunar Materials**
Moynier, Frederic; Albarede, Francis; Herzog, Gregory F.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On the Moon, S [see 1] and Cd [2] show an interesting pattern of isotopic variation: In soils, they tend to be isotopically heavy relative to bulk meteoritic or terrestrial values; in rocks, their isotopic abundances differ little from normal values; and in pyroclastic glasses such as 74220, the lighter stable isotopes may be enriched. Zinc and copper share with S and Cd the cosmochemical properties of volatility and chalcophilicity. We therefore hypothesized that these four elements might behave alike isotopically. Xue et al. [3] previously reported enrichments in the heavier isotopes of Zn in lunar soils, but the measurements had modest precision and have not been confirmed. Presented here are measurements of the elemental and/or isotopic abundances of Cu and Zn in lunar materials.
Derived from text
*Copper; Fractionation; Zinc; Lunar Soil; Lunar Rocks; Isotopes; Volatility*

**20050174700** Manchester Univ., UK
**Xenon in Yamato 000593 & NWA 817- Nakhlites from Two Diverse Terrestrial Environments**
Mohapatra, R. K.; Crowther, S.; Gilmour, J. D.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Yamato 000593 and NWA 817 are two martian meteorites collected respectively from Antarctic ice and Morocco. They are the first Nakhlites to be found in the (cold and hot) desert environments. We have analysed these meteorites for their xenon

isotopes to understand the nature of volatile components, and present here preliminary data and results from the study. Additional information is included in the original extended abstract.
Author (revised)
*Nakhlites; Xenon Isotopes; Meteoritic Composition; Isotope Ratios*

**20050174701** Washington Univ., Saint Louis, MO, USA
**Viscoelastic Evolution of Lunar Multi-Ring Basins**
Mohit, P. S.; Phillips, R. J.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Multi-ring basins on the Moon provide a window into early lunar thermal history. Most of the oldest basins are highly degraded and have little topographic expression. This has typically been explained by relaxation of relief through viscous flow of the crust and mantle on geologic timescales. However, the great age of these basins also allows the possibility that they formed when the lunar crust was very hot or partially molten, facilitating enhanced crater collapse during formation or very rapid relaxation. Any successful hypothesis for basin evolution must explain why South Pole-Aitken basin (SPA), believed to be the oldest and largest impact basin on the Moon, has retained high-amplitude topographic relief. Here we determine the conditions necessary to produce viscous relaxation and discuss the implications of these results for lunar thermal history. Additional information is included in the original extended abstract.
Author (revised)
*Structural Basins; Lunar Crust; Lunar Mantle; Viscous Flow*

**20050174702** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**The Importance of Adsorption Water in the Upper Martian Surface**
Moehlmann, D. T. F.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Odyssey has proven the existence of water in the soil of the upper martian surface (meter depths) at equatorial and mid-latitudes. The water content can regionally reach values up to about 15%. This water is in the form of irreversibly chemisorbed, of partially reversibly structurally bound ('crystal') water, or of reversibly bound, liquid-like, and partially unfrozen, adsorption water. This adsorption water can have remarkable influences on the interaction of the uppermost martian surface with the atmosphere, where morning fog indicates the presence of near-surface water. Saturation of water vapor and related adsorption and condensation can be reached during night and morning hours, while desorption dominates during warmer daytime conditions. This atmospheric water vapor interacts by adsorption and desorption with the uppermost parts of the martian surface and also with the surfaces of dust and other particles.
Derived from text
*Water Vapor; Adsorption; Mars Surface; Moisture Content*

**20050174703** Massachusetts Inst. of Tech., Cambridge, MA, USA
**Primary Martian Basalts at Gusev Crater: Experimental Constraints**
Monders, A. G.; Medard, E.; Grove, T. L.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Until recently the only information on Martian magmatic processes came from SNC meteorites, young magmatic rocks thought to have been ejected through meteoritic impact from the volcanic areas of Tharsis or Elysium. Most of these rocks, however, contain accumulated crystals, and all have suffered various extents of fractional crystallization and crustal assimilation, making it difficult to characterize their source regions. Lavas were also analyzed by the Mars Pathfinder mission, but the analyzed compositions are andesitic and represent differentiated magmas as well. Basaltic rocks have recently been described from the Spirit landing site at Gusev Crater. They are dark, fine-grained vesicular rocks, containing \h25% phenocrysts. Chemical analyses of abraded samples by Alpha-Particle X-Ray Spectrometer are consistent with primitive basalts, with up to 12% MgO. Gusev Crater is located in the northernmost region of the highly cratered Southern Highlands; rocks with spectral characteristic similar to Gusev Crater basalts have also been documented in the cliffs surrounding Isidis Planitia, suggesting that the Gusev basalts may represent an important component of the ancient Noachian Martian crust. These are the first available data on primitive Martian basalts. High-pressure, high-temperature phase relations of the Gusev basalts have been investigated in order to understand their formation conditions. The inverse experimental approach has been

used to explore the processes of mantle melting and crust formation on Mars. Additional information is included in the original extended abstract.
Author (revised)
*Mars Craters; Basalt; Chemical Analysis; Planetary Mantles; Planetary Geology; Mars (Planet)*

**20050174704** Open Univ., Milton Keynes, UK
**Evidence from HRSC Mars Express for a Frozen Sea Close to Mars' Equator**
Murray, John B.; Muller, Jan-Peter; Neukam, Gerhard; Werner, Stephanie C.; Hauber, Ernst; Markiewicz, Wojciech J.; Head, James W., III; Foing, Bernard H.; Page, David; Mitchell, Karl L., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cerberus Fossae fissures on Mars are the source of both lava and water floods dated at between 2 and 10 million years old. Evidence for resulting lava plains has been identified in eastern Elysium, but seas and lakes from these fissures and previous flooding events were presumed to have evaporated and sublimed away. HRSC images from the ESA Mars Express spacecraft indicate that they may still be there. We have found evidence consistent with a presently-existing frozen body of water, with surface pack-ice, around +5 deg. latitude and 150 deg. east longitude in southern Elysium. It measures about 800 km x 900 km and averages up to 45 m deep: similar in size and depth to the North Sea. It has probably been protected from complete sublimation by a surface sublimation lag formed from suspended sediment exposed by early loss of the surface ice. Its age from crater counts is 5 +/- 2 Ma.
Author
*Body Fluids; Craters; Mars Express; Water; Lava*

**20050174705** Open Univ., Milton Keynes, UK
**Late Stage Water Eruptions on the Flanks of Large Martian Volcanic Constructs**
Murray, John B.; vanWykdeVries, Ben; Muller, Jan-Peter; Neukam, Gerhard; Page, David; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The HRSC Mars Express images have provided us with the first widespread 10-20m resolution coverage of five large Martian volcanoes: Olympus Mons, Ascraeus Mons and Arsia Mons, Albor and Hecates Tholus. A number of common features emerge: 1. No unequivocal lava-producing flank vents have as yet been found on any of these volcanoes, and no pyroclastic cones. Long and voluminous flows (in excess of 300 km long and 10 km wide) radiate from the summit, their origins having been obscured within the caldera collapse in each case. 2. Near the foot of the flanks, concentric graben have developed at Ascraeus Mons, Arsia Mons, and Albor Tholus. 3. Late stage collapse pits and sinuous rilles have developed near the foot of the outer slopes, that cut across and therefore post-date all visible lava flows.
Derived from text
*Water; Mars Volcanoes; Mars Surface; Slopes*

**20050174707** Brown Univ., Providence, RI, USA
**Compositional Diversity of the Martian Crust from OMEGA Observations**
Mustard, J. F.; Poulet, F.; Gendrin, A.; Mangold, N.; Bibring, J.-P.; Langevin, Y.; Gondet, B.; Belluci, G.; Altieri, F., et al.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: The igneous mineral composition of the martian crust is a function of the initial conditions of planet formation and the subsequent evolution of the interior and its interaction with the crust and surface. Our knowledge of the mineral composition of the crust has been derived from the study of meteorites, in situ lander observations, and remotely sensed data. Visible-near infrared reflectance data over the 0.35 - 5.1 m wavelength region obtained by the OMEGA instrument on the Mars Express spacecraft brings valuable new data to investigate the composition of the martian crust. Among the rock-forming igneous minerals, this wavelength region is most sensitive to the presence of iron-bearing mafic minerals, principally olivine and pyroxene. Through the first 12 months of operations, the OMEGA experiment has covered greater than 50% of the planet s surface with spatial resolution ranging from 300 m/pixel to 4.8 km/pixel. Here we report on the global properties of these mafic minerals.
Author
*Mars Surface; Minerals; Planetary Evolution; Planetary Crusts*

**20050175701** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXVI, Part 17**

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The following topics were discussed: A Model for the Formation of Paterae on Io; LIBS-based Detection of As, Br, C, Cl, P, and S in the VUV Spectral Region in a Mars Atmosphere; Mass Independent Sulfur in Achondrites: Possible Evidence of Photochemistry in the Solar Nebula; Grain Size-dependent Viscosity and Oceans in Icy Satellites; Claritas Paleolake Studied from the MEX HRSC Data; Mars Express HRSC Colors of White Rock, Arabia, Mars; Lava and Flows of the Arcadia Region of Mars; Isotopic Composition of Lunar Soils and the Early Differentiation of the Moon; Trace Element Analysis of Lunar Soils by ICP-MS; Highly Siderophile Elements and Osmium Isotope Systematics in Ureilites: Are the Carbonaceous Veins Primary Components?; Evaporative Evolution of Martian Brines Based on Halogens in Nakhlites and MER Samples; Io from High-Resolution Galileo PPR Data Taken Simultaneously with SSI or NIMS Observations; Loki, Io: Groundbased Observations and a Model for Periodic Overturn; Deconstructing a Few Myths in the Interpretation of Satellite-Altitude Crustal Magnetic Field: Examples from Mars Global Surveyor; Semi-Autonomous Rover Operations: A Mars Technology Program Demonstration; Rotational Studies of Asteroids with Small Telescopes; Mineralogy and Temperature-induced Spectral Investigations of A-type Asteroids 246 Asporina and 446 Aeternitas; and Thermal History Calculations Versus Full Convection Models: Application to the Thermal Evolution of Mercury. Recent Solar-Proton Fluxes

Derived from text

*Asteroids; Convection; Mineralogy; Mars Surface; Mars Atmosphere; Photochemical Reactions; Spacecraft Instruments; Trace Elements; Lunar Soil*

**20050175702** Arizona Univ., Tucson, AZ, USA

**A Model for the Formation of Paterae on Io**

Radebaugh, Jani; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Paterae on Io are similar to calderas on the Earth and other planets, yet they have some differences, such as their great sizes (from 2 to 206 km diameter) and lack of high edifices. Tidal heating from Jupiter leads to the production of molten material and the eruption of large amounts of mafic to ultramafic lava within Io s paterae, as well as across its surface. Formation of paterae is likely also different from our understood models of caldera formation, as the process must lead to the unique morphologies of the features we observe. I describe a possible model for the formation of a typical patera, which uses our collective observations of Io s paterae and current understanding of Io s interior as the basis for the steps in the model. Derived from text

*Io; Mineralogy; Volcanoes; Calderas; Heating*

**20050175703** Purdue Univ., West Lafayette, IN, USA

**Thermal History Calculations Versus Full Convection Models: Application to the Thermal Evolution of Mercury**

Redmond, Hannah L.; King, Scott D.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Thermal history calculations simplify the full equations of convective motion to a basic energy balance [1]. The development of thermal history calculations requires a relationship between the convective vigor, represented by the Rayleigh number (Ra), and the surface heat flow, represented by the Nusselt number (Nu) Nu = Ra(sup Bet ) where Beta is the exponent in the Rayleigh number-Nusselt number relation. The value of the exponent varies considerably depending on model assumptions [2-5]. More troubling, as a planet cools, it passes through stages where different values of the exponent would be appropriate. Hence comparing thermal history calculations with more complete convection simulations seems appropriate. Derived from text

*Convection; Nusselt Number; Rayleigh Number; Equations of Motion*

**20050175704** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Ion Composition in Saturn's Plasma Environment: Early Results from the Cassini Plasma Spectrometer**

Reisenfeld, D. B.; Baragiola, R. A.; Crary, F. J.; Coates, A. J.; Goldstein, R.; Hill, T. W.; Johnson, R. E.; McComas, D. J.; Sittler, E. C.; Shappirio, M. D., et al.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 1 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Prior to Cassini s arrival at Saturn, most of what was known about the composition of the plasma in Saturn s environment was derived from limited measurements by Pioneer 11 and Voyager 1 and 2 in 1979-1981[1-3]. The measurements reported here were made by the Cassini Plasma Spectrometer (CAPS) [4] during the first two Cassini orbits, including the closest approach to Saturn and the rings during the tour, and a close flyby of Titan. The CAPS instrument resolves ion energy/charge from 1 V to 50 kV and ion mass/charge from 1 to approx.100 amu/e, and it measures electron energy from 1 eV to 28 keV. Initial composition measurements of Saturn s magnetosphere show that protons dominate outside approx.8 R(sub s), while inside this radius the plasma is dominated by a mix of water-derived ions and N(+). Over the A and B rings a plasma layer is observed composed of O2(+) and O(+) . The close passage near Titan shows a rich network of both positive and negative molecular ions. We report preliminary analysis of these and other composition findings.

Derived from text

*Ion Charge; Saturn Atmosphere; Plasma Layers; Molecular Ions; Negative Ions; Electron Energy*

**20050175706** California Univ., Los Angeles, CA, USA

**Relationships Among Oxidation State, Bulk Chemistry, Oxygen-Isotopic Composition, Petrologic Type and Chondrule Size in Ordinary Chondrites**

Rubin, Alan E.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Each ordinary-chondrite (OC) group comprises chondrites of different petrologic types and exhibits a narrow range in oxidation state, bulk chemical composition, oxygen-isotopic composition and chondrule size. Relationships among these properties reflect both nebular and asteroidal processes. These relationships are further discussed in this paper.

Derived from text

*Oxidation; Oxygen Isotopes; Chondrites; Petrology; Chondrule; Chemical Composition*

**20050175707** Vermont Univ., Burlington, VT, USA

**Shear-induced Segregation of Fe-Liquid in Planetsimals: Coupling Core Forming Compositions with Transport Phenomena**

Rushmer, T.; Petford,Nick; Humayun, M.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Timescales for first planetesimal accretion and differentiation have recently been under intense scrutiny. Although the isotopic data (mainly the decay of short-lived isotopes Hf-182 to W-182) are still being gathered and interpreted, current data suggest that core formation in early planetesimals was likely a rapid process. The most recent estimations using high precision W isotopic data from iron meteorites show a range in timing, but suggest some samples have formed in less than 2 Ma of solar system formation. Liquid iron-rich metal segregating from a molten silicate mantle (magma ocean) is a widely cited mechanism for segregating the Earth's core. However, the short times for core formation based on W-Hf isotope systematics permit other segregation mechanisms for liquid metal to be active during core formation in growing planetesimals. For example, deformation may assist the segregation of low degree metallic melts and may enhance both kinetics and efficiency of the physical segregation process. Here we report the results of a series of deformation experiments combined with modeling to investigate mechanisms of core-metal transport during planetesimal accretion and their associated liquid metal geochemical signatures. We then explore the relationship between melt fraction and porosity to compare the migration rate of liquid metal driven by buoyancy pressure gradients with a theoretical model of melt segregation in a deforming porous medium that takes into account the coupling between volume strain (dilatancy) and shear stress.

Derived from text

*Protoplanets; Shear Stress; Iron; Liquid Metals; Geochemistry; Planetary Cores*

**20050175708** Bern Univ., Bern, Switzerland

**Modeling Ice Stability with Topography on a Local Scale, Mars**

Russell, P. S.; Lefort, A.; Thomas, N.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Models addressing the stability of ice on a global scale have been put forth by several authors. General circulation models are inherently large in scale and take into account general elevation, but not specific topographic geometry, in determining energy balances and ice stability. In this study, we seek to assess the stability of ice on a more local scale: a scale at which the effects of topography will potentially cause spatial variation in ice stability by differentially modifying the energy balance at the ice's surface.

Derived from text

*Ice; Stability; Mathematical Models; Mars Surface; Topography*

**20050175716** Mount Holyoke Coll., South Hadley, MA, USA

**Fundamental Mvssbauer Parameters of Hydrous Iron Sulfates**

Rothstein, Y.; Dyar, M. D.; Schaefer, M. W.; Lane, M. D.; Bishop, J. L.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations

Contract(s)/Grant(s): NNG04GG12G; NAG5-12687; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hydrous iron sulfates, which form as alteration products of sulfides, are rare on Earth. On Mars, the low temperature and pH found in the martian permafrost create ideal conditions for the formation of this group of minerals [1], which includes such phases as coquimbite (Fe2(SO4) 9H2O) and amarantite (FeSO4(OH) 3H2O). Viking, Mars Pathfinder, MER and OMEGA data [e.g., [2]] have all indicated the presence of high sulfur contents on the surface of Mars, but the mineralogy of the sulfur-rich phases has not been well constrained. Recent work by [3] suggests that hydrous iron sulfates might satisfy the Martian thermal emission, vis-near IR, and M ssbauer spectra. These data suggest that sulfide and sulfate minerals might be significant contributors to all types of spectra acquired on the Martian surface.

Derived from text

*Mossbauer Effect; Iron; Mars Surface; Sulfur; Sulfides; Near Infrared Radiation; Infrared Spectra*

**20050175717** Brown Univ., Providence, RI, USA

**Petrology and Melt Compositions in Nakhlite MIL 00346: Significance of Data from Natural Sample and from Experimentally Fused Groundmass and M.I.'s**

Rutherford, M. J.; Calvin, C.; Nicholis, M.; McCanta, M.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Textural and compositional analyses of Mil-03348 phenocrysts and refuse groundmass indicate magmatic conditions and environment of crystallization for this new nakhlite.

Author

*Nakhlites; Petrology; Meteoritic Composition; Melts (Crystal Growth)*

**20050175718** Portland State Univ., OR, USA

**Filter-Press Differentiation: A Newly-Recognized Fractionation Mechanism for Silicate Inclusions in Sombrerete and Possibly in Other Iron Meteorites**

Ruzicka, A.; Hutson, M.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Sombrerete is an ungrouped silicated iron that we have been studying using petrographic, SEM, microprobe, and SIMS techniques. Our data suggest that a novel crystal/liquid fractionation mechanism, which we call filter-press differentiation , was responsible for producing bulkchemical heterogeneity for inclusions in Sombrerete. In this mechanism, the metal host acts as a filter to separate liquidus crystals from residual melt in inclusions, allowing only the latter to pass and enabling differentiation to occur. Dynamical forces act as a press to allow flow to occur between inclusions.

Author

*Fractionation; Inclusions; Iron Meteorites; Petrography; Silicates*

**20050175719** National Museum of Natural History, Washington, DC, USA

**Halite, Sulfate, and Clay Assemblages in the Nakhla Martian Meteorite**

Rost, D.; Vicenzi, E. P.; Pauli, E. C.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Secondary mineral assemblages are commonly observed in nakhlites. They include carbonates, sulfates, clays, amorphous silicates, and halite in different settings and combinations. Since water is a prerequisite for their formation, the study of these minerals should help us to determine when, how long, and how much liquid water was present beneath ancient Mars. However, the findings are usually ambiguous and a complex, multistage history seems to be typical than exceptional. That water once percolated through the nakhlite rocks in a preterrestrial environment is beyond doubt: Sulfate and low T silicate assemblages are likely the result of aqueous alteration and precipitation. How much water is required to account for this postigneous mineralization, and moreover, if one single evaporation event might be responsible for all observed secondary mineral assemblages, is still in dispute. The solutes (alkali metals, halogens, S, and CO2) may have been leached from bedrock or atmospherically processed as has been shown for S. With these issues in mind, we started the examination of different secondary mineral assemblages, each to be comprehensively analyzed by multiple microchemical techniques. While initial studies focused on carbonate-silicate assemblages in Lafayette and an anhydrite-bearing assemblage in Nakhla, here we report our first results for halite-clay assemblages in Nakhla veinlets. In addition, the mineral chemistry of clays associated with halite is compared to those found in association with anhydrite.

Derived from text

*Clays; Halites; Sulfates; SNC Meteorites; Nakhlites*

**20050175720** Redlands Univ., CA, USA

**Loki, Io: Groundbased Observations and a Model for Periodic Overturn**

Rathbun, J. A.; Spencer, J. R.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Io is the most volcanically active body in the solar system and Loki is the largest and most powerful volcano on Io. The Galileo spacecraft was unable to observe Loki at high resolution, except at night using the Near-Infrared Mapping Spectrometer (NIMS) and the Photopolarimeter-Radiometer (PPR) and only on a few occasions, so most of the data on Loki is from groundbased observatories. Loki s infrared brightness has been measured from the ground on approximately a monthly basis since 1989. Using that data, Rathbun et al. found that from 1989 through 2001 Loki s eruptions were periodic, not merely episodic as previously thought, with a period of 540 days (Figure 1; with more recent data added). They suggested that the periodicity could be the result of overturn of a gravitationally unstable crust on a liquid lava lake. If this model is correct, the 200 km diameter of Loki places it in an interesting and important size regime, bridging the gap between typical terrestrial lava lakes, that are two orders of magnitude smaller, and global asthenospheric convection, which is two orders of magnitude larger. Similarities between the behavior of lava lakes and plate tectonics are widely known, but Loki behaves differently. Plate tectonics on Earth is a continuous process. Similarly, the crust on most terrestrial lava lakes is in constant motion (while active). Loki is active for only approximately 230 days out of every 540 day cycle. This is somewhat similar to the proposed global activity on Venus, where the planet s entire surface is overturned approximately every 500 million years. Obviously, Loki s overturn timescale is much smaller but since it can be studied directly it may indirectly yield information about Venus.

Author

*Io; Volcanoes; Brightness; Lava; Lakes*

**20050175721** Research Corp., Tucson, AZ, USA

**LIBS-based Detection of As, Br, C, Cl, P, and S in the VUV Spectral Region in a Mars Atmosphere**

Radziemski, L. J.; Cremers, D. A.; Benelli, K.; Khoo, C.; Harris, R. D.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Several elements important to planetary geology (e.g. Br, C, Cl, P, S) and the human exploration of Mars (e.g. toxic elements such as As) have strong emission lines in the purge and vacuum ultraviolet (VUV) spectral region (100 to 200 nm). This spectral region has not been extensively studied using geological samples. Prior LIBS work by others examined sulfide mineral identification and Cl/C and Br/C ratio determinations in organic materials [1,2]. We studied emissions from the LIBS plasma in this region using a sample chamber filled with 7 torr (930 Pa) of CO2 to simulate the Martian atmosphere. Lower pressures were also used to evaluate the effect of residual CO2 on the spectra. The effects of time delay and laser energy on

LIBS detection at reduced pressure were examined. The effect of ambient CO2 on the detection of C in soil was also evaluated. Lines useful for the spectrochemical analysis of As, Br, C, Cl, P, and S were determined, calibration curves prepared, and limits of detection determined for these elements. The experiments reported here were aimed at in-situ (closeup) analysis rather than stand-off detection at many meters [3-5].
Derived from text
*Detection; Organic Materials; Planetary Geology; Spectroscopic Analysis; Laser-Induced Breakdown Spectroscopy; Mars Atmosphere; Emission Spectra*

**20050175722** California Univ., San Diego, La Jolla, CA, USA
**Mass Independent Sulfur in Achondrites: Possible Evidence of Photochemistry in the Solar Nebula**
Fai, V. K.; Jackson, T. L.; Thiemens, M. H.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In our continuing effort to resolve and interpret the sulfur isotopic heterogeneity of meteorites[ 1-5], we analyzed a number of achondritic meteorites. Like oxygen, sulfur has more than two stable is otopes and therefore it is feasible to deconvolute the isotopic anomaly from the mass dependent isotopic fractionation that occurred during parent body processes . Any non-mass dependent fractionation process produced due to mass independent photochemical or physicochemical processes in the presolor nebula may be characterized by a nonzero (or variable) ? 33S or ?36S. It has been shown that the gas phase photochemical reactions, involving CS2, SO2 and H2S, either in the Earth s Archaean as well as present day atmo sphere, Mars, or in laboratory experiments, fractionate S is otopes mass independently [6-12]. Lab studies of photochemical reactions have shown that the sign of mass independent fractionation (MIF) depends upon the wavelength of UV light [7], presumably due to the energetics of intersystem, electronic state crossings. In light of these observations, it is important to investigate S in various meteorites as other than oxygen, sulfur is the only multiisotopic element that could potentially record early mass independent processes, both self shielding, as first hypothesized by [13], photochemical, or mass independent chemical reactions.
Derived from text
*Photochemical Reactions; Solar Nebula; Sulfur Dioxides; Carbon Disulfide; Fractionation; Vapor Phases; Hydrogen Sulfide; Sulfur*

**20050175723** California Inst. of Tech., Pasadena, CA, USA
**Grain Size-dependent Viscosity and Oceans in Icy Satellites**
Rainey, E. S. G.; Stevenson, D. J.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

To model thermal evolution of large icy satellites it is necessary to model convection in the outer ice layer. The major uncertainty involved in such models is the viscosity of ice, which is not well known at stresses appropriate for planetary interiors. Extrapolation of laboratory results to planetary conditions gives a viscosity that is grain size-dependent [1]. Most models of thermal convection in icy satellites have used a Newtonian viscosity, since the stresses involved are very low and the stress dependence of ice viscosity is expected to be weak. However, the grain size dependence of ice viscosity is significant, and since grain size is stress-dependent the viscosity of ice in the interior of large icy satellites is effectively non-Newtonian. Here we derive scaling laws for grain size in a convective icy satellite, and with scaling laws for non-Newtonian stagnant lid convection, apply them to the question of whether subsurface oceans exist in large icy satellites.
Derived from text
*Viscosity; Icy Satellites; Grain Size; Extrapolation; Oceans*

**20050175724** North Dakota Univ., Grand Forks, ND, USA
**Rotational Studies of Asteroids with Small Telescopes**
Reddy, V.; Dyvig, R. R.; Heathcote, B. D.; Pravec, P.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701
Contract(s)/Grant(s): UND-12030144; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Today, there are approx. 100,000 numbered asteroids with more continually being discovered, but only approx. 2,000 of them have accurate rotational periods. Rotational periods of asteroids, especially near-earth asteroids (NEA), are important for

understanding their collisional evolution. Rotational periods are also very useful for radar and near-IR spectroscopic observations. Asteroid lightcurves, taken over several apparitions, help in determining the orientation of rotation axes, and even their shapes. While there has been increasing interest in rotational studies over the last decade, the rate at which rotation periods are determined is light years behind the discovery rate of new asteroids. The availability of small telescopes (less than 1.0 m), affordable CCD cameras and user-friendly telescope automation and data reduction software provide a unique opportunity for small universities and amateur astronomy groups to pursue original asteroid research. In this work, we present the results of rotational studies of main belt Asteroid 1459 Magnya, and Apollo-type potentially hazardous asteroid (PHA) 2004 VW14 as examples of research that can be conducted using small telescopes. Details of observational and data reduction methods are presented with the goal of encouraging other small telescope users to pursue similar work.
Author
*Asteroids; Rotation; Near Infrared Radiation*

**20050175725** NASA Johnson Space Center, Houston, TX, USA
**Mineralogy and Temperature-induced Spectral Investigations of A-type Asteroids 246 Asporina and 446 Aeternitas**
Reddy, V.; Hardersen, P. S.; Gaffey, M. J.; Abell, P. A.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A-type asteroids are a relatively rare taxonomic class with no more than 17 known objects. They were first identified as a separate group of R-type asteroids based on broadband spectrophotometry by, and were later classified based on ECAS data by Tholen (1984). These asteroids have moderately high albedos (0.13-0.39), extremely reddish slopes shortward of 0.7 m and a strong absorption feature centered at approx. 1.05 m. More recent surveys like the Small Main-Belt Asteroid Spectroscopic Survey (SMASS) and SMASS II have expanded the taxonomic classes including the A-type, adding 12 new asteroids to the original five.
Derived from text
*Mineralogy; Temperature Dependence; Asteroids; Spectra*

**20050175726** New Mexico Univ., Albuquerque, NM, USA
**Recent Solar-Proton Fluxes**
Reedy, R. C.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The event-integrated fluences of energetic solar protons up to 2004 at the Earth have been determined and compared to previous data. The current solar cycle has been very active, and very large fluxes of solar protons have been observed that have had serious effects in the solar system and will have produced many radionuclides in the surfaces of meteorites. Such huge events are not expected again until about 2008 or 2009.
Author
*Radioactive Isotopes; Solar Protons; Solar Cycles*

**20050175727** Washington Univ., Saint Louis, MO, USA
**Subduction Initiation by Stagnant Lid Convection in Spherical Shell Geometry: Implications for Mars**
Reese, C. C.; Solomtov, V. S.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Rheological constraints suggest that for viscous creep alone, Martian mantle convection occurs in the stagnant lid regime where the lithosphere is immobilized due to high viscosity. On the other hand, the possibility of lithospheric recycling early in Mars history has been discussed in the context of surface morphology (Sleep, 1994), magnetic anomalies (Connerney et al., 1999) and magnetic field generation (Nimmo and Stevenson, 2000). Subduction occurs only if brittle fracture sufficiently weakens the upper lithosphere. Initiation of subduction in the stagnant lid regime may play a key role in transient lithospheric mobilization during Mars early evolution. Numerical simulations of time dependent, stagnant lid convection in an internally heated spherical shell are performed in order to obtain scaling relationships for convection induced lid stresses. As was found in two-dimensional simulations, stagnant lid convection in spherical shell geometry requires a very weak lithosphere (Solomatov, 2004a;b) for initiation of subduction.
Derived from text
*Rheology; Planetary Structure; Magnetic Fields; Lithosphere; Spherical Shells; Morphology*

**20050175728** Harvard Univ., Cambridge, MA, USA

**Trace Element Analysis of Lunar Soils by ICP-MS**

Ranen, M. C.; Jacobsen, S. B.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The average composition of the lunar surface is still not well known for many elements. Orbiting missions such as the Lunar Prospector and Clementine missions were able to produce global maps of Th, K, and FeO using gamma ray spectroscopy and UVVIS with a recent recalibration by [1]. Jolliff et. al. [2] called for the lunar crust to be made of three major crustal terranes, the Procellarum KREEP Terrane (PKT), Feldspathic Highlands Terrane (FHT) and the South Pole-Aitken Terrane (SPAT). The FHT makes up almost 85% of the crust, yet there is still little known about the trace element and isotopic composition of the ancient highland crust or the average crust in general. Together, the FHT and the PKT make up approximately 95% of the lunar crust. Measuring elemental concentrations from both the FHT and PKT will allow for a better estimate of the bulk composition of the lunar crust for a variety of elements. The Apollo 14 mission sampled material with the highest concentration of KREEP-like material while the Apollo 16 mission was the only mission to land in the highlands [3]. Samples of the lunar regolith should best show an average composition for the area because meteoritic impacts continually 'stir' the regolith. Even though each sample will have a small degree of meteoritic contamination as well as components from other sites brought to the sampling site by meteoritic impact a composite of soils will provide an average composition for that area.

Derived from text

*Lunar Surface; Lunar Soil; Trace Elements; Hypervelocity Impact; Lunar Rocks; Iron Oxides*

**20050175732** Harvard Univ., Cambridge, MA, USA

**Isotopic Composition of Lunar Soils and the Early Differentiation of the Moon**

Ranen, M. C.; Jacobsen, S. B.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The isotopic composition of the Lunar Highlands crust is still not well defined. This study will measure Hf-W, Rb-Sr, Lu-Hf, and 147,146Sm- 143,142Nd on a suite of 14 lunar soils from the Apollo 14 and Apollo 16 missions. The overall goal of this project is to estimate the isotopic composition of the average lunar crust in order to constrain timescales and magnitude of magma ocean crystallization.

Derived from text

*Lunar Crust; Lunar Soil; Crystallization; Isotopes; Magma*

**20050175735** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

**Ages of Rampart Craters in the Xanthe Terra Region and Southern Chryse Planitia, Mars: Implications for the Distribution of Ground Ice in Equatorial Regions**

Reiss, D.; Michael, G.; Hauber, E.; vanGasselt, S.; Jaumann, R.; Neukum, G.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Many large craters on Mars exhibit ejecta blankets which are not observed on other terrestrial planets like the Moon. As found by many researchers the morphology is suggested to be caused by volatile rich target material or atmospheric effects. However, in a given area a certain minimum diameter exists for craters which show fluidized ejecta blankets, called the onset diameter. Geographic mapping shows a latitude dependence of the onset diameters. In equatorial regions the onset diameters are typically 4 to 7 km versus 1 to 2 km in high latitudes (50 deg. Lat.) which might indicate a ice rich layer in depths of about 300 to 400 m near the equator and approx. 100 m at 50 latitudes. As pointed out by rampart craters may have formed over a significant time interval and therefore reflect the ground ice depths at a given time. We determined the absolute ages of rampart craters in two near equatorial regions on Mars by measuring the ejecta blankets superposed crater frequencies in Mars Express High Resolution Stereo Camera (HRSC) imagery. The images used for our measurements have a resolution between 12 to 15 m/pxl and cover large areas (approx. 105 sq km) which allows us to determine small-crater diameters and to work in a regional context.

Author

*Atmospheric Effects; Ejecta; Ice; Imagery; Morphology; Mars Craters*

**20050175739** Colorado Univ., Boulder, CO, USA

**Degree-1 Mantle Convection and the Origin of the Martian Hemispheric Dichotomy**

Roberts, James H.; Zhong, Shijie; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The hemispheric dichotomy on Mars is thought to have formed very early in the planet s history, possibly within the first 100 million years [1,2]. This feature has been attributed either to exogenic mechanisms (one or more giant impacts) [24] or to endogenic processes such as degree1 mantle convection [5]. While endogenic processes such as degree1 mantle convection may also be able to form the dichotomy, previous studies have required special conditions and long timescales to set up a degree1 pattern [69]. We explore the range of parameters in which degree1 convection develops and the timescale required for it to happen. Phase changes have been suggested as one mechanism for producing long-wavelength mantle structures [68]. We investigated the effects of the endothermic spinel-perovskite and the exothermic olivine-spinel phase transitions on the convective pattern in the mantle under a variety of rheological conditions. We also investigated the possibility viscosity layering in the mantle [9], since a sharp change in viscosity with depth will help to promote long-wavelength structures more easily than a continuous variation. We pay particular attention to the timescale required for a degree1 pattern to appear. We used finite element convection codes to solve the continutity, momentum, and energy equations in 2D axisymmetric and in 3-D (CitcomS) spherical geometry.

Author

*Mars (Planet); Dichotomies; Hemispheres; Perovskites*

**20050175742** Northwestern Univ., Evanston, IL, USA

**Is Ilmenite Always the Dominant Carrier of Titanium in Lunar Mare Basalts?**

Riner, M. A.; Robinson, M. S.; Tangeman, J. A.; Elphic, R. C.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The dominant cause for lunar visible color differences is variations in the degree of soil maturity and the abundance of FeO and opaque minerals, such as ilmenite. The addition of opaque minerals to a lunar soil tends to decrease the overall reflectance and continuum slope (darkens and decreases 'redness'). As a soil weathers its reflectance is also lowered but its slope increases (darkens and increases 'redness'). By exploiting these color trends numerous studies have attempted to correlate the abundance of TiO2 in the form of ilmenite to variations in blue to red ratios (i.e. 415 to 750 nm Clementine bandpasses) with varying degrees of success. Discrepancies between independent methods have been attributed to: unknown opaque phases in the lunar soil; overcorrection of thorium values in Lunar Prospector epithermal and thermal neutron data; mixing of highlands and mare basalt materials; and uncorrected scattered light effects. To investigate this problem we are examining the spectral differences between plausible lunar analog opaque mineral powders and their respective quenched glasses.

