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

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# Introduction

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

- NASA, NASA contractor, and NASA grantee reports
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- 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.

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Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at help@sti.nasa.gov. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the NASA Technical Reports Server (TRS) – the publicly available contents of the NASA Aeronautics and Space Database.

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## 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.

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## 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

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## 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*.

**20040058096** NASA Langley Research Center, Hampton, VA, USA
**Assessing Videogrammetry for Static Aeroelastic Testing of a Wind-Tunnel Model**
Spain, Charles V.; Heeg, Jennifer; Ivanco, Thomas G.; Barrows, Danny A.; Florance, James R.; Burner, Alpheus W.; DeMoss, Joshua; Lively, Peter S.; [2004]; 10 pp.; In English; 3rd Astrobiology Science Conference, 28 Mar. - 1 Apr. 2004, Moffett Field, CA, USA
Contract(s)/Grant(s): 23-762-80-P1
Report No.(s): AIAA Paper 2004-1677; No Copyright; Avail: CASI; A02, Hardcopy

The Videogrammetric Model Deformation (VMD) technique, developed at NASA Langley Research Center, was recently used to measure displacements and local surface angle changes on a static aeroelastic wind-tunnel model. The results were assessed for consistency, accuracy and usefulness. Vertical displacement measurements and surface angular deflections (derived from vertical displacements) taken at no-wind/no-load conditions were analyzed. For accuracy assessment, angular measurements were compared to those from a highly accurate accelerometer. Shewhart's Variables Control Charts were used in the assessment of consistency and uncertainty. Some bad data points were discovered, and it is shown that the measurement results at certain targets were more consistent than at other targets. Physical explanations for this lack of consistency have not been determined. However, overall the measurements were sufficiently accurate to be very useful in monitoring wind-tunnel model aeroelastic deformation and determining flexible stability and control derivatives. After a structural model component failed during a highly loaded condition, analysis of VMD data clearly indicated progressive structural deterioration as the wind-tunnel condition where failure occurred was approached. As a result, subsequent testing successfully incorporated near-real-time monitoring of VMD data in order to ensure structural integrity. The potential for higher levels of consistency and accuracy through the use of statistical quality control practices are discussed and recommended for future applications.
Author
*Wind Tunnel Models; Wind Velocity; Accelerometers; Aeroelasticity; Deformation; Deterioration; Displacement Measurement*

## 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*.

**20040043764** Air Univ., Maxwell AFB, AL
**Aircrew Performance Cutting-Edge Tech: Emerging Human Performance Enhancement Technology Vision in Support of Operational Military Aviation Strategy**
Belland, Kris M.; Apr. 2002; 67 pp.; In English
Report No.(s): AD-A420625; AU/AWC/CSAT/2001-12; No Copyright; Avail: CASI; A04, Hardcopy

Using cutting-edge technology to create a human factors advantage in military operations will contribute to success on the battlefield of the future whether below the surface, on the surface, in the air, or in space. Human factors system selection in the past has appeared to be arbitrary and intermittent, with no unifying vision and apparently little or no coordination

between the military services. Mature, timely applied technology will reduce risk and enhance combat capability. By decreasing mishaps during training and combat, there will be a reduced number of lost lives of highly trained and costly aircrew, while preserving training and combat assets (aircraft/unmanned vehicles). A concomitant increase in survivability through better understanding of human factors technology will ultimately give the modern aviation warrior a tactical edge throughout the full spectrum of combat and provide secondary benefits to the civilian aviation sector. This paper will explain currently available and emerging aviation human factors technological advances in today's military aviation weapons systems and recommend a vision (and direction) for the most promising, emerging aviation human factors-related technological advances. Emerging human factors areas addressed in this paper include fatigue; vision enhancement/refractive eye surgery; nuclear, biological, and chemical weapons; directed energy weapons; mishap reduction; service culture; situational awareness; spatial disorientation; simulation; and training. It is hoped that this vision will focus technological direction so that the advances may be incorporated more rapidly into operational aviation combat systems.
DTIC
*Aircraft Safety; Augmentation; Cutting; Flight Crews; Flight Safety; Human Factors Engineering; Human Performance; Warfare*