Derived from text

*Ilmenite; Titanium Oxides; Lunar Maria; Basalt; Thermal Neutrons; Lunar Soil; Continuums*

**20050175743** Massachusetts Inst. of Tech., Cambridge, MA, USA

**Rotationally Resolved Spectroscopy of Vesta in the 2-3 micron Region**

Rivkin, A. S.; McFadden, L. A.; Binzel, R. P.; Sykes, M.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The asteroid 4 Vesta has generated great interest among asteroid scientists throughout history. It is the third largest asteroid and has an unusually high albedo of 0.42. This combination of factors makes it the brightest asteroid, and it is visible to the naked eye during its most favorable apparitions. The surface of Vesta shows evidence of rotational spectral variation. This has been quantified and mapped using HST data. The variation has been interpreted both as due to compositional differences and due to regolith maturation processes. The spectrum itself (classified as 'V-class' in asteroid taxonomies shows a close resemblance to the howardite-eucrite-diogenite (HED) group of meteorites. These meteorites represent samples from a differentiated parent body, and geochemical arguments as well as the discovery of a dynamical family with Vesta-like spectra and V-class nearEarth objects. has led to a near-consensus that the HED meteorites come from Vesta.

Derived from text

*Geochemistry; Meteoritic Composition; Vesta Asteroid; Regolith*

**20050175744** Centre National de la Recherche Scientifique, Paris, France

**Hydrogen Isotopic Composition of Aliphatic Linkages in Carbonaceous Chondrites Insoluble Organic Matter**

Remusat, L.; Palhol, F.; Robert, F.; Derenne, S.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Isotopic D, C-13 and N-15 compositions are often used to determine the origin of organic matter in extraterrestrial samples and especially in carbonaceous chondrites [1-3]. Several studies have dealt with soluble organic compounds in carbonaceous chondrites, for example PAHs [4] or amino acids [5, 6] but most of the chondritic carbon occurs as macromolecular insoluble organic matter (IOM). Bulk isotopic compositions of chondritic IOM are around 1000% for deltaD, -19% for delta13C and 25% for delta15N (values can be a little bit lesser or greater depending on the sample and the authors). However, several authors have raised the problem of the lack of homogeneity in the isotope composition in the IOM. This has been especially shown using step combustion experiments but did not allow determining if this non-homogeneity occurs at the molecular level [1, 2]. To address this question, it is necessary to assess compound specific isotope composition by combining gas chromatography and isotope ratio mass spectrometry (GC-irMS). In this respect, a compound specific carbon isotope composition study was performed on the aromatic compounds generated through flash and hydrous pyrolysis of Orgueil and Murchison IOM [7, 8]. delta13C of aromatic compounds produced in these experiments on Orgueil and Murchison IOM were measured showing a specific isotopic signature (enrichment in C-13 compared to terrestrial samples) and an heterogeneity within the sample (delta13C depending on the number of carbon). As stressed above, exceptional D-enrichments are observed in extraterrestrial samples. However, no measurement of hydrogen isotope composition was performed so far on individual structures from chondritic IOM.

Derived from text

*Hydrogen Isotopes; Carbonaceous Chondrites; Organic Compounds; Amino Acids; Nitrogen 15; Carbon 13*

**20050175749** Aix-Marseilles Univ., France

**A Synthesis on the Magnetic Properties of Martian Meteorites**

Rochette, P.; Gattacceca, J.; Chevrier, V.; Hoffmann, V.; Lorand, J. P.; Funaki, M.; Hochleitner, R.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Magnetic measurements of meteorites are non destructive techniques allowing to investigate in the case of SNCs: 1.the type of magnetic minerals, 2.the possible in situ remanence in order to interprete the observed crustal magnetization, 3.the intensity of the magnetic field in which the natural remanent magnetization (NRM) is acquired, 4.the petrofabric through the anisotropy of magnetic susceptibility. Detailed magnetic data is presently available on all Martian meteorites known today, except Yamato 793605, 980459 and 1075, GRV99027, NWA 1950 and 3171, i.e. 26 over 32 unpaired SNCs. These data have been or will be published in, and this contribution summarizes these 3 papers. We also include here original paleomagnetic data on MIL03346.

Author

*Magnetic Properties; Mars (Planet); SNC Meteorites; Magnetic Measurement; Magnetic Fields*

**20050175752** Arizona State Univ., Tempe, AZ, USA

**Global Spectral Classification of Martian Low-Albedo Regions with MGS-TES**

Rogers, A. D.; Bandfield, J. L.; Christensen, P. R.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Global Surveyor Thermal Emission Spectrometer (TES) data may be used to derive the modal mineralogy of the upper approx. 10-100 m of coarse particulate surfaces on Mars. Previous work by have shown that mineralogic diversity occurs at global, regional and local scales, including spatial variations in plagioclase, pyroxene, high-silica (Si/O greater than approx. 0.35) component(s), olivine, and hematite abundance. In addition, demonstrated that the spectral response of low-albedo surfaces may be grouped into two broad classes, referred to as 'global endmembers': 1) Surface Type 1, which is occurs primarily in the southern highlands, with a few isolated occurrences in the northern lowlands, and 2) Surface Type 2, which is found primarily in the northern lowlands, but also has significant concentrations scattered throughout the southern highlands. However, since these initial studies, local occurrences of extremely-different mineralogies from those characteristic of Surface Types 1 and 2, such as the olivine-rich and quartz-rich terrains have been identified. In addition, larger regions have been shown to have subtle spectral differences from the global endmembers, including but not limited to Solis Planum, Ares Vallis, and nonhematite regions in Aram Chaos. The differences in spectral shapes of these regions indicate that they may differ

in primary mineralogy or alteration history from areas that exhibit the typical spectral character of Surface Types 1 and 2. Author

*Mars Surface; Mineralogy; Albedo; Thermal Emission; Spectrum Analysis; Spectrometers*

**20050175754** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA, Nantes Univ., France

**VIMS Observations of Titan During the First Two Close Flybys by the Cassini-Huygens Mission**

Rodriquez, S.; LeMouelic, S.; Sotin, C.; Buratti, B. J.; Brown, R. H.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The joint NASA-ESA-ASI Cassini-Huygens mission reached the saturnian system on July 1st 2004. It started the observations of Saturn s environment including its atmosphere, rings, and satellites (Phoebe, Iapetus and Titan). Titan, one of the primary scientific interests of the mission, is veiled by an ubiquitous thick haze. Its surface cannot be seen in the visible but as the haze effects decrease with increasing wavelength, there is signal in the infrared atmospheric windows if no clouds are present. Onboard the Cassini spacecraft, the VIMS instrument (Visual and Infrared Mapping Spectrometer) is expected to pierce the veil of the hazy moon and successfully image its surface in the infrared wavelengths, taking hyperspectral images in the range 0.4 to 5.2 micron. On 26 October (TA) and 13 December 2004 (TB), the Cassini-Huygens mission flew over Titan at an altitude lower than 1200 km at closest approach. VIMS acquired several tens of image cubes with spatial resolution ranging from a few tens of kilometers down to 1.5 kilometer per pixel, demonstrating its capability for studying Titan s geology.

Author

*Infrared Imagery; Infrared Spectra; Mapping; Saturn Atmosphere; Space Probes*

**20050175755** Mount Holyoke Coll., South Hadley, MA, USA

**Effects of Variable Temperature on Mossbauer Data Acquisition: Laboratory-based and MER A Results**

Rothstein, Y.; Sklute, E. C.; Dyar, M. D.; Schaefer, M. W.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations

Contract(s)/Grant(s): NNG04GG12G; NAG5-12687; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mossbauer spectrometers on the Spirit and Opportunity rovers have played a valuable role in identifying mineralogy at both the Gusev and Meridiani landing sites. Key to the application of Mossbauer results is the issue of how accurately the peak positions, on which the mineral identifications are based, can be determined. Remote Mossbauer spectroscopy has by necessity some unusual experimental constraints that may influence the confidence with which peak positions can be fit. We present here an analysis of the effects of variable temperature and short duration run times on spectral resolution.

Derived from text

*Spectrometers; Mars Roving Vehicles; Data Acquisition; Mars Surface; Mineralogy*

**20050175756** NASA Ames Research Center, Moffett Field, CA, USA

**Near-Infrared (0.67-4.7 microns) Optical Constants Estimated for Montmorillonite**

Roush, T. L.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Various models of the reflectance from particulate surfaces are used for interpretation of remote sensing data of solar system objects. These models rely upon the real (n) and imaginary (k) refractive indices of the materials. Such values are limited for commonly encountered silicates at visual and near-infrared wavelengths (lambda, 0.4-5 microns). Availability of optical constants for candidate materials allows more thorough modeling of the observations obtained by Earth-based telescopes and spacecraft. Two approaches for determining the absorption coefficient (alpha=2pik/lambda) from reflectance measurements of particulates have been described; one relies upon Kubelka-Munk theory and the other Hapke theory. Both have been applied to estimate alpha and k for various materials. Neither enables determination of the wavelength dependence of n, n=f(lambda). Thus, a mechanism providing this ability is desirable. Using Hapke-theory to estimate k from reflectance measurements requires two additional quantities be known or assumed: 1) n=f(lambda) and 2) d, the sample particle diameter. Typically n is assumed constant (c) or modestly varying with lambda; referred to here as n(sub 0). Assuming n(sub 0), at each lambda an estimate of k is used to calculate the reflectance and is iteratively adjusted until the difference between the model

and measured reflectance is minimized. The estimated k's (k(sub 1)) are the final results, and this concludes the typical analysis.
Derived from text
*Montmorillonite; Near Infrared Radiation; Optical Materials*

**20050175757** Ecole Normale Superieure, Paris, France
**The High Resolution Transmission Electron Microscopy: A Powerful Tool for Studying the Organization of Terrestrial and Extra-Terrestrial Carbons**
Rouzaud, J.-N.; Skrzypczak, A.; Bonal, L.; Derenne, S.; Quirico, E.; Robert, F.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

HRTEM appears as a powerful technique to access the organization of natural terrestrial or extra-terrestrial carbons. These preliminary data are very promising as structural and microtextural information is revealed. The suggested interpretations in terms of precursor nature, metamorphism degree and possible formation processes will be further investigated using image quantification techniques.
Author
*Carbon; High Resolution; Transmission Electron Microscopy; Metamorphism (Geology)*

**20050175758** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**The Rocks of Gusev Crater as Viewed by Mini-TES**
Ruff, S. W.; Christensen, P. R.; Blaney, D. L.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We are developing the means to separate atmospheric spectral features from rock spectra. Measurements made in the late afternoon when the temperature difference between the rocks and sky is the greatest provide spectra that are least impacted by downwelling radiance. Additionally, the long wavelength range of Mini-TES spectra contain spectral features that are least effected by contributions from the atmosphere due to its relative transparency in this range. Mini-TES spectra have thus been used to reveal the geological diversity in Gusev crater and will continue to be a rich source of mineralogical information as Spirit continues its traverse.
Derived from text
*Mars Craters; Thermal Emission; Spectroscopy; Sedimentary Rocks; Mineralogy*

**20050175759** FGUP NPC NEDRA, Yaroslavl, Russia
**The Effect of Parametric Resonance on the Structure of Planetary Rings**
Rosaev, A. E.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Planetary rings are a very complex system. It is a mixture of different-size collided particles. The electromagnetic forces can play an important role. However, in spite of very small mass of particles, gravitational forces between particles always take place and cannot be neglected. The main target of this research is to show, that effect of mutual ring's particles interaction maybe significant. On the other hand, by what way to gravitation may be taken into account? It is natural, to consider motion of the probe particle in the gravitational field of homogeneous ring. Perturbation force in this case calculated as an integral. In the limit, this integral can be substituted by sum with very large N. At the symmetric circular ring we can apply central configuration model. (The system of N massive points m, placed at vertex of regular polygon + central mass M, is called central configuration). In case of lowcollisional ring with large particles, this discrete model has some advantages over continues model. The model of the central configurations successfully applied to the real planetary rings by Meyer K.R. and Schmidt D.S.[1].
Derived from text
*Planetary Rings; Gravitational Fields; Complex Systems; Perturbation*

**20050175761** Bern Univ., Bern, Switzerland
**Circum-Polar Craters with Interior Deposits on Mars: Polar Region Geologic, Volatile, and Climate History with Implications for Ground Ice Signature in Arabia Terra**
Russell, P. S.; Head, J. W.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ice-rich crater-interior fill deposits at subpolar latitudes (here, between 65 and 80 ) represent an important class of feature on Mars that may hold clues as to 1) the stability of ice in local topographic settings, 2) the geologic and climate history of the polar regions, and 3) the large-scale transport patterns of volatiles in the past. The most prominent case of a crater with interior deposits as studied here is Korolev, (73 N, 165 E, 80 km across) which contains a deposit of ice-rich material with a maximum height above the crater floor of approximately 1.5 km. The interior ice-rich deposit is a smooth-surfaced dome with relatively steep sides descending into a surrounding annular trough along the interior of the crater wall. This dome and trough morphology is asymmetric in that the trough is deeper and broader on the equatorwards side of the crater than on the polewards side. Other craters around both poles contain similar ice deposits with variable morphologies. Here we document the distribution and full morphological range of crater-interior deposits around both poles and then group the craters into general types based on variation in fill morphology, using MOLA, MOC, and THEMIS data. These groupings are explored for trends in size, location (latitude, longitude, relative distance from the pole), orientation, and associated features, and are interpreted in light of our modeling study of ice stability within a crater. We seek a model of emplacement and evolution of this peculiar class of volatile-related martian feature that explains their occurrence, location, variability, and history. Special attention will be paid to any implications for polar region history and a formerly more extensive cap. Finally, we speculate on possible implications of crater interior deposits in Arabia Terra and the heightened detection of hydrogen there by the neutron spectrometers on Mars Odyssey.

Derived from text

*Polar Regions; Mineral Deposits; Mars Surface; Climatology; Planetary Geology; Mars Craters*

**20050175762** California Univ., San Diego, La Jolla, CA, USA

**Experimental Determination of Li, Be and B Partitioning During CAI Crystallization**

Ryerson, F. J.; Brenan, J. M.; Phinney, D. L.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The main focus of the work is to develop a better understanding of the distribution of the elements B, Be and Li in melilite, fassaitic clinopyroxene, anorthite and spinel, which are the primary constituents of calcium-aluminum-rich inclusions (CAIs). These elements are the parent or decay products of short-lived nuclides (specifically, Be-7 and Be-10) formed by cosmic ray spallation reactions on silicon and oxygen. Recent observations suggest that some CAIs contain fossil Be-7 and Be-10 in the form of excess amounts of their decay products (B and Li). The exact timing of Be-7 and Be-10 production is unknown, but if it occurred early in CAI history, it could constrain the birthplace of CAIs to be within a limited region near the infant sun. Other interpretations are possible, however, and bear little significance to early CAI genesis. In order to interpret the anomalies as being primary , and thus originating at high temperature, information on the intermineral partitioning of both parent and daughter elements is required.

Derived from text

*Crystallization; Lithium; Boron; Inclusions; Calcium; Aluminum; Mineralogy; Beryllium 7; Beryllium 10*

**20050175763** Universidad Complutense, Madrid, Spain

**On Ancient Shorelines and Heat Flows on Mars**

Ruiz, Javier; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: The existence of features indicative of shorelines of ancient oceans on Mars has been proposed [1-4], and diverse efforts have been carried out to test validity of these proposal. Specifically targeted MOC images have not found support for the shoreline hypothesis [5,6], although these results have been disputed [4,7,8]. Another analyses find several features along putative shorelines in northwestern Arabia Terra, which have been interpreted as due to coastal erosion [9,10]. The present-day martian topography has also been used to test the shoreline hypothesis [11-13]. Of the two global proposed shorelines, revised and renamed by [4], the Deuteronilus shoreline slightly deviates from an equipotential surface, and thus has been considered to be an acceptable paleo-shoreline candidate: the elevation of this shoreline is -3792 +/- 236 m, and the total elevation range of is approx.1.1 km [13]. Otherwise, the putative older and higher-standing Arabia shoreline deviates substantially from an equipotential surface, indicating that it is not representative of a true shoreline; according to [13], the Arabia shoreline shows a mean altitude of -2090 +/- 1400 m, and a total elevation range of approx.5.6 km. If reality of global shorelines is accepted, then present-day topographic variations in these features postdate shorelines formation. So, their topographic range should provide information on large-scale vertical movement of the lithosphere, which in turn would

provide information on the thermal evolution of Mars [14]. Here I discuss some aspect related to the link between shoreline elevation range and the evolution of the martian lithosphere.
Derived from text
*Shorelines; Topography; Planetary Geology; Erosion; Oceans*

**20050175879** NASA Glenn Research Center, Cleveland, OH, USA
**Exploration Rover Concepts and Development Challenges**
Zakrajsek, James J.; McKissock, David B.; Woytach, Jeffrey M.; Zakrajsek, June F.; Oswald, Fred B.; McEntire, Kelly J.; Hill, Gerald M.; Abel, Phillip; Eichenberg, Dennis J.; Goodnight, Thomas W.; March 2005; 30 pp.; In English; First Space Exploration Conference: Continuing the Voyage of Discovery, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA
Contract(s)/Grant(s): WBS 22-794-20-69
Report No.(s): NASA/TM-2005-213555; AIAA Paper 2005-2525; E-14998; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents an overview of exploration rover concepts and the various development challenges associated with each as they are applied to exploration objectives and requirements for missions on the Moon and Mars. A variety of concepts for surface exploration vehicles have been proposed since the initial development of the Apollo-era lunar rover. This paper provides a brief description of the rover concepts, along with a comparison of their relative benefits and limitations. In addition, this paper outlines, and investigates a number of critical development challenges that surface exploration vehicles must address in order to successfully meet the exploration mission vision. These include: mission and environmental challenges, design challenges, and production and delivery challenges. Mission and environmental challenges include effects of terrain, extreme temperature differentials, dust issues, and radiation protection. Design methods are discussed that focus on optimum methods for developing highly reliable, long-life and efficient systems. In addition, challenges associated with delivering a surface exploration system is explored and discussed. Based on all the information presented, modularity will be the single most important factor in the development of a truly viable surface mobility vehicle. To meet mission, reliability, and affordability requirements, surface exploration vehicles, especially pressurized rovers, will need to be modularly designed and deployed across all projected Moon and Mars exploration missions.
Author
*Modularity; Lunar Roving Vehicles; Mars Roving Vehicles; Manned Lunar Surface Vehicles; Lunar Environment; Mars Surface; Mars Environment*

**20050175899** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXVI, Part 18**
[2005]; In English; See also 20050175900 - 20050176034
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1234-Pt-18; Copyright; Avail: CASI; C01, CD-ROM

Topics discussed include: PoDS: A Powder Delivery System for Mars In-Situ Organic, Mineralogic and Isotopic Analysis Instruments Planetary Differentiation of Accreting Planetesimals with 26Al and 60Fe as the Heat Sources Ground-based Observation of Lunar Surface by Lunar VIS/NIR Spectral Imager Mt. Oikeyama Structure: First Impact Structure in Japan? Central Mounds in Martian Impact Craters: Assessment as Possible Perennial Permafrost Mounds (Pingos) A Further Analysis of Potential Photosynthetic Life on Mars New Insight into Valleys-Ocean Boundary on Mars Using 128 Pixels per Degree MOLA Data: Implication for Martian Ocean and Global Climate Change; Recursive Topography Based Surface Age Computations for Mars: New Insight into Surficial Processes That Influenced Craters Distribution as a Step Toward the Formal Proof of Martian Ocean Recession, Timing and Probability; Laser-induced Breakdown Spectroscopy: A New Method for Stand-Off Quantitative Analysis of Samples on Mars; Milk Spring Channels Provide Further Evidence of Oceanic, \g1.7-km-Deep Late Devonian Alamo Crater, Southern Nevada; Exploration of Martian Polar Residual Caps from HEND/ODYSSEY Data; Outflow Channels Influencing Martian Climate: Global Circulation Model Simulations with Emplaced Water; Presence of Nonmethane Hydrocarbons on Pluto; Difference in Degree of Space Weathering on the Newborn Asteroid Karin; Circular Collapsed Features Related to the Chaotic Terrain Formation on Mars; A Search for Live (sup 244)Pu in Deep-Sea Sediments: Preliminary Results of Method Development; Some Peculiarities of Quartz, Biotite and Garnet Transformation in Conditions of Step-like Shock Compression of Crystal Slate; Error Analysis of Remotely-Acquired Mossbauer Spectra; Cloud Activity on Titan During the Cassini Mission; Solar Radiation Pressure and Transient Flows on Asteroid Surfaces; Landing Site Characteristics for Europa 1: Topography; and The Crop Circles of Europa.
Derived from text
*Asteroids; Europa; Extraterrestrial Life; Lunar Surface; Quantitative Analysis; Solar Radiation; Mars (Planet); Mars Environment; Mars Surface*

**20050175901** Academy of Sciences (Russia), Moscow, Russia

**Exploration of Martian Polar Residual Caps from HEND/Odyssey Data**

Sanin, A. B.; Mitrofanov, I. M.; Litvak, M. L.; Kozyrev, A. S.; Parshukov, A. V.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 1 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have used data of the High Energy Neutron Detector (HEND) onboard NASA '2001 Mars Odyssey' to observe Martian residual polar caps. It s well known what seasonal polar caps are consists mainly from CO2 ice which sublimates during spring revealing residual caps. Till recent time major science information about presence of water ice/CO2 frost within residual caps was based on Viking observations and theoretical models of martian climatere. From Viking data analysis it was found what the North residual cap consists from water ice (water mass fraction is close to 100%) and dust. The south residual cap is covered by thick layer of CO2 frost all year round and it is not clear how thick this CO2 deposit and which fraction of water ice is present underneath. Recent data (Mars Odyssey, Mars Express) shows what south residual cap may be enriched by water ice mixed with dust and CO2 frost [1,2].

Derived from text

*Polar Caps; Mars Surface; Deposits; Mars Express; Ice*

**20050175903** Hawaii Univ., Honolulu, HI, USA

**Variations Among Dark-toned Intracrater Deposits in Amazonis Planitia**

Schneider, R. D.; Hamilton, V. E.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Intracrater dark-toned deposits are common on the Martian surface, and are typified by distinctly lower albedos and higher thermal inertias relative to their surroundings. Several regions on Mars have markedly higher concentrations of dark intracrater features, and studies of these areas can yield important information on regional wind regimes as well as sand supply and composition. One particular study of some of these regions determined that the intracrater deposits are composed of sandsized lithic particles that are locally derived. One purpose of this study is to build on those results by investigating an additional region in detail. For this study, we examined 21 dark intracrater deposits in Amazonis Planitia. Here we present visible and spectral variations among the dark toned deposits, using data from the Mars Odyssey Thermal Emission Imaging System (THEMIS) and Mars Global Surveyor Thermal Emission Spectrometer (TES).

Derived from text

*Amazon Region (South America); Mineral Deposits; Mars Craters; Mars Surface*

**20050175904** Washington Univ., Saint Louis, MO, USA

**Radiative Transfer Photometric Analyses at the Mars Exploration Rover Landing Sites**

Seelos, F. P.; Arvidson, R. E.; Guinness, E. A.; Wolff, M. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Exploration Rover (MER) Panoramic Camera (Pancam) [1] observations include multispectral data sets designed specifically to support the photometric analysis of Martian surface materials [2]. We report on the numerical inversion of observed Pancam radiance on sensor data to determine the best fit surface bidirectional reflectance parameters as defined by Hapke theory [3]. The model bidirectional reflectance parameters for the Martian surface provide constraints on physical and material properties and allow for the direct comparison of Pancam and orbital data sets.

Derived from text

*Radiative Transfer; Photometry; Landing Sites; Mars Exploration; Mars Surface; Bidirectional Reflectance*

**20050175906** National Air and Space Museum, Washington, DC, USA

**The Medusae Fossae Formation: Mapping the Origins**

Shockey, K. M.; Zimbelman, J. R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

To better understand the origins of the Medusae Fossae Formation (MFF), we are mapping the Gordii Dorsum escarpment and surrounding areas in the eastern part of MFF between 202.5deg and 225degE longitude, which is the southeast portion of quadrangle eight on Mars. The MFF is a friable, extensive Amazonian deposit that overlies the crustal dichotomy boundary

and adjacent lowlands between approximately 130deg and 240degE longitude [1], between the Tharsis and Elysium volcanic provinces. The area being mapped is slightly south west of Olympus Mons. Yardangs and pedestal craters attest to considerable aeolian deflation of the MFF in recent geologic time [1, 2]. Although diverse explanations for the MFF have been proposed (summarized by [1]), recent work has focused on deposition of loess or ignimbrite by aeolian processes [1, 3-6]. The origins of MFF are still controversial; the current mapping should provide new constraints for testing the many hypotheses of origin.
Derived from text
*Igneous Rocks; Escarpments; Geochronology; Craters; Crusts; Deposits*

**20050175908** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Cassini CIRS Observations of Iapetus' Thermal Emission**
Spencer, J. R.; Pearl, J. C.; Segura, M., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Cassini s Composite Infrared Spectrometer (CIRS, [1]) mapped Iapetus thermal emission from 7 to approx.300 microns during the spacecraft s December 31st 2004 flyby of the satellite. Short-wavelength spectra were obtained with the CIRS 'FP3' (10 - 17 micron) and 'FP4' (7 - 10 micron) detector arrays, each consisting of 1 x 10 pixels with a spatial resolution of 0.29 milliradians, while longer wavelength observations used the 'FP1' detector, with a single-aperture detector with 4 milliradian diameter. The detectors are scanned across the target to build up an image cube with two spatial dimensions and one spectral dimension. CIRS daytime observations covered the dark terrain of Cassini Regio, except for high northern latitudes which were occupied by bright terrain, while nighttime observations covered a mixture of bright and dark terrain. The 120,000 km flyby distance provided a maximum spatial resolution of 35 km in the FP3 and FP4 detectors, and 500 km in the FP1 detector.
Derived from text
*Infrared Spectrometers; Thermal Emission; Iapetus; Spatial Resolution; Terrain*

**20050175909** Cornell Univ., Ithaca, NY, USA
**Recent Results from the Spirit Mars Exploration Rover Mission**
Squyres, S. W., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Exploration Rover Spirit landed in Gusev crater, and has been exploring there with emphasis on a search for evidence of ancient aqueous processes. The landing site lay on cratered basaltic plains. After investigation of these plains, Spirit drove approximately 2.5 km to the southeast toward the Columbia Hills, a low range of hills with summits approx.100 meters above the plains. Since Sol 156 of the mission, Spirit has been characterizing the rocks of the Columbia Hills. The primary area of geologic investigation has been the West Spur of Husband Hill, which is the westernmost extension of the highest summit in the range.
Derived from text
*Basalt; Landing Sites; Craters; Rocks*

**20050175910** Alma Coll., MI, USA
**Validation of Methods Used to Determine Microcrack Porosity in Meteorites**
Strait, M. M.; Consolmagno, G. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

For several years we have been measuring the porosity of meteorite hand samples to find and characterize the primordial porosity, which may lead to a better understanding of how individual grains accumulate and lithify to form meteorites. For hand samples, bulk volume is determined using a modified Archimedean method, while grain volume is measured with a He gas pycnometer; from these two experimental measurements, the porosity is determined. Meanwhile, a thin section of the same meteorite is imaged using backscatter scanning electron microscopy; the resulting images are digitized and the number of pixels in the grayscale range that corresponds to void space (or different materials of interest) are counted. Finally, a model porosity is calculated that accounts for changes in grain density because of weathering that a meteorite has experienced in the corrosive terrestrial atmosphere, and this value is compared to physical measurements.
Derived from text
*Meteorites; Microcracks; Porosity*

**20050175911** Tokyo Univ., Kashiwa, Japan

**An Efficient Methane Producing Mechanism Due to Iron Meteorite Impacts**

Sugita, S.; Schultz, P. H.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Whether or not paleo-Mars had a warm and wet climate is one of the most controversial issues in planetary science. If a large amount of methane existed, Mars may have been kept warm due to its strong greenhouse effect. In this study, we propose a mechanism to produce a large amount of methane from iron meteorites impacting H2O under a CO2-rich atmosphere.

Author

*Iron Meteorites; Methane; Hypervelocity Impact; Mars Surface*

**20050175912** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Aeolian Processes at the Mars Exploration Rover Opportunity Landing Site**

Sullivan, R.; Bell, J. F., III; Calvin, W.; Fike, D.; Golombek, M.; Greeley, R.; Grotzinger, J.; Herkenhoff, K.; Jerolmack, D.; Malin, M., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The traverse of the Mars Exploration Rover Opportunity across its Meridiani Planum landing site has shown that wind has affected regolith by creating drifts, dunes, and ubiquitous ripples, by sorting grains during aeolian transport, by forming bright wind streaks downwind from craters seen from orbit, and by eroding rock with abrading, wind-blown material. Pre-landing orbiter observations showed bright and dark streaks tapering away from craters on the Meridiani plains. Further analysis of orbiter images shows that major dust storms can cause bright streak orientations in the area to alternate between NW and SE, implying bright wind streak materials encountered by Opportunity are transient, potentially mobilized deposits. Opportunity performed the first in situ investigation of a martian wind streak, focusing on a bright patch of material just outside the rim of Eagle crater. Data from Pancam, the Miniature Thermal Emission Spectrometer (Mini-TES), the Alpha-Particle X-Ray Spectrometer (APXS), and the Mossbauer spectrometer either are consistent with or permit an air fall dust interpretation. We conclude that air fall dust, deposited in the partial wind shadow of Eagle crater, is responsible for the bright streak seen from orbit, consistent with models involving patchy, discontinuous deposits of air fall dust distributed behind obstacles during periods of atmospheric thermal stability during major dust storms.

Derived from text

*Mars Exploration; Mars Roving Vehicles; Mars Landing Sites; Aeolian Tones; Wind (Meteorology)*

**20050175913** Miyagi Univ. of Education, Japan

**Ground-based Observation of Lunar Surface by Lunar VIS/NIR Spectral Imager**

Saito, M.; Takata, T.; Matsushita, M.; Chishima, T.; Ikeda, Y.; Hirao, N.; Iijima, Y.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ground-based Lunar VIS/NIR Spectral Imager is developed in order to understand mineral abundance of the lunar surface and resulting spectral analysis of the lunar surface. Three dimensional spectral and spatial images of the nearside of the moon can be obtained. Preliminary imaging and data reduction have been conducted in the area of mare Serenitatis and Tranquillitatis. Global imaging of the entire nearside of the moon is planned to be conducted.

Author

*Lunar Surface; Imaging Techniques; Minerals; Spectrum Analysis*

**20050175914** Tokyo Univ., Japan

**Difference in Degree of Space Weathering on the Newborn Asteroid Karin**

Sasaki, T.; Sasaki, S.; Watanabe, J.; Sekiguchi, T.; Yoshida, F.; Ito, T.; Kawakita, H.; Fuse, T.; Takato, N.; Dermawan, B.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

'Space weathering' is the term applied to darkening albedo, reddening spectral slope, and obscuring absorption bands of planetary surface materials with time. The mismatch between reflectance spectra of most common asteroids (S-type asteroids) and most common meteorites (ordinary chondrites) might be caused by the space weathering [1-3]. Recent laboratory

experiments simulating micrometeorite impact heating [4] confirmed Hapke s old hypothesis that the spectral darkening/reddening are caused by formation of nanophase iron particles [5,6]. In the meantime, a recent study of celestial mechanics discovered a new-born group of asteroids, 'Karin cluster group', which is thought to be remnants of a collisional breakup only 5.8 million years ago [7]. Indeed recent observation showed Karin family asteroids may have fresh surfaces [8]. Here we report a near-infrared spectroscopy of the brightest asteroid 832 Karin among this cluster group. Fig.1: Light curve of 832 Karin. Our observation corresponds to the phase of rotations of red (first set), green (second set), and blue regions (last set). This figure was adopted and modified from Yoshida et al. [9].
Derived from text
*Space Weathering; Albedo; Darkening; Spectroscopy; Asteroids; Reflectance; Micrometeorites; Hypervelocity Impact*

**20050175915** Tokyo Univ., Japan
**Circular Collapsed Features Related to the Chaotic Terrain Formation on Mars**
Sato, H.; Kurita, K.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Xanthe Terra region on Mars is known as a site of most drastic evolution related to the formations of huge chaotic terrain and multiple outflow channels. In this region, there are strange circular collapsed features. Some of them have cracked cavity or deep moat along the rim, others have plane blocks or knobby mounds. In several areas, these features are clustered to form a chaotic region. Chaotic terrain has been interpreted as a site for the emanation of large amount of water [1,2]. Costard [3] interpreted the circular collapse as thermokarsts resulting from the magmatic heat degradation of the craters formed in the permafrost. But its relation to the formation of the chaotic terrain is not well clarified. In this study, we examined distribution and morphologies of the circular collapses. We explore a model of its formation and give suggestions how the chaotic terrains were formed and discharged a huge amount of water.
Derived from text
*Planetary Geology; Terrain; Craters; Mars Surface; Permafrost; Cavities*

**20050175917** Lunar and Planetary Inst., Houston, TX, USA
**The Crop Circles of Europa**
Schenk, P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During its rapid flyby of Europa in 1979, Voyager observed an enigmatic narrow arcuate depression near the terminator. Although Galileo failed to achieve one of its prime mission objectives, near-global coverage of the Galilean satellites at sub-kilometer scales, several terminator observations were acquired at dispersed longitudes and several additional arcuate depressions were observed. These limit morphologic mapping to 5 narrow longitudinal bands. With precision registration of all Galileo imaging now complete, a partial global map of these features is now possible.
Derived from text
*Europa; Topography; Circles (Geometry); Circumferences; Imaging Techniques*

**20050175919** Washington State Univ., WA, USA
**Scenarios for the Evolution of Life on Mars**
Schulze-Makuch, D.; Irwin, L. N.; Lipps, J. H.; LeMone, D.; Dohm, J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Life as we know it has three basic requirements: an energy source, polymeric chemistry, and liquid water. These conditions were available on both Earth and Mars in their early histories. Since environmental conditions on both planets were similar initially, life may have originated separately on both planets. Alternatively, Martian and Earth organisms may have had a common origin, with interplanetary transfer of originating forms of life among the terrestrial inner planets [1,2]. Once established, however, life on Earth and Mars would necessarily have followed different trajectories, as the environmental history appears to have diverged drastically on the two planets after the first few hundred million years. the last 3.7 G.a. (Fig.1), with prevailing cold and dry conditions punctuated by episodic endogenic-driven activity that resulted in flooding, ponding in the northern plains, and short-lived hydrologic cycles [3-8].
Derived from text
*Biological Evolution; Extraterrestrial Life; Mars (Planet); Hydrological Cycle; Life Sciences*

**20050175920** Arkansas Univ., Little Rock, AR, USA

**Bridging a High School Science Fair Experience with First Year Undergraduate Research: Using the E-SPART Analyzer to Determine Electrostatic Charge Properties of Compositionally Varied Rock Dust Particles as Terrestrial Analogues to Mars Materials**

Scott, A. G.; Williams, W. J. W.; Mazumder, M. K.; Biris, A.; Srirama, P. K.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NASA missions to Mars confirm presence of surficial particles, as well as dramatic periods of aeolian reworking. Dust deposition on, or infiltration into, exploration equipment such as spacecraft, robotic explorers, solar panel power supplies, and even spacesuits, can pose significant problems such as diminished power collection, short circuits / discharges, and added weight. We report results conducted initially as a science fair project and a study now part of a first year University undergraduate research experience.

Derived from text

*Mars Missions; Science; Research and Development; Electrostatic Charge; Sedimentary Rocks; Interplanetary Dust; Analyzers; NASA Space Programs; Education*

**20050175922** Arkansas Univ., Fayetteville, AR, USA

**Stability of Water and Gully Formation on Mars**

Sears, Derek; Roe, Larry; Moore, Shauntae; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The water-carved gully features discovered by Malin and Edgett [1] in the Mars Global Surveyor images indicate that water has flowed onto the surface of Mars in recent times (Fig. 1). This is despite a thirty-year-old notion that water would evaporate immediately as it became exposed on the surface [2]. This has led to an interest in the evaporation rate of water of Mars [3-9].