**20040058105** NASA Langley Research Center, Hampton, VA, USA
**Flight Simulator Evaluation of Synthetic Vision Display Concepts to Prevent Controlled Flight Into Terrain (CFIT)**
Arthur, Jarvis J., III; Prinzel, Lawrence J., III; Kramer, Lynda J.; Parrish, Russell V.; Bailey, Randall E.; April 2004; 127 pp.; In English
Contract(s)/Grant(s): WU 23-728-60-10
Report No.(s): NASA/TP-2004-213008; L-18365; No Copyright; Avail: CASI; A07, Hardcopy
In commercial aviation, over 30-percent of all fatal accidents worldwide are categorized as Controlled Flight Into Terrain (CFIT) accidents, where a fully functioning airplane is inadvertently flown into the ground. The major hypothesis for a simulation experiment conducted at NASA Langley Research Center was that a Primary Flight Display (PFD) with synthetic terrain will improve pilots ability to detect and avoid potential CFITs compared to conventional instrumentation. All display conditions, including the baseline, contained a Terrain Awareness and Warning System (TAWS) and Vertical Situation Display (VSD) enhanced Navigation Display (ND). Each pilot flew twenty-two approach departure maneuvers in Instrument Meteorological Conditions (IMC) to the terrain challenged Eagle County Regional Airport (EGE) in Colorado. For the final run, flight guidance cues were altered such that the departure path went into terrain. All pilots with a synthetic vision system (SVS) PFD (twelve of sixteen pilots) noticed and avoided the potential CFIT situation. The four pilots who flew the anomaly with the conventional baseline PFD configuration (which included a TAWS and VSD enhanced ND) had a CFIT event. Additionally, all the SVS display concepts enhanced the pilot s situational awareness, decreased workload and improved flight technical error (FTE) compared to the baseline configuration.
Author
*Flight Simulators; Terrain; Enhanced Vision; Display Devices; Automatic Flight Control; Civil Aviation*

**20040058968** Department of Defense, Arlington, VA
**Logistics: F/A-18E/F Integrated Readiness Support Teaming Program (D-2003-120)**
Aug. 8, 2003; 87 pp.; In English
Report No.(s): AD-A421491; IG/DOD-D-2003-120; No Copyright; Avail: CASI; A05, Hardcopy
In June 1999, the Naval Air Systems Command prepared a business case analysis outlining the benefits that DoD would derive from teaming with industry to obtain total logistics support for the F/A-18E/F aircraft, referred to as the F/A-18E/F Integrated Readiness Support Teaming (FIRST) Program. The business case analysis showed a 30-year cost avoidance of $1.4 billion that was based on a comparison of costs associated with the teaming initiative for seven major cost elements to those costs without the initiative. The Naval Air Systems Command used the business case to justify entering into a teaming arrangement with Boeing. However, lacking sufficient program funds for the effort, the Naval Air Systems Command requested that the Naval Inventory Control Point, Philadelphia (NAVICP) provide assistance through the Navy Working Capital Fund.
DTIC
*Inventory Controls; Logistics; Military Aircraft*

**20040058980** Air Force Research Lab., Wright-Patterson AFB, OH

**Automated Aerial Refueling Research. Summary Presentation**

Hinchman, Jacob; Oct. 2003; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A421534; AFRL-VA-WP-TP-2003-344; AFRL-VA-WP-TP-2003-344; No Copyright; Avail: CASI; A03, Hardcopy

Briefing reports on multi-vehicle wind tunnel tests conducted by Bihrle to obtain interaction data between a KC-135 tanker and a UAV receiver. The data will be used to develop a refueling simulation to evaluate controllability and preliminary automated designs for UAV refueling. The briefing discusses use of this data with a combination of automatic refueling and collision avoidance. This is very preliminary data on interactions. It has military application for advanced UAV refueling.

DTIC

*Air to Air Refueling; Refueling; Wind Tunnel Tests*

**20040058998** Army Aeromedical Research Lab., Fort Rucker, AL

**The Role of Human Causal Factors in U.S. Army Unmanned Aerial Vehicle Accidents**

Manning, Sharon D.; Rash, Clarence E.; LeDuc, Patricia A.; Noback, Robert K.; McKeon, Joseph; Mar. 2004; 35 pp.; In English

Report No.(s): AD-A421592; USAARL-2004-11; No Copyright; Avail: CASI; A03, Hardcopy

For the period FY95-FY03, each Unmanned Aerial Vehicle (UAV) accident was reviewed and classified by a series of characteristics using two approaches. The first was a variant on a methodology referred to as the Human Factors Analysis and Classification System (HFACS). The HFACS captures data for four levels of human-related failure: Unsafe acts, preconditions for unsafe acts, unsafe supervision, and organizational influences. The second analysis approach was based on the accident methodology defined in Department of the Army Pamphlet 385-40, 'Army accident investigation and reporting.' Human causal factors are identified during this analysis and broken down into five types of failure: Individual failure, leader failure, training failure, support failure, and standards failure. Where the assignment of cause included human error, the accident data including narrative and findings were analyzed to identify specific human causal factors (e.g., high/low workload, fatigue, poor crew coordination, etc.). No single human causal factor was responsible for all accidents. However, both methods of analysis identified individual unsafe acts or failures as the most common human-related causal factor category (present in approximately 61 percent of the 18 human error related accidents).

DTIC

*Aircraft Accidents; Drone Vehicles; Errors; Human Factors Engineering; Human Performance; Pilotless Aircraft*

**20040059020** Air Univ., Maxwell AFB, AL

**A-10s over Kosovo. The Victory of Airpower over a Fielded Army as Told by the Airmen Who Fought in Operation Allied Force**

Haave, Christopher E.; Haun, Phil M.; Dec. 2003; 365 pp.; In English

Report No.(s): AD-A421682; No Copyright; Avail: CASI; A16, Hardcopy

In May 1999, our 81st Expeditionary Fighter Squadron (EFS) was flying out of Gioia del Colle Air Base (AB), Italy, conducting around-the-clock combat operations in support of Operation Allied Force (OAF). In the midst of this, several pilots began talking about writing a book. Those of us who were airpower and mllitary-history buffs noticed that the combat we were experiencing was far different from much of what we had studied. After Slobodan Milosevic capitulated and OAF ended in June, we took stock of what we had done and promised each other to write down our combat experiences and observations. A-10s over Kosovo is the fruit of that commitment. Our initial vision for this book was to let each pilot tell an anecdote or two. Taken collectively, those stories would provide others with an idea of what an A-10 group had, or had not, accomplished. However, as we wrote and exchanged ideas, we decided that the book should focus primarily on the missions. Therefore, in the end, our book includes many personal accounts of our relocation and beddown, aircraft maintenance, and combat experiences; we tried to describe the tactical execution of those missions and the many activities that directly, or indirectly, supported them. We have limited our focus to the contributions of the 40th Expeditionary Operations Group (EOG) comprised of personnel from the 81st EFS at Spangdahlem AB, Germany, and the 74th EFS from Pope Air Force Base, North Carolina. While we fondly mention some of the combat contributions of our fellow A-10 warriors in the 104th EOG who operated out of Trapani AB, Sicily, we do not tell their complete story.

DTIC

*Military Operations*

**20040059086** Air Univ., Maxwell AFB, AL
**Airpower Journal Index, 1987-1996**
Lang, Pamela; Petersen, Michael J.; Jul. 1998; 208 pp.; In English
Report No.(s): AD-A421860; No Copyright; Avail: CASI; A10, Hardcopy

In 1993 Air University Press published the Airpower Journal Index, 1987-1991. The Journal has now been in print for over 10 years. Since our first index, we've grown from a fledgling publication-a professional journal dedicated to the advancement of airpower and the understanding of its application to the operational level of war-into the chief of staffs professional flagship publication. After reconstituting and convening our editorial board and widening our referee network, we now publish selected articles that examine strategy and policy Issues. Further, we have completed construction of and now continuously Improve our Internet publication, Air Chronicles. This updated Index compiles the first 10 years of the Airpower Journal's efforts to promote the Air Force professional dialogue and to encourage a broad discussion. This publication lists all articles, editorials, and short commentaries from the first 10 volumes of Airpower Journal (1987-1996) in author, title, and subject indexes. The subject index-divided into 135 categories-also includes book reviews, listed alphabetically by name of the book's author. The other categories of the subject index list entries alphabetically by title. A typical entry includes the author's name, title of the article/editorial/commentary, volume number, issue number, date of issue, and inclusive page numbers. Articles, editorials, and commentaries may be cross-referenced in as many as five different categories. We used our best judgment in assigning entries to subject categories, although- in the spirit of both inclusiveness and usefulness-we have deliberately placed entries in categories that may be only marginally appropriate. We have retained most of the category titles used in the Airpower Journal Index, 1987-1991 but have added 24 new categories that reflect such changes as the demise of the Soviet Union and the return of Russia, the emergence of information warfare, and the revolution in military affairs.
DTIC
*Periodicals*