Derived from text

*Extraterrestrial Water; Evaporation Rate; Mars Surface*

**20050175923** NASA Ames Research Center, Moffett Field, CA, USA

**A Compact Instrument for Remote Raman and Fluorescence Measurements to a Radial Distance of 100 m**

Sharma, S. K.; Misra, A. K.; Lucey, P. g.; McKay, C. P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Compact remote spectroscopic instruments that could provide detailed information about mineralogy, organic and biomaterials on a planetary surface over a relatively large area are desirable for NASA s planetary exploration program. Ability to explore a large area on the planetary surfaces as well as in impact craters from a fixed location of a rover or lander will enhance the probability of selecting target rocks of high scientific contents as well as desirable sites in search of organic compounds and biomarkers on Mars and other planetary bodies. We have developed a combined remote inelastic scattering (Raman) and laser-induced fluorescence emission (LIFE) compact instrument capable of providing accurate information about minerals, organic and biogenic materials to a radial distance of 100 m. Here we present the Raman and LIFE (R-LIFE) data set.

Derived from text

*Remote Sensing; Laser Induced Fluorescence; Planetary Surfaces; Mineralogy; Organic Compounds; Probability Theory*

**20050175924** Brown Univ., Providence, RI, USA

**Debris-covered Glaciers Within the Arsia Mons Fan-shaped Deposit: Implications for Glaciation, Deglaciation and the Origin of Lineated Valley Fill**

Shean, D. E.; Head, J. W.; Marchan, D. R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent MOC and THEMIS data have shed new light upon intriguing flow-like features on Mars including viscous flow-like features, lobate debris aprons, concentric crater fill, lineated valley fill, and features interpreted as rock glaciers or debris-covered glaciers. These features are distributed over low- to mid-latitudes and all appear to have experienced flow due

to the presence of volatiles. Here we consider debris-covered glaciers features that consist of a relatively pure glacier ice core covered by a thin (sub-m to m scale) layer of debris. A debris cover typically develops from rockfall or direct atmospheric dust deposition in the accumulation zone of the glacier and/or through sublimation of ice in the ablation zone, resulting in a surficial lag deposit of supraglacial and englacial debris. Using new data, we assess the origin of these features at Arsia Mons. We also consider how this interpretation may provide insight into processes of glaciation and deglaciation on Mars, and discuss its application to other areas containing candidate deposits of glacial origin.
Derived from text
*Debris; Glaciology; Planetary Geology; Valleys; Mineral Deposits; Mars Volcanoes*

**20050175926** Massachusetts General Hospital, Boston, MA, USA
**Measurement of Recoil Losses and Ranges for Spallation Products Produced in Proton Interactions with Al, Si, Mg at 200 and 500 MeV**
Sisterson, J. M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899
Contract(s)/Grant(s): NAG5-7987; NAG5-10538; CO503-0018-0005; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Cosmic rays interact with extraterrestrial materials to produce a variety of spallation products. If these cosmogenic nuclides are produced within an inclusion in such material, then an important consideration is the loss of the product nuclei, which recoil out of the inclusion. Of course, at the same time, some atoms of the product nuclei under study may be knocked into the inclusion from the surrounding material, which is likely to have a different composition to that of the inclusion [1]. For example, Ne-21 would be produced in presolar grains, such as SiC, when irradiated in interstellar space. However, to calculate a presolar age, one needs to know how much 21Ne is retained in the grain. For small grains, the recoil losses might be large [2, 3] To study this effect under laboratory conditions, recoil measurements were made using protons with energies from 66 - 1600 MeV on Si, Al and Ba targets [3, 4, 5].
Derived from text
*Losses; Cosmic Rays; Spallation; Protons; Aluminum; Silicon; Magnesium; Neon Isotopes*

**20050175928** Arizona Univ., Tucson, AZ, USA
**The Atmospheric View from the Side Window of Huygens Probe**
Smith, P. H.; Tomasko, M. G.; Doose, L. R.; Rizk, B.; Moores, J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As the Huygens Probe descends through Titan s atmosphere on January 14, 2005 its six instruments will record a description of the atmospheric structure and composition impossible to deduce from remote sensing. The Descent Imager/Spectral Radiometer (DISR) [1] will provide data sets that are central to the interpretation of the radiative and thermal balance of the dense atmosphere. The primary spectral and imaging results will be reported elsewhere at this conference; however, there is an additional mode of data collection that gives a unique and informative insight into subtle variations in the haze and cloud profile. This mode is called by the team: the side-looking image strips. At the time of writing the probe has not yet encountered Titan. Without the actual data set this abstract cannot be considered more than a placeholder, a brief description of the data and its analysis leading to the types of results that may reasonably be expected.
Derived from text
*Atmospheric Composition; Temperature Measurement; Titan Atmosphere; Radiometers*

**20050175929** NASA Johnson Space Center, Houston, TX, USA
**Modeling Visible/Near-Infrared Photometric Properties of Dustfall on a Known Substrate**
Sohl-Dickstein, J.; Johnson, J. R.; Grundy, W. M.; Guinness, E.; Graff, T.; Shepard, M. K.; Arvidson, R. E.; Bell, J. F., III; Christensen, P.; Morris, R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We present a comprehensive visible/near-infrared two-layer radiative transfer modeling study using laboratory spectra of variable dust thicknesses deposited on substrates with known photometric parameters. The masking effects of Martian airfall dust deposition on rocks, soils, and lander/rover components provides the incentive to improve two-layer models [1-3]. It is believed that the model presented will facilitate understanding of the spectral and compositional properties of both the dust

layer and substrate material, and allow for better compensation for dust deposition.
Derived from text
*Near Infrared Radiation; Photometry; Dust; Substrates; Volcanology; Radiative Transfer; Mars Surface*

**20050175930** Washington Univ., Saint Louis, MO, USA
**An Oxygen-18 Rich Presolar Silicate Grain from the Acfer 094 Meteorite: A NanoSIMS and ToF-SIMS Study**
Stadermann, F. J.; Floss, C.; Bland, P. A.; Vicenzi, E. P.; Rost, D.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Acfer 094 meteorite is a primitive carbonaceous chondrite with an unusually high concentration of presolar grains [1-4]. The presolar components of this meteorite s matrix have been identified on the basis of their highly anomalous O isotopic compositions and recent advances in microanalytical technology, most notably the development of the NanoSIMS [1, 3, 4]. In an initially unrelated study [5], we used the NanoSIMS to determine the O isotopic variations in small Ca-Al rich inclusions (micro-CAIs) that were identified in the matrix of Acfer 094 by time-of-flight secondary ion mass spectrometry (ToF-SIMS) imaging. Here we report on the accidental discovery of an O-18-rich presolar grain during the course of these measurements. Since the area of the presolar grain was previously analyzed by ToF-SIMS, we have correlated elemental and isotopic data to aid in the mineralogical identification of the particle.
Derived from text
*Carbonaceous Chondrites; Composition (Property); Imaging Techniques; Secondary Ion Mass Spectrometry; Silicates; Oxygen 18; Microanalysis; Isotopes*

**20050175931** Massachusetts Inst. of Tech., Cambridge, MA, USA
**Using Future Observations to Determine Whether the Source of Mercury's Magnetic Field is an Active Dynamo**
Stanley, S.; Zuber, M. T.; Bloxham, J.; Hutchison, W. E.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mariner 10's observations during the first and third flybys of Mercury in 19741975, revealed the presence of a magnetic field of internal origin [1,2]. The inferred magnetic dipole moment of approximately 300 nT-RM(sup 3) is not well constrained due to the spatial distribution and limited quantity of the data [3], but even with this uncertainty, the inferred field strength appears problematic for all typical sources of planetary magnetic fields. One possibility is that the field is due to crustal remanent magnetization from a dynamo operating in Mercury's past [46]. If this is the case, then Mercury's crustal magnetism is quite different from that of Earth and Mars where crustal magnetic fields are short wavelength (i.e. non-dipolar) features. Another possibility is that the dipole field is the result of a presently active dynamo. Recent Earth-based radar measurements of Mercury's librations in longitude [7] have demonstrated that the core and mantle of Mercury are decoupled, and hence that the core must be at least partially fluid. This provides the basic necessary (although by no means sufficient) condition for an active dynamo to be the source of the observations.
Derived from text
*Planetary Magnetic Fields; Geomagnetism; Field Strength; Dipole Moments; Magnetic Properties; Planetary Mantles*

**20050175932** Carnegie Institution of Washington, Washington, DC, USA
**A Morphological and Chemical Study of Carbonate Globules Contained Within Mantle Xenoliths of the Sverrefjell Volcano Spitsbergen-Implications for ALH84001**
Steele, A.; Amundsen, H. E. F.; Fries, M.; Vicenzi, E.; Benning, L.; Maule, J.; Mysen, B.; Toporski, J.; Schweizer, M.; Fogel, M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Previous studies have shown that carbonate globules contained within carbonate cemented breccia associated with the Sverrefjell volcano are similar to those found in the ALH84001 meteorite. Previous studies have also documented the occurrence of populations of carbonate globules within olivine rich mantle xenoliths from the same area. We have applied a number of analytical instruments to documenting the mineralogy and morphology of these mantle xenolith samples in an attempt to understand further the conditions of formation of these structures and how they relate to previous carbonate globules studied from this site and the carbonate globules found in ALH84001.
Derived from text
*Carbonates; Globules; Morphology; Spitsbergen (Norway); Volcanoes; Mineralogy; Inclusions; Earth Mantle*

**20050175934** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Mapping of Titan: First Results from the Cassini RADAR**

Stofan, E. R.; Elachi, C.; Lopes, R.; Lorenz, R.; Kirk, R. L.; Paganelli, F.; Wood, C. A.; Wall, S. D.; Luine, J.; Soderblom, L. A.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Like Venus, the surface of Titan is hidden from view, with little known about its geology prior to Cassini. The first Synthetic Aperture Radar (SAR) swath across the surface of Titan has revealed a surprisingly complex surface, with few features that can be reliably identified as impact craters. More detailed reports on the results of the first radar encounter with Titan can be found in this volume.

Derived from text

*Titan; Cassini Mission; Planetary Mapping; Synthetic Aperture Radar*

**20050175935** Panjab Univ., Chandigarh, India

**Planetary Differentiation of Accreting Planetesimals with 26Al and 60Fe as the Heat Sources**

Sahijpal, S.; Soni, P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Detailed numerical simulations involving linear accretional growth and planetary differentiation of planetesimals with Al-26 and Fe-60 as the heat sources have been attempted. Contrary to the instantaneously triggered formation of iron-core and eucritic-crust for instantaneous planetary accretion models, the growth of iron-core and the extrusion of eucritic melt were evolved progressively according to thermal evolution of accreting planetesimal. Revised estimates of initial Fe-60/Fe-56 were used.

Derived from text

*Aluminum Isotopes; Heat Sources; Iron Isotopes; Protoplanets; Planetary Geology*

**20050175936** Florida Univ., Cape Kennedy, FL, USA

**Synergistic Effects of Low Pressure, Low Temperature, and CO2 Atmospheres Inhibit the Growth of Terrestrial Bacteria Under Simulated Martian Conditions**

Schuerger, Andrew C.; Nicholson, Wayne L.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars spacecraft are assembled under strict conditions of sanitation and components are sterilized at various times during the payload integration process. Sterilizing procedures can include the use of dry-heat, wet-heat, gaseous steriliants, and/or chemical surface treatments depending on the spacecraft component and phase of assembly. Thus, the total bioburden at launch is constrained significantly and generally must be below 3 x 10(exp 5) spores per vehicle for Category IV missions. Schuerger et al. demonstrated that after spacecraft land on Mars, it is likely that sun-exposed surfaces can receive significant levels of UV irradiation to reduce the viable bioburden by up to 6 decades in as short a span as several tens of minutes under clear sky conditions (optical depth approximately 0.5). However, a significant portion of any landed vehicle will contain surfaces that are completely shielded from UV irradiation. The objective of the current study was to determine if common spacecraft contaminants shielded from solar UV irradiation can grow and replicate under the low pressure, low temperature, and high CO2 atmospheres that are present at the surface of Mars.

Derived from text

*Bacteria; Carbon Dioxide; Low Pressure; Low Temperature; Simulation; Mars Environment; Mars Surface*

**20050175937** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**To Land on Europa**

Shirley, James H.; Carlson, Robert W.; Zimmerman, Wayne F.; Rivellini, Tommaso P.; Sabahi, Dara; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Science Definition Team (SDT) for NASA's Jupiter Icy Moons Orbiter (JIMO) Mission recommends including a lander as an integral part of the science payload of the JIMO Mission. The Europa Surface Science Package (ESSP) could comprise up to 25% of science payload resources. We have identified several key scientific and technical issues for such a

lander, including 1) the potential effects of propellant contamination of the landng site, 2) the likely macroscopic surface roughness of potential landing sites, and 3) the desire to sample materials from depths of approximately 1 m beneath the surface. Discussion and consensus building on these issues within the science community is a prerequisite for establishing design requirements.
Derived from text
*Europa; Landing Sites; Space Missions; NASA Space Programs*

**20050175938** Carnegie Institution of Washington, Washington, DC, USA
**Why the Martian Mantle is (Mostly)'Wet'**
Solomon, Sean C.; Aharonson, Oded; Hauck, Steven A., II; Jakosky, Bruce M.; Phillips, Roger J.; Zuber, Maria T.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The question of the water content of the mantle of Mars is an important one for reasons ranging from the composition of the objects from which the planet was assembled, to the melting conditions and transport properties of Martian mantle material, to the history of outgassing of water to the surface and its implications for geological and biological processes. One source of information on this question is the water content of the magmas from which Martian meteorites were formed, and Jones has recently argued that those magmas were effectively dry and by implication there is no compelling reason that the Martian mantle should contain a significant amount of water. A broader view of water in the Martian mantle, which we take here, demonstrates that the water content of the Martian mantle likely depended on time and location, that wet and dry depend on one s perspective, and from many important perspectives the bulk of the Martian mantle is likely wet. Early Mars. Scenarios for the formation of
Derived from text
*Planetary Mantles; Mars Surface; Moisture Content; Planetary Geology*

**20050175939** Northrop Grumman Space Technology, Redondo Beach, CA, USA
**A Novel Approach to the Detection of Bouguer Anomalies and Mass Concentrations**
Sollitt, Luke; Arenberg, Jonathan; Lunar and Planetary Science XXXVI, Part 18; [2005]; 1 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A novel detection approach is presented to detect Bouguer anomalies and associated mass concentrations (mascons) beneath the surfaces of planetary bodies. This approach, developed from standard laser altimetric methods, uses multiple beams at different angles in the plane of the spacecraft flight path to take coincident topographical maps. Comparison of the co-registered maps allows the determination of attitude variations in the spacecraft flight path, and hence of the mascons underneath. This method might allow for the determination of mascons with minimal tracking data from the spacecraft, during single passes over terrain. In this way, mascons could be detected during missions that orbit bodies for short periods of time. The spatial resolution of this measurement is as yet unspecified, but will depend on the power available to the instrument.
Author
*Anomalies; Detection; Bouguer Law; Mascons*

**20050175940** Louisiana State Univ., Baton Rouge, LA, USA
**Error Analysis of Remotely-Acquired Mossbauer Spectra**
Schaefer, Martha W.; Dyar, M. Darby; Agresti, David G.; Schaefer, Bradley E.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations
Contract(s)/Grant(s): NAG5-12687; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On the Mars Exploration Rovers, Mossbauer spectroscopy has recently been called upon to assist in the task of mineral identification, a job for which it is rarely used in terrestrial studies. For example, Mossbauer data were used to support the presence of olivine in Martian soil at Gusev and jarosite in the outcrop at Meridiani. The strength (and uniqueness) of these interpretations lies in the assumption that peak positions can be determined with high degrees of both accuracy and precision. We summarize here what we believe to be the major sources of error associated with peak positions in remotely-acquired spectra, and speculate on their magnitudes. Our discussion here is largely qualitative because necessary background

information on MER calibration sources, geometries, etc., have not yet been released to the PDS; we anticipate that a more quantitative discussion can be presented by March 2005.
Derived from text
*Error Analysis; Mars Exploration; Mars Surface; Mars Roving Vehicles; Spectroscopy; Roving Vehicles*

**20050175941** California Inst. of Tech., Pasadena, CA, USA
**Cloud Activity on Titan During the Cassini Mission**
Schaller, E. L.; Brown, M. E.; Roe, H. G.; Bouchez, A. H.; Trujillo, C. A.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ground-based observations and recent Cassini images through narrow methane windows have revealed Titan's surface features and variable tropospheric clouds. Clouds have been regularly observed near Titan's south pole since their discovery and typically contribute about 1% of the total brightness of Titan's disk. Until the recent discovery of clouds at midlatitudes, clouds were only observed at far southern latitudes the current area of maximum solar insolation. In addition to these daily clouds, Titan also occasionally experiences large cloud outbursts. These were first observed spectroscopically by Griffith et al. who saw a dramatic brightening of Titan in atmospheric windows corresponding to cloud cover of 7-9% of Titan's disk. More recently, a dramatic brightening of the south polar clouds was observed in October 2004 with Keck adaptive optics images. While infrequent observations from large telescopes and from Cassini flybys are useful for studying the morphologies of clouds and occasional cloud outbursts, only a continuous monitoring project can provide the type of dataset necessary to begin to determine the frequency and duration of these outbursts. This study focuses on quantifying the attributes of these large cloud outbursts and placing the Cassini observations into the broader context of the full range of cloud activity on Titan.
Derived from text
*Cassini Mission; Cloud Cover; Titan; Photometry*

**20050175942** Michigan Univ., Ann Arbor, MI, USA
**Solar Radiation Pressure and Transient Flows on Asteroid Surfaces**
Scheeres, D. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The motion of particles on the surfaces of asteroids are a strong function of the body s shape, gravity, spin state, and environment. Small particles will, in addition, be subject to non-gravitational accelerations. Any event on an asteroid that lofts material will expose these smaller particles to a strongly perturbed orbital environment where substantial migration across the surface may occur, and may even lead to escape from the body. There is much previous research investigating the effect of these forces on regolith distributions on asteroids. Recent observations have verified the existence of regolith down to very small grains. Specifically, the NEAR Shoemaker mission at Eros discovered the presence of dust ponds apparently consisting of fine particles at isolated regions on its surface. Similarly, recent observations of comet Wild 2 during the Stardust flyby indicates the presence of dust on the surface of that body. Recent studies have attempted to explain the presence of the Eros dust ponds by introducing nongravitational forces that preferentially act on small particles, the most prominent being electromagnetic levitation of dust fines and seismic shaking. Several recent studies discuss the possibility that these effects lead to the transport and pooling of particles on the surface of Eros, and hence on other asteroids as well. In this paper, we discuss the effect of solar radiation pressure (SRP) on small regolith particles. SRP is an additional force that acts on asteroid regolith whose effect has not been considered as having an influence on the motion of small particles across asteroid surfaces. We show that the effect of SRP is easily large enough to play a major role in the migration of dust particles, whether or not electromagnetic levitation or seismic shaking is present. In general, the sunlight that reaches the particle at dusk and dawn will be the most effective in mobilizing it, as in these conditions SRP will provide the largest lateral force. Another important aspect is that SRP will not be a constant force, but will turn in the asteroid surface frame as the asteroid rotates, providing a time varying force that can lead to the transient flow of material on an asteroid surface. We find that these forces can be an important factor in controlling the distribution of the smallest particles on an asteroid, and is a factor that helps explain the dust ponds found on Eros. We apply our analysis to the asteroids Eros, target of the NASA's NEAR mission, and Itokawa, target of the Japanese Space Agency's Hayabusa Mission.
Derived from text
*Asteroids; Solar Radiation; Pressure; Regolith; Mathematical Models*

**20050175943** Lunar and Planetary Inst., Houston, TX, USA

**Landing Site Characteristics for Europa 1: Topography**

Schenk, P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Europa and its putative sub-surface ocean remain top priorities for planetary exploration. Ongoing efforts to develop a robust program for the next phase of Europa exploration include serious consideration of a landed science package. Indeed, unambiguous determination of surface/subsurface chemistry and the internal structure of Europa's water and ice layers may require a surface package. The success of a Europa lander depends in large part on a firm understanding of the slope and roughness characteristics of the surface. In this report I survey the available topographic data and describe the slope characteristics of different geologic terrains. A major conclusion and a constraint on any Europa lander is that the surface is, with very few exceptions much steeper over more of its surface than on Mars.

Derived from text

*Europa; Landing Sites; Structural Properties (Geology); Topography*

**20050175945** AVL-AST doo, Zagreb, Croatia

**Recursive Topography Based Surface Age Computations for Mars: New Insight into Surficial Processes That Influenced Craters Distribution as a Step Toward the Formal Proof of Martian Ocean Recession, Timing and Probability**

Salamuniccar, G.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This work investigates new algorithm how to measure influence on craters distribution, providing new insight into: the processes that caused this influence (probably lava flows and polar caps), the amount of resurfacing and the ocean hypothesis.

Derived from text

*Topography; Fluid Flow; Probability Theory; Craters*

**20050175946** Toulouse Univ., France

**Laser-induced Breakdown Spectroscopy: A New Method for Stand-Off Quantitative Analysis of Samples on Mars**

Salle, B.; Mauchien, P.; Lacour, J.-L.; Maurice, S.; Wiens, R. C.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: ChemCam, Laser Induced Remote Sensing for Chemistry and Micro-Imaging, has been selected by NASA for the mobile Mars Science Laboratory (MSL) rover, scheduled for launch in 2009 [1,2]. ChemCam s Laser- Induced Breakdown Spectroscopy (LIBS) instrument will ablate surface coatings from materials at stand-off distances of up to 10 meters and measure elemental composition of underlying rocks and soils. The LIBS technique uses high powered laser pulses focused on the target at stand-off to obtain a plasma which emits light. Collection of the plasma light, followed by spectral dispersion and detection, permits identification of the elements present in the sample via their characteristic spectral lines. Advantages of the method compared to conventional elemental analysis methods, in the context of Mars exploration, include: - stand-off analysis capability [3], - no sample preparation, - rapid analysis (few minutes), - simultaneous multi-element detection of major, minor and trace elements, - ability to clean thin layer of dust and measure composition through depth profiling. Quantitative elemental analysis of materials is possible by comparing the LIBS signal obtained for a given element to a suitable calibration curve. However, the LIBS signal emitted by the same element depends on the matrix in which it is embedded [4-9]. This matrix effect leads to the necessity of many calibration curves, in principle, one for any substrate composition. This quantitative method can not be applied in the case of unknown samples that will be encountered on Mars. Recently, a new quantitative method has been developed to determine, without calibration curves, the concentration of atomic components in solid, liquid and gaseous samples [10]. This calibration free LIBS approach was tested in Ref. [11] on several samples of terrestrial origin, mostly volcanic rocks, which could be analogue to expected Martian samples. Results for main constituents were found in agreement with an EDX analysis. They demonstrate that the calibration free LIBS method can be of very great help for any first search in a mineralogical analysis. The aim of this work was first to evaluate the cap abilities of the calibration free LIBS method in air at atmospheric pressure and close distance. The application of this method to LIBS experiments at stand-off distances in environmental Martian conditions on geological samples is in progress.

Derived from text

*Laser-Induced Breakdown Spectroscopy; Igneous Rocks; Chemical Composition; Chemical Analysis; Geology; Trace Elements; Surface Properties; Remote Sensing; Quantitative Analysis*

**20050175947** Brown Univ., Providence, RI, USA

**Alternative Cratering Scenarios for the Deep Impact Collision**

Schultz, P. H.; Anderson, J. L. B.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In July 2005, a 360 kg impactor will collide with Comet 9P Tempel 1. While the mass and velocity of the impactor are known, the impact angle at the moment of impact and the nature of the upper 10m to 30 m of the comet are not. In preparation for the range of possible consequences, a series of laboratory experiments have been performed in order to assess a range of possible scenarios with implications for realtime analyses. These experiments are not designed to simulate uniquely the Deep Impact (DI) impact in all stages of growth. But late-stage crater growth, penetration depth, ejecta evolution, and final morphology (as well as the initial thermal flash) all can be examined using a wide range of target types in the laboratory.
Derived from text

*Cratering; Hypervelocity Impact; Cometary Collisions*

**20050175948** Geological Survey, Denver, CO, USA

**Milk Spring Channels Provide Further Evidence of Oceanic, \g1.7-km-Deep Late Devonian Alamo Crater, Southern Nevada**

Sandberg, C. A.; Poole, F. G.; Morrow, J. R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: Milk Spring, the locality that yielded a 6-cm-long accretionary bomb ejected by the Alamo Impact, is now found to contain the farthest offshore, stratigraphically deepest breccia-filled channels [1-2]. Current directions of these and other offplatform channel-fill deposits (Figs. 1-2) indicate southeastward (craterward) transport. Recent work shows this crater had a final diameter of 44-65 km and was excavated to a depth of \g1.7 km but was later dismembered and buried beneath younger rocks [2]. Allochthonous and semi-autochthonous polymict breccias resulting from the marine impact are now exposed in nearly 20 mountain ranges in southern Nevada. They were emplaced in roughly semicircular belts of shoreward-thinning megabreccia and tsunamite deposits, designated Zones 1, 2, and 3, across the early Late Devonian carbonate platform and adjacent slope (Fig. 1). Megatsunami uprush and/or backwash deposits are now documented on the carbonate platform beyond the outermost Zone 3 at Devils Gate (DVG), Nevada, and in the Confusion Range (CON) and South Burbank Hills (SBH), Utah (Fig. 1). dated by conodonts as Eifelian kockelianus Zone (Fig. 3). Ejected Ordovician conodonts, carbonate lapilli, an ejecta bomb, and a likely Ordovician alga Receptaculites have been found at several of the outcrops. Interpretation: The Alamo Breccia truncated at least 500 m of stratigraphic section from coeval rocks of the early Frasnian punctata Zone on the carbonate
Derived from text

*Breccia; Carbonates; Deposits; Craters; Stratigraphy*

**20050175949** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Mars Exploration Rover Cameras: A Status Report**

Schwochert, M. A.; Maki, J. N.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

With more than 68,000 images returned from the surface of Mars to date, the Mars Exploration Rover (MER) camera suite continues to perform extremely well. Image signal to noise ratios (SNRs) are greater than 200:1, flat fields remain stable, and single-pixel degradation has been negligible. Acting as the eyes of the robotic field geologists, the 18 MER cameras continue to play a leading role in major scientific findings at both Gusez Crater and Meridiana Planum. All 4 types of cameras, the hazard avoidance (Hazcam), navigation (Navcam), the color panoramic (Pancam) and the microscopic imager (MI), continue to return data from the Martian surface from both Rovers. In addition to the rover cameras, each lander utilized a descent imager (DI) to help facilitate safe landing and provide landing site context. The Pancam and MI are part of the scientific instrument payload of the rovers. In addition to gathering gathering science image data, the Pacams also support sun finding and measure atmospheric dust optical depth. The Hazcam and Navcam stereo pairs are used for traverse planning, autonomous navigation and general imaging.
Derived from text

*Mars Exploration; Mars Roving Vehicles; CCD Cameras*

**20050175951** Notre Dame Univ., IN, USA

**Central Mounds in Martian Impact Craters: Assessment as Possible Perennial Permafrost Mounds (Pingos)**

Sakimoto, S. E. H.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact craters on Mars are a window into the martian surface and near-surface revealing local target properties as well as local geologic processes. The central peaks or mounds of martian impact craters are key indicators in determining these target properties and processes. Here, we show some of the range of non-typical crater central peaks and consider post-impact formation and modification origins for some or all of their topographic signature, with particular emphasis on pingo-like (perennial permafrost mound) modes of origin.

Derived from text

*Damage Assessment; Impact; Mars Craters; Permafrost; Mars Surface; Landforms*

**20050175952** NASA Ames Research Center, Moffett Field, CA, USA

**Outflow Channels Influencing Martian Climate: Global Circulation Model Simulations with Emplaced Water**

Santiago, D. L.; Colaprete, A.; Haberle, R. M.; Sloan, L. C.; Asphaug, E. I.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The existence of surface water on Mars in past geologic epochs is inferred on the basis of geomorphologic interpretation of spaceflight images, and is supported by the recent Mars Odyssey identification of ice-rich soils [1]. The Mars Exploration Rovers have provided further chemical evidence for past surface hydrologic activity [2]. One issue is whether this water-rich climate ever existed in a steady state, or whether it was triggered by catastrophic events such as large impacts [3], and/ or catastrophic outburst floods, the topic of consideration here.

Derived from text

*Atmospheric Circulation; Atmospheric Models; Mars Surface; Climate; Geomorphology*

**20050175953** College of William and Mary, Williamsburg, VA, USA

**A Further Analysis of Potential Photosynthetic Life on Mars**

Sakon, John J.; Burnap, Robert L.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Three primary requirements for life-water, essential elements and energy-are found within the near-surface of Mars [2,3,4,8,10]. Shielded from the various stresses imposed by the Martian surface environment, it is believed that life could find the perfect niche within meters of the surface [2,4,5,6]. Simple photosynthetic organisms could theoretically receive enough energy from the sun at certain periods -whether once every year [4,5,6,9] or once every ten thousand years [4,13]-to thaw out from a frozen, dormant state and reproduce until they refreeze. This theory is based upon examples set by extremophiles-including photosynthetic cyanobacteria-currently living within the Antarctic and Arctic ice caps on Earth that hibernate through frozen conditions and remain viable upon thawing [5,6,7,12]. Potential Martian habitats sufficient to protect and sustain such cyanobacteria for long periods include the polar ice caps [4,5,9] as well as various sedimentary rock formations [13].

Derived from text

*Extraterrestrial Life; Mars Surface; Water; Organisms; Habitats*

**20050175954** AVL-AST doo, Zagreb, Croatia

**New Insight into Valleys-Ocean Boundary on Mars Using 128 Pixels per Degree MOLA Data: Implication for Martian Ocean and Global Climate Change**

Salamuniccar, G.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This work investigates new insight into the relationship between morphology and elevation of Martian valleys termini and hypothetical Martian ocean including their implication for global climate change using 128 pixels per degree MOLA data.

Derived from text

*Valleys; Oceans; Boundaries; Mars Environment; Climate Change; Climatology*

**20050175955** Tokyo Univ., Japan

**Presence of Nonmethane Hydrocarbons on Pluto**

Sasaki, T.; Kanno, A.; Ishiguro, M.; Kinoshita, D.; Nakamura, R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Edgeworth-Kuiper belt objects are supposed to be the remnants of icy planetesimals and Pluto is one of the largest objects among them. However, Pluto is an exceptional object not only in the size, but also in the surface composition with the very volatile ices, such as nitrogen, methane and carbon monoxide [1-3]. Recently a few observations tried to search other hydrocarbons in the L bands [4], whose absorption is much stronger compared with the overtones in the J, H, and K bands. However, it is difficult to make precise spectroscopic measurements in the L band because of the strong and variable telluric extinctions. Here we report a high-resolved Pluto s L band spectra successfully derived by Subaru Telescope.

Derived from text

*Carbon Monoxide; Kuiper Belt; Nitrogen; Methane; Pluto (Planet); Hydrocarbons*

**20050175956** Harvard Univ., Cambridge, MA, USA

**Martian Landslides in Valles Marineris: Wet or Dry?**

Soukhovitskaya, Veronika; Manga, Michael; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Evidence for the presence or absence of liquid water on Mars's surface provides important constraints on the climatic and dynamic evolution of the Martian surface and interior. Here we analyze the geometric properties of landslides on Earth and compare these with landslides in Valles Marineris to learn about the dynamics of Martian landslides. The goal is to determine whether liquid water played a significant role in forming Martian landslides in Valles Marineris.

Derived from text

*Landslides; Mars Surface; Mars Volcanoes; Mathematical Models; Water; Earth Surface*

**20050175957** Indiana Univ., Bloomington, IN, USA

**Granular Microbial Habitats Built from Iron Sulfides: Alternative Microbial Lifestyles?**

Schieber, J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Concentrically zoned pyrite grains of sand to pebble size occur in shallow marine sandstones of Ordovician and Proterozoic age. Though usually thought of as a product of post-depositional chemical processes, these particular pyrite grains participated in sediment surface processes for extended time periods. The observation of fossilized remains of filamentous and coccoid microorganisms within these pyrite oncoids indicates that they are the result of microbially driven chemical processes. Microbes initiated oncoid growth by encrusting and binding sediment grains, and then continued to grow on this nucleus until a size of a few millimetres was reached. Laminae with radial fibrous iron sulfide morphology suggest marcasite as the original iron sulfide. This was confirmed through electron backscatter diffraction analyis with an SEM. Due to its preference for low pH conditions, marcasite might be a common iron sulfide in reducing Martian sediments and may enclose microbial remains during growth. The concentric laminae of pyrite oncoids indicate frequent movement during growth and imply residence in the mobile surface sediment. Cross-bedding and ripples in these sandstones indicate an energetic environment that may have precluded establishment of matforming microbial communities. Microbial communities that constructed pyrite oncoids were pioneers in a dynamic environment that was adverse to more traditional microbial life styles, such as mat building.

Derived from text

*Iron; Microorganisms; Sulfides; Granular Materials*

**20050175958** Technische Univ., Munich, Germany

**Registering HRSC Imagery of the Mars Express Mission to Mars Observer Laser Altimeter Data**

Spiegel, M.; Schmidt, R.; Stilla, U.; Baumgartner, A.; Neukum, G.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations

Contract(s)/Grant(s): DLR-50-QM-0103; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The High Resolution Stereo Camera (HRSC) on board of ESA Mission Mars Express started imaging the surface of planet

Mars in color and stereoscopically in high resolution in January 2004. The Institute of Photogrammetry and GeoInformation (IPI) of the University of Hannover and the Department Photogrammetry and Remote Sensing (FPF) of the Technische Universitaet Muenchen are jointly processing the data of the HRSC. The primary goal is to register the HRSC data to the Mars Observer Laser Altimeter data (MOLA). With the result of the processing chain (especially with the improved exterior orientation), high quality products such as DTMs, ortho images and shaded reliefs can be derived from the imagery. In the following sections HRSC and MOLA data, the concept, and results of photogrammetric point determination with and without MOLA data as control information in the bundle adjustment is described.
Derived from text
*High Resolution; Mars Global Surveyor; Imagery; Mars Express; Mars Observer; Stereophotography; Remote Sensing; Imaging Techniques*

**20050175959** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Outstanding Science in the Neptune System from an Aerocaptured NASA 'Vision Mission'**
Spilker, T. R.; Spilker, L. J.; Ingersoll, A. P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 1 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In 2003 NASA released its Vision Mission Studies NRA (NRA-03-OSS-01-VM) soliciting proposals to study any one of 17 Vision Missions described in the NRA. The authors, along with a team of scientists and engineers, sucessfully proposed a study of the Neptune Orbiter With Probes (NOP) option, a mission that performs Cassini-level science in the Neptune system without fission-based electric power or propulsion. The Study Team includes a Science Team composed of experienced planetary scientists, many of whom helped draft the Neptune discussions in the 2003 Solar System Exploration Decadal Survey (SSEDS), and an Implementation Team with experienced engineers and technologists from multiple NASA Centers and JPL.
Derived from text
*NASA Programs; Space Missions; Neptune (Planet); Aerocapture; Solar System; Aerospace Sciences*

**20050175960** Centre National de la Recherche Scientifique, Grenoble, France
**Northern Seasonal Condensates on Mars by OMEGA/Mars Express**
Schmitt, B.; Doute, S.; Langevin, Y.; Forget, F.; Bibring, J.-P.; Gondet, B., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The determination of the physical state and coexistence modes of the ices and dust composing the seasonal condensates, as well as their temporal evolution, are of prime importance for the understanding of the microphysics of the sublimation/condensation/deposition processes of volatiles. The spatial and temporal distributions of the condensates constrains the seasonal cycle of volatile exchange (mainly CO2 and H2O) between the surface and the atmosphere. They also provide some clues to understand the current and past climatic cycles through the study of inter-annual evolutions. Before the Mars Express mission (ESA) the evolution of the seasonal condensations have been essentially monitored by following the albedo and temperature changes of the surface. The two most recent studies of that kind have been performed with the TES spectrometer and the MOC camera onboard the Mars Global Surveyor. Since January 2004 the OMEGA imaging spectrometer allows to directly monitor the abundance, physical state and distribution of the CO2, water and dust components of the condensates through their visible and near-infrared spectral signatures.
Derived from text
*Mars Express; Mars Surface; Condensates; Imaging Spectrometers; Annual Variations*

**20050175961** Tennessee Univ., Knoxville, TN, USA
**Petrography and Mineral Characterization of Lunar Mare Basalt Meteorite LAP 02-224**
Schnare, Darren W.; Taylor, Lawrence A.; Day, James M. D.; Patchen, Allan D.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

LAP 02-224 is a low-Ti mare-basalt meteorite discovered in the LaPaz Ice Field, Antarctica in 2002. We report on polished thin sections of this meteorite. LAP 02-224 is part of a suite of meteorites discovered in the same locality that are thought to be paired.
Derived from text
*Basalt; Lunar Maria; Meteorites; Minerals; Petrography*

**20050175962** Technische Hochschule, Hanover, Germany

**Automatic Tie Point Generation for the Processing of HRSC Imagery of the Mars Express Mission**

Schmidt, R.; Spiegel, M.; Heipke, C.; Oberst, J.; Neukum, G.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations

Contract(s)/Grant(s): DLR-50-QM-0104; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

With Mars Express being in orbit for one year now, the spacecraft has returned more than 250 image strips to earth taken by the multiple line scanner camera HRSC (High Resolution Stereo Camera). The three-dimensional position of the spacecraft is determined by combining ranging and Doppler shift measurements. An onboard star tracker is used to control the spacecraft s attitude (and thus the pointing of the body-fixed camera). These values result in a three-dimensional position and attitude of the spacecraft over time (termed 'exterior orientation' (EO) in classical photogrammetry). Unfortunately, these parameters are sometimes poorly constrained. However, the HRSC experiment with its multiple stereo lines is designed with the goal in mind to improve these nominal values of exterior orientation by means of photogrammetric techniques. This is accomplished in two steps. First, a large number of tie points between the multiple stereo strips are extracted via digital image matching (DIM). Then, a bundle adjustment (BA) is performed to correct the EO, using the collected tie points as observations for the unknown EO parameters.

Derived from text

*Imagery; Photogrammetry; High Resolution; Rangefinding; Mars Express; Attitude (Inclination); Cameras*

**20050175964** Hawaii Univ., Honolulu, HI, USA

**Seasonal Surface Frost at Low Latitudes on Mars**

Schorghofer, Norbert; Edgett, Kenneth S.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The continuous or nearly-continuous south polar seasonal cap has long been known to extend from the pole to about 60degS. In Hellas, the cap extends further north, covering all of Hellas Planitia. Viking IRTM observations showed that temperatures across Hellas at this time of year are consistent with CO2 freezing at slightly higher temperatures than it does at the pole, owing to the greater atmospheric pressure in the basin. Less well known or recognized is the presence of southern winter frost at lower latitudes. During the past 4 Mars years, MGS MOC blue WA and NA imaging capabilities have been used to document occurrence of seasonal patches of frost at latitudes as low as 35degS, and even 24degS. Figure 1 reveals seasonal frost in the form of bright patches on pole-facing crater walls in the region 40-36degS 134-140degE. For instance, R02-00411 shows frost in at least nine craters on south or south-southwest facing slopes. The frost was observed in the southern winter of 1999 (Mars year 1), was monitored by MOC in 2002/2003 (Mars year 3), and is also present in the current southern winter (Mars year 4). No blue filter MOC images (except 7.5 km/pixel daily global images) were taken at this site in the southern winter of 2001 (Mars year 2). These observations demonstrate that frost forms in this region annually.

Derived from text

*Frost; Craters; Thermal Mapping; Polar Caps; Atmospheric Pressure; Carbon Dioxide*

**20050175966** Lockheed Martin Corp., Houston, TX, USA

**Evolution of Meteorite Chip Samples During Typical Storage Methods: A Seven and a Half Year ALH 84001 Case Study**

Schwandt, Craig S.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A reasonable amount of effort and expense is utilized in the collection and curation of meteorite samples as evident from protocols and practices used at Johnson Space Center (JSC) for example. Visiting the JSC curation web-site (http://curator.jsc.nasa.gov/curator/antmet/antmet.htm) it is evident that great care is used for meteorite storage and specimen division. An inference is that these efforts are undertaken in order that the meteorites alter as little as possible. These efforts are a 'no-brainer'. However, questions arise such as, do most meteoriticists utilize dry nitrogen storage cabinets (as a minimum attempt at sample preservation), or freezers? Should everyone? How is the outcome of research changed due to undetected or unidentified alteration during nonstandardized uncontrolled storage? These are not new questions, but examination of an ALH84001, 278 sample chip intermittently over the course of the past seven years suggests that significant alteration transpires much quicker than anticipated or acknowledged.

Derived from text

*Chips; Meteorites; Preserving*

**20050175967** Max-Planck-Inst. fuer Chemie, Mainz, Germany

**Noble Gases in Mineral Separates from Shergotty and Zagami**

Schwenzer, S. P.; Hermann, S.; Ott, U.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The similar 'fingerprints' of noble gas abundance patterns in the SNC meteorites and in the data from the Viking mission have played a key role in establishing the SNC meteorites as Martian [1, 2]. Further, noble gases with completely different isotopic signatures have been found and are regarded as coming from the Martian interior [3]. Similar findings for nitrogen [e.g., 2] show the presence of Martian atmospheric as well as an interior component (for an overview see [4]).

Derived from text

*Abundance; Rare Gases; Shergottites; Nitrogen; Meteoritic Composition; Mars Atmosphere; Isotopic Labeling*

**20050175968** Hawaii Univ., Honolulu, HI, USA

**Remote Raman Measurements of Minerals with Mars Microbeam Raman Spectrometer (MMRS)**

Sharma, S. K.; Wang, Alian; Haskin, Larry A.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In a rover or lander-based investigation of Mars, a key priority should be detailed and definitive characterizations of minerals and impact glasses on the surface and exposed subsurfaces in craters. These mineralogical data will improve our understanding of Mars evolutionary history. Remote Raman investigations of surface and sub-surface mineralogy in crater walls could provide information about the changes caused by (i) past stream and lake environments, (ii) hydrothermal interaction with the upper Martian crust, and (iii) the planet's early igneous chemical differentiation. An assessment of whether life might have formed on Mars calls for a better understanding of the nature of the planet, with an emphasis on the presence and role of water during its evolution. Laser Raman spectroscopy has potential for yielding better knowledge of past and present Mars environments, by examining any organics and biominerals that may be present on Mars. With these data, we could provide a more rational view of the possible development of life on Mars. Micro-Raman and remote Raman spectroscopy have been demonstrated to be effective tools for investigating mineralogy of terrestrial rocks and Martian meteorites; as the Raman lines of minerals are sharp and distinct. The Raman fingerprints of minerals do not shift appreciably and remain distinct even in sub-micron grains and so can be used for mineral identification in fine-grained rocks. In order to use the remote Raman spectrograph for space mission, it is essential to minimize the size, weight, and power consumption of the instrument. Toward this goal, we have measured remote Raman spectra of various minerals with the UH remote Raman receiver interfaced with the miniaturized Mars microbeam Raman spectrometer (MMRS), conceived and developed at Washington University, St. Louis.

Derived from text

*Mars Surface; Microbeams; Mineralogy; Planetary Geology; Raman Spectroscopy*

**20050175969** University of Western Washington, Bellingham, WA, USA

**Thin Wafer Transmission Mossbauer Spectra of Four Shergottites: Implications for Mineralogy of Rocks at Mars Exploration Rover Sites**

Seda, Takele; Irving, Anthony J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 1 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report here the preliminary results of a Mossbauer spectroscopy study of four different shergottite meteorites found in Northwest Africa and Oman, which span the known range of petrologic types. In contrast to traditional methods, we discovered that excellent spectra could be obtained in transmission mode from small (approx.15 mm diameter) and thin (approx.1mm) wafers of these specimens. This technique has advantages over traditional analysis of powdered samples since it is non-destructive, representative of the specimen, and permits subsequent studies to be performed on the intact samples. Our results may assist in the mineralogic interpretation of the back-scattered Mossbauer spectra obtained by the MER mission on rocks at the Spirit and Opportunity landing sites.

Derived from text

*Backscattering; Planetary Geology; Mars Surface; Meteorites; Mineralogy; Wafers*

**20050175971** NASA Ames Research Center, Moffett Field, CA, USA

**Experimental Study on Interactions Between H Atoms and Organic Haze**

Sekine, Y.; Imanaka, H.; Khare, B. N.; Bakes, E. L. O.; McKay, C. P.; Sugita, S.; Matsui, T.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In Titan s atmosphere composed of N2 and CH4, irradiations of both solar ultraviolet light and charged particles induce active chemical reactions. In the processes of these reactions, a large amount of hydrogen (H) atoms are expected to be formed by dissociation of CH4 and other hydrocarbons [e.g., 1, 2]. Theoretical models suggest that these active H atoms need to be converted to stable hydrogen molecules (H2) efficiently to maintain unsaturated hydrocarbons and organic haze in Titan s atmosphere [e.g., 1]. Furthermore, molecular hydrogen is an important greenhouse effect gas in Titan s atmosphere, and small variation in its abundance strongly affects Titan s surface temperature [3]. Thus, the formation of H2 molecules from H atoms is a key reaction for both the atmospheric chemistry and the surface environment of Titan. Although several numerical calculations have been conducted to investigate the atmospheric chemistry of Titan with hypothesized recombination reactions of H atoms, such as catalytic scheme of C4H2 [e.g., 1, 2], it is still unclear what chemical reaction is responsible for the conversion of H atoms to H2 molecules in Titan s atmosphere.

Derived from text

*Hydrogen Atoms; Haze; Nitrogen; Charged Particles; Ultraviolet Radiation; Chemical Reactions; Hydrocarbons; Molecular Gases; Atmospheric Chemistry*

**20050175972** Brown Univ., Providence, RI, USA

**Arsia Mons Fan-shaped Deposit: Spatial and Temporal Relationships Among Cold-based Glacial Facies from HRSC Data**

Shean, D. E.; Head, J. W.; Marchant, D. R.; Neukum, G., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent reexamination of the fan-shaped deposits on the NW flanks of the Tharsis Montes and Olympus Mons has revived earlier interpretations that these deposits could have a glacial origin. New spacecraft data and improved understanding of cold-base glacier behavior has led to the interpretation that these features are the depositional remains of cold-based tropical mountain glaciers of Amazonian age. The fanshaped deposits were subdivided into an outer ridged facies (interpreted to be drop moraines derived from advance and retreat of an ice sheet), an intermediate knobby facies (interpreted to be sublimation tills predominantly due to vertical downwasting of an ice sheet), and a smooth facies (interpreted to be debris-covered glacial deposits and/or rock glacier deposits representing some of the last phases of icesheet activity). Here we examine new synoptic high resolution HRSC (High Resolution Stereo Camera) data to analyze some of the key questions raised in previous analyses concerning the characteristics of the fan-shaped deposit facies and their age relationships.

Derived from text

*Glaciers; Mars Volcanoes; Mineral Deposits; Mars Surface; Spatial Distribution; Stereophotography; High Resolution; Low Temperature*

**20050175973** New Mexico Univ., Albuquerque, NM, USA

**A View of KREEP-rich Lunar Basaltic Magmatism Through the Eyes of NWA 773**

Shearer, C. K.; Borg, L. E.; Papike, J. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The record of basaltic magmatism on the Moon indicates that lunar mantle melting and basalt transport to the lunar crust occurred over a period of at least 3.4 billion years from 4.46 Ga to 1.0 Ga. The production of KREEP-rich basalts appears to extend over a significant portion of this period from the emplacement of the Mg-suite (starting at 4.46 Ga) to basaltic magmas represented by olivine cumulate clasts in NWA773 at 2.865 Ga. This KREEP geochemical signature probably represents the last dregs of residual liquid remaining from the crystallization of the lunar magma ocean (LMO). Isotopic ratios and ratios of incompatible trace elements of KREEP-rich rocks virtually all conform to a single uniform pattern, suggesting that the KREEP component was derived from a single source. This component appears to dominate the near-side terrain of the Moon. Here and in a companion abstract, we use geochemical and isotopic characteristics of the olivine cumulate clast in NWA773 to explore the: (1) the petrologic relationships among products of KREEP-rich basaltic magmatism and (2) the mechanisms by which the KREEP signature was incorporated into these basaltic magmas. Based on trace element characteristics of olivine in NWA773 and isotopic systematics of this lithology from a concurrent study, we conclude that the

most likely model for the production of the wide range of compositional distinct KREEPy basalts is melting of distinct LMO cumulate horizons that contain small abundances of a KREEP component.
Derived from text
*Kreep; Basalt; Lithology; Lunar Mantle; Magma; Geochemistry*

**20050175974** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Applicability of Electrical and Electroanalytical Techniques to Detect Water and Characterize the Geochemistry of Undisturbed Planetary Soils**
Seshadri, S.; Buehler, M. G.; Anderson, R. C.; Kuhlman, G. M.; Keymeulen, D.; Cheung, I. W.; Schaap, M. G.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The search for life is a primary goal of NASA s planetary exploration program. The search is, of necessity, tiered in both the detection approach (looking for evidence of microbial fossils or the presence of water in the geological history of a planetary body and/or looking for evidence of water, energy sources, precursors to life, signatures of life and/or life itself in the present day planetary environment) and in the survey method (scale, range, specificity) employed. Terrestrial investigations suggests that life as we know it requires water. Thus, the search for extant microbial life and habitats requires identifying water-bearing soils. Determining Reduction-Oxidation (REDOX) couples present in water, once it is found, provides information on soil geochemistry and identifies potential chemical energy sources for life. Mars offers a near-term target for conducting this search. The identification of gully formation [1], layered deposits [2] and elemental ratios of bromine and chlorine [3] present indirect evidence that water was abundant locally in the Martian past. Additionally, Viking images of polar ice and frost formation on the surface of Mars demonstrate that water can exist in at least some near-surface regions of present-day Mars. Atmospheric pressure data further suggest that liquid water may be stable for short periods of time in the mid-latitudes of the Martian surface. [4] Measurements of the global distribution of hydrogen in the Martian regolith offer tantalizing indirect evidence that water may at least exist in near-surface soils. [5] Evidently, any water to be found is likely to exist as soil mixtures at levels ranging between approx.0.5% and approx.5 %.
Derived from text
*Soils; Deposits; Geochemistry; Planetary Environments; Potential Energy; Oxidation-Reduction Reactions; Mars Surface; Planetary Geology*

**20050175975** NASA Johnson Space Center, Houston, TX, USA
**Rb-Sr and Sm-Nd Isotopic Studies of Lunar Highland Meteorite Y86032 and Lunar Ferroan Anorthosites 60025 and 67075**
Shih, C.-Y.; Nyquist, L. E.; Reese, Y.; Yamaguchi, A.; Takeda, H.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar meteorite Yamato (Y) 86032 is a feldspathic breccia containing anorthositic fragments similar to ferroan anorthosite (FAN) clasts commonly found in Apollo 16 highland rocks. Previous Ar-39-Ar-40 analyses of a grey anorthositic clast (,116 GC) in Y86032 revealed an old degassing age of 4.39 plus or minus 0.06 Ga, which is as old as crystallization ages of some FANs e.g. 60025, 67016 and 67215, as determined by the more robust Sm-Nd radiometric method. The calculated initial Nd value for the clast is -1.8 plus or minus 0.3 for the age. The old age and its negative initial Nd value indicate that Y86032 contains components of the primitive lunar crust related to the lunar magma ocean (LMO). We undertook further Rb-Sr and Sm-Nd isotopic investigation of three major lithologies in the meteorite as described in the mineralogical and petrological studies. Ar-39-Ar-40 analyses of these component lithologies are presented in this volume. Also, we analyzed two Apollo 16 FANs, 60025 and 67075, to compare their ages and isotopic signatures to Y86032. Y86032 probably came from a feldspathic highland terrane (FHT) on the northern farside highlands, a locality not sampled by the Apollo and Luna missions.
Derived from text
*Anorthosite; Highlands; Lunar Crust; Meteorites; Mineralogy; Samarium Isotopes; Neodymium Isotopes; Strontium Isotopes; Rubidium Isotopes; Petrology*

**20050175976** California Univ., Los Angeles, CA, USA
**Wark-Lovering Rims Record a Short Timescale for Changing Conditions in the Early Solar Nebula**
Simon, J. I.; Russell, S. S.; Tonui, E.; Dyl, K. A.; Manning, C. E.; Young, E. D.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Refractory Ca, Al-rich inclusions (CAIs), the oldest nebular condensates, contain a record of the early solar system. Most constituents of the primitive chondrite meteorites, comprising the primary building blocks of the planets, formed under conditions characterized by relatively high partial pressures of rock-forming gases (including oxygen) while CAIs formed at low partial pressures in a solarlike gas. The timescale over which this fundamental change in conditions occurred is, potentially, a primary constraint on the timescale over which the early solar nebula itself evolved. Here we present new Mg isotope data that, when coupled with oxygen barometry data show that the ubiquitous Wark-Lovering (WL) rims on CAIs formed in places resembling chondrite-forming regions of the solar nebula between 0 and 300,000 years after initial CAI formation. The results suggest that the most primitive solar system objects moved from a reducing solar-like gas to a more oxidizing region of chondritic dust enrichment within 105 years or less. Shock waves provide a plausible astrophysical environment for the formation of the CAI rims.
Derived from text
*Solar Nebula; Planetary Geology; Calcium; Aluminum; Inclusions*

**20050175977** Chicago Univ., Chicago, IL, USA
**Bulk Chemical and Isotopic Compositions of Spinel-, Hibonite-rich Spherules: Clues to Their Origin**
Simon, S. B.; Grossman, L.; Hutcheon, I. D.; Phinney, D. L.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Melilite-free, spinel-, hibonite-bearing spherules, a major type of refractory inclusion in CM2 chondrites, consist of phases that are predicted by thermodynamic calculations to condense from a cooling gas of solar composition but are not predicted to coexist with each other. Throughout updates and additions to the data base over the years, calculations consistently show that melilite should condense after hibonite and before spinel, and that hibonite should react completely with the gas to form spinel. Despite this, hibonite-, spinel-bearing inclusions that are melilite-free or very melilite-poor are much more abundant in CM chondrites than hibonite-melilite or melilite-spinel inclusions. The origin of the melilite-free inclusions has puzzled researchers for years. One way to reconcile the observed assemblages with the condensation calculations is if melilite originally present was lost due to evaporation of Ca, Si and Mg during heating of the precursors. The loss of SiO2 and CaO from an Al2O3-rich CMAS liquid would stabilize spinel and prevent extensive Mg evaporation. If evaporation occurred while the inclusions were partially molten, then they should be measurably enriched in the heavier isotopes of the affected elements (i.e., F(sub Mg), F(sub Ca) greater than 0). Previous studies of Ca and Mg isotopes in hibonite-spinel inclusions showed -10 less than F(sub Mg) less than 7 and -4 less than F(sub Ca) less than 5, providing a hint that Ca and Mg evaporation did take place, but failing to reveal any correlation between Mg and Ca isotopic compositions, or between isotopic and chemical compositions. We have undertaken a petrologic and ion probe study of spinel-bearing inclusions from Murchison to see if they are isotopically fractionated and if there are any correlations of isotopic composition with mineral assemblage. Petrographic classifications and textural descriptions were given in a previous report. Here we focus on the bulk chemical and isotopic compositions of the inclusions.
Author
*Isotopic Labeling; Petrography; Spherules; Spinel; Chemical Composition; Mineralogy*

**20050175978** Arizona Univ., Tucson, AZ, USA
**Influence of Silicate Melt Composition on Metal/Silicate Partitioning of W, Ge, Ga and Ni**
Singletary, S. J.; Domanik, K.; Drake, M. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG5-12795; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The depletion of the siderophile elements in the Earth's upper mantle relative to the chondritic meteorites is a geochemical imprint of core segregation. Therefore, metal/silicate partition coefficients (Dm/s) for siderophile elements are essential to investigations of core formation when used in conjunction with the pattern of elemental abundances in the Earth's mantle. The partitioning of siderophile elements is controlled by temperature, pressure, oxygen fugacity, and by the compositions of the metal and silicate phases. Several recent studies have shown the importance of silicate melt composition on the partitioning of siderophile elements between silicate and metallic liquids. It has been demonstrated that many elements display increased solubility in less polymerized (mafic) melts. However, the importance of silicate melt composition was believed to be minor compared to the influence of oxygen fugacity until studies showed that melt composition is an important factor at high pressures and temperatures. It was found that melt composition is also important for partitioning of high valency siderophile elements. Atmospheric experiments were conducted, varying only silicate melt composition, to assess the importance of

silicate melt composition for the partitioning of W, Co and Ga and found that the valence of the dissolving species plays an important role in determining the effect of composition on solubility. In this study, we extend the data set to higher pressures and investigate the role of silicate melt composition on the partitioning of the siderophile elements W, Ge, Ga and Ni between metallic and silicate liquid.
Derived from text
*Melts (Crystal Growth); Silicates; Germanium; Tungsten; Gallium; Nickel*

**20050175979** New Mexico Univ., Albuquerque, NM, USA
**Do Early Liquidus Phases in Olivine-Phyric Martian Basalts Reflect the Characteristics of Their Mantle Sources? Insights from NWA 1110, NWA 1195, and NWA 2046**
Shearer, C. K.; Borg, L. E.; Papike, J. J.; Chaklader, J.; Symes, S. J.; Irving, A. J.; Herd, C. D. K.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Herd et al. [1], Herd [2], Wadhwa [3] and Goodrich et al. [4] demonstrated that the fO2 in martian basalts represented by the shergottites varies by 2 to 3 log units and is correlated with geochemical parameters such as LREE/HREE, initial 87Sr/86Sr, and initial Nd. These correlations have been interpreted as indicating the presence of reduced, incompatible element- depleted and oxidized, incompatible element-enriched reservoirs that were produced during early stages of martian differentiation ( 4.5 Ga) [1,2,3,4,5,6,7]. Martian basaltic magmatism is thought to represent mixing between these two reservoirs. Whether this mixing process is a product of assimilation (mantle-derived, reduced basalts that assimilated an upper-mantle or lower-crustal oxidized reservoir) or mixing of two mantle reservoirs during melting is still a point of debate. The relationships between fO2 and incompatible element characteristics have been determined by two largely independent approaches; fO2 from mineral equilibria or multivalent element behavior (Eu) and bulk elemental-isotopic measurements. Here, we evaluate the use of a single phase (olivine) that potentially records simultaneously both the incompatible element behavior and fO2 conditions during the earliest stages of martian basalt crystallization.
Derived from text
*Magma; Basalt; Crystallization; Assimilation; Liquidus; Geochemistry; Crusts*

**20050175980** Colorado Univ., Boulder, CO, USA
**Effects of Rocks on Martian Ground Ice and Neutron Flux**
Sizemore, H. G.; Mellon, M. T.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recently, a remarkably consistent picture of the global distribution of near-surface ground ice on Mars has emerged from both observation and theory. Leakage neutron and gamma ray emission data from the Gamma-Ray Spectrometer (GRS) onboard Mars Odyssey indicate the presence of an ice-rich subsurface soil layer extending throughout the mid- to high-latitudes in both Martian hemispheres. A variety of theoretical studies have predicted the occurrence of shallowly buried ground-ice in the same geographic regions indicated by GRS data [2 & references therein]. We present numerical simulations of the three-dimensional distribution of ground ice in a heterogeneous soil and discuss the implications of our results for the interpretation of GRS neutron data.
Author
*Ice; Mars Surface; Rocks; Flux (Rate)*

**20050175981** Bayreuth Univ., Germany
**Crystal Structure of Troilite from Chondrites Etter and Georgetown**
Skala, Roman; Cisarova, Ivana; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899
Contract(s)/Grant(s): GACR-205/02/1101; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Troilite represents a ubiquitous constituent in many meteorite types it is common in chondrites, several types of achondrites as well as in most of iron meteorites. Its crystal structure is noncentrosymmetric and a refinement carried out on a synthetic analogue prepared by a sulfurization of an iron wire revealed the presence of both inversion related spatial atomic arrangements in roughly equivalent volumes representing the inversion twin. Here we present a refinement of crystal structure

of troilites from two ordinary chondrites in attempt to find out if the absolute structure depends on the formation conditions of troilite.
Author
*Chondrites; Crystal Structure; Troilite*

**20050175982** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Sensitive Amino Acid Composition and Chirality Analysis with the Mars Organic Analyzer (MOA)**
Skelley, Alison M.; Scherer, James R.; Aubrey, Andrew D.; Grover, William H.; Ivester, Robin H. C.; Ehrenfreund, Pascale; Grunthaner, Frank J.; Bada, Jeffrey L.; Mathies, Richard A.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Detection of life on Mars requires definition of a suitable biomarker and development of sensitive yet compact instrumentation capable of performing in situ analyses. Our studies are focused on amino acid analysis because amino acids are more resistant to decomposition than other biomolecules, and because amino acid chirality is a well-defined biomarker. Amino acid composition and chirality analysis has been previously demonstrated in the lab using microfabricated capillary electrophoresis (CE) chips. To analyze amino acids in the field, we have developed the Mars Organic Analyzer (MOA), a portable analysis system that consists of a compact instrument and a novel multi-layer CE microchip.
Derived from text
*Amino Acids; Mars (Planet); Sensitivity; Chirality; Analyzers*

**20050175984** Geological Survey, Flagstaff, AZ, USA
**The Southern Utopia Highland-Lowland Boundary: Basin Structural Controls on Aquifer Development and Volatile-driven Resurfacing**
Skinner, J. A., Jr.; Tanaka, K. L.; Rodriquez, J. A. P.; Kargel, J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Erosion and burial have obscured, removed, or otherwise modified many exposures of the globe-encircling highland-lowland boundary (HLB) scarp and its downslope plains. Southern Utopia Planitia, however, consists of uninterrupted HLB plains that are notably absent of the subduing, overprinting, and/or obliterating effects of regional-scale sedimentary, volcanic, or tectonic environments. The landforms of southern Utopia HLB and their geologic, stratigraphic, and geomorphic associations are therefore critical to understanding the evolution of the HLB plains overall. Building on regional mapping efforts and topical studies, we detail the landform suites that dominate the southern margin of Utopia Planitia. Based on our observations and interpretations, we propose that the southern Utopia HLB plains units were derived from and within a structurally isolated, basinmarginal sedimentary sequence related to the Utopia multi-ring impact structure. The HLB plains were deposited and resurfaced via volatile-related processes through the Hesperian and into the Early Amazonian.
Derived from text
*Aquifers; Highlands; Structural Basins; Volcanoes; Geomorphology; Volatility; Mars Surface*

**20050175985** Mount Holyoke Coll., South Hadley, MA, USA
**Mossbauer Spectroscopy of Shocked Amphiboles**
Sklute, E. C.; Dyar, M. D.; Minitti, M. E.; Leshin, L. A.; Guan, Y.; Luo, S.; Ahrens, T. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations
Contract(s)/Grant(s): NNG04GG12G; NAG5-12687; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This study suggest that shock pressures experienced by meteorites and rocks on planetary surfaces may be sufficient to either change Fe oxidation state or render the samples susceptible to rapid changes without otherwise altering chemical composition. It is clear that additional studies on other common meteoritic minerals such as olivine and pyroxene are needed. Furthermore, studies of the relation between redox exchanges and shock post-shock thermal history and environmental conditions (H2O, O2, CO2) need to be completed so that the results can be applied to a broad spectrum of meteoritic and planetary materials.
Derived from text
*Amphiboles; Spectroscopy; Meteorites; Planetary Surfaces; Shock Waves*

**20050175986** Mount Holyoke Coll., South Hadley, MA, USA

**Temperature Dependence and Recoil-free Fraction Effects in Olivines Across the Mg-Fe Solid Solution**

Sklute, E. C.; Rothstein, Y.; Dyar, M. D.; Schaefer, M. W.; Menzies, O. N.; Bland, P. A.; Berry, F. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations

Contract(s)/Grant(s): NNG04GG12G; NAG5-12687; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Olivine and pyroxene are the major ferromagnesian minerals in most meteorite types and in mafic igneous rocks that are dominant at the surface of the Earth. It is probable that they are the major mineralogical components at the surface of any planetary body that has undergone differentiation processes. In situ mineralogical studies of the rocks and soils on Mars suggest that olivine is a widespread mineral on that planet s surface (particularly at the Gusev site) and that it has been relatively unaffected by alteration. Thus an understanding of the characteristics of Mossbauer spectra of olivine is of great importance in interpreting MER results. However, variable temperature Mossbauer spectra of olivine, which are needed to quantify recoil-free fraction effects and to understand the temperature dependence of olivine spectra, are lacking in the literature. Thus, we present here a study of the temperature dependence and recoil-free fraction of a series of synthetic olivines. Derived from text

*Olivine; Solid Solutions; Temperature Dependence; Magnesium; Iron*

**20050175987** Carleton Univ., Ottawa, Ontario, Canada

**Magnetic Susceptibility of Stony Meteorites: Evaluation of Anisotropy and Frequency Dependence**

Smith, D. L.; Ernst, R. E.; Samson, C.; Herd, R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The characterization of meteorites provides insights into the evolution of the solar system. However, most widely used classification methods are destructive to the sample and time consuming. Coupled with the increasing backlog of meteorites worldwide, there is a need for a new non-destructive method of rapid and accurate classification. Magnetic properties have been demonstrated as a method of satisfying these requirements. We evaluate four parameters that show promise as classification tools and discriminants: bulk magnetic susceptibility and its frequency dependence (465, 825, 4650 and 19000 Hz), and the degree and shape of the anisotropy of magnetic susceptibility (AMS). Magnetic susceptibility (MS) measurements were performed on 361 meteorite specimens. 145 of these 361 specimens, covering 14 classes of chondrites, primitive achondrites and achondrites, have been measured for AMS at a frequency of 19000 Hz. Frequency dependence of bulk magnetic susceptibility (FDMS) was evaluated using frequencies of 465, 825, 4650 and 19000 Hz on 96 of the 361 specimens. An additional 222 specimens were also measured at 825 and 19000 Hz. We present the most comprehensive study of meteorite AMS and FDMS to date. All specimens used in the study belong to the National Meteorite Collection of Canada of the Geological Survey of Canada (GSC), Natural Resources Canada. The collection contains about 2700 meteorites and thus provides an excellent opportunity for scientific research on multiple classes of meteorites and variation within meteorite classes.
Derived from text

*Anisotropy; Magnetic Permeability; Meteorites; Frequency Distribution*

**20050175989** Carleton Univ., Ottawa, Ontario, Canada

**Measuring the Bulk Density of Meteorites and Rock Samples Non-Destructively Using 3D Laser Imaging**

Smith, D. L.; Samson, C.; Herd, R.; Ernst, R. E.; Christie, I.; Sink, J-E; DesLauriers, A.; Ernst, R. E.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A rapidly expanding inventory of meteorite specimens worldwide (mainly from Antarctica and deserts in Asia and Africa) has resulted in a backlog of unclassified samples. Some of these specimens are small and/or fragile, and preservation of all of them is a priority. There has therefore been growing interest in rapid non-destructive characterization of meteorites using petrophysical properties including magnetic susceptibility (MS), anisotropy of magnetic susceptibility (AMS), porosity and bulk density. Bulk density is a physical parameter that varies among rock types and can provide insight into the origin of rock material. Current measurement techniques, however, are destructive and suffer from various degrees of inaccuracy and precision. Soaking the sample in a fluid and employing Archimedes Principle is the most utilized technique, although errors can be introduced by fluid entering the pore spaces and irreversible damage to the specimen can occur. An alternative method uses the displacement of tiny glass beads to imitate the fluid in Archimedes Principle. Although the technique is

non-destructive, it suffers from shaking and compaction of the beads and several other forms of error. We present initial results of a new non-destructive technique for determining the bulk density of meteorites and other solid objects using the Laser Camera System (LCS), an auto-synchronous laser scanner developed by Neptec Design Group of Ottawa, Canada, and demonstrated during Mission STS-105 of space shuttle Discovery. Eleven chondrites and achondrites which vary in shape, size, surface roughness and reflectance were imaged and their densities computed. Combined with other physical properties, such as MS and AMS, density can characterize each meteorite class and thus provide a robust method of rapid classification. In addition, this approach provides insight into the origin and formation of meteorites, and can be applied to asteroidal studies.
Derived from text
*Imaging Techniques; Laser Applications; Magnetic Permeability; Rocks; Three Dimensional Models; Meteorites*

**20050175993** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**A Dynamic Fountain Model for Lunar Dust**
Stubbs, T. J.; Vondrak, R. R.; Farrell, W. M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During the Apollo era of exploration it was discovered that sunlight was scattered at the terminators giving rise to horizon glow and streamers above the lunar surface. This was observed from the dark side of the Moon during sunset and sunrise by both surface landers and astronauts in orbit. These observations were quite unexpected, as the Moon was thought to be a pristine environment with a negligible atmosphere or exosphere. Subsequent investigations have shown that the sunlight was most likely scattered by electrostatically charged dust grains originating from the surface. It has since been demonstrated that this dust population could have serious implications for astronomical observations from the lunar surface. The lunar surface is electrostatically charged by the Moon s large-scale interaction with the local plasma environment and the photoemission of electrons due to solar ultra-violet (UV) light and X-rays. The like-charged surface and dust grains then act to repel each other, such that under certain conditions the dust grains are lifted above the surface. We present a dynamic fountain model which can explain how sub-micron dust is able to reach altitudes of up to approximately 100 km above the lunar surface. Previous static dust levitation models are most applicable to the heavier micron-sized grains in close proximity proximity to the surface, but they cannot explain the presence of extremely light grains at high altitudes. If we relax the static constraint applied to previous models, and instead assume that the grains are in constant motion (under the action of dynamic forces), a new picture emerges for the behavior of sub-micron lunar dust.
Derived from text
*Lunar Dust; Dynamic Models*

**20050175994** NASA Ames Research Center, Moffett Field, CA, USA
**Infrared Spectroscopic Analyses of Sulfate, Nitrate, and Carbonate-bearing Atacama Desert Soils: Analogs for the Interpretation of Infrared Spectra from the Martian Surface**
Dalton, J. B.; Dalton, J. B.; Ewing, S. A.; Amundson, R.; McKay, C. P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Atacama Desert of northern Chile is the driest desert on Earth, receiving only a few mm of rain per decade. The Mars climate may, in the past, have been punctuated by short-lived episodes of aqueous activity. The paleo-Martian environment may have had aqueous conditions similar to the current conditions that exist in the Atacama, and Mars soils may have formed with soil chemistry and mineralogy similar to those found in the Atacama. Remote and in-situ analysis of the Martian surface using infrared technology has a long heritage. Future investigations of the subsurface mineralogy are likely to build upon this heritage, and will benefit from real life lessons to be learned from terrestrial analog studies. To that end, preliminary results from a near- and mid-infrared spectroscopic study of Atacama soil profiled at a range of depths are presented.
Author
*Carbonates; Deserts; Infrared Spectroscopy; Mars Surface; Nitrates; Soils; Spectroscopic Analysis; Sulfates*

**20050175995** Chicago Univ., Chicago, IL, USA
**Vanadium K XANES of Synthetic Olivine: Valence Determinations and Crystal Orientation Effects**
Sutton, S. R.; Newville, M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Vanadium can exist in a large number of valence states in nature (2+?, 3+, 4+ and 5+) and determinations of V valence is therefore valuable in defining the oxidation states of earth and planetary materials over a large redox range. Synchrotron-based x-ray absorption near edge structure (XANES) spectroscopy is well-suited for measurements of V valence with ~micrometer spatial resolution and ~ppm elemental sensitivity. Applications of microXANES have been demonstrated for basaltic glasses. Applications to minerals are feasible but complicated by orientation effects and some results for spinel have been reported. Here we report initial results for olivine from laboratory crystallization experiments. The goal is to define the valence partitioning between olivine and melt and quantify the magnitude of orientation effects, the latter tested by measuring grains at a variety of orientations in the same charge.
Derived from text
*Crystals; Olivine; Valence; Vanadium; X Ray Absorption*