**20040059111** Department of the Air Force, Washington, DC
**Air Mobility Issues 2002. Air Force Jounral of Logistics. Volume 26, Number 1, Spring 2002**
Jan. 2002; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421935; No Copyright; Avail: CASI; A03, Hardcopy

The Air Force Journal of Logistics is published quarterly and is the professional logistics publication of the USA Air Force. The theme of this issue is Air Mobility. Articles concern air refueling, air power, airlift operations, air mobility, air logistics and awards.
DTIC
*Logistics; Mobility; Support Systems*

**20040059190** Space and Naval Warfare Systems Center, San Diego, CA
**An Advanced Telereflexive Tactical Response Robot**
Gilbreath, G. A.; Ciccimaro, D. A.; Everett, H. R.; Apr. 2000; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422082; No Copyright; Avail: CASI; A02, Hardcopy

ROBART III is intended as an advanced demonstration platform for non-lethal tactical response, extending the concepts of reflexive teleoperation into the realm of coordinated weapons control (i.e., sensor-aided control of mobility, camera, and weapons functions) in law enforcement in urban warfare scenarios. A rich mix of ultrasonic and optical proximity and range sensors facilitates remote operation in unstructured and unexplored buildings with minimal operator oversight. Supervised autonomous navigation and mapping of interior spaces is significantly enhanced by an innovative algorithm which exploits the fact that the majority of man-made structures are characterized by (but not limited to) parallel and orthogonal walls. This paper presents a brief overview of the advanced telereflexive man-machine interface and its associated 'human-centered mapping' strategy.
DTIC
*Dynamic Response; Robots*

**20040059210** National Aerospace Lab., Amsterdam
**Evaluating Human Interaction with Advanced Air Traffic Management Automation**
Hilburn, Brian G.; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422128; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
*Air Traffic Control*

**20040059281** Air Force Research Lab., Wright-Patterson AFB, OH
**Differences in Pilot Automation Philosophies in the US and Russian Air Forces Ground Collision Avoidance Systems**
Albery, William B.; Khomenko, Mikhail N.; Oct. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422250; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
*Automatic Pilots; Collision Avoidance; Disorientation; Human Factors Engineering; Man Machine Systems; Physiology; Terrain*

**20040059294** Air Force Research Lab., Wright-Patterson AFB, OH
**Work-Centered Decision Support**
Young, Michael J.; Eggleston, Robert G.; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422252; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
*Decision Support Systems; Graphical User Interface; Human Performance; Workloads (Psychophysiology)*

**20040059630** Warsaw Univ., Warsaw, Poland
**Simulator Technology in Optimising the Human-Automated System Interface**
Szczepanski, Cezary; Oct. 2003; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422307; No Copyright; Avail: CASI; A03, Hardcopy
Over time, the increasing complexity of the human- machine environment has required greater and greater abilities in input data analysis, decision making, and system control on the part of the human operator. Time deficits combined with the above requirements gradually brought about the introduction of automated systems to support the human operator in his/her task performance. Complex, hierarchical control systems began to overtake a part of the work typically done by human operators. However, after an initial euphoria, problems appeared. The smooth cooperation between the human operator and the automated system sometimes became ineffective and even problematic. That situation usually happened during unusual situations when standard decisions should have been modified and new action taken. Mishaps and fatalities occurred, showing that a problem existed that needed to be worked out. In these complicated situations, researchers and designers need a tool for replicating the environment of the human operator, with all the factors and stimuli that act on the human in the real situation. That need for replication spurred the creation of simulator technology. This paper describes the flight simulator technology that was used to optimize the cockpits of a new combat helicopter and an F-16 jet fighter. (11 figures, 10 refs.)
DTIC
*Cockpits; Computer Aided Design; Flight Control; Flight Simulators; Man Machine Systems; Simulators*