**20050175996** NASA Johnson Space Center, Houston, TX, USA, Kyushu Univ., Japan
**Infrared Micro-Spectroscopy of Organic and Hydrous Components in Some Antarctic Micrometeorites**
Suzuki, A.; Kebukawa, Y.; Nakashima, S.; Keller, L. P.; Zolensky, M. E.; Nakamura, T.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Micrometeorites extracted from Antarctic ice are a major source of extraterrestrial materials available for study in the laboratory. Materials in this size range are important because the peak in the mass flux distribution of extraterrestrial particles accreted by the Earth occurs for particles approximately 200 microns in diameter with a mass accretion rate estimated at approximately 40 x 10(exp 6) kilograms per year. It has been suggested that micrometeorites may have contributed much pre-biotic organic matter to the early Earth, but the types and abundances of organic material in micrometeorites are poorly known. We have conducted infrared (IR) micro-spectrocopy of small micrometeorites (about 100 microns in size) in order to characterize organic matter that is present in the particles. The obtained results were compared with IR signatures of representative carbonaceous chondrites.
Derived from text
*Antarctic Regions; Infrared Spectroscopy; Micrometeorites; Organic Materials; Hydroxides*

**20050175997** Academy of Sciences (USSR), Moscow, USSR
**Impact Erosion of Atmosphere: Some Results of Numerical Simulations for Vertical Impacts**
Svetsov, V. V.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Atmospheric cratering by impacts could result in substantial losses of atmospheres in the course of planetary evolution. However the values of atmospheric masses escaping planets after impacts and impactor masses retained by planets still remain to be determined with necessary accuracy. A simple tangent-plane approximation and the model of angular-dependent vapor-atmosphere interaction are imperfect and too crude. Numerical simulations of vertical impacts of comets and asteroids from 1 to 30 km in size at 20-50 kilometers per second show that the losses of the modern Earth atmosphere after these impacts are less than the amounts of volatiles delivered by the impactors. Estimates show that the impacts of bodies smaller in diameter than 1 km are likely to be more efficient in atmospheric erosion because (as a first approximation) the escaping mass of heated air is proportional to an impactor cross-section while the supply with atmophile elements is proportional to an impactor mass. In this study numerical simulations of vertical impacts have been made for impactor diameters D from 75 m to 10 km and velocities V from 15 to 70 km/s. The aim was to calculate the losses of air and retained masses of impactors.
Derived from text
*Erosion; Simulation; Earth Atmosphere; Hypervelocity Impact*

**20050175998** Imperial Coll. of Science and Technology, London, UK
**Patterned Substrates for the Phoenix Microscopy Station**
Sykulska, H.; Vijendran, S.; Pike, W. T.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The aim of this work is to understand how Martian analog soils and dust adhere to substrates of different materials and topography. The Phoenix MECA package includes a microscopy station with an optical microscope and an atomic force microscope (AFM). Samples of the Martian soil and dust will be transferred into the spacecraft from the robotic arm to the microscopes via individual substrates. The design of these substrates are crucial for preparing the samples for microscopy,

especially for the AFM which has a very limited field of view and height range. In addition, the AFM and substrates are mounted vertically, so good adhesion of the particles to the substrates will be critical.
Derived from text
*Mars Surface; Optical Microscopes; Substrates; Atomic Force Microscopy*

**20050175999** Science Applications International Corp., Chantilly, VA, USA
**Tracing Oxygen Fugacity in Asteroids and Meteorites Through Olivine Composition**
Sunshine, J. M.; Bus, S. J.; Burbine, T. H.; McCoy, T. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Olivine absorptions are known to dominate telescopic spectra of several asteroids. Among the meteorite collection, three groups (excluding Martian meteorites), the pallasites, brachinites, and R group chondrites are plausible analogs to olivine-rich asteroids in that they are dominated by olivine. These meteorite groups have distinct petrologic origins. The primitive achondrite brachinites (which include both depleted and undeleted subgroups) are products of relatively minor differentiation and evolved in oxidizing environments. R chondrites are also thought to have formed in high oxygen states, but are closely related to ordinary chondrites (yet with their own distinct compositions and oxygen isotopic signatures). In contrast, pallasites, widely thought to be mantle components from much more evolved bodies, formed in more reducing environments. Petrologic indicators that are identifiable in spectral data must be used in order to infer the petrologic history of asteroids from surveys of their actual population. As discussed below, olivine composition (e.g. Fa#) can provide key constraints in exploring the origin and significance of olivine dominated asteroids.
Derived from text
*Asteroids; Meteorites; Oxygen; Olivine*

**20050176000** Lawrence Livermore National Lab., Livermore, CA, USA
**Nitrogen Isotopic Anomalies in a Hydrous Interplanetary Dust Particle**
Smith, J. B.; Dai, Z. R.; Weber, P. K.; Graham, G. A.; Hutcheon, I. D.; Bajt, S.; Ishii, H.; Bradley, J. P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations
Contract(s)/Grant(s): NASA Order W-19894; W-7405-eng-48; DE-AC03-76F00098; NAG5-10623; NAG5-10696; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Interplanetary dust particles (IDPs) collected in the stratosphere are the fine-grained end member (5 - 50 microns in size) of the meteoritic material available for investigation in the laboratory. IDPs are derived from either cometary or asteroidal sources. Some IDPs contain cosmically primitive materials with isotopic signatures reflecting presolar origins. Recent detailed studies using the NanoSIMS have shown there is a wide variation of isotopic signatures within individual IDPs; grains with a presolar signature have been observed surrounded by material with a solar isotopic composition. The majority of IDPs studied have been anhydrous. We report here results from integrated NanoSIMS/FIB/TEM/Synchrotron IR studies of a hydrous IDP, focused on understanding the correlations between the isotopic, mineralogical and chemical compositions of IDPs.
Author
*Nitrogen Isotopes; Anomalies; Interplanetary Dust; Mineralogy*

**20050176001** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Parga Chasma: Coronae and Rifting on Venus**
Smrekar, S. E.; Stofan, E. R.; Buck, W. R.; Martin, P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The majority of coronae (quasicircular volcano-tectonic features) are found along rifts or fracture belts, and the majority of rifts have coronae [e.g. 1,2]. However, the relationship between coronae and rifts remains unclear [3-6]. There is evidence that coronae can form before, after, or synchronously with rifts [3,4]. The extensional fractures in the rift zones have been proposed to be a result of broad scale upwelling and traction on the lower lithosphere [7]. However, not all rift systems have a significant positive geoid anomaly, as would be expected for an upwelling site [8]. This could be explained if the rifts lacking anomalies are no longer active. Coronae are generally accepted to be sites of local upwelling [e.g. 1], but the observed rifting is frequently not radial to the coronae and extends well beyond the coronae into the surrounding plains. Thus the question

remains as to whether the rifts represent regional extension, perhaps driven by mantle tractions, or if the coronae themselves create local thinning and extension of the lithosphere. In the first case, a regional extension model should be consistent with the observed characteristics of the rifts. In the latter case, a model of lithospheric loading and fracturing would be more appropriate. A good analogy may be the propagation of oceanic intraplate volcanoes [9].
Derived from text
*Coronas; Volcanoes; Geoids; Geological Faults; Lithosphere; Tectonics*

**20050176002** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Global Admittance Estimates of Elastic and Crustal Thickness of Venus: Results from Top, Hot Spot, and Bottom Loading Models**
Smrekar, S. E.; Anderson, F. S.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have calculated admittance spectra using the spatio-spectral method [14] for Venus by moving the central location of the spectrum over a 1 grid, create 360x180 admittance spectra. We invert the observed admittance using top-loading (TL), hot spot (HS), and bottom loading (BL) models, resulting in elastic, crustal, and lithospheric thickness estimates (Te, Zc, and Zl) [0]. The result is a global map for interpreting subsurface structure. Estimated values of Te and Zc concur with previous TL local admittance results, but BL estimates indicate larger values than previously suspected.
Derived from text
*Crusts; Thickness; Lithosphere; Estimating; Electrical Impedance*

**20050176003** NASA Johnson Space Center, Houston, TX, USA
**Contribution of Organic Material to the Stable Isotope Composition of Some Terrestrial Carbonates as Analogs for Martian Processes**
Socki, Richard A.; Gibson, Everett K., Jr.; Bissada, K. K.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Understanding the isotopic geochemistry of terrestrial carbonate formation is essential to understanding the evolution of the Martian atmosphere, hydrosphere, and potential biosphere. Carbonate minerals, in particular, are important secondary minerals for interpreting past aqueous environments, as illustrated by the carbonates present in ALH84001 [1]. Models for the history of Mars suggest that the planet was warmer, wetter, and possessed a greater atmospheric pressure within the first billion years as compared to present conditions [2],[3],[4], and likely had an active hydrologic cycle. Morse and Marion [5] point out that associated with this hydrologic cycle would be the active chemical weathering of silicate minerals and thus consumption of atmospheric CO2 and deposition of carbonate and silica. It is during this warmer and wetter period of Martian history that surface and/or near-surface conditions would be most favorable for harboring possible microbiological life. Carbonates within ALH84001 offer evidence that fluids were present at 3.9 Gy on Mars [6]. A more through understanding of the effects of aqueous weathering and the potential contribution of organic compounds on the isotopic composition of Martian carbonate minerals can be gained by studying some terrestrial occurrences of carbonate rocks.
Derived from text
*Atmospheric Composition; Organic Materials; Isotopes; Carbonates; Geochemistry; Mars Atmosphere; Atmospheric Pressure*

**20050176004** Geological Survey, Flagstaff, AZ, USA
**Deconvolution of Cassini VIMS Titan Cubes into Atmospheric Spectral Scattering, Surface Topographic, and Surface Spectroscopic Components**
Soderblom, L. A.; Brown, R. H., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cassini Visual Infrared Mapping Spectrometer (VIMS) collects spectral imaging cubes at 352 wavelengths from 0.3 to 5.2 mm [1]. The VIMS data discussed here were acquired during the Ta flyby of Titan on October 26, 2004. This study focuses on analysis of the 256 near-infrared spectra (0.88 to 5.2 mm) of a particularly high resolution VIMS cube (CM1477496141_1 also released as Cassini PIA06982). The cube covers an unusual bright feature located near 8 N, 144 W and has a resolution of approx.2.5 km/pixel (fig 1.). Sotin and colleagues [2] suggest this may be a cryovolcanic center. They

also note an exceedingly important aspect of this cube: surface topography is quite apparent as E-W linear ridges and valleys, most clearly in the darker regions south of the bright spiral feature in fig. 1.
Derived from text
*Atmospheric Scattering; Spectroscopy; Topography; Infrared Imagery; Imaging Techniques; Infrared Spectrometers*

**20050176005** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**Geophysical Constraints on the Composition and Structure of the Martian Interior**
Sohl, F.; Schubert, G.; Spohn, T.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Important geophysical constraints on the bulk composition and interior structure of Mars are provided by the knowledge of its mean density p an polar moment-of-inertia (Mol) factor C/MR(sub p)(sup 2). Whereas the former can be calculated from the planet's mass M and radius R(sub p) and has been known relatively well for a long time, the polar moment of inertia C has been derived only recently from a combined analysis of Mars Global Surveyor tracking and Mars Pathfinder amd Viking Lander range and Doppler data. A re-analysis of the data resulted in the most recent value of C/MR(sub p)(sup 2) = 0.3650+/-0.0012, a significantly lower value than the most often used value of C/MR(sub p)(sup 2) = 0.3662+/-0.0017. The improved value is consistent with the model of a hydrostatic planet with nonhydrostatic contributions to the Mol factor entirely related to the axisymmetric distribution of topographic loads about Tharsis.
Derived from text
*Geophysics; Mars Surface; Topography; Composition (Property); Loads (Forces)*

**20050176006** Nantes Univ., France
**Mineralogy of the Magnetic Anomaly Site South of Syrtis Derived from OMEGA/Mars Express Hyperspectral Data**
Sotin, C.; LeMouelic, S.; Combe, J.-P.; Quesnel, Y.; Langlais, B.; Mustard, J.; Ladai, A.; Bibring, J.-P.; Langevin, Y.; Gendrin, A.; Erard, S.; Gondet, B., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Global Surveyor has detected a strong magnetic field of lithospheric origin on Mars [1]. It is at least one order of magnitude larger than the Earth's lithospheric field. Both its geographical distribution and its high intensity have raised the question of the origin of these anomalies. The possible associated materials are mainly iron bearing minerals (magnetite, hematite, pyrrhotite, pure iron,..). Plausible processes include volcanism or plutonism, i.e. thermal remanent magnetization (TRM), or hydration and weathering, i.e. crystallization remanent magnetization (CRM) [2]. The serpentinization process provides a geological model. Under the assumptions of an hydrated basaltic crust with mantle convection and Earth-like dynamo, the interaction of enstatite with water could produce lizardite and magnetite, which records the magnetic field. Similarly, olivine altered by water produces serpentine and magnetite. Spectra of mafic minerals (pyroxenes and olivines) and their alteration products (lizardite, serpentine,..) display diagnostic absorption bands in the visible-infrared range. The OMEGA imaging spectrometer onboard Mars Express provides hyperspectral images of the martian surface. We use this unprecedented data set to investigate mineralogical heterogeneities and study the possible link with local magnetic anomalies in the Syrtis Major area. A detailed investigation of the mineralogy of this region is described in Mustard et al. (this volume).
Derived from text
*Mineralogy; Magnetic Anomalies; Mars Express; Absorption Spectra; Crusts; Hydration; Mars Surface*

**20050176007** Washington Univ., Saint Louis, MO, USA
**MER Analyst's Notebook: Integrating Data and Documentation for Mission Playback**
Stein, T. C.; Arvidson, R. E.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The MER Analyst's Notebook provides access to the MER mission data archives by integrating sequence information, engineering and science data, and documentation into web-accessible pages to facilitate mission 'replay.' This provides context needed by scientists to understand observations made by the nondeterministic mission. The MER Notebook is not an operational but rather a reference tool made available to participating scientists and to the Planetary Data System (PDS) community. Data and documentation are transferred from the Jet Propulsion Laboratory (JPL) to Washington University each day throughout the mission and are ingested into the MER science team version of the Notebook. The public version of the

Analyst's Notebook is comprised of peer-reviewed, released data and is updated coincident with quarterly PDS data releases.
Derived from text
*Data Integration; Space Missions; Mars Exploration; Mars Roving Vehicles*

**20050176008** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Cassini CIRS Observations of Saturn's Rings**
Spilker, Linda J.; Pilorz, Stuart H.; Wallis, Brad D.; Brooks, Shawn M.; Edgington, Scott G.; Flasar, F. Michael; Pearl, John C.; Showalter, Mark R.; Ferrari, Cecile; Achterberg, Richard K., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the spring of 2004, during Cassini s approach to Saturn, the Cassini Composite Infrared Spectrometer (CIRS) began acquiring thermal spectra of Saturn s rings. CIRS is a Fourier-transform spectrometer that measures radiation in the thermal infrared from 7 microns to 1 millimeter (1400 to 10/cm). CIRS has a set of 21 detectors, consisting of two 1 x 10 linear arrays with a pixel size of 0.3 mrad, and one 4 mrad circular detector. Just after the completion of the Saturn orbit insertion (SOI) burn, CIRS performed an especially high spatial resolution scan of portions of Saturn s A, B and C rings. In the months following SOI, additional ring measurements have been obtained, including radial scans on the lit and unlit sides of the rings, and azimuthal scans across the shadowed regions of the A, B and C rings.
Derived from text
*Saturn Rings; Infrared Spectrometers; Millimeter Waves; Azimuth; Fourier Transformation; Infrared Radiation; Linear Arrays*

**20050176009** Field Museum of Natural History, Chicago, IL, USA
**Al-Mg Isotopic Systematics in the Angrite Sahara 99555 and the Primitive Achondrite Brachina**
Spivak-Birndorf, L.; Wadhwa, M.; Janney, P. E.; Foley, C. N.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Understanding the role of the extinct radionuclide Al-26 (t(sub 1/2) approx.0.72 My) in the early solar system has long been an important problem in cosmochemistry. The Al-26-Mg-26 decay system has been applied as a fine scale chronometer for early solar system events [1,2,3]. There has also been a long standing debate about the potential for Al-26 as a source of heat in the melting and differentiation of early solar system materials [4,5]. So far, definitive evidence for the in situ decay of Al-26, inferred from excesses of its daughter isotope Mg-26, has only been reported in a small number of differentiated meteorites [6-9].
Derived from text
*Aluminum Isotopes; Magnesium Isotopes; Radioactive Isotopes; Achondrites; Meteorites; Extinction; Melting*

**20050176010** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Distribution and Abundance of Mars' Atmospheric Argon**
Sprague, A. L.; Boynton, W. V.; Kerry, K. E.; Nelli, Steven; Murphy, Jim; Reedy, R. C.; Metzger, A. E.; Hunten, D. M.; Janes, K. D.; Crombie, M. K.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations
Contract(s)/Grant(s): 122-87-26; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One and one half Mars years (MY 26 and 27) of atmospheric Argon measurements are described and studied in the context of understanding how Argon, a minor constituent of Mars atmosphere that does not condense at Mars temperatures, can be used to study martian circulation and dynamics. Argon data are from the 2001 Mars Odyssey Gamma Subsystem (GS) of the suite of three instruments comprising the Gamma Ray Spectrometer (GRS). A comprehensive data analysis including gamma-ray production and attenuation by the atmosphere is included. Of particular interest is the enhanced abundance of Ar over the observed Ar abundance at lower latitudes at south (up to a factor of 10) and north (up to a factor of 4) polar regions during winter. Calibration of the measurements to actual Ar abundance is possible because GS measurements cover the same latitude and season as measurements made by the gas chromatograph mass spectrometer (GCMS) on Viking Landers 1 and 2 (VL1 and VL2). [2].
Derived from text
*Argon; Mars Atmosphere; Gamma Rays; Planetary Temperature; Gas Chromatography*

**20050176011** Idaho Univ., Moscow, ID, USA

**Evidence for Polar Wander in the Gravity and Magnetic Fields of Mars**

Sprenke, Kenneth F.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Evidence for polar wander on Mars can be found in the gravitational and magnetic fields of the planet. The gravity field of Mars when corrected for the geometry of Tharsis, shows a residual geoid that was apparently rotationally unstable prior to the rise of Tharsis. Stable spin axis positions on the nonhydrostatic residual figure of Mars are 15deg to 90deg from the present-day poles, suggesting a similar amount of polar wander with the rise of Tharsis. The most stable spin axis position on the residual geoid is at 30degE, 32degS and 210degE, 32degN. The magnetic field of Mars shows an alignment of magnetic doublet anomalies with the direction of magnetization. A geostatistical analysis of polarity alignments in the martian magnetic field reveals the general pattern of magnetization, and locates the paleopoles near 50degE, 40degS and 230degE, 40degN. This result, which is consistent with the gravitational result, suggests significant polar wander since the martian crust was magnetized.

Derived from text

*Gravitational Fields; Planetary Magnetic Fields; Mars Surface; Planetary Geology; Magnetic Anomalies*

**20050176012** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

**Relationships Between Depths of Water Ice Absorption Bands-Indicator of Changes in Particle Size of Water Ice on the Surface of Ganymede**

Stephan, K.; Jaumann, R.; Hibbitts, C. A.; Hansen, G. B.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During the Galileo Mission Ganymede, one of the icy Galilean satellites was observed with the Near Infrared Mapping Spectrometer (NIMS) and the Solid State Imaging System (SSI). NIMS observed the satellite in the spectral range between 0.7 and 5 microns with spatial resolutions up to 3 km/pixel. A detailed analysis of spectral variations across the surface of Jupiter's satellite Ganymede included relationships between the well known absorption bands of water ice at 1.5 and 2 microns. The ratio of the measured band depths reveals global differences which cannot be explained by compositional changes. Images acquired by SSI with spatial resolutions up to 50 times better than NIMS provided the geomorphological context of the study. Both data sets were geometrically reprojected to make a comparison between them possible.

Author

*Absorption Spectra; Ganymede; Geomorphology; Satellite Surfaces; Particle Size Distribution; Water Depth; Ice*

**20050176013** Lunar and Planetary Inst., Houston, TX, USA

**Inferring Early Mars Climate from Comparison of Drainage Basins' Morphologies on Mars and Earth**

Stepinski, T. F.; Stepinski, A. P.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Morphologies of Martian and terrestrial drainage basins are encapsulated by their circularity functions enabling objective and quantitative comparison. A neural net technique is used to construct a geomorphic similarity map for a population of basins. First, we study a control population of terrestrial basins for which climate data is available. We establish a correlation between basin s morphology and climate. Second, we study a sizable population of terrestrial and Martian basins. We find a systematic difference between morphologies of basins on the two planets. By extrapolating morphology-climate correlation to Martian basins, this difference could be understood in terms of climatic differences with Martian basins developing in extremely dry climate.

Author

*Climatology; Drainage; Mars (Planet); Structural Basins; Morphology; Earth (Planet)*

**20050176014** NASA, Washington, DC, USA

**Mini-SAR: An Imaging Radar for the Chandrayaan-1 Mission to the Moon**

Spudis, Paul D.; Bussey, Ben; Lichtenberg, Chris; Marinelli, Bill; Nozette, Stewart; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The debate on the presence of ice at the poles of the Moon continues. We will fly a small imaging radar on the Indian Chandrayaan mission to the Moon, to be launched in September, 2007. Mini-SAR will map the scattering properties of the lunar poles, determining the presence and extent of polar ice.
Derived from text
*Ice; Imaging Radar; Moon*

**20050176015** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**NASA's New Millennium ST-9 Project**
Stevens, C. M.; Stocky, J. F.; Nelson, R. M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 1 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NASA's New Millennium Program (NMP), has inaugurated the Space Technology 9 (ST9) mission, an integrated system validation project. This is the latest of a series of in-space technology validation activities that began in 1996 with Deep Space 1. The New Millennium Program identifies the technological capabilities needed for future space science missions and the technology advances that will help provide those capabilities.
Derived from text
*NASA Programs; Space Missions; Aerospace Sciences; Systems Integration*

**20050176016** University of Northern Illinois, De Kalb, IL, USA
**Comparing Topographic Profiles on Venus and Earth**
Stoddard, P. R.; Jurdy, D. M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Atla and Beta Regiones on Venus are both marked by pronounced geoid and topographic highs. They are found at nodal points in a network of chasmata. Chasmata are linear to arcuate troughs with ridges extending thousands of kilometers, and may be active rift zones. A third type of tectonic feature, coronae, are quasi-circular volcanic constructs large enough to depress the lithosphere upon which they sit. They have been classified as domal, circular, and calderic which may reflect an evolutionary sequence from young to old. As chasmata congregate at the regiones, coronae are noticeably absent. Previous studies have used various forms of data, such as crater morphology, terrain attitude, admittance, etc., to better understand the evolution and connection of these features. Here, we use topographic profiles to look for well-understood terrestrial analogs to Venusian features.
Derived from text
*Planetary Geology; Topography; Venus (Planet); Earth (Planet); Tectonics*

**20050176017** Southwest Research Inst., San Antonio, TX, USA
**Development of a Surface Enhanced Raman Spectroscopy Technique for Identification of Biomarkers on Mars**
Sridhar, N.; Dunn, D. S.; Price, K. T.; Miller, M. A.; Pabalan, R. T.; Abrajano, T. A.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the most important goals for the Mars missions is obtaining evidence of past or present life. In-situ analyses using a suite of on-board instruments on a number of small, scout missions to Mars are envisaged prior to more detailed sample return missions. There is a keen interest in Raman spectroscopy as an in-situ analytical tool because of the possibility of obtaining molecular and mineralogical information. The main limitations of Raman spectroscopy are its inherently low intensity compared to the elastically scattered laser intensity and interference from fluorescence due to the electronic excitation of the molecule by the laser. Analysis of biomarkers indicative of life on Mars will require higher sensitivity and signal to noise ratio than normal Raman spectroscopy can offer. Surface Enhanced Raman Spectroscopy (SERS) is a phenomenon whereby the Raman intensity is increased by as much as a million fold due to the presence of nano-size silver or other appropriate metal particles on the surface to be analyzed [1,2]. Therefore, SERS technique may be useful for analyzing small concentrations of biomarkers in the Mars soil or minerals. SERS requires extremely close proximity of the molecule to be analyzed to the metal particles that form the SERS substrate. Such close proximity is difficult to achieve for solid phase. An 'inverted' SERS technique is demonstrated where SERS-sensitive metal nanoparticles are deposited on the material to be analyzed.
Derived from text
*Raman Spectroscopy; Mineralogy; Metal Particles; Mars Surface; Excitation*

**20050176018** NASA Johnson Space Center, Houston, TX, USA

**Genesis Recovery Processing**

Stansbery, E. K., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Genesis spacecraft, launched in August 2001 to collect samples of the solar wind, returned to Earth on 8 September 2004. The Sample Return Capsule (SRC) failed to deploy its drogue parachute and parafoil and subsequently impacted the Utah Test and Training Range (UTTR) at an estimated 310 kph (193 mph). The goal of the Genesis mission to collect and return samples of the solar wind for precise elemental and isotopic analysis provides the scientific community with a unique set of materials to aid in understanding the origin of our solar system. The spacecraft orbited the Earth-Sun L1 point for 29 months exposing a suite of fifteen types of ultrapure, ultraclean materials in several different locations. Most of the materials were mounted on fixed or deployable wafer panels called collector arrays . A few materials were mounted as targets in the focal spot of an electrostatic mirror (the concentrator ). Other materials were strategically placed to maximize the area for solar-wind collection.

Derived from text

*Solar Wind; Isotopes; Chemical Analysis; Solar System; Electrostatics*

**20050176019** Hawaii Univ., Honolulu, HI, USA

**Preliminary Analysis of Nakhlite MIL 03346, with a Focus on Secondary Alteration**

Stopar, J. D.; Lawrence, S. J.; Lentz, R. C. F.; Taylor, G. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

MIL 03346 is a new Antarctic Martian meteorite that has been classified as a clinopyroxenite and nakhlite based on its abundant calcic pyroxene. We have completed a preliminary petrologic analysis of MIL 03346 thin section 94 and present our findings here. Several brownish patches are visible under optical microscopy and are likely associated with alteration. Similar discoloration is observed on all of the olivine grains present. Characterizing alteration processes in this meteorite is important for understanding aqueous alteration on Mars. Models of dissolution rates have been explored to constrain the duration of aqueous processes over Martian history. However, aqueous alteration is a complex process, and here, we explore the alteration of olivine and deposition of secondary minerals in order to better understand Martian aqueous processes.

Derived from text

*Antarctic Regions; Nakhlites; Mars Surface; Revisions*

**20050176020** NASA Johnson Space Center, Houston, TX, USA

**Genesis Preliminary Examination: Ellipsometry Overview**

Stansbery, E. K.; McNamara, K. M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Genesis spacecraft returned to Earth on September 8, 2004, experiencing a non-nominal reentry in which both the drogue and main parachutes failed to deploy causing the capsule to impact the surface of the UTTR desert at a speed of approximately 310 kph (193 mph). The impact caused severe damage to the capsule and a breach of the science canister in the field. The science canister was recovered and transported to the cleanroom at UTTR within approximately 8 hours of reentry. Although the ground water table did not rise to canister level before removal, damp soil and debris from the heat shield and other spacecraft components did enter the canister and contaminate some collector surfaces. The objective of preliminary examination of the Genesis collectors is to provide the science community with the information necessary to request the most useful samples for their analysis.

Derived from text

*Accumulators; Ground Water; Ellipsometry; Water Tables; Samplers; Aerosols*

**20050176021** Kharkov Univ., Kharkov, Ukraine

**Adhesion Forces Between Regolith Particles: Constraints on the Conditions of Electrostatic Lofting of Dust**

Starukhina, L. V.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Sunlight scattering on electrostatically lofted fine dust is considered to produce the horizon glow observed at the lunar

terminators during the Apollo expeditions [1]. At the dayside of the Moon, regolith surface becomes positively charged due to photoelectron emission; at the nightside, the charge is negative due to electrons of the solar wind. Particle detachment from the surface under the action of a force of still unknown nature (e.g., seismic or electrostatic) may be the key to understanding of the origin of the ponded deposits on Eros [2]. In most theories of dust lofting developed so far, repulsion of regolith particles from the surface was compared with gravitational attraction of the particles to the parent body, so gravity was supposed to be the only or the main obstacle that prevents particle lofting. This is valid in particle flight, but not at the moment of the start. In the approach of gravity-controlled detachment, limitations on the size of lofting particles are rather weak. E. g., at surface potentials of a few volts, gravity force becomes negligible as compared to the electrical force at sizes less than or equal to 10 microns.
Derived from text
*Adhesion; Regolith; Dust; Lofting; Deposits; Gravitation*

**20050176022** New Mexico Tech, Albuquerque, NM, USA
**Theoretical Evaporite Karst Development on Mars**
Staffrd, K. W.; Boston, P. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 1 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent confirmation of stratified sulfate-rich rocks on Mars [1], [2], [3] indicates that significant evaporite deposits may exist both exposed at the surface and in the subsurface. The presence of evaporites suggests that evaporite karst development similar to that observed on Earth may be present.
Derived from text
*Sedimentary Rocks; Mineral Deposits; Karst; Sulfates*

**20050176023** Bologna Univ., Italy
**Fossil Endolithic Cyanobacteria in Evaporites: Implications for the Astrobiological Exploration**
Stivaletta, N.; Barbieri, R.; Marinangeli, L.; Ori, G. G.; Bosco, M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The search for Terrestrial analogues of Martian environments focuses on certain conditions in which physical and chemical parameters exceed those commonly experienced in Earth-like ambient conditions. These environmental conditions approach the known limits to terrestrial life [1]. Arid and saline environments are thought to be good terrestrial analogues of Martian environments that host or may have hosted life. Evaporite deposits are indicators of bodies of water and this has implications for astrobiology. Evaporites allow to test the preservation potential of biologically induced structures because of the rapid sealing provided by precipitating minerals. Moreover, they allow an evaluation of the fossilization conditions for specific groups of extremophiles, such as moderate and extreme halophiles. The surface of Mars has harsh conditions, therefore life, if ever it existed on its surface, might have withdrawn into more protected environments [2]. On Earth, endolithic microorganisms in hot and cold deserts are an example of how life has withdrawn into protected zones. These microniches provide protection from dessication, rapid temperature variation, UV radiation flux, and, in turn, they allow a sufficient light penetration for photosynthetic processes [3]. In this study we document morphologies interpreted as the product of endolithic cyanobacterial colonies and microbial-derived biosedimentary structures from modern spring mounds developed in Chott el Jerid, a complex of arid and saline environments of southern Tunisia. These mounds are morphologically distinct from eolian landforms, such as dunes, and are characterized by sands and salt precipitation (especially gypsum) that form superficial crusts [4]. The microbial-derived, mineralized (subfossil) morphologies are preserved in these gypsum crusts.
Derived from text
*Crusts; Deposits; Landforms; Microorganisms*

**20050176025** NASA Ames Research Center, Moffett Field, CA, USA
**Field Simulation of a Drilling Mission to Mars to Search for Subsurface Life**
Stoker, C. R.; Lemke, L. G.; Cannon, H.; Glass, B.; Dunagan, S.; Zavaleta, J.; Miller, D.; Gomez-Elvira, J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The discovery of near surface ground ice by the Mars Odyssey mission and the abundant evidence for recent Gulley features observed by the Mars Global Surveyor mission support longstanding theoretical arguments for subsurface liquid water on Mars. Thus, implementing the Mars program goal to search for life points to drilling on Mars to reach liquid water,

collecting samples and analyzing them with instrumentation to detect in situ organisms and biomarker compounds. Searching for life in the subsurface of Mars will require drilling, sample extraction and handling, and new technologies to find and identify biomarker compounds and search for living organisms. In spite of its obvious advantages, robotic drilling for Mars exploration is in its technological infancy and has yet to be demonstrated in even a terrestrial field environment.
Derived from text
*Ice; Extraterrestrial Water; Extraction; Mars Exploration; Organisms*

**20050176026** NASA Ames Research Center, Moffett Field, CA, USA
**Characterization of a Subsurface Biosphere in a Massive Sulfide Deposits at Rio Tinto, Spain: Implications for Extant Life on Mars**
Stoker, C. R.; Stevens, T.; Amils, R.; Gomez-Elvira, J.; Rodriquez, N.; Gomez, F.; Gonzalez-Toril, E.; Aguilera, A.; Fernandez-Remolar, D.; Dunagan, S., et al.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The recent discovery of abundant sulfate minerals, particularly Jarosite by the Opportunity Rover at Sinus Merdiani on Mars has been interpreted as evidence for an acidic lake or sea on ancient Mars [1,2], since the mineral Jarosite is soluble in liquid water at pH above 4. The most likely mechanism to produce sufficient protons to acidify a large body of liquid water is near surface oxidation of pyrite rich deposits [3]. The acidic waters of the Rio Tinto, and the associated deposits of Hematite, Goethite, and Jarosite have been recognized as an important chemical analog to the Sinus Merdiani site on Mars [4]. The Rio Tinto is a river in southern Spain that flows 100 km from its source in the Iberian pyrite belt, one of the Earth s largest Volcanically Hosted Massive Sulfide (VHMS) provinces, into the Atlantic ocean. The river originates in artesian springs emanating from ground water that is acidified by the interaction with subsurface pyrite ore deposits. The Mars Analog Rio Tinto Experiment (MARTE) has been investigating the hypothesis that a subsurface biosphere exists at Rio Tinto living within the VHMS deposit living on chemical energy derived from sulfur and iron minerals. Reduced iron and sulfur might provide electron donors for microbial metabolism while in situ oxidized iron or oxidants entrained in recharge water might provide electron acceptors.
Derived from text
*Biosphere; Sulfides; Extraterrestrial Life; Mineral Deposits; Sulfates; Iron Oxides; Ground Water*

**20050176027** StoneAeroSPACE, Gaithersburg, MD, USA
**The DEPTHX Project: Pioneering Technologies for Exploration of Extraterrestrial Aqueous Channels**
Stone, W. C.; Greenberg, R.; Durda, D. D.; Franke, E. A.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Liquid water is not unique to our own planet, and the strategy of following the path to extraterrestrial water is likely to produce great discoveries, especially in the area of astrobiology. Reaching liquid water will involve not just landing on a target planet, but penetrating below the surface with technologies that will permit exploration and characterization of the aqueous environment. For example, Europa s global ocean lies below many kilometers of ice. In anticipation of missions to explore of Europa s ocean, considerable planning and technology development has addressed the problem of drilling, melting, or punching through the thick ice with a variety of possible types of robotic penetrators [e.g. 1]. Similarly, consideration has been given to submarines that might be launched into the subsurface ocean after the ice is penetrated [e.g. 2]. Considerable attention has been paid to Antarctica s Lake Vostok as an analog to Europa, because of these common issues of penetration through thick ice to a pristine aqueous environment. The most interesting aqueous environments may be within channels of liquid through solid strata, such as where Europa s ocean may penetrate hot springs on its floor [3] or tidal cracks in its surface ice [e.g. 4, 5]. Those settings may provide conditions uniquely hospitable to extraterrestrial life.
Derived from text
*Drilling; Extraterrestrial Water; Extraterrestrial Oceans; Marine Technology; Extraterrestrial Life; Exobiology*

**20050176028** Indiana Univ., Bloomington, IN, USA
**How Can a Fingerprint of Primitive Bacteria Look Like? A Carbon and Iron Stable Isotopic Study of an Iron-oxidizing Bacterial Community**
Schieber, J.; Beard, B. L.; Strapoc, D.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Judging from recent data, Martian surface waters of the past were rich in iron and sulfate [1], suggesting that metabolic pathways based on chemical reactions that utilize dissolved iron may have been employed by ancient life forms. On Earth, such pathways are abundantly exemplified by microbes that oxidize or reduce iron [2,3]. Microbial communities centered on these kinds of bacteria may be viable Mars analogs, and research on their biosignatures may help us to identify indications of past microbial life forms on Mars. Therefore we conducted a pilot study of carbon and iron isotopic characteristics of iron oxidizing bacteria in a small creek SE of Bloomington, Indiana (Fig. 1). We ve chosen these two elements, because carbon is major building block of life as we know it and iron provides a chemical energy for these organisms. The apparent exclusive occurrence of the mat biota in our study near a source of iron-rich (12.5 ppm Fe) waters, seems to suggest that iron availability confers a tangible benefit. This benefit could be (a) energy gain or alternatively a (b) reduction of ambient pO2. The latter can be considered a benefit because these microbes are microaerophilic [4]. Carbon isotopes: Leptothrix, the predominant mat building organism, is a chemoheterotroph and requires an organic carbon source to flourish [5]. Because we observed that the mats recovered within about a week

Derived from text

*Carbon; Iron; Isotopes; Bacteria; Chemical Reactions; Sulfates; Oxidation; Metabolism; Microorganisms*

**20050176030** University of Western Ontario, London, Ontario, Canada

**Lunar Laser Ranging and the Location of Lunokhod 1**

Stooke, P. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Five laser retroreflectors were emplaced on the Moon during the 1960s and 1970s. Four are routinely used today for ranging and associated studies of lunar dynamics, geophysics and geodesy. The fifth, deployed on Lunokhod 1, has not been detected since early 1971. Its location, the most northerly of any lunar landing site, would be a useful addition to current ranging options. On the assumption that the reflector is functional but is not being accurately targeted on the lunar surface, a revised location is proposed to assist new efforts to obtain laser returns.

Derived from text

*Lunar Rangefinding; Lunokhod Lunar Roving Vehicles; Retroreflectors; Lunar Landing Sites*

**20050176031** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Impact of Lunar Dust on the Exploration Initiative**

Stubbs, T. J.; Vondrak, R. R.; Farrell, W. M.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

From the Apollo era it is known that dust on the Moon can cause serious problems for exploration activities. Such problems include adhering to clothing and equipment, reducing external visibility on landings, and causing difficulty to breathing and vision within the spacecraft. An important step in dealing with dust-related problems is to understand how dust grains behave in the lunar environment. All astronauts who walked on the Moon reported difficulties with lunar dust. Eugene Cernan, commander of Apollo 17, stated that one of the most aggravating, restricting facets of lunar surface exploration is the dust and its adherence to everything no matter what kind of material, whether it be skin, suit material, metal, no matter what it be and it's restrictive friction-like action to everything it gets on. Dust has also been highlighted as a priority by the Mars Exploration Program Assessment Group (MEPAG): 1A. Characterize both aeolian dust and particulates that would be kicked up from the martian regolith by surface operations of a human mission with fidelity sufficient to establish credible engineering simulation labs and/or software codes on Earth. We shall briefly describe the properties of lunar dust and its impact on the Apollo astronauts, and then summarize three main problems areas for understanding its behavior: Dust Adhesion and Abrasion, Surface Electric Fields and Dust Transport. These issues are all inter-related and must be well understood in order to minimize the impact of dust on lunar surface exploration.

Derived from text

*Lunar Dust; Moon; Lunar Surface; Lunar Environment*

**20050176032** Tokyo Univ., Japan

**The Formation of Radial Linements on Fluidized Ejecta**

Suzuki, A.; Kumagai, I.; Nagata, Y.; Kurita, K.; Barnouin-Jha, O. S.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Many Martian craters possess peculiar ejecta whose fluidized morphologies differ from other ballistic ejecta seen in dry, airless environment. An important subclass of such fluidized ejecta is found at pedestal craters. These ejecta typically possess concave inner lobe consisted of near rim moat, outward rise and distal cliff, and faint outer lobe without distinct distal rampart. These ejecta are also sometimes classified as double layered ejecta (DLE). Depositional features of the inner and the outer lobe are so distinct that there would be at least two different processes of ejecta sedimentation in a single impact. New imaging dataset (MOC and THEMIS) revealed that the pedestal craters have numerous radial lineations on their ejecta. These lineations continue from the surface of the inner lobe to that of the outer lobe, indicating that the flow after sedimentation of the inner lobe generates these lineations. Mouginis-Mark proposed that these lineations are only visible on pedestal craters. Two factors are typically invoked to describe the flow of ejecta at Martian craters: (1) subsurface volatiles that are incorporated into the ejecta; and (2) the dynamic response of the atmosphere subsequent to an impact. In this study, we have conducted water tank experiments examining the interaction between a vortex ring and a particle layer to see how the atmosphere displaces the ejecta material and modifies the surface morphology during the generation of surface lineations on the ejecta of pedestal craters. We will discuss the late stage interaction between a vortex ring and the ejecta particles, suggesting that even present Martian conditions are sufficient to form lineations seen on fluidized ejecta.
Author
*Ejecta; Mars Craters; Mars Surface; Fluidics*

**20050176033** Tennessee Univ., Chattanooga, TN, USA
**Geochronology of NWA 1195 Based on Rb-Sr and Sm-Nd Isotopic Systematics**
Symes, S. J.; Borg, L. E.; Shearer, C. K.; Asmerom, Y.; Irving, A. J.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The shergottite meteorites comprise a diverse array of igneous samples from Mars. They are classified into three groups including basalts, lherzolites, and olivine-bearing porphyritic (olivinephyric) rocks. All have roughly basaltic compositions, yet the trace-element and isotopic compositions cover an enormous range. Many of the shergottites share a common crystallization age of approximately 175 Ma, while others have ages between approximately 330-575 Ma. Northwest Africa 1195 (NWA) is a recently identified shergottite that was found in the Safsaf region of eastern Morocco. It petrographically resembles other olivine-phyric shergottites such as DaG 476, SaU 005, Dhofar 019, and NWA 1068. In order to determine its relationship to other shergottites and to better understand the composition of shergottite source regions, we have determined its Rb-Sr and Sm-Nd isotopic compositions.
Author
*Geochronology; Isotopic Labeling; Strontium Isotopes; Rubidium Isotopes; Samarium Isotopes; Neodymium Isotopes*

**20050176034** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Surface Dust Redistribution on Mars as Observed by the Mars Global Surveyor**
Szwast, M. A.; Richardson, M. I.; Vasavada, A. R.; Lunar and Planetary Science XXXVI, Part 18; [2005]; 2 pp.; In English; See also 20050175899; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The global redistribution of dust by the atmosphere is geologically and climatologically important. Dust deposition and removal at the surface represents ongoing sedimentary geology: a vestige of aeolian processes responsible for the concentration of vast dustsheets and potentially for ancient layered units at various locations on Mars. The varying amount of dust on the surface has also long been hypothesized as a factor in determining whether regional or global dust storms occur in a given year. Indeed, the atmosphere has a very short, sub-seasonal time-scale (or memory) and as such, any inter-annual variability in the climate system that is not simply ascribable to stochastic processes, must involve changing conditions on the surface. An excellent, multi-year dataset is provided by the Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES) and the Mars Orbiter Camera Wide Angle imager (MOC-WA). This dataset allows investigation into the degree to which surface dust deposits on Mars really change: over decadal time scales, over the course of the annual cycle, and as a result of global and regional dust storms. The MGS mapping orbit data set extends over almost 3 Martian years at the time of writing. These data sets include one global dust storm and smaller regional storms (one in the first TES mapping year and two in the third).
Derived from text
*Mars Surface; Mars Global Surveyor; Mars (Planet); Dust Storms*

**20050176062** California Inst. of Tech., Pasadena, CA, USA

**Planetary Origin Evolution and Structure**

Stevenson, David J.; [2005]; 3 pp.; In English

Contract(s)/Grant(s): NAG5-10189; No Copyright; Avail: CASI; A01, Hardcopy

This wide-ranging grant supported theoretical modeling on many aspects of the formation, evolution and structure of planets and satellites. Many topics were studied during this grant period, including the evolution of icy bodies; the origin of magnetic fields in Ganymede; the thermal histories of terrestrial planets; the nature of flow inside giant planets (especially the coupling to the magnetic field) and the dynamics of silicate/iron mixing during giant impacts and terrestrial planet core formation. Many of these activities are ongoing and have not reached completion. This is the nature of this kind of research. Author

*Planetary Evolution; Planetology; Planetary Structure*

**20050176413** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXVI, Part 19**

[2005]; ISSN 1540-7845; In English; Lunar and Planetary Science XXXVI, 14-18 Mar. 2005, Houston, TX, USA; See also 20050176414 - 20050176458

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1234-Pt-19; Copyright; Avail: CASI; C01, CD-ROM

The topics include: 1) The abundances of Iron-60 in Pyroxene Chondrules from Unequilibrated Ordinary Chondrites; 2) LL-Ordinary Chondrite Impact on the Moon: Results from the 3.9 Ga Impact Melt at the Landing Site of Appolo 17; 3) Evaluation of Chemical Methods for Projectile Identification in Terrestrial and Lunar Impactites; 4) Impact Cratering Experiments in Microgravity Environment; 5) New Achondrites with High-Calcium Pyroxene and Its implication for Igneous Differentiation of Asteroids; 6) Climate History of the Polar Regions of Mars Deduced form Geologic Mapping Results; 7) The crater Production Function for Mars: A-2 Cumulative Power-Law Slope for Pristine Craters Greater than 5 km in Diameter Based on Crater Distribution for Northern Plains Materials; 8) High Resolution Al-26 Chronology: Resolved Time Interval Between Rim and Interior of a Highly Fractionated Compact Type a CAI from Efremovka; 9) Assessing Aqueous Alteration on Mars Using Global Distributions of K and Th; 10) FeNi Metal Grains in LaPaz Mare Basalt Meteorites and Appolo 12 Basalts; 11) Unique Properties of Lunar Soil for In Situ Resource Utilization on the Moon; 12) U-Pb Systematics of Phosphates in Nakhlites; 13) Measurements of Sound Speed in Granular Materials Simulated Regolith; 14) The Effects of Oxygen, Sulphur and Silicon on the Dihedral Angles Between Fe-rich Liquid Metal and Olivine, Ringwoodite and Silicate Perovskite: Implications for Planetary Core Formation; 15) Seismic Shaking Removal of Craters 0.2-0.5 km in Diameter on Asteroid 433 Eros; 16) Focused Ion Beam Microscoopy of ALH84001 Carbonate Disks; 17) Simulating Micro-Gravity in the Laboratory; 18) Mars Atmospheric Sample Return Instrument Development; 19) Combined Remote LIBS and Raman Spectroscopy Measurements; 20) Unusual Radar Backscatter Properties Along the Northern Rim of Imbrium Basin; 21) The Mars Express/NASAS Project at JPL; 22) The Geology of the Viking 2 Lander Site Revisited; 23) An Impact Genesis for Loki Patera? 24) Mars Polar Cap Edges Tracked over 3 Full Mars Years; 25) Elemental Abundance in Presolar SiC: Comparing Grains Separated by Acid Residue and Gently Separation Procedures; 26) First Results from the Descent Imager/Spectral Radiometer (DISR) Experiment on the Huygens Entry Probe of Titan; 27) Minor Element Behavior of Pallasite Olivine: Understanding Pallasite Thermal History and Chronology; 28) Canonical Anorthite in a Grosnaja Forsterite-bearing CAI; 29) Experimental Evidence for Condensation of 'Astrophysical' Carbonate; 30) Distribution and Classification of Multiple Coronae on Venus; 31) Recognition of Rayed Craters on Mars in THEMIS Thermal Infrared Imagery: Implications for Martian Meteorite Source Regions; 32) Geochemical Modeling of Evaporites on Mars: Insight from Meridiani Planum; 33) Hadean Crustal Processes Revealed from Oxygen Isotopes and U-Th-Pb Depth Profiling of Pre-4.0 Ga Detrital Zircons from Western Australia; 34) On Modeling the Seepage of Water into the Martian Subsurface; 35) Martial Gullies and Groundwater: A Series of Unfortunate Exceptions; 36) Olivine and Carbonate Globules in ALH84001: A Terrestrial Analog, and Implications for Water on Mars; 37) A Reevaluation of Mass Movements Within the Valles Marineris Region of Mars Using MOLA and MOC Data; 38) Evidence of Hydrated 109P/Swift-Tuttle Meteoroids from Meteor Spectroscopy; 39) Cr-54 Anomalies in the Solar System: Their Extent and Origin; 40) Reevaluation of the Mn-53-Cr-53 Systematic in the Basaltic Achondrites; 41) Effective Liquid Metal-Silicate Mixing Upon Shock by Power-Law Droplet Size Scaling in Richtmyer-Meshkov Like Perturbations; 42) Post-Impact Deformation of Impact Craters: Towards a Better Understanding Through the Study of Mjolnir Crater; 43) Cutting Silica Aerogel for Particle Extraction; 44) Liquid Hydrocarbons on Titan's Surface? How Cassini ISS Observations Fit into the Story (So Far); and 45) Mesoscale Simulations of Polar Circulations: Late Spring to Late Summe

CASI

*Planetary Geology; Lunar Exploration; Mars Exploration; Mars (Planet)*

**20050176414** Tokyo Univ., Hongo, Japan

**The Abundances of Iron-60 in Pyroxene Chondrules from Unequilibrated Ordinary Chondrites**

Tachibana, S.; Huss, G. R.; Kita, N. T.; Shimoda, H.; Morishita, Y.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In recent years, clear evidence that Fe-60 was present in the early solar system has been found in sulfides, magnetite, and silicates from unequilibrated ordinary and enstatite chondrites [1-5]. Iron-60 decays to Ni-60 with a half-life of 1.5 million years. Because it is produced in stars much more efficiently than by energetic-particle irradiation, its presence in the early solar system indicates that stellar nucleosynthesis contributed to the inventory of short-lived radionuclides. Initial ratios, (Fe-60/Fe-56)0, inferred for chondritic materials range from approx.1x10(exp -7) to \g1x10(exp -6) and are significantly higher than the steady-state value in interstellar medium (approx.2.6x10(exp -8) [6]). Thus, stellar production of 60Fe shortly before the solar system formation is required, suggesting a setting such as the Orion nebula, where cluster star formation occurs [7]. However, many details remain to be worked out, not the least of which is to establish a reliable estimate of (Fe-60/Fe-56)0 for the solar system.

Derived from text

*Interstellar Matter; Energetic Particles; Iron Isotopes; Nickel Isotopes; Pyroxenes; Chondrule; Chondrites; Radioactive Isotopes*

**20050176415** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Unusual Radar Backscatter Properties Along the Northern Rim of Imbrium Basin**

Thompson, T. W.; Campbell, Bruce A.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In general, radar backscatter from the lunar terrae is 2-4 times that of the maria. One exception to this is the terra terrain along the northern rim of Imbrium Basin. The highlands that surround Sinus Iridum and crater Plato have long-wavelength (70-cm) radar backscatter that is comparable to or lower than that from the adjacent maria. We are studying new 70-cm radar images and earlier multispectral data to better constrain the regional geology.

Derived from text

*Radar Imagery; Backscattering; Lunar Maria; Craters*

**20050176416** Arizona Univ., Tucson, AZ, USA

**First Results from the Descent Imager/Spectral Radiometer (DISR) Experiment on the Huygens Entry Probe of Titan**

Tomasko, M. G.; Doose, L. R.; Rizk, B.; Smith, P.; See, C.; Bushroe, M.; McFarlane, L.; Engel, S.; Eibl, A.; Karkoschka, E., et al.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 1 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cassini-Huygens mission was launched on October 15, 1997, and arrived in Orbit around Saturn in July, 2004. The Huygens Probe was released from the Cassini Orbiter on December 24, 2004 and entered Titan s atmosphere on January 14, 2005. Here we give the first results from the Descent Imager/Spectral Radiometer (DISR) instrument aboard the Huygens Probe during its descent into the atmosphere of Titan. Measurements were made by several different optical systems and sensors.

Derived from text

*Huygens Probe; Titan Atmosphere; Optical Measuring Instruments; Space Probes*

**20050176418** Museum fuer Naturkunde, Berlin, Germany

**LL-Ordinary Chondrite Impact on the Moon: Results from the 3.9 Ga Impact Melt at the Landing Site of Apollo 17**

Tagle, Roald; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Moon allows a view to the past of Earth, offering a unique opportunity to study the ancient impact history of our planet. Since the first impact melt (IM) samples were brought back by the Apollo missions, controversies existed regarding the ancient impact population and the projectile types involved in the late heavy bombardment [e.g. 1,2,3]. The intention of this paper is first to re-evaluate PGE data on lunar rocks using the newest methods of impactor identification based on linear

correlation [4] and second to discuss the various problems related to the identification of an impactor component given the special conditions present on the Moon.
Derived from text
*Chondrites; Impact Melts; Impactors; Landing Sites; Lunar Rocks*

**20050176419** Tennessee Univ., Knoxville, TN, USA
**Unique Properties of Lunar Soil for In Situ Resource Utilization on the Moon**
Taylor, Lawrence A.; Taylor, Dawn S.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Moon is an enormous Earth-orbiting space station, a natural satellite outside of Earth s gravity well, with raw materials that can be put to practical use as humanity expands outward into the solar system. The establishment of a base of operations on the Moon in preparation for and implementation of further exploration of the Solar System looms large upon the horizon. Paramount in these endeavors is the need to learn to 'live off the land' on the Moon. This will involve the 'In-Situ Resource Utilization' (ISRU) of the materials on the lunar surface for a plethora of uses. Such studies for lunar ISRU will include: facilities construction, regolith digging and moving, trafficability (e.g., roads, landing pads), microwave processing, conventional heat sintering, oxygen production, dust abatement, mineral beneficiation, solar-wind gas release, cement manufacture, radiation protection, et cetera. The surface mobility (rovers), scientific instrument, and EVA (extra vehicular activity) communities also must address the nature of the lunar materials as well. The various engineering and material science studies that are necessary for these endeavors will mostly address the lunar regolith (crushed rock) and soil (\h1 cm of regolith) for their starting materials on the Moon. It is to the unique properties of the lunar soil that this presentation is directed, particularly as regards the areas of 'dust mitigation' and the techniques of 'microwave sintering/melting of lunar soil,' both subject to recent activity by our Tennessee group [1,2].
Derived from text
*Lunar Soil; In Situ Resource Utilization; Lunar Surface; Regolith; Minerals; Microwaves*

**20050176422** Los Alamos National Lab., NM, USA
**Mars Atmospheric Sample Return Instrument Development**
Thompson, J.; Wiens, R. C.; Bernardin, R. C.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The isotopic and chemical composition of the Mars atmosphere holds important clues to that planet s evolution and climate history. Our current knowledge of the Mars atmospheric composition comes from several sources. The Viking landers [e.g., 1] measured the overall composition, but isotopic compositions are known to greater precision from measurements of gas trapped in the SNC meteorites [e.g., 2]. Better measurements are planned to be made on the Mars Science Laboratory, but it is very likely that some measurements will not be made to the precision necessary for scientific interpretation. Clear examples of this are O-18/O-16 and O-17/O-16 (needed to better than +/-1%) and C-14/C-12. The latter would be used to constrain recent exchange of atmospheric CO2 with buried CO2 [3]. Accurate measurement of isotopologues [e.g., 4] represents another class of measurements not likely to be attained in-situ on Mars.
Derived from text
*Air Sampling; Atmospheric Composition; Mars Atmosphere; Isotopic Labeling; SNC Meteorites; Meteoritic Composition; Composition (Property)*

**20050176423** Laboratoire de Geochimie et Cosmochimie, Paris, France
**Reevaluation of the Mn-53-Cr-53 Systematic in the Basaltic Achondrites**
Trinquier, A.; Birck, J. L.; Allegre, C. J.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Previous chromium isotopic work has shown the presence of live Mn-53 in the early solar system in the source of basaltic achondrites and therefrom a magmatic activity which was very short and early on their parent body. The details of the history and the absolute time scale are still debated. The discovery of a homogeneous Cr-54 deficit in the HED meteorites (see companion Cr-54 abstract) requires that the Cr-53 isotopic effects related to Mn-53 decay to be reevaluated. During Cr isotopic measurement, after exponential mass fractionation correction using Cr-50 and Cr-52 residual random second order variations

are present in the Cr-54/Cr-52 and Cr-53/Cr-52 ratios. Lugmair and Shukolyukov used the correlation between the two fluctuations to correct Cr-53/Cr-52 ratios for this second order dispersion. They assumed that Cr-54/Cr-52 is equal to terrestrial when the measured ratios are close to the Cr laboratory standard. This way high precision at the 5 ppm level have been obtained, in particular for the Mn-53-Cr-53 study of the HED meteorites. Nevertheless this assumes that the Cr-54/Cr-52 is exactly terrestrial. If small Cr-54 anomalies are present in the samples this procedure may introduce a bias in the Cr-53/Cr-52 ratios. With the evidence of a Cr-54 deficit of 0.72 plus or minus 0.02 e in basaltic achondrites, it is necessary to reevaluate the Cr-53 isotopic effects as well. Our experimental procedure does not require a second order fractionation correction to obtain a few ppm level of precision in the measurement of the Cr-53/Cr-52 ratios.
Author
*Achondrites; Basalt; Chromium Isotopes; Manganese Isotopes; Solar System*

**20050176425** Vassar Coll., Poughkeepsie, NY, USA
**A Reevaluation of Mass Movements Within the Valles Marineris Region of Mars Using MOLA and MOC Data**
Tribbett, K. L.; McAdoo, B. G.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Valles Marineris (VM) has remained a prime research site for twenty-five years. Various processes ranging from fluvial to volcanic are believed to have contributed to its complex geomorphology. Studies of the features within VM, thus, have implications for the evolution of Mars. We present here a reevaluation of mass movements within the VM region, and a unique comparison between VM landslides and submarine landslides based on MOLA and MOC data. A total of twenty one mass movements (nine landslides and 12 slumps) were surveyed.
Derived from text
*Geomorphology; Mars Surface; Mars Volcanoes; Mars Global Surveyor; Mass Flow*

**20050176426** Oregon State Univ., Corvallis, OR, USA
**Mesoscale Simulations of Polar Circulations: Late Spring to Late Summer**
Tyler, Daniel, Jr.; Barnes, J. R.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The OSU Mars MM5 computer model has been developed to study mesoscale atmospheric circulations on Mars. Development of the model and its validation against Viking and Pathfinder lander meteorology is described. Recently the model was used in a comprehensive high-resolution study of atmospheric circulations in the northern polar region during midsummer. We will discuss results from this midsummer study along with select results from simulations performed in support of the proposed Mars Scout Phoenix mission that will land at high latitude in late spring (Ls~80).
Derived from text
*Mesoscale Phenomena; Polar Regions; Zonal Flow (Meteorology); Summer; Spring (Season); Computerized Simulation*

**20050176428** Deutsches Museum, Munich, Germany
**Evaluation of Chemical Methods for Projectile Identification in Terrestrial and Lunar Impactites**
Tagle, R.; Hecht, L.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Due to relative enrichment of Re over Os during differentiation of the Earth crust from the mantle and the decay of Re-187 to Os-187, the Os-187/Os-188 ratios in crustal rocks are strongly enriched compared to the Earth s mantle and most extraterrestrial material (e.g., chondrites). Thus, Os isotope ratios can be used to identify a meteoritic component in impactites formed on the Earth [1, 2]. Even proportions of less than 0.05 wt.% projectile can be detected in the case of an almost pure continental crustal target. A disadvantage of this method is that it does not allow the clear differentiation between a possible Earth mantle and a meteoritic component. Furthermore, this method can not be used to identify the type of impactor, since the variation of the Os isotope ratios between different meteorite types is much smaller than the those that could be inferred from projectile contaminated impactites.
Derived from text
*Impactors; Contamination; Chondrites; Rhenium Isotopes; Osmium Isotopes; Isotope Ratios; Projectiles*

**20050176429** Toho Gakuen Univ., Japan

**Impact Cratering Experiments in Microgravity Environment**

Takagi, Y.; Hasegawa, S.; Teramoto, K.; Yano, H.; Yamamoto, S.; Abe, M.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Since impact cratering phenomena on planetary bodies were the key process which modified surface topography and formed regolith layers, many experimental studies were performed to elucidate the phenomena and presented some scaling laws[1][2]. However, experiments to study surface gravity effects were not many due to technical difficulties. Especially experiments in reduced gravity environments were rare, though systematic experiments in enhanced gravity environments were performed by the Boeing group using a centrifuge machine (e.g. [3]). Recently Colwell [4] performed some impact experiments into a dust-covered surface in a space shuttle payload. However, the impact velocities were very low ( \h 100 cm/sec). Only data available to the scaling law are data in Fig. 1 of Gault and Wedekind [5]. Although the crater scale estimation in microgravity environment is necessary for crater chronology on small asteroids, elucidation of regolith layer formation process, and mission planning of asteroid exploration, such as MUSES-C Hayabusa, experimental studies in reduced gravity were not enough.

Derived from text

*Impact Velocity; Cratering; Asteroids; Chronology; Microgravity; Regolith*

**20050176430** Chiba Inst. of Tech., Narashino, Japan

**New Achondrites with High-Calcium Pyroxene and Its Implication for Igneous Differentiation of Asteroids**

Takeda, Hiroshi; Yamaguchi, A.; Otsuki, M.; Ishii, T.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

High-Ca pyroxenes have been a minor component in chondrites, primitive chondrites, and the HED achondrites. We report two new achondrites from hot deserts, which contain more high-Ca pyroxenes than previously described. With additional data of silicate inclusions in the IAB and IIE irons, we propose that the high-Ca pyroxenes are important component in partial melts of chondritic source materials. Sunshine et al. [1] performed analyses of reflectance spectra of several S-type asteroids (Thetis and the Merxia and Agnia family members) and found that ratios of high-Ca pyroxene to total pyroxene are clearly inconsistent with any known chondritic material. We reported that a coarse-grained material rich in plagioclase and diopside (Di) occurs in the Caddo County IAB iron meteorite [2,3]. This material represents a new type of chemically differentiated extraterrestrial andesitic silicate material. We report two new meteorites from hot deserts, which contain significant amount of augite (Aug) and discusses igneous processes in the asteroidal objects in the earliest solar system.

Derived from text

*Achondrites; Calcium; Pyroxenes; Chondrites; Reflectance; Grain Size; Iron Meteorites; Plagioclase; Silicates*

**20050176431** Geological Survey, Flagstaff, AZ, USA

**Climate History of the Polar Regions of Mars Deduced from Geologic Mapping Results**

Tanaka, K. L.; Kolb, E. J.; Skinner, J. A., Jr.; Rodriguez, J. Alexis P.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

New detailed geologic mapping of the polar regions of Mars reveals their history of dust deposition and erosion and other geologic processes and events. We propose a climate history for the polar regions of Mars, based on our mapping results combined with previous crater density studies and orbitally driven climate modeling. Our geologic mapping includes the northern plains of Mars at 1:15M scale [1], the south polar region (60- 90 S) at 1:5M [2], and the polar layered deposits at 1:1.5M [3]. We primarily use MOLA topography at 460, 230, and 114 m/pixel resolutions respectively at progressively higher latitudes as MOLA shot density increases, hundreds of THEMIS VIS images at 19 m/pixel, and hundreds of MOC images at meters/pixel.

Derived from text

*Climate Models; Geological Surveys; Mapping; Polar Regions; Mars Surface; Planetary Mapping; Planetary Geology; Erosion*

**20050176432** Geological Survey, Flagstaff, AZ, USA

**The Crater Production Function for Mars: A -2 Cumulative Power-Law Slope for Pristine Craters Greater Than 5 km in Diameter Based on Crater Distributions for Northern Plains Materials**

Tanaka, K. L.; Skinner, J. A., Jr.; Barlow, N. G.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The random bombardment of planetary surfaces by asteroids and comets has enabled the application of crater densities as a primary measure of relative ages of surfaces on Mars and other cratered bodies. Diameters of craters are a function primarily of impact energy determined by the velocity and mass of the projectiles [e.g., 1]. Over time, collections of craters for an otherwise undisturbed surface can be used as a statistical sample to define an idealized size-frequency distribution, known as a crater production function (CPF). In spite of extensive previous work, consensus has not been reached yet as to the form of the CPF for Mars, especially in the approx.2 to 20 km size range. We feel that much of the problem may be due to complex resurfacing that has resulted in non-ideal crater populations over much of Mars. Based on revised geologic mapping and an improving crater database, we present preliminary results that indicate that the CPF follows closely a -2 power low in the 5 to approx.100 km diameter range.

Derived from text

*Craters; Planetary Surfaces; Mars Surface; Geological Surveys; Asteroids; Frequency Distribution*

**20050176433** Hawaii Univ., Honolulu, HI, USA

**Assessing Aqueous Alteration on Mars Using Global Distributions of K and Th**

Taylor, G. Jeffrey; Stopar, J.; Boynton, W.; Brueckner, J.; Waenke, H.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the prime goals of the scientific exploration of Mars is to understand the abundance, distribution, and history of water on the planet. There is abundant evidence from morphology, surface compositions at the Viking, Pathfinder, and MER sites, and martian meteorites that aqueous processes have been active, at least intermittently, on Mars. The effects of such alteration may be recorded in the elemental composition of the Martian surface. Here we focus on using K and Th data from the Mars Odyssey Gamma Ray Spectrometer (GRS) to assess the effect of aqueous processes on elemental distributions. The data reduction methods are described by Boynton et al. [1].

Derived from text

*Mars Surface; Chemical Composition; SNC Meteorites; Morphology; Gamma Ray Spectrometers*

**20050176436** Tokyo Univ., Japan

**Measurements of Sound Speed in Granular Materials Simulated Regolith**

Teramoto, K.; Yano, H.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Up until now, many asteroids have been observed from ground but only a few have been explored by spacecraft. Gravity measurements by these spacecraft, observations of asteroid mutual perturbation events, and discoveries of asteroid satellites have revolutionized our understanding of asteroid bulk densities [1]. Most asteroids appear to have bulk densities that are well below the grain density of their likely meteorite analogs. This implies that many asteroids have significant porosity values [2]. All information of spacecraft measurements come from only surface of asteroids with the exception of mass and density data. Thus, although high porosity of asteroids is suggested, we have never investigated asteroid internal structure directly. On the other hand, the existence of regolith on small asteroids has been proven by surface images from the Galileo and NEAR missions [1]. (25143) Itokawa, a sub-km asteroid as a target of HAYABUSA mission, is also suggested of that there is regolith layer on its surface [3]. Recently, radar sounder exploration for internal structure is applied to some planets and a comet; this method is better adapted to large spatial resolution ( \g1 km) than small objects. Thus, we need another way to investigate as small asteroids internal structure as Itokawa in fine spatial resolution. We attempt to apply elastic waves for small scale sub-surface structure of asteroids. If asteroids have regolith generally, it is necessary to understand physical property of granular materials and their motions first. For the above reasons, one of the most basic physical value, sound speed (P-wave velocity) measurements are demonstrated in granular materials simulated regolith in this study.

Derived from text

*Asteroids; Velocity Measurement; Granular Materials; P Waves; Regolith; Gravitation*

**20050176438** Brown Univ., Providence, RI, USA

**The Geology of the Viking 2 Lander Site Revisited**

Thomson, B. J.; Schultz, P. H.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Remotely sensed data have greatly advanced our knowledge of the Martian surface, yet the link between orbital observations and surface processes remains incomplete. The basic issue is spatial resolution: while orbital data sets with global coverage typically have spatial resolutions approx.100 m/pixel or coarser, the physical interactions that control spectral observations made from orbit operate on much smaller spatial scales (e.g., 10(exp -6) m for visible light). Our only access to Mars at such small scales is at the landing sites, of which we are limited to only five (VL1, VL2, MPF, Spirit, and Opportunity). The flood of recent orbital data allows us to apply a new level of scrutiny to the older landing sites and to reassess their geologic histories.

Derived from text

*Geology; Landing Sites; Remote Sensing; Mars Surface*

**20050176439** Tennessee Univ., Knoxville, TN, USA

**Recognition of Rayed Craters on Mars in THEMIS Thermal Infrared Imagery: Implications for Martian Meteorite Source Regions**

Tornabene, L. L.; McSween,H. Y., Jr.; Moersch, J. E.; Piatek, J. L.; Milam, K. A.; Christensen, P. R.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Four definitive large (km-sized) rayed craters have been recently identified on Mars bearing the provisional IAU names of Tomini (D=7.4 km), Gratteri (D=6.9 km), Zumba (D=3.3 km) and Dilly (D=2.0 km). These four craters are similar to the martian rayed crater Zunil (D=10.1 km) with rays that are most easily recognized by a thermophysical contrast in THEMIS nighttime (nTIR) and daytime (dTIR) thermal infrared images from the Mars Odyssey Thermal Infrared Imaging System (THEMIS). A thermophysical contrast between the rays and their surroundings is the distinguishing characteristic of these craters, rather than a contrast in albedo as with well known lunar analogs. The largest crater, Zunil, has an estimated secondary crater field population of approximately 10(exp 7) suggesting that these craters eject numerous blocks, perhaps even some with sufficient velocities to escape Mars (greater than 5 kilometers per second). With Zunil, these craters are presently thought to be the best candidate source craters for the Martian Meteorites (MMs). This hypothesis is based on observations, inferences and models with respect to the MMs and our current knowledge of the martian surface.

Derived from text

*Infrared Imagery; Mars Craters; Mars Surface; SNC Meteorites; Themis Project; 2001 Mars Odyssey*

**20050176440** NASA Johnson Space Center, Houston, TX, USA

**Focused Ion Beam Microscopy of ALH84001 Carbonate Disks**

Thomas-Keprta, Kathie L.; Clemett, Simon J.; Bazylinski, Dennis A.; Kirschvink, Joseph L.; McKay, David S.; Vali, Hojatollah; Gibson, Everett K., Jr.; Romanek, Christopher S.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Our aim is to understand the mechanism(s) of formation of carbonate assemblages in ALH84001. A prerequisite is that a detailed characterization of the chemical and physical properties of the carbonate be established. We present here analyses by transmission electron microscopy (TEM) of carbonate thin sections produced by both focused ion beam (FIB) sectioning and ultramicrotomy. Our results suggest that the formation of ALH84001 carbonate assemblages were produced by considerably more complex process(es) than simple aqueous precipitation followed by partial thermal decomposition as proposed by other investigators [e.g., 1-3].