**20040059715** Barmby Consulting, Vienna, VA, USA
**Target Acquisition for Offensive Systems**
Barmby, John G.; Mar. 2001; 9 pp.; In English
Report No.(s): AD-A421776; No Copyright; Avail: CASI; A02, Hardcopy
In order to better evaluate the cost effectiveness of offensive weapon systems, increased attention should be paid to quantifying target acquisition (TA) by the shooters. Recent conflicts such as the Gulf War and Kosovo have illustrated the importance of proper TA. The calculation of the probability of target acquisition is difficult. It should start with an understanding of the five elements in the process, especially, the rules of engagement. Information on target characteristics in a battle setting (signatures) needs to be assessed. Determination must be made as to the contributions (cueing) from support systems not on the attack platform along with the effectiveness of the command, control, communications, intelligence (C3I) net. Next, the on-board equipment, whether pods or integral, and procedures should be investigated based upon test results including pilot proficiency. Then the estimate needs to be degraded for wartime factors such as lighting (day or night), weather (clouds), dust, camouflage, terrain, decoys and stress. The analyst should specify the assumptions, describe the logic, and note the operational environment in order to improve the confidence in the estimates. Equal cost force analyses can be useful for assessing system alternatives and trade-offs among the probabilities.
DTIC
*Target Acquisition*

## 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*.

**20040043883** Air Force Inst. of Tech., Wright-Patterson AFB, OH
**Cooperative Control Simulation Validation Using Applied Probability Theory**
Schulz, Christopher S.; Aug. 2003; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A420800; AFIT/GAE/ENY/03S-14; No Copyright; Avail: CASI; A05, Hardcopy

Several research simulations have been created to support the development and refinement of teamed autonomous agents using decentralized cooperative control algorithms. Simulation is the necessary tool to evaluate the performance of decentralized cooperative control algorithms; however, these simulations lack a method to validate their output. This research presents a method to validate the performance of a decentralized cooperative control simulation environment for an autonomous Wide Area Search Munition (WASM). Rigorous analytical methods for six wide area search and engagement scenarios involving Uniform, Normal, and Poisson distributions of N real targets and M false target objects are formulated to generate expected numbers of target attacks and kills for a searching WASM. The mean value based on the number of target attack and kills from Monte Carlo simulations representative of the individual scenarios are compared to the analytically derived expected values. Emphasis is placed on WASMs operating in a multiple target environment where a percentage of the total targets are either false targets or may be misconstrued as false by varying the capability of the WASM's Automatic Target Recognition (ATR) capability. (8 tables, 18 figures, 22 refs.)
DTIC
*Autonomous Navigation; Computerized Simulation; Control Simulation; Drone Vehicles; Probability Theory; Program Verification (Computers)*

**20040058112** NASA Langley Research Center, Hampton, VA, USA
**A Study of Vehicle Structural Layouts in Post-WWII Aircraft**
Sensmeier, Mark D.; Samareh, Jamshid A.; [2004]; 8 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Structures Conference, 19-23 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-762-40-31
Report No.(s): AIAA Paper 2004-1624; Copyright; Avail: CASI; A02, Hardcopy

In this paper, results of a study of structural layouts of post-WWII aircraft are presented. This study was undertaken to provide the background information necessary to determine typical layouts, design practices, and industry trends in aircraft structural design. Design decisions are often predicated not on performance-related criteria, but rather on such factors as manufacturability, maintenance access, and of course cost. For this reason, a thorough understanding of current best practices in the industry is required as an input for the design optimization process. To determine these best practices and industry trends, a large number of aircraft structural cutaway illustrations were analyzed for five different aircraft categories (commercial transport jets, business jets, combat jet aircraft, single engine propeller aircraft, and twin-engine propeller aircraft). Several aspects of wing design and fuselage design characteristics are presented here for the commercial transport and combat aircraft categories. A great deal of commonality was observed for transport structure designs over a range of eras and manufacturers. A much higher degree of variability in structural designs was observed for the combat aircraft, though some discernable trends were observed as well.
Author
*Structural Design; Aerospace Vehicles; Jet Aircraft; Transport Aircraft; Aircraft Industry; Layouts*