Derived from text

*Ion Beams; Microscopy; Carbonates; Chemical Properties*

**20050176441** State Univ. of New York, Stony Brook, NY, USA

**Geochemical Modeling of Evaporites on Mars: Insight from Meridiani Planum**

Tosca, N. J.; McLennan, S. M.; Clark, B. C.; Grotzinger, J. P.; Hurowitz, J. A.; Jolliff, B. L.; Knoll, A. H.; Schroeder, C.; Squyres, S. W.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

New data returned from the MER mission have revealed abundant evaporites in the sedimentary record at Meridiani Planum. A working hypothesis for the formation of these materials involves the evaporation of fluids derived from the weathering of Martian basalt and subsequent diagenesis. On Earth, evaporite formation in exclusively basaltic settings is rare. Also, because of the complex physical and chemical nature of the sedimentary rocks at Meridiani Planum, fluid chemistry prior to evaporation is difficult to derive by inverse modeling. An alternative approach taken here is to investigate mineral precipitation during the evaporation of fluids derived by weathering of typical basalts. Data obtained in the laboratory from the weathering of synthetic Martian basalt provides a starting point for the investigation of evaporation processes at Meridiani Planum.
Derived from text
*Geochemistry; Mars Surface; Minerals; Models; Evaporation*

**20050176442** Colorado Univ., Boulder, CO, USA
**Hadean Crustal Processes Revealed from Oxygen Isotopes and U-Th-Pb Depth Profiling of Pre-4.0 Ga Detrital Zircons from Western Australia**
Trail, D.; Mojzsis, S. J.; Harrison, T. M.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations
Contract(s)/Grant(s): NAG5-13497; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Because physical and chemical processes of the past are determined from analysis of a preserved geologic record, little is known about terrestrial crustal processes of the first 500 Ma during the so-called Hadean Eon. What is known from direct measurements has been derived almost exclusively from the study of greater than 4.0 Ga detrital zircons from the Jack Hills, Western Australia. The geochemistry of these zircons has direct application to understanding the origin and evolution of the rocks during the Hadean because: (i) U-Th-Pb age determinations by ion microprobe suggests the presence of crust as early as 4.37 Ga, or shortly after lunar formation; (ii) high-resolution U-Th-Pb zircon depth profiles reported here reveal several episodes of zircon growth in the Hadean previously unrecognized; (iii) core regions of pre-4.0 Ga zircons with igneous compositions are enriched in O-18 and contain metaluminous and peraluminous mineral inclusions, both features indicative of S-type grainitod protoliths. Study of these ancient zircons provides a unique window into the first half billion years that permits assessment of the potential of the Hadean Earth to host an emergent biosphere.
Derived from text
*Australia; Geochemistry; Lead (Metal); Oxygen Isotopes; Thorium; Geochronology; Earth Crust; Uranium*

**20050176443** Los Alamos National Lab., NM, USA
**Combined Remote LIBS and Raman Spectroscopy Measurements**
Thompson, J.; Wiens, R.; Sharma, S.; Lucey, P.; Misra, A.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Laser-Induced Breakdown Spectroscopy (LIBS) and Raman spectroscopy (RS) are very complementary techniques. RS yields information about minerals and their polymorphs, and also identifies organic molecules from vibrational spectra. LIBS yields detailed information on elemental compositions, including many minor and trace elements. Here we present a combined data set of remote LIBS and RS measurements, showing how they complement each other. Recent work has discussed combining these techniques, and provided a few examples of their complementarity. Burgio et al. [1] used the combination to provide in-situ analyses of paint pigments in a historic art work. Wiens et al. [2] discussed the feasibility of constructing an instrument, suitable for spaceflight, that would be capable of both techniques. Recent papers have demonstrated the feasibility of using both techniques at stand-off distances, including using remote RS to distinguish coral from calcite, which looked identical to LIBS, and using LIBS to determine the Fe/Mg ratio of an olivine and the Mg/Ca ratio of a dolomite, which can be difficult for RS [3-4].
Derived from text
*Laser-Induced Breakdown Spectroscopy; Raman Spectroscopy; Minerals; Trace Elements; Remote Sensing; Chemical Composition*

**20050176444** Los Alamos National Lab., NM, USA
**On Modeling the Seepage of Water into the Martian Subsurface**
Travis, B. J.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Water has played a role on Mars in each of its epochs, including the present: ice at the poles, vapor in the atmosphere, both in the near surface. A number of studies suggest that sizable bodies of water likely were present on the Martian surface in its early history, and that some of that water surely made its way into the subsurface and may still be present there today. There are several avenues by which surface water could enter a subsurface aquifer system, including: the Clifford model of polar cap basal melting and subsequent infiltration and redistribution; infiltration of rainfall or melting of surface snow accumulations; floods of water from surface ruptures associated with magmatic hotspots and volcanic activity; and seepage below a lake or ocean. This study considers details of how water might infiltrate the subsurface, and time spans required.
Derived from text
*Mars Surface; Seepage; Surface Water; Mathematical Models*

**20050176445** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**The Mars Express/NASA Project at JPL**
Thompson, T. W.; Horttor, R. L.; Acton, C. H., Jr.; Zamani, P.; Johnson, W. T. K.; Plaut, J. J.; Holmes, D. P.; No, S.; Asmar, S.; Goltz, G.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 1 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ESA s Mars Express Mission involves international collaboration between the European Space Agency (ESA) and the European space agencies with the National Aeronautics and Space Administration (NASA) as a junior partner. The primary objective of this mission is to search for hydrologic resources on the surface of Mars. Mars Express was launched from Baikonur, Kazakhstan on June 2, 2003 and arrived at Mars on December 25, 2003. Orbital science observations started in January 2004.
Derived from text
*Mars Express; NASA Programs; Mars Surface*

**20050176446** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**An Impact Genesis for Loki Patera?**
Thorsos, I. E.; Davies, A. G.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

What happens when a large impact event takes place on a satellite with a thin crust and lithosphere? In the early Solar System impact cratering and volcanism were the dominate processes shaping the surfaces of the terrestrial planets. Impact events may have triggered additional volcanism by uplifting partially molten mantle material to the surface, where it melts due to pressure release. Subsequently, the shattered crust may have provided pathways for magma to reach the surface creating a longer term hot spot. As the crusts of the terrestrial planets thickened, the ability of impacts to trigger volcanism diminished [1]. However, the highly-volcanic jovian satellite Io is located in a 'high-impact' area of the Solar System [2], a victim of material attracted by Jupiter s gravitational field. In 1994 huge impacts were observed when fragments of comet Shoemaker-Levy 9 impacted Jupiter. The large icy satellites of Jupiter (Europa, Ganymede and Callisto) are pockmarked with many impact craters. Yet no impact features have been found on Io [3]. This is because of rapid resurfacing of Io due to volcanism, estimated at approx.1 cm/year [4] which over short geological time erases evidence of impacts. Io, however, has a lithosphere over a molten or partially-molten mantle [e.g., 5], and the effects of a sufficiently large impact may extend far beyond the evolution of the impact crater alone. At least one example of impact-triggered volcanism may exist in the Solar System today: the Loki Patera complex on Io.
Derived from text
*Cratering; Geochronology; Planetary Surfaces; Crusts; Craters; Ganymede; Gravitational Fields*

**20050176447** Lunar and Planetary Inst., Houston, TX, USA
**Olivine and Carbonate Globules in ALH84001: A Terrestrial Analog, and Implications for Water on Mars**
Treiman, A. H.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations
Contract(s)/Grant(s): NCC2-1184; NAG5-12771; NAG5-13279; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Carbonate globules in ALH84001 are associated with small olivine grains an unexpected finding because the olivines equilibrated at high T while the carbonate is chemically zoned and unequilibrated. A possible explanation comes from a terrestrial analog on Spitsbergen (Norway), where some carbonate globules grew in cavities left by aqueous dissolution of

olivine. For ALH84001, the same process may have acted, with larger olivines dissolved out and smaller ones shielded inside orthopyroxene. Carbonate would have been deposited in holes where the olivine had been. Later shocks crushed remaining void space, and mobilized feldspathic glass around the carbonates.
Author
*Carbonates; Globules; Mars Surface; Olivine; Water; Earth Analogs*

**20050176448** Geological Survey, Flagstaff, AZ, USA
**Mars Polar Cap Edges Tracked over 3 Full Mars Years**
Titus, T. N.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The polar caps of Mars have been observed since 1666 [1]. The advance and retreat of the polar caps were one of the first observations that indicated Mars had seasons. In more recent history, the polar caps have gained significance in that they are one of the driving forces of martian climate, with approximately 25% of the atmosphere being cycled through the polar caps annually [2]. Understanding the nature of the seasonal polar caps is imperative if we are to understand the current martian climate. The retreat of the martian seasonal caps has been monitored by both satellite and telescopic observations, over a period of several years. Most of these studies utilized visible imaging to determine the albedo contrast between the edge of the seasonal cap and the volatile free soil [3,4]. The use of visible imaging, while widely used, has some limitations. Cap edge detection depends on albedo contrast between the polar cap and the soil. This contrast is below reliable detection methods where the CO2 cap is dark, as in the south polar cryptic region [5], or during the advance of the seasonal cap [6]. The visible method also fails to distinguish between CO2 and H2O ices. Kieffer and Titus [7], using the Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES), observed a warm and bright annulus around the retreating northern seasonal CO2 polar cap.
Derived from text
*Polar Caps; Mars Environment; Carbon Dioxide*

**20050176449** California Univ., Los Angeles, CA, USA
**Evidence of Hydrated 109P/Swift-Tuttle Meteoroids from Meteor Spectroscopy**
Trigo-Rodriguez, J. M.; Castro-Tirado, A. J.; Llorca, J.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations
Contract(s)/Grant(s): Proj. AYA-2004-01515; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Evidence for the possible presence of water in meteoroids released from comet 109P/Swift-Tuttle is presented. The absence of chondritic principal components supports the idea that the structure of the meteoroids from this comet follows the dustball model where mineral grains can exhibit aqueous alteration as recently proposed. A study of the Fe and Mg chemical abundances for five photographic Perseid meteoroids is presented. We also include the first results of a Perseid fireball spectrum obtained during the 2004 campaign of this meteoroid stream from the Spanish Meteor Network (SPMN). The spectrum shows O and H lines produced during flares associated with the fragmentation of the meteoroid, consistent with the presence of water in the mineral components of the meteoroid.
Derived from text
*Spectroscopy; Perseid Meteoroids; Hydration; Comets; Meteoroids*

**20050176450** Manchester Univ., UK
**Elemental Abundance in Presolar SiC: Comparing Grains Separated by Acid Residue and Gentle Separation Procedures**
Tizard, J.; Henkel, T.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Presolar grains were first isolated eighteen years ago from primitive meteorites opening a new window to study individual stars [1]. SiC is one of the more abundant presolar grains and the most studied. Most grains fall into the 0.5-5 nm size range. Many thousands of grains examined so far have been isolated using acids to dissolve the solar system material around them [2]. There is good evidence that the acids etch the grain surfaces and may alter elemental and even isotopic ratios at least in the outer surfaces of the grains [3]. Recent studies by Bernatowicz et al. [4], who located 81 presolar SiC grains in a

disaggregated Murchison whole rock sample also found 60 % of SiC grains to be coated with an apparently amorphous, possibly organic phase. An explanation is that grains may have been protected during their residence in the ISM by surface coatings, including simple ices. The composition of these outer layers may hold evidence of the grain s formation and passage through the interstellar medium. It is important to know if and how different treatments to separate out the presolar grains affect their chemical and physical make up.
Derived from text
*Silicon Compounds; Amorphous Materials; Meteorites; Residues; Size Distribution*

**20050176451** Nevada Univ., Las Vegas, NV, USA
**Effective Liquid Metal-Silicate Mixing Upon Shock by Power-Law Droplet Size Scaling in Richtmyer-Meshkov Like Perturbations**
Tschauner, O.; Willis, M. J.; Asimow, P. D.; Ahrens, T. J.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Possible geochemical imprints of giant impacts in the early Earth are highly relevant for our understanding of the evolution of the Earth. Aspects of present-day Earth such as, for instance, the potassium and light element contents of the core may be direct results of such early giant impacts. Furthermore, the He-paradox and the abundance pattern of highly siderophile elements have been interpreted as result of giant impacts in hadean time. One essential parameter in modelling the possible geochemical consequences of giant impacts is the degree of material dispersion and mechanical mixing during the impact. In particular, dispersion of an impactor's metal core into terrestrial protomantle material has a decisive influence on post-impact evolution of the Earth. Here we show that metal-silicate mixing upon shock is extremely efficient due to dispersion of metal droplets in liquid silicate where the number of droplets scales negatively with the droplet size rather than showing any preferred size or normal distribution. The same relation holds for silicate melt droplets in molten metal.
Derived from text
*Drop Size; Geochemistry; Liquid Metals; Perturbation; Silicates*

**20050176452** Oslo Univ., Norway
**Post-Impact Deformation of Impact Craters: Towards a Better Understanding Through the Study of Mjolnir Crater**
Tsikalas, F.; Faleide, J. I.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Marine impact craters have greater chances to be preserved than subaerial ones because they are, most likely, covered by post-impact sediments. However, post-impact sediments can, in some cases, reach considerable thicknesses and sediment loading above the primary impact relief may result in substantial postimpact deformation and structural modification. The impact-induced lateral change in porosity within an impact structure in a sedimentary target is a key property to understand impact processes, post-impact compaction, and crater burial history. Although several impact craters have experienced considerable postimpact deformation (e.g. Chesapeake Bay, Chicxulub, Montagnais, Manson, Bosumtwi craters; Bedout and Silverpit structures) quantification of this process is almost entirely absent. Therefore, a great need exists for such studies as post-impact modifications may have obscured or blurred many of the typical structural, morphological and geophysical characteristics of marine impact craters in sedimentary targets. We urge the introduction of a post-impact modification correction factor to better describe the degree of both the exerted deformation and of the required structural and morphological restoration.
Derived from text
*Deformation; Mars Craters; Geophysics; Hypervelocity Impact*

**20050176453** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Cutting Silica Aerogel for Particle Extraction**
Tsou, P.; Brownlee, D. E.; Glesias, R.; Grigoropoulos, C. P.; Weschler, M.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The detailed laboratory analyses of extraterrestrial particles have revolutionized our knowledge of planetary bodies in the last three decades. This knowledge of chemical composition, morphology, mineralogy, and isotopics of particles cannot be provided by remote sensing. In order to acquire these detail information in the laboratories, the samples need be intact,

unmelted. Such intact capture of hypervelocity particles has been developed in 1996. Subsequently silica aerogel was introduced as the preferred medium for intact capturing of hypervelocity particles and later showed it to be particularly suitable for the space environment. STARDUST, the 4th NASA Discovery mission to capture samples from 81P/Wild 2 and contemporary interstellar dust, is the culmination of these new technologies. In early laboratory experiments of launching hypervelocity projectiles into aerogel, there was the need to cut aerogel to isolate or extract captured particles/tracks. This is especially challenging for space captures, since there will be many particles/tracks of wide ranging scales closely located, even collocated. It is critical to isolate and extract one particle without compromising its neighbors since the full significance of a particle is not known until it is extracted and analyzed. To date, three basic techniques have been explored: mechanical cutting, lasers cutting and ion beam milling. We report the current findings.
Derived from text
*Aerogels; Remote Sensing; Silicon Dioxide; Particles; Extraction*

**20050176456** Centre de Recherches Petrographiques et Geochimiques, Nancy, France
**Experimental Evidence for Condensation of 'Astrophysical' Carbonate**
Topani, A.; Robert, F.; Libourel, G.; deDonato, P.; Barres, O.; dHendecourt, L.; Ghanbaja, J.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The observation of the approx. 91 microns band in infrared spectra of two planetary nebulae [1] and one protostar [2] has been recently attributed to the presence of carbonates. Because of the absence of large parent bodies in these environments, such carbonates could not have been formed by aqueous alteration. The common association of carbonates with liquid water has thus been questioned. However, these detections remain controversial [3]. Furthermore, the only known mechanism to form carbonates at low pressure (!1 bar) is aqueous alteration. An experimental study has thus been conducted to understand the possibility to form carbonates without liquid-water. The main dust component observed in these astrophysical environments is amorphous silicate [4], which is thought to have condensed far from equilibrium [5]. Here, we report the first experimental evidence that carbonates can be formed in association with amorphous silicates during non-equilibrium condensation in circumstellar conditions.
Derived from text
*Amorphous Materials; Astrophysics; Carbonates; Stellar Envelopes; Planetary Nebulae; Silicates*

**20050176457** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Liquid Hydrocarbons on Titan's Surface? How Cassini ISS Observations Fit into the Story (So Far)**
Turtle, E. P.; Dawson, D. D.; Fussner, S.; Hardegree-Ullman, E.; Ewen, A. S.; Perry, J.; Porco, C. C.; West, R. A.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Titan is the only satellite in our Solar System with a substantial atmosphere, the origins and evolution of which are still not well understood. Its primary (greater than 90%) component is nitrogen, with a few percent methane and lesser amounts of other species. Methane and ethane are stable in the liquid state under the temperature and pressure conditions in Titan s lower atmosphere and at the surface; indeed, clouds, likely composed of methane, have been detected. Photochemical processes acting in the atmosphere convert methane into more complex hydrocarbons, creating Titan s haze and destroying methane over relatively short timescales. Therefore, it has been hypothesized that Titan s surface has reservoirs of liquid methane which serve to resupply the atmosphere. Early observations of Titan s surface revealed albedo patterns which have been interpreted as dark hydrocarbon liquids occupying topographically low regions between higher-standing exposures of bright, water-ice bedrock, although this is far from being the only explanation for the observed albedo contrast. Observations made by the Imaging Science Subsystem during Cassini's approach to Saturn and its first encounters with Titan show the bright and dark regions in greater detail but have yet to resolve the question of whether there are liquids on the surface.
Derived from text
*Hydrocarbons; Liquids; Titan Atmosphere; International Space Station; Cassini Mission; Satellite Surfaces*

**20050176459** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXVI, Part 20**
[2005]; ISSN 1540-7845; In English; Lunar and Planetary Science Conference, 14-18 Mar. 2005, Houston, TX, USA; See also 20050176460 - 20050176485
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1234-Pt-20; Copyright; Avail: CASI; C01, CD-ROM

The topics include: 1) Virtual Reality Technology as a Tool to Enhance Collaboration Between Space Exploration and Public Outreach: The Case Using the Mars Exploration Rover Images; 2) Atmospheric Electron-induced X-Ray Spectrometer (AEXS) Instrument Development; 3) Impact of Low Thermal Conductivity Layers on the Bulk Conductivity of a Martian Crustal Column; 4) Impacting Classroom Teachers Through Long-Term Professional Development; 5) Oxygen, Ca, and Ti Isotopic Compositions of Hibonite-bearing Inclusions; 6) Phenomenological Excitation Functions of Xe Isotopes with Protons on Nuclei of Cs, La and Ce; 7) Double-Diffusive Convection and Other Modes of Salinity-modulated Heat and Material Transport in Europa s Ocean; 8) Slope Morphologies of the Hellas Mensae Constructs, Eastern Hellas Planitia, Mars; 9) Development of Polygonal Thermal Contraction Patterns in a South Polar Trough, Mars 3 Years of Observations; 10) Martian Relevance of Dehydration and Rehydration in the Mg-Sulfate System; 11) Formation of Martian Volcanic Provinces by Lower Mantle Flushing? 12) Can Glasses Help Us to Unravel the Origin of Barred Olivine Chondrules? 13) Loki Patera: A Magma Sea Story; 14) Compositions of Partly Altered Olivine and Replacement Serpentine in the CM2 Chondrite QUE93005; 15) Model of Light Scattering by Lunar Regolith at Moderate Phase Angles: New Results; 16) Radiation Resistance of a Silicone Polymer Grease Based Regolith Collector for the HERA Near-Earth Asteroid Sample Return Mission; 17) Analysis of the Tectonic Lineaments in the Ganiki Planitia (V14) Quadrangle, Venus; 18) Nanometer-sized Diamonds from AGB Stars; 19) Quantifying Exact Motions Along Lineaments on Europa; 20) Geometry of Thrust Faults Beneath Amenthes Rupes, Mars; 21) Mapping of the Physical Characteristics and Mineral Composition of a Superficial Layer of the Moon or Mars and Ultra-Violet Polarimetry from the Orbital Station; 22) Negative Searches for Evidence of Aqueous Alteration on Asteroid Surfaces; 23) What Processes Have Shaped Basalt Boulders on Earth and Mars? Studies of Feature Persistence Using Facet Mapping and Fractal Analysis; 24) The Popigai Fluidizites: Dense Water Inclusions in Lechatelierite; Evidence for Shock-generated Carbonate and Hydrous Silicate Melts; 25) Missing Xenon Problem and Climate of the Early Earth; and 26) More on Magnetic Spectra from Correlated Crustal Sources on Mars
CASI
*Planetary Geology; Lunar Geology; Mars (Planet)*

**20050176460** Consejo Nacional de Investigaciones Cientificas y Tecnicas, Argentina
**Can Glasses Help Us to Unravel the Origin of Barred Olivine Chondrules?**
Varela, M. E.; Kurat, G.; Zinner, E.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Barred olivine (BO) chondrules are one of the most striking objects in chondrites. Their omnipresence and particular texture caught the attention of researchers and, thus, considerable effort has been put into unravelling their origin(s). Here we report on detailed studies of two BO chondrules and elaborate the prominent role liquids played in their origin. Additional information is included in the original extended abstract.
Author (revised)
*Chondrule; Olivine; Meteoritic Composition; Glass*

**20050176461** Open Univ., Milton Keynes, UK
**Nanometer-sized Diamonds from AGB Stars?**
Verchovsky, A. B.; Fisenko, A. V.; Semjonova, L. F.; Wright, I. P.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The property of meteoritic presolar nanodiamonds to form a stable colloid in liquids with low pH, due to the negative charge they acquire because of formation of COOH(-) groups on their surfaces, is used to separate the diamonds from other acid-resistant components such as SiC, spinel and other oxides. This property, which was discovered by Lewis at al., provides a very effective way to produce pure diamond residue. Such residues, depending on their grain size, contain up to 80% of carbon which is close to the theoretical value (the rest being surface-adsorbed species such as H2O, O2 and others). However, even such high purity diamond residues always contain a very small amount (\h1%) of isotopically heavy carbon (with delta 13C up to +20% which is distinctly different from the carbon isotopic composition of the main diamond components, with delta 13C of typically -30 to -45%). The coarsest grain-size fractions contain the greatest quantities of the high delta 13C component. This isotopically heavy carbon is observed during stepped combustion at relatively high temperatures after the main peak of carbon release. It is believed that this is fine-grained SiC, which is also able to form a colloid. In order to investigate the properties of such SiC we developed procedures to enrich diamond fractions with the putative colloidal SiC

and analysed them for their C and N isotopic compositions. Additional information is included in the original extended abstract.
Author (revised)
*Asymptotic Giant Branch Stars; Diamonds; Nanocrystals; Meteoritic Composition; Stellar Composition*

**20050176462** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**More on Magnetic Spectra from Correlated Crustal Sources on Mars**
Voorhies, C. V.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The spectral method for distinguishing crustal from core-source magnetic fields has been re-examined, modified and applied to both a comprehensive geomagnetic field model and an altitude normalized magnetic map of Mars. These observational spectra are fairly fitted by theoretical forms expected from certain elementary classes of magnetic sources. For Earth we found fields from a core of radius 3512 plus or minus 64 km, in accord with the 3480 km seismologic radius, and a crust represented by a shell of random dipolar sources at radius 6367 plus or minus 14 km, just beneath the 6371.0 km mean radius. For Mars we found only a field from a crust represented in same way, but 46 plus or minus 10 km below the planetary mean radius of 3389.5 km, and with sources about 9.6 plus or minus 3.2 times stronger than Earth's. It is remarkable that the same simple theoretical form should fairly fit crustal magnetic spectra for both worlds and return crustal-source depth estimates of plausible magnitude. Evidently, the idea of an ensemble of compact, quasi-independent, magnetized regions within these planetary crusts has some merit. Yet such estimates, at best a kind of average, depend upon both the observational spectrum fitted and the physical basis of the theoretical spectrum.
Derived from text
*Mars Surface; Planetary Crusts; Mathematical Models; Magnetic Fields; Spectral Methods*

**20050176463** Academy of Sciences (USSR), Moscow, USSR
**Phenomenological Excitation Functions of Xe Isotopes with Protons on Nuclei of Cs, La and Ce**
Ustinova, G. K.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Production cross sections of isotopes in nuclear reactions with high energy particles represent an actual problem of the modern cosmochemistry. To analyze formation of the isotopic content of cosmic matter and its evolution under different radiation conditions, the knowledge of isotope excitation functions on all nearby target nuclei for large energy spectra of nuclear-active particles of cosmic radiations is required. Experiment is unable to provide all the plenitude of the necessary information. In this connection, some semi-empirical systematics of nuclear reactions are elaborated, among which the Rudstam systematics [1] should be assessed as the best one. Reflecting correctly, on the whole, the main regularities of the processes, they, nevertheless, do not always fit satisfactorily experimental data. The essentially better exactness can be reached if our approach (elaborated earlier [2, 3]), based on the possibility of separation of the Rudstam parameters, depending on mass At of the target nucleus and on mass Ai of the product isotope, is used.
Derived from text
*Phenomenology; Excitation; Nuclear Particles; Xenon Isotopes; Energy Spectra; Cosmochemistry; Cosmic Rays*

**20050176464** Kharkov Univ., Kharkov, Ukraine
**Model of Light Scattering by Lunar Regolith at Moderate Phase Angles: New Results**
Velikodsky, Yu. I.; Korokhin, V. V.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have presented a model for the polarimetric and photometric characteristics of the lunar regolith at moderate phase angles based on realistic assumptions on regolith microstructure. Now we have new important observational data, which allow to improve a determination of model parameters and to make some conclusions about physical characteristics of the lunar surface: 1. We have performed in 2004 photopolarimetric CCD-observations of the Moon at very large phase angles 145 and 153 deg. (earlier we had data only for phase angles less than 123 deg.). So we can now study both sides of maximum of positive polarization. 2. We have used data of absolute photometry of Lane and Irvine at phase angles 40-120 deg. in two spectral bands. This has allowed us to find the model parameters for different wavelengths, and, besides, our model has had a good agreement with both brightness and polarization phase dependences at phase angles, at least, 40-120 deg. A full

description of our model is available at http:/www.univer.kharkov.ua/astron/dslpp/moon/polar/.
Derived from text
*Light Scattering; Phase Shift; Regolith; Lunar Rocks; Mathematical Models; Microstructure*

**20050176465** Freie Univ., Berlin, Germany
**Development of Polygonal Thermal Contraction Patterns in a South Polar Trough, Mars-3- Years of Observations**
vanGasselt, S.; Thorpe, A.; Neukum, G.; Reiss, D.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As part of our mapping and classification work focused on Martian south polar polygonal patterns [1-2], we have taken special interest in areas that have been imaged two or more times by the Mars Orbiter Camera (MOC) instrument in order to identify seasonal variations. We present multi-temporal observations of variations in polygonal patterns and a qualitative discussion regarding their formation. The region of interest covers a south polar trough (SPT) at about 281deg E and 87deg S (fig. 1) that is incised into the south polar residual cap (SPRC), exposing underlying dark lane deposits.
Derived from text
*Troughs; Polar Regions; Classifications; Annual Variations; Deposits*

**20050176466** Pomona Coll., Claremont, CA, USA
**Analysis of the Tectonic Lineaments in the Ganiki Planitia (V14) Quadrangle, Venus**
Venechuk, E. M.; Hurwitz, D. M.; Drury, D. E.; Long, S. M.; Grosfils, E. B.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459
Contract(s)/Grant(s): NAG5-10157; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Ganiki Planitia quadrangle, located between the Atla Regio highland to the south and the Atalanta Planitia lowland to the north, is deformed by many tectonic lineaments which have been mapped previously but have not yet been assessed in detail. As a result, neither the characteristics of these lineaments nor their relationship to material unit stratigraphy is well constrained. In this study we analyze the orientation of extensional and compressional lineaments in all non-tessera areas in order to begin characterizing the dominant tectonic stresses that have affected the region.
Derived from text
*Structural Properties (Geology); Tectonics; Venus Surface*

**20050176467** Idaho Univ., Moscow, ID, USA
**Quantifying Exact Motions Along Lineaments on Europa**
Vetter, J. C.; Kattenhorn, S. A.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations
Contract(s)/Grant(s): NCC5-577; NNG04GI69G; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Evaluating the precise motions along lineaments on the surface of Jupiter's icy moon, Europa, is a valuable tool for interpreting the development and history of lineaments of various morphologies. Such morphologies include strike-slip faults, dilational bands, ridges, and convergence zones. However, the exact mode of origin and kinematic behavior of these various lineaments are not obvious based on morphology alone. In fact, the apparent motions implied by displaced crosscut features can provide misleading indications of true motions along lineaments. Identifying the precise motions (combinations of sliding and opening/closing) is critical to the accurate characterization and interpretation of each of these lineament types. Lineaments of interest (i.e., those having displaced relatively older features in some manner) are identified on Galileo spacecraft images and measurements are made of the total offset, the separation, and relative orientations of crosscut features with respect to the lineament of interest. Specifically, by using these measured quantities and a series of trigonometric equations, the precise motions (i.e., dilation, convergence, strike-slip, or a combination of strike-slip and dilation or convergence) can be determined. These measurements are, however, limited by the resolution of the available images. This study focuses on motion analysis techniques for Europan lineaments and the precise characterization of fault-orthogonal and/or strike-slip motion along lineaments of varying morphologies. We highlight potential pitfalls of cursory analyses of motion indicators. For example, lineaments with obvious lateral offsets have typically been identified simply as strike-slip faults. This assumption may actually be incorrect, as fault-orthogonal motions may contribute to apparent lateral displacements (offsets or separations). Also, variability in the amount of fault motion along the trace length should theoretically be identifiable using the outlined technique.

Strike-slip faults on Europa have conventionally been presumed to have a constant slip magnitude along their lengths; however, we posit that variable distributions of slip may be common, as is typical along terrestrial strike-slip faults.
Derived from text
*Europa; Structural Properties (Geology); Motion; Morphology*

**20050176468** Oxford Univ., Oxford, UK
**What Processes Have Shaped Basalt Boulders on Earth and Mars? Studies of Feature Persistence Using Facet Mapping and Fractal Analysis**
Viles, H. A.; Brearley, J. A.; Bourke, M. C.; Holmlumd, J.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Basalt boulders on both Earth and Mars are shaped by a range of forces. Structural and lithological characteristics are acted upon by aeolian, fluvial and other process regimes to produce a palimpsest of features. In order to be able to diagnose process histories from features observed on boulders it is important to know which features (or groups of features) are diagnostic of individual process regimes and how persistent such features are under subsequent process regimes. A first step, as reported in a companion paper, is to produce atlases of features produced by different process regimes. Following this, techniques such as facet mapping can be used to quantify the presence of various features, either using field survey or imaging. Alternatively, where digital imagery is available, methods such as fractal analysis can be used to quantify surface roughness to see whether fundamental differences in surface topography can be associated with different process regimes. In this paper we present an application of facet mapping and fractal analysis techniques to 1) basalt boulders studied in the field at Ephrata Fan, Washington State, U.S.A. and 2) recorded via imaging by the Spirit Rover at Gusev Crater. At Ephrata Fan, a classic Marsanalog site, we aimed to determine how intensively structurally-controlled and fluvially-created features had been affected by subsequent breakdown processes. At Gusev Crater we aimed to find whether there was any evidence of fluvially-created features remaining on boulders at a site where fluvial processes have been hypothesized as occurring in the past.
Derived from text
*Basalt; Earth Surface; Mars Surface; Fractals; Flat Surfaces; Lithology*

**20050176469** Japan Aerospace Exploration Agency, Ibaraki, Japan
**Virtual Reality Technology as a Tool to Enhance Collaboration Between Space Exploration and Public Outreach: The Case Using the Mars Exploration Rover Images**
Uno, Jun; Mikouchi, Akiko K.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A great variety of high-quality images of Mars from the rovers Spirit and Opportunity recently provided an opportunity for the public to experience the red planet as never before. However, visual observation of these images is not enough to fully appreciate their scientific relevance. Here we present computer-based outreach material, 'Mission Specialist 4 -Mars Rover,' developed by the VR (virtual reality) team at the Japanese Aerospace Exploration Agency (JAXA). The goal of this material is to provide tools to expand the appreciation of martian geology and rover engineering and to provide public outreach about Mars exploration.
Derived from text
*Mars Exploration; Planetary Geology; Mars Surface; Visual Observation; Mars Photographs*

**20050176470** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Atmospheric Electron-induced X-Ray Spectrometer (AEXS) Instrument Development**
Urgiles, E.; Wilcox, J. Z.; Toda, R.; Crisp, J.; George, T.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: This paper describes the progress in data acquisition and establishing the observational capability of the AEXS instrument. The AEXS is a miniature instrument[1-4] based on the excitation of characteristic X-Ray Fluorescence (XRF) and luminescence spectra using a focused electron beam which enables nondestructive evaluation of sample surfaces in planetary ambient atmospheres. In situ operation is obtained through the use of a thin electron transmissive membrane to isolate the vacuum of the AEXS source from the outside ambient atmosphere. Thus eliminating the need for a vacuum pumped

sample chamber as is common in all laboratory SEM s. The transmitted electrons impinge on the sample exciting XRF spectra from the irradiated spot on in-situ or collected samples with sub-mm to cm-scale spatial resolution at Mars atmospheric pressure. The AEXS system (Fig 1) consists of a high-energy (\g10keV) electron gun encapsulated by the isolation membrane, an XRF detection and analyzer system, and a high voltage power supply. The XRF data are analyzed to determine the elemental abundance for the irradiated spots. The approach to demonstrating a proof of concept of the AEXS has been through 1) demonstrating the viability of microfabricated membranes, 2) assembling AEXS setups with increasingly integrated functional components, and 3) simulating the AEXS observational capabilities. The development of the instrument is described in detail in the poster paper[4] at this conference. This paper focuses on describing the progress of the AEXS instrument to acquire XRF data and using commercially available software to analyze the data streams and determine the accuracy, precision and resolution of the analysis compared to the certified elemental abundance.
Derived from text
*X Ray Spectrometers; Data Flow Analysis; Mars Atmosphere; Nondestructive Tests; Atmospheric Pressure; Irradiation*

**20050176471** Texas Univ., Dallas, TX, USA
**Impact of Low Thermal Conductivity Layers on the Bulk Conductivity of a Martian Crustal Column**
Urquhart, M. L.; Hanson, William B.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Estimates of the thermal conductivity of the Martian crust are important in theoretical calculations of the depth to melting of the Martian cryosphere. The thermal conductivity of real layers in the subsurface is not well constrained. Thermal modelers typically use 1-d models, and treat the crust as a single homogeneous layer. Variation in thermal conductivity with depth is generally treated through the adoption of a column-averaged value. Choosing an average thermal conductivity for the crust of Mars may be too simple an approach to make accurate predictions on the depth to melting for water ice, especially if low thermal conductivity layers are present. The effect of a low thermal conductivity layer on the thermal gradient and depth to melting was demonstrated by Mellon and Phillips in the context of a possible explanation for young gulley landforms on Mars [1]. The implications of low thermal conductivity layers on theoretical calculations of the depth to melting for water ice on Mars were also briefly discussed in Urquhart and Gulick [2]. Here we show why the consideration of the presence of low conductivity layers is important in calculations of the potential depth of a Martian water table.
Derived from text
*Low Conductivity; Thermal Conductivity; Planetary Crusts; Planetary Geology; Landforms*

**20050176473** Tokyo Univ., Japan
**Oxygen, Ca, and Ti Isotopic Compositions of Hibonite-bearing Inclusions**
Ushikubo, T.; Hiyagon, H.; Sugiura, N.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mass independent isotopic anomalies of O, Ca, and Ti of refractory inclusions are evidence for existence of isotopic heterogeneity in the early solar nebula. Oxygen isotopic anomaly of delta17O approx. delta18O approx. -50 permil is commonly observed in refractory inclusions and is distinct from those of other chondritic materials [1]. This suggests that refractory inclusions were derived from a common O-16-rich reservoir. In contrast, large isotopic anomalies of Ca and Ti (especially neutron-rich isotopes, Ca-48 and Ti-50) are typically observed in hibonite-bearing inclusions [2-5]. This suggests that some hibonite-bearing inclusions were derived from a reservoir different from that of common refractory inclusions. However, the relationship between the O-16-rich reservoir and the reservoir of Ca and Ti isotopic anomalies has not been established because O isotopic compositions of hibonite-bearing inclusions with Ca and Ti isotopic anomalies [6-8]. In the present study, O, Ca, and Ti isotopic compositions of hibonite-bearing inclusions were measured.
Derived from text
*Oxygen; Calcium Isotopes; Inclusions; Isotopic Labeling; Solar Nebula; Titanium Isotopes; Composition (Property)*

**20050176474** Washington Univ., Seattle, WA, USA
**Double-Diffusive Convection and Other Modes of Salinity-modulated Heat and Material Transport in Europa's Ocean**
Vance, S.; Brown, J. M.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Accounting for thermodynamic properties of aqueous solutions relevant to Europa s ocean, we assess the affect of salinity on dynamics and heat transport from floor to ceiling in the ocean. This work builds on previous efforts [1], [2], that focused on constraining plume buoyancy, rise height, speed, and size in a homogeneously salty model ocean. We focus on buoyancy (here defined as (p(sub ocean)-p(sub plume))/p(sub ocean)) of a plume with excess salinity in an ocean of model-specified salinity. In order to characterize equations of state of both plume and ocean as a function of depth, we also calculate a probable temperature profile.
Derived from text
*Convection; Diffusivity; Heat Transfer; Thermodynamic Properties*