**20040058966** Department of Defense, Arlington, VA
**Logistics: Allegations Concerning the Administration of Contracts for Electronic Flight Instruments on the C-130H Aircraft (D-2003-115)**
Jun. 30, 2003; 34 pp.; In English
Report No.(s): AD-A421484; IG/DOD-D-2003-115; No Copyright; Avail: CASI; A03, Hardcopy

Managers of acquisition programs and logistics planners should read this report to obtain information concerning the need to coordinate contracting and logistics planning processes. In addition, contract specialists, inspectors, and engineers at the

Defense Contract Management Agency should read this report to understand and use the Corrective Action Request process.
DTIC
*Electronic Equipment; Flight Instruments; Logistics; Management Information Systems; Transport Aircraft*

**20040058969** Department of Defense, Arlington, VA
**Logistics: Condition Based Maintenance-Plus (D- 2003-125)**
Aug. 27, 2003; 21 pp.; In English
Report No.(s): AD-A421493; IG/DOD-D-2003-125; No Copyright; Avail: CASI; A03, Hardcopy

This audit was initiated to determine whether DoD was still achieving the maintenance savings from reliability centered maintenance that were identified in Inspector General of the Department of Defense Report No. 91-098, 'Aircraft Depot Maintenance Programs,' June 17, 1991. During the survey phase of this audit, we found that DoD was implementing a new maintenance concept (condition based maintenance- plus) that focuses on the actual condition of the weapon system and its components when determining maintenance requirements as opposed to time-phased or preventive maintenance procedures. Condition based maintenance-plus is one of the six initiatives of the Future Logistics Enterprise that is being implemented under the direction of the Deputy Under Secretary of Defense (Logistics and Material Readiness). The objective of the Future Logistics Enterprise is to provide integrated end-to- end logistical support.
DTIC
*Aircraft Maintenance; Maintenance*

**20040059084** Boeing Co., Long Beach, CA
**B-1B Wing Shear Bearing Maintenance Repair (SD11)**
Borden, Lance; Apr. 2, 2004; 18 pp.; In English
Contract(s)/Grant(s): F33657-01-D-2050
Report No.(s): AD-A421857; NA-04-1143; No Copyright; Avail: CASI; A03, Hardcopy

The primary purpose of this report is to provide documentation regarding the status of the Contractor Field Team (CFT) Wing Shear Bearing Maintenance Repair effort at Ellsworth AFB for the period 27 February 2004 through 29 March 2004. Three (3) aircraft were in work during March 2004 with one (1) aircraft completed. The completed aircraft was a combined Wing Shear Bearing (WSB) repair/Block E Mod (A/C 86- 0136). WSB only repair of Aircraft 86-0125, assigned to Ellsworth AFB, was begun on 24 March in a second hangar. This is the second aircraft of the additional 7 B-1 aircraft added to the CFT workload, the first being Edwards AFB flight-test A/C 85-0068 recently completed. Currently, twelve (19) aircraft are to be repaired by the Contractor Field Team (CFT) under this delivery order. Two of the eight aircraft scheduled for concurrent WSB/ Block E/ PC Card modifications have been completed.
DTIC
*Bomber Aircraft; Maintenance; Shear Properties; Wings*

**20040059112** National Defense Univ., Washington, DC
**UCAVs-Technological, Policy, and Operational Challenges**
Barry, Charles L.; Zimet, Elihu; Oct. 2001; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421937; No Copyright; Avail: CASI; A02, Hardcopy

The Bush administration and Congress are in concert on the goal of developing a fleet of unmanned aircraft that can reduce both defense costs and aircrew loses in combat by taking on at least the most dangerous combat missions. Unmanned combat aerial vehicles (UCAVs) will be neither inexpensive enough to be readily expendable nor--at least in early development--capable of performing every combat mission alongside or in lieu of manned sorties. Yet the tremendous potential of such systems in widely recognized, and allies as well as potential of such systems is widely recognized, and allies as well as potential adversaries are moving quickly to mount their own research and development programs. The USA is committed to fielding UCAV capabilities by 2010, principally for the missions of suppression of enemy air defense and deep strike, which are among the highest risk tasks for the Air Force and naval aviation.
DTIC
*Combat; Policies*