**20050176475** Freie Univ., Berlin, Germany
**Slope Morphologies of the Hellas Mensae Constructs, Eastern Hellas Planitia, Mars**
vanGasselt, S.; Hauber, E.; Neukum, G.; Reiss, D.; Scholten, F.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In 2004, the High Resolution Stereo Camera (HRSC) onboard Mars Express has obtained about a dozen of large-area image strips with a resolution of 12 to 25 metres per pixel that cover the Eastern Hellas Planitia region - a region which is characterised by large constructs of remnant hills and adjacent debris aprons. Although lobate debris aprons (LDA) in general have been interpreted to consist of rock debris and interstitial ice in varying proportions [1] image data from the Mars Orbiter Camera (MOC), THEMIS instruments and HRSC unequivocally show that these landforms are morphologically complex and that a variety of slope processes have to be taken into account when interpreting these features. We found further evidence for a retreat of a mantling deposit [2] and substantial changes in the water/ice-balance of that region.
Derived from text
*Cameras; High Resolution; Landforms; Mars Surface; Slopes; Laser Doppler Velocimeters*

**20050176476** Arkansas Univ., Fayetteville, AR, USA
**Radiation Resistance of a Silicone Polymer Grease Based Regolith Collector for the HERA Near-Earth Asteroid Sample Return Mission**
Venechuk, E. M.; Franzen, M. A.; Sears, D. W. G.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The goal of the HERA mission is to collect regolith from a near-Earth asteroid. After launch, HERA will approach a pre-determined asteroid, match its orbit, descend to the surface, touch for a few seconds, and ascend. The touch-and-go impregnable pad (TGIP that contacts the surface passively collects regolith by embedding it in silicone polymer grease. After collection, the pad and regolith are contained in the spacecraft and returned to Earth for removal from the grease and subsequent analysis. The collector must survive the six years of the mission in a hostile space environment. One major factor to be considered is radiation from both galactic and solar sources. Although it is difficult to simulate space irradiation in the laboratory, using a radiation capable of ionizing and breaking bonds, which have typical energies of only 0.25 eV, provides an effective reproduction. In terms of the absorbed dose rate, predicted galactic dose rates between Earth and Mars are approximately 14 cGy/year and up to 2 Gy/day for solar doses. Knowing the dose rates of our space environment simulation sources, we can express the administered dose in our experiments in terms of dose expected on the mission.
Derived from text
*Greases; Regolith; Sample Return Missions; Silicones; Polymers; Radiation Tolerance*

**20050176477** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Geometry of Thrust Faults Beneath Amenthes Rupes, Mars**
Vidal, A.; Mueller, K. M.; Golombek, M. P.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Amenthes Rupes is a 380 km-long lobate fault scarp located in the eastern hemisphere of Mars near the dichotomy boundary. The scarp is marked by about 1 km of vertical separation across a northeast dipping thrust fault (top to the SW) and offsets heavily-cratered terrain of Late Noachian age, the visible portion of which was in place by 3.92 Ga and the buried portion in place between 4.08 and 4.27 Ga. The timing of scarp formation is difficult to closely constrain. Previous geologic mapping shows that near the northern end of Amenthes Rupes, Hesperian age basalts terminate at the scarp, suggesting that

fault slip predated the emplacement of these flows at 3.69 to 3.9 Ga. Maxwell and McGill also suggest the faulting ceased before the final emplacement of the Late Hesperian lavas on Isidis Planitia. The trend of the faults at Amenthes, like many thrust faults at the dichotomy boundary, parallels the boundary itself. Schultz and Watters used a dislocation modeling program to match surface topography and vertical offset of the scarp at Amenthes Rupes, varying the dip and depth of faulting, assuming a slip of 1.5 km on the fault. They modeled faulting below Amenthes Rupes as having a dip of between 25 and 30 degrees and a depth of 25 to 35 km, based on the best match to topography. Assuming a 25 degree dip and surface measurements of vertical offset of between 0.3 and 1.2 km, Watters later estimated the maximum displacement on the Amenthes Rupes fault to be 2.90 km. However, these studies did not determine the geometry of the thrust using quantitative constraints that included shortening estimates. Amenthes Rupes deforms large preexisting impact craters. We use these craters to constrain shortening across the scarp and combine this with vertical separation to infer fault geometry. Fault dip was also estimated using measurements of scarp morphology. Measurements were based on 460 m (1/128 per pixel) digital elevation data from the Mars Orbiter Laser Altimeter (MOLA), an instrument on the Mars Global Surveyor (MGS) satellite.
Derived from text
*Dichotomies; Geological Faults; Mars Surface; Planetary Geology*

**20050176478** Main Astronomical Observatory, Kiev, Ukraine
**Mapping of the Physical Characteristics and Mineral Composition of a Superficial Layer of the Moon or Mars and Ultra-Violet Polarimetry from the Orbital Station**
Vidmachenko, A. P.; Morozhenko, A. V.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 1 pp.; In English; See also 20050176459; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Already more 30 years the problem of remote mineralogical mapping of the Moon or Mars superficial layer by using of spectrophotometric observations in visual and near infrared wavelengths ranges is important. However the decision of such task was very ambiguous. It is caused by what even intensity of such widely researched absorption band as piroxen, - substantially depends on effects of multi-scattering in a superficial layer. We suggest simplifying the decision of this task considerably. With this purpose we proposed using remote observational data of value of the second Stokes parameter Q. It is known that value of this parameter mainly formed in process of single scattering only. Taking into account some technical complexity of such experiment, at the first stage we suggest using observational data on measurements of degree of linear polarization of ultraviolet light at phase angles in limits from 800 up to 1200, that is, in those limits in which values of Brewster s angles are practically for all ground materials. Reflectivity of the Moon superficial layer is about 1% for wavelengths smaller 300 nm. Therefore intensity of the diffusely-reflected radiation is formed practically only at single reflection. It will allow to determine with a high degree of reliability the size of real part of a refraction parameter from value of phase angle at which it is observed a maximal value of a degree of polarization (that is, at Brewster s angle) Development and manufacturing of equipment, which necessary for carry out of such work, formulation of a corresponding scientific task and the subsequent processing of an observational material - can be successfully executed by specialists of the Main astronomical observatory of the NAS of Ukraine.
Author
*Minerals; Planetary Mapping; Polarimetry; Spectrophotometry; Moon; Mars Surface*

**20050176479** NASA Johnson Space Center, Houston, TX, USA
**Negative Searches for Evidence of Aqueous Alteration on Asteroid Surfaces**
Vilas, F.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Small bodies in the Solar System preserve evidence of the processes occurring during early Solar System formation, unlike the larger planets that undergo continuous churning of their surfaces. We study these bodies to understand what processes affected different stages of Solar System formation. The action of aqueous alteration (the alteration of material by the interaction of that material with liquid formed by the melting of incorporated ice) of near-subsurface material has been inferred to occur on many asteroids based on the spectrophotometric evidence of phyllosilicates and iron alteration minerals. The definitive indication of aqueous alteration is the 3.0- micron absorption feature attributed to structural hydroxyl (OH) and interlayer and adsorbed water (H2O) in phyllosilicates (clays) (hereafter water of hydration). A weak absorption feature centered near 0.7 microns attributed to an Fe (2+) right arrow Fe (3+) charge transfer transition in oxidized iron in phyllosilicates has been observed in the reflectance spectra and photometry of approximately 50% of the main-belt C-class asteroids. An approximately 85% correlation between this 0.7- micron feature and the 3.0- micron water of hydration absorption feature was found among the low-albedo asteroids. The feature is usually centered near 0.68 microns in asteroid

spectra, and ranges in wavelength from approximately 0.57 to 0.83 microns. Serendipitously, three of the Eight Color Asteroid Survey filters the v (0.550 microns), w (0.701 microns), and x (0.853 microns)-bracket this feature well, and can be used to determine the presence of this feature in the reflectance properties of an asteroid, and probe the aqueous alteration history of larger samples of asteroid data. Two efforts to search for evidence of aqueous alteration based on the presence of this 0.7-micron absorption feature are presented here.
Derived from text
*Asteroids; Aqueous Solutions; Revisions; Solar System Evolution*

**20050176480** Los Alamos National Lab., NM, USA
**Martian Relevance of Dehydration and Rehydration in the Mg-Sulfate System**
Vaniman, D. T.; Chipera, S. J.; Bish, D. L.; Carey, J. W.; Feldman, W. C.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Evidence for sulfate salts in soils on Mars has persisted from the initial recognition of an Mg-S correlation in 1976 X-ray fluorescence data collected by Viking through detection of similar Mg-S correlations at the Pathfinder landing site. Results from the Mars Exploration Rover MER-B (Opportunity) at Meridiani Planum provide compelling evidence that sediments rich in Ca- and Mg-sulfate salts formed on Mars by precipitation from water. Whether present within soils or sediments, sulfate salts include many hydrated species that may be significant reservoirs of water near the martian equatorial surface. The Mg-sulfate system includes the common terrestrial minerals epsomite (MgSO4 7H2O, 51 wt% water), hexahydrite (MgSO4 6H2O, 47 wt% water), and kieserite (MgSO4 H2O, 13 wt% water). Rare minerals of the series include pentahydrite (MgSO4 5H2O, 43 wt% water), starkeyite (MgSO4 4H2O, 37 wt% water), and sanderite (MgSO4 2H2O, 23 wt% water). Other hydration states are not recognized as minerals but can be synthesized. In a companion abstract for this conference, Chipera et al. summarize data delimiting the stability field for starkeyite. In previous work we have found that hydration in the Mg-sulfate system is affected by sluggish transformations and pathway dependence. Those studies also recognized possible formation of an X-ray amorphous form of MgSO4 nH2O, where n has persistent values slightly greater than 1. At 298 K the amorphous form can be generated within a few hours from hexahydrite at very low relative humidity (\h1% RH), similar to RH at the martian equatorial surface at mid-day in summer. Higher RH, up to 100%, can be attained at equatorial regions in the colder temperatures of early morning and for prolonged periods (approx. 2 x 10(exp 4) yrs) during episodes of high obliquity. The extreme range of RH variation over several timescales at the martian equatorial surface makes the hydration state of Mg-sulfate phases a matter of some interest, particularly since these minerals may hold a considerable amount of water in accessible near-surface areas where water ice should not be stable. Additional information is included in the original extended abstract.
Author
*Magnesium Sulfates; Planetary Composition; Soils; Mars Surface*

**20050176481** Institut de Physique du Globe, Paris, France
**Formation of Martian Volcanic Provinces by Lower Mantle Flushing?**
vanThienen, P.; Lognonne, Ph.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 1 pp.; In English; See also 20050176459; Original contains color illustrations
Contract(s)/Grant(s): RTN2-2001-00414; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The two main volcanic centres on Mars, Tharsis and Elysium, are often interpreted in terms of mantle plume hotspots. Several workers have tried to explain why there seem to be only two and not more plumes, invoking exothermic and endothermic phase transitions. Alternative explanations include an impact genesis and the reduced thermal conductivity of the thick southern lithospere. As the cooling of Mars after a possible magma ocean stage takes place in a top-down manner, a thermal boundary layer at the CMB takes some time to develop, unless one assumes the core to be initally superheated. Some workers have speculated on this. We present results of 2D cylindrical shell numerical mantle convection experiments (EBA) in which we try to ascertain whether the flushing of the lower mantle (present if one assumes a small to intermediate size for the martian core, within uncertainties) could provide a mechanism for the generation of a small number of plume-like features, showing localized upwelling of hot material. This would remove the necessity of an initial/early TBL at the CMB. We investigate the effects of solid-state phase transitions, viscosity stratification in the mantle (related to solid-state phase transitions), and the presence of a thick southern hemisphere crust. Two different stratified viscosity models are applied. The first has a lower mantle which is a factor 10 stronger than the upper mantle, similar to the viscosity contrast inferred in the Earth's mantle, e.g. from glacial rebound studies. The second model has a transition zone which is a factor 10 stronger than

the upper and lower mantle, based on recent work by Walzer et al.. Additional information is included in the original extended abstract.
Author
*Planetary Geology; Mars Volcanoes; Planetary Mantles; Mars (Planet)*

**20050176482** NASA Johnson Space Center, Houston, TX, USA
**Compositions of Partly Altered Olivine and Replacement Serpentine in the CM2 Chondrite QUE93005**
Velbel, M. A.; Tonui, E. K.; Zolensky, M. E.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Some phyllosilicates in CM carbonaceous chondrites formed by aqueous alteration of anhydrous precursor phases. Although broad trends in the compositions of hydrous phyllosilicates are recognized and believed to be related to trends in degree of aqueous alteration, details of the reactions that formed specific secondary minerals remain obscure. This paper reports compositional relationships between remnants of partially pseudomorphically (or alteromorphically) replaced silicates and their alteration products (serpentine) in the CM2 chondrite QUE93005 and compares it with previously published results for ALH81002. Reactants and products were characterized by optical petrography, backscattered scanning electron microscopy (BSEM), and electron microprobe. By focusing on serpentine formed from known reactants (olivines), and on only those instances in which some of the reactant silicate remains, direct compositional relationships between reactants and products, and the elemental mobility required by the reactions, can be established. Additional information is included in the original extended abstract.
Author (revised)
*Carbonaceous Chondrites; Serpentine; Silicates; Meteoritic Composition*

**20050176483** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Loki Patera: A Magma Sea Story**
Veeder, G. J.; Matson, D. L.; Rathbun, A. G.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We consider Loki Patera on Io as the surface expression of a large uniform body of magma. Our model of the Loki magma sea is some 200 km across; larger than a lake but smaller than an ocean. The depth of the magma sea is unknown, but assumed to be deep enough that bottom effects can be ignored. Edge effects at the shore line can be ignored to first order for most of the interior area. In particular, we take the dark material within Loki Patera as a thin solidified lava crust whose hydrostatic shape follows Io's isostatic surface (approx. 1815 km radius of curvature). The dark surface of Loki appears to be very smooth on both regional and local (subresolution) scales. The thermal contrast between the low and high albedo areas within Loki is consistent with the observed global correlation. The composition of the model magma sea is basaltic and saturated with dissolved SO2 at depth. Its average, almost isothermal, temperature is at the liquidus for basalt. Additional information is included in the original extended abstract.
Author (revised)
*Io; Satellite Surfaces; Magma; Planetary Geology*

**20050176484** Academy of Sciences (USSR), Novosibirsk, USSR
**The Popigai Fluidizites: Dense Water Inclusions in Lechatelierite; Evidence for Shock-generated Carbonate and Hydrous Silicate Melts**
Vishnevsky, S. A.; Gibsher, N. A.; Raitala, J.; Ohman, T.; Palchik, N. A.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations
Contract(s)/Grant(s): RFBR-04-05-64127; AF-207759; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Earlier, the Popigai impact fluidizites, which are the first occurrence of so kind in the terrestrial impact structures, were preliminary described. The fluidizites form dykes in the target gneisses and are tuff-like agglomerates made up of glass (10-90 vol. %), host gneiss fragments and cryptograin matrix. Commonly, the particles of the glass are fluidal porous (up to pumice state) schlieren welded with the matrix and strongly replaced with smectite. There are three types of the glass particles among the fresh ones: I) homogeneous glass derived from the target gneisses; II) fine-banded heterogeneous glass, with alternating of 'femic', homogeneous (type I) and salic species; III) salic glasses, including those ones derived from quartz (diaplectic

quartz glass and lechatelierite, both coesite-bearing). Shadows of femic and some other minerals of target rocks, as well as high-temperature indicators (together with lechatelierite, with its melting point greater than 1700 C, there are globules of magnetite, native iron, zircon and ruthile, with the melting/decomposing points greater than 1590 C, greater than 1530 C, approximately 1800 C and greater than 1850 C, correspondingly), are present within the glasses. Low totals suppose that all the glasses are enriched with volatiles (glass type/wt. % of volatiles): I/4-12; II/5-24; III/2-7 for silica glasses and III/12-25 for other type III glasses. No petrographic evidences of shock metamorphism are found either in the host gneisses or their fragments within the dykes. In general, hyaline components of the fluidizites were volatile+melt mixtures derived from the target gneissses within the margin part of shock melting zone, approximately equal to 50- 60 GPa, approximately 14-15 km far from the center of the explosion. Host gneisses were placed initially within the zone of weak shock metamorphism (P less than 8-10 GPa, greater than 25-30 km far from the center of the explosion).
Derived from text
*Carbonates; Melts (Crystal Growth); Petrology; Silicates; Inclusions; Water; Mineralogy*

**20050176485** Academy of Sciences (Russia), Moscow, Russia
**'Missing Xenon' Problem and Climate of the Early Earth**
Vityazev, A. V.; Pechernikova, G. V.; Bashkirov, A. G.; Lunar and Planetary Science XXXVI, Part 20; [2005]; 2 pp.; In English; See also 20050176459; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The proposed here solution for the problem of Xe deficit on the Earth and Mars is based on the fact of its enrichment in comparison to other noble gases in gas hydrates and models of impact erosion at final stage of the planet formation. The Earth state to the time of completion of its growth and problems of early atmosphere and hydrosphere are the focus of attention of many specialists on the Earth science. Theoretical models and data on short- and longlived radioactive isotopes say in favor that collecting of the main mass by the Earth, formation of the Moon and differentiation of the Earth into the core and primitive mantle were performed for the most part to the end of the first 100 Myr after formation of the Sun. As for a degree of the interior degassing, masses and compositions of the atmosphere and hydrosphere at 0.1-0.5 Ga, there is a broad range of opinions from presumption that the atmosphere and hydrosphere were absent at this stage at all (naked stage) up to hypotheses for presence of a massive atmosphere similar to the modern Venerian one and containing mainly carbon dioxide. There are also intermediate models with a moderate mass of the atmosphere containing nitrogen, noble gases in modern proportions and trace amounts of CO2, CH4, H2S (SO2), H2O. Isotopic anomalies of oldest (4.2-4.4 Ga) Australian zircons are interpreted as a hint to a sedimentoges in presence of water basins.
Derived from text
*Climate; Earth Sciences; Xenon; Cosmochemistry; Mars (Planet)*

**20050176502** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Cryogenic System for Interferometry of High-precision Optics at 20 K: Design and Performance**
Blake,Peter; Chambers, John; Mink, Ronald G.; Content, David; Davila, Pamela; Robinson, F. David; Chrzanowski, Chris; Shirgur, Badri; Frohlich, chip; [2005]; 1 pp.; In English; SPIE Symposium on Optics and Photonics, 31 Jul. - 4 Aug. 2004, San Diego, CA, USA
Report No.(s): AS04-AS08-65; SPIE Paper-5904-29; No Copyright; Avail: Other Sources; Abstract Only

This report describes the facility and experimental methods at the Goddard Space Flight Center Optics Branch for the measurement of the surface figure of cryogenically-cooled spherical mirrors using standard phase-shifting interferometry, with a standard uncertainty below 2nm rms. Two developmental silicon carbide mirrors were tested: both were spheres with radius of curvature of 600 mm, and clear apertures of 150 mm. The mirrors were cooled within a cryostat, and the surface figure error measured through a fused-silica window. The GSFC team developed methods to measure the in-situ SFE at 20 K with a combined standard uncertainty below 2 nm rms and the change in SFE with temperature (the cryochange) with a combined standard uncertainty of 0.25 -- 0.75 nm rms. This paper will present the measurement facility, methods, and uncertainty analysis.
Author
*Cryogenics; Optics; Interferometry; Precision*

**20050177047** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**The Gas Chromatograph Mass Spectrometer (GCMS) Experiment on the Cassini-Huygens Probe: First Results**
Niemann, H.; Demick, J.; Haberman, J.; Harpold, D.; Kasprzak, W.; Raaen, E.; Way, S.; Atreya, S.; Carignan, G.; Bauer, S., et al.; [2005]; 1 pp.; In English; Huygens Meeting, 30 May - 3 Jun. 2005, Crete, Greece; No Copyright; Avail: Other Sources; Abstract Only

The Huygens Probe of the Cassini Huygens Mission entered the atmosphere of the moon Titan on January 14, 2005. The GCMS was part of the instrument complement on the Probe to measure in situ the chemical composition of the atmosphere during the probe descent and to support the Aerosol Collector Pyrolyzer (ACP) experiment by serving as detector for the pyrolization products. The GCMS collected data from an altitude of 146 km to ground impact for a time interval of 2 hours and 37 minutes. The Probe and the GCMS survived the ground impact and collected data for 1 hour and 9 minutes on the surface in the near surface environment until signal loss by the orbiter. The instrument collected 5634 mass spectra during descent and 2692 spectra on the ground over a range of m/z from 2 to 141. Eight gas chromatograph samples were taken during the descent and two on the ground. This is a report on work in progress. The major constituents of the lower atmosphere were found to be N2 and CH4. The methane-mixing ratio was found to increase below the turbopause, about 35 km altitude, monotonically toward the surface to levels near saturation. After surface impact a steep increase of the mixing ratio was observed suggesting evaporation of surface condensed methane due to heating by the GCMS sample inlet heater. Other constituents were found to be in very low concentrations, below ppm levels. The presence of Argon 40 was confirmed. The results for the other noble gases are still being evaluated. Other hydrocarbons and nitriles were also observed and quantitative evaluation is in progress. Preliminary ratios for the major carbon and nitrogen isotopes were computed from methane and molecular nitrogen measurements.
Author
*Gas Chromatography; Huygens Probe; Mass Spectrometers; Titan*

**20050177085** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Kepler Mission to Detect Earth-like Planes**
Kondo, Yoji; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Kepler Mission has been approved and funded for launch into an Earth-trailing orbit in 2007. The satellite observatory is designed to detect Earth-like planets in the Cygnus region of the sky (one hundred square degrees). If all goes as planned, we expect to detect some 60 Earth-like planets, plus a greater number of larger planets. None of the planets that have been discovered so far are not Earth-like; they are mostly Jupiter-sized, large planets.
Author
*Space Missions; Earth Orbits; Detection*

**20050177233** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Mars 1064-nm Spectral Radiance Measurements from the Receiver Noise Response of the Mars Orbiter Laser Altimeter**
Sun, Xiaoli; Neumann, Gregory A.; Abshire, James B.; Zuber, Maria T.; March 08, 2005; 28 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Mars Orbiter Laser Altimeter not only provides surface topography from the laser pulse time-of-flight, but also two radiometric measurements, the active measurement of transmitted and reflected laser pulse energy, and the passive measurement of reflected solar illumination. The passive radiometry measurement is accomplished in a novel fashion by monitoring the noise density at the output of the photodetector and solving for the amount of background light. The passive radiometry measurements provide images of Mars at 1064-nm wavelength over a 2 nm bandwidth with sub-km spatial resolution and with 2% or better precision under full illumination. We describe in this paper the principle of operation, the receiver mathematical model, its calibration, and performance assessment from sample measurement data.
Author
*Mars Global Surveyor; Radiance; Receivers; Mathematical Models; Mars Surface*

## 92
## SOLAR PHYSICS

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

**20050174616** California Univ., Los Angeles, CA, USA
**Preliminary Evaluation of the Secondary Ion/Accelerator Mass Spectrometer, MegaSIMS**
Mao, P. H.; Hunihiro, T.; McKeegan, K. D.; Coath, C. D.; Jarzebinski, G.; Burnett, D.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The GENESIS Discovery Mission seeks to measure the average elemental and isotopic composition of the solar system

to a precision and accuracy sufficient to address important questions in planetary science. In September, 2004, the GENESIS sample return capsule (SRC) returned to Earth with its payload of solar wind samples, captured in ultra-pure target materials. Due to an assembly error, the parachute on the sample return capsule never opened, causing the capsule to impact Earth at terminal velocity, approx. 300 km/h. Most of the target materials were broken and all of the science materials suffered some degree of surface contamination. Fortunately, however, both of the SiC concentrator targets, one of which we will request for oxygen and nitrogen analysis, returned fully intact.
Derived from text
*Solar System; Chemical Composition; Ion Accelerators; Isotopes*

**20050174649** NASA Johnson Space Center, Houston, TX, USA
**Genesis: Sorting Out the Pieces**
McNamara, K. M.; Westphal, Andrew; Butterworth, A. L.; Burnett, D. S.; Lunar and Planetary Science XXXVI, Part 13; [2005]; 2 pp.; In English; See also 20050174558; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Genesis mission returned to Earth on September 8, 2004, experiencing a non-nominal reentry. The parachutes which were supposed to slow and stabilize the capsule throughout the return failed to deploy, causing the capsule to impact the desert floor at a speed of nearly 200 MPH. The result is that instead of receiving 301 intact solar wind collectors, mission personnel recovered and documented more than 10,000 collector fragments. Most of the fragments were pieces of the collector arrays but were not recovered on their original array locations. These were classified by size (longest dimension), identity (sometimes a guess) and found location (when known). The work took more than one month in Utah, and details are discussed elsewhere[1] The samples were transferred to their permanent home at the Johnson Space Center on October 4, 2004.
Derived from text
*Solar Wind; Samplers; Genesis Mission*

**20050175713** Montana Univ., Missoula, MT, USA
**The GENESIS Mission Solar Wind Samples: Collection Times, Estimated Fluences, and Solar-Wind Conditions**
Reisenfeld, D. B.; Wiens, R. C.; Barraclough, B. L.; Steinberg, J. E.; De-Koning, C.; Zurbuchen, T.; Burnett, D. S.; Lunar and Planetary Science XXXVI, Part 17; [2005]; 2 pp.; In English; See also 20050175701; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The NASA Genesis mission collected solar wind on ultrapure materials between November 30, 2001 and April 1, 2004. The samples were returned to Earth September 8, 2004. Despite the hard landing that resulted from a failure of the avionics unit to deploy the parachute, many samples were returned in a condition that should permit achievment of the primary science goals of the mission. Analyses of these samples should give a far better understanding of the solar isotopic composition. Further, the photospheric composition is thought to be representative of the solar nebula with a few exceptions, so that the Genesis mission will provide a baseline for the average solar nebula composition with which to compare present- day compositions of planets, meteorites, and asteroids.
Derived from text
*Solar Wind; Asteroids; Genesis Mission; Isotopes*

**20050176059** Smithsonian Astrophysical Observatory, Cambridge, MA, USA
**Nature and Variability of Coronal Streamers and their Relationship to the Slow Speed Wind**
Strachan, Leonard; May 2005; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-12781; No Copyright; Avail: CASI; A01, Hardcopy

NASA Grant NAG5-12781 is a study on the 'Nature and Variability of Coronal Streamers and their Relationship to the Slow Speed Wind.' The two main goals of this study are to identify: 1) Where in the streamer structure does the solar wind originate, and 2) What coronal conditions are responsible for the variability of the slow speed wind. To answer the first question, we examined the mostly closed magnetic field regions in streamer cores to search for evidence of outflow. Preliminary results from the OVI Doppler dimming ratios indicates that most of the flow originates from the edges of coronal streamers but this idea should be confirmed by a comparison of the coronal plasma properties with in situ solar wind data. To answer the second question, the work performed thus far suggests that solar minimum streamers have larger perpendicular velocity distributions than do solar maximum streamers. If it can be shown that solar minimum streamers also produce higher solar wind speeds then this would suggest that streamers and coronal holes have similar solar wind acceleration mechanisms. The key to both questions lie in the analysis of the in situ solar wind data sets. This work was not able to be completed during

the period of performance and therefore the grant was formally extended for an additional year at no cost to NASA. We hope to have final results and a publication by the end of the calendar year 2004. The SAO personnel involved in the research are Leonard Strachan (PI), Mari Paz Miralles, Alexander Panasyuk, and a Southern University student Michael Baham.
Author
*Solar Corona; Solar Wind Velocity; Velocity Distribution*

**20050176424** Lunar and Planetary Inst., Houston, TX, USA
**Martian Gullies and Groundwater: A Series of Unfortunate Exceptions**
Treiman, A. H.; Lunar and Planetary Science XXXVI, Part 19; [2005]; 2 pp.; In English; See also 20050176413; Original contains black and white illustrations
Contract(s)/Grant(s): CAN-02-OSS-01; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Gullies are commonly inferred to represent debris flows, lubricated and carried by liquid water that flowed from underground. The inference of groundwater, based principally on the apparent initiation of gullies at specific bedrock layers, has not been considered for consistency with local geology. Here, I examine gully occurrences for: presence of impermeable layers (aquicludes) in the subsurface, that the layers not tilt away from the gully-bearing walls, and that liquid water could have been available at or above the gully elevations.
Derived from text
*Ground Water; Mars (Planet); Landforms*

**20050177044** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Satellite Measurements of Middle Atmospheric Impacts by Solar Proton Events in Solar Cycle 23**
Jackman, C.; Labow, G.; DeLand, M.; Fleming, E.; Sinnhuber, M.; Russell, J.; [2005]; 1 pp.; In English; International Space Science Institute Meeting, 6-10 Jun. 2005, Bern, Switzerland; No Copyright; Avail: Other Sources; Abstract Only

Solar proton events (SPEs) are known to have caused changes in constituents in the Earth's neutral polar middle atmosphere in the most recent solar maximum period (solar cycle 23). The highly energetic protons produced ionizations, excitations, dissociations, and dissociative ionizations of the background constituents in the polar cap regions (greater than 60 degrees geomagnetic latitude), which led to the production of HOx (H, OH, HO2) and NOy (N, NO, NO2, NO3, N2O5, HNO3, HO2NO2, ClONO2, BrONO2). The HOx increases led to short-lived ozone decreases in the polar mesosphere and upper stratosphere due to the short lifetimes of the HOx constituents. Polar middle mesospheric ozone decreases greater than 50% were observed and computed to last for hours to days due to the enhanced HOx. The NOy increases led to long-lived polar stratospheric ozone changes because of the long lifetime of the NOy family in this region. Upper stratospheric ozone decreases of greater than 10% were computed to last for several months past the solar events in the winter polar regions because of the enhanced NOy. Solar cycle 23 was especially replete with SPEs and huge fluxes of high energy protons occurred in July and November 2000, September and November 2001, April 2002, October 2003, and January 2005. Smaller, but still substantial, proton fluxes impacted the Earth during other months in this cycle. Observations by the Upper Atmosphere Research Satellite (UARS) Halogen Occultation Experiment (HALOE) and Solar Backscatter Ultraviolet 2 (SBUV/2) instruments along with GSFC 2D Model predictions will be shown in this talk.
Author
*Middle Atmosphere; Solar Cycles; Solar Protons; Satellite-Borne Instruments*

**20050177063** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Magnetic Fields and Flows in Open Magnetic Structures**
Jones, Harrlson P.; [2004]; 1 pp.; In English; NSO Workshop 22: Large Structures and their Role in Solar Activity, 18-22 Oct. 2004, Sunspot, NM, USA; No Copyright; Avail: Other Sources; Abstract Only

Open magnetic structures connect the solar surface to the heliosphere and are thus of great interest in solar-terrestrial physics. This talk is primarily an observational review of what is known about magnetic fields and particularly flows in such regions with special focus on coronal holes and origins of the fast solar wind. First evidence of the connection between these two features was seen in correlations of Skylab data with in situ measurements of the solar wind soon after the discovery of coronal holes, which are now known to emanate from unipolar magnetic regions at the photosphere. Subsequently many observations of have been made, ranging from oscillations in the underlying photosphere and chromosphere, to possible beginnings of the solar wind as observed by Doppler shifts in high chromospheric and transition-region lines, to coronagraphic time-lapse studies of outward-moving blobs of material which perhaps trace elements of solar-wind plasma. Some of the many

unresolved and controversial issues regarding details of these observations and their association with the solar wind will be discussed.
Author
*Solar Magnetic Field; Coronal Holes; Solar Wind; Magnetic Field Configurations*

**20050177080** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Far-UV Radiation of the Early Sun**
Heap, Sally; [2005]; 1 pp.; In English; NASA's Astrobiology Institute Annual Conference, 10-13 Ar, 2005, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Far-UV radiation is responsible for the photolysis of important greenhouse gases such as CO2, NH3 (ammonia), CH4 (methane) and more generally, the global UV photochemistry of the early atmosphere. In our project, we are concentrating on the young Sun's effect on methane, since UV sunlight (lambda less than 1450 Angstroms) was the main destruction mechanism for methane in the early Earth's atmosphere. Since the UV luminosity of the early Sun cannot be calculated a priori; it can only be estimated from observations of stars similar to the young Sun. We report our results based on Hubble + FUSE spectra of stars selected from Gaidos (1998) Catalog of Nearby Young Solar Analogs (YSA's).
Author
*Far Ultraviolet Radiation; Sun; Photolysis*

**20050177115** NASA Lewis Research Center, Cleveland, OH, USA, TRW, Inc., USA, California Univ., Los Angeles, CA, USA, Southwest Research Inst., USA
**TEMPEST: Twin Electric Magnetospheric Probes Exploring on Spiral Trajectories--A Proposal to the Medium Class Explorer Program**
Research and Technology 1995; March 1995; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The objective of the Twin Electric Magnetospheric Probes Exploring on Spiral Trajectories (TEMPEST) mission is to understand the nature and causes of magnetic storm conditions in the magnetosphere whether they be manifested classically in the buildup of the ring current, or (as recently discovered) by storms of relativistic electrons that cause the deep dielectric charging responsible for disabling satellites in synchronous orbit, or by the release of energy into the auroral ionosphere and the plasma sheet during substorms.
Derived from text
*NASA Programs; Research and Development; Explorer Satellites*

**20050177219** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Transition Region Emission and the Energy Input to Thermal Plasma in Solar Flares**
Holman, Gordon D.; Holman, Gordon D.; Dennis, Brian R.; Haga, Leah; Raymond, John C.; Panasyuk, Alexander; [2005]; 1 pp.; In English; AGU/SPD Meeting, 22-27 May 2005, New Orleans, LA, USA
Report No.(s): AGU-61006-121; No Copyright; Avail: Other Sources; Abstract Only

Understanding the energetics of solar flares depends on obtaining reliable determinations of the energy input to flare plasma. X-ray observations of the thermal bremsstrahlung from hot flare plasma provide temperatures and emission measures which, along with estimates of the plasma volume, allow the energy content of this hot plasma to be computed. However, if thermal energy losses are significant or if significant energy goes directly into cooler plasma, this is only a lower limit on the total energy injected into thermal plasma during the flare. We use SOHO UVCS observations of O VI flare emission scattered by coronal O VI ions to deduce the flare emission at transition region temperatures between 100,000 K and 1 MK for the 2002 July 23 and other flares. We find that the radiated energy at these temperatures significantly increases the deduced energy input to the thermal plasma, but by an amount that is less than the uncertainty in the computed energies. Comparisons of computed thermal and nonthermal electron energies deduced from RHESSI, GOES, and UVCS are shown.
Author
*Energy Dissipation; High Temperature Plasmas; Solar Flares; X Ray Astronomy; Solar Wind; Solar Physics*

**20050177221** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**A Catalog of Coronal 'EIT Wave' Transients**
Thompson, B. J.; Myers, D. C.; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

SOHO Extreme Ultraviolet Imaging Telescope (EIT) data have been visually searched for coronal 'EIT wave' transients over the period beginning 24 March 1997 extending through 24 June 1998. The dates covered start at the beginning of regular

high-cadence (more than 1 image every 20 minutes) observations, ending at the 4-month interruption of SOHO observations in mid-1998. 176 events are included in this catalog. The observations range from 'candidate' events, which were either weak or had insufficient data coverage, to events which were well-defined and were clearly distinguishable in the data. Included in the catalog are times of the EIT images in which the events are observed, diagrams indicating the observed locations of the wavefronts and associated active regions, and the speeds of the wavefronts. The measured speeds of the wavefronts varied from less than 50 to over 700 km/sec with 'typical' speeds of 200-400 Msec.
Author
*Catalogs (Publications); Solar Corona; Solar Flares; Coronas*

## 99
## GENERAL

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

**20050174523** Army Engineer District, Huntington, WV, USA
**Great Kanawha River Navigation Charts. Mouth to Head of Navigation**
Jul. 2004; 90 pp.; In English
Report No.(s): PB2005-103000; Copyright; Avail: National Technical Information Service (NTIS)
Navigation charts show the location and identification of commercial docks, fleeting harbors and many private and public pleasure craft facilities, but may not depict the full extent of the facilities. Also, extensive recreational development and other riverbank installations may exist which are not shown in navigational charts. Vessel operators are encouraged to operate in a manner to preclude damage and/or destruction of these facilities during periods of increased river levels.
NTIS
*Navigation Aids; Charts*

# Subject Term Index


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