**20040059114** Air Univ., Maxwell AFB, AL
**Organizational Structure for Air National Guard Tactical Aircraft Maintenance**
Ventresca, Rudolph; Oct. 1991; 117 pp.; In English
Report No.(s): AD-A421948; No Copyright; Avail: CASI; A06, Hardcopy

Over the past 25 to 30 years, the active Air Force has made dramatic changes in the organization and structure of fighter aircraft maintenance units, while Air National Guard (ANG) maintenance units have remained substantially the same. The acceptance of the gaining-command concept in 1960 effectively bound the ANG to abide by the training and policy guidelines of the active Air Force. According to this concept each Air National Guard unit is aligned by mission with an active Air Force major command. During peacetime each major command is responsible for providing policy guidelines and monitoring the training of each of its designated units to include conducting operational readiness inspections (ORI). Upon mobilization the various Guard units are integrated with their gaining command to complete a total force structure capable of meeting wartime contingencies. The Vietnam experience taught us some lessons about organizing for combat and training the way we plan to fight. The active tactical air forces (TAF) responded to those lessons learned and to a changing environment by changing the structure of their maintenance organization. The changes that were made could affect the ANG's ability to integrate with the active forces when mobilized and to interact with them during peacetime training, exercises, and deployments.
DTIC
*Aircraft Maintenance; Armed Forces (United States)*

**20040059126** Air Univ., Maxwell AFB, AL
**The Praetorian STARShip: The Untold Story of the Combat Talon**
Thigpen, Jerry L.; Dec. 2001; 508 pp.; In English
Report No.(s): AD-A421975; No Copyright; Avail: CASI; A22, Hardcopy

Jerry Thigpen's study on the history of the Combat Talon is the first effort to tell the story of this wonderfully capable machine. This weapons system has performed virtually every imaginable tactical event in the spectrum of conflict and by any measure is the most versatile C-130 derivative ever produced. First modified and sent to Southeast Asia (SEA) in 1966 to replace theater unconventional warfare (UW) assets that were limited in both lift capability and speed the Talon I quickly adapted to theater UW tasking including infiltration and resupply and psychological warfare operations into North Vietnam. After spending four years in SEA and maturing into a highly respected UW weapons system the Joint Chief of Staff (JCS) chose the Combat Talon to lead the night low-level raid on the North Vietnamese prison camp at Son Tay. Despite the outcome of the operation the Talon I cemented its reputation as the weapons system of choice for long-range clandestine operations. In the period following the Vietnam War USA Air Force (USAF) special operations gradually lost its political and financial support which was graphically demonstrated in the failed Desert One mission into Iran. Thanks to congressional supporters like Earl Hutto of Florida and Dan Daniel of Virginia funds for aircraft upgrades and military construction projects materialized to meet the ever-increasing threat to our nation. Under the leadership of such committed hard-driven officers as Brenci Uttaro Ferkes Meller and Thigpen the crew force became the most disciplined in our Air Force. It was capable of penetrating hostile airspace at night in a low-level mountainous environment covertly to execute any number of unconventional warfare missions.
DTIC
*Combat*

**20040059155** Space and Naval Warfare Systems Command, San Diego, CA
**An Automated UAV Mission System**
Mullens, Katheerine D.; Pacis, Estrellina B.; Stancliff, Stephen B.; Burmeister, Aaron B.; Denewiler, Thomas A.; Sep. 2003; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422026; No Copyright; Avail: CASI; A03, Hardcopy

In March of last year, engineers from SPAWAR Systems Center, San Diego (SSC San Diego) and Allied Aerospace (formerly Micro Craft, Inc.) conducted the first known launch of a Vertical Takeoff and Landing Unmanned Air Vehicle (UAV) from an Unmanned Ground Vehicle (UGV) in Holtville, California (2002). The launch concluded a week-long demonstration to the Defense Advanced Research Projects Agency as part of the U.S. Army's Future Combat Systems Organic Air Vehicle Phase I effort. The launch involved Allied Aerospace's 29-inch Lift Augmented Ducted Fan iSTAR UAV and SSC San Diego's Mobile Detection Assessment Response System-Exterior UGV.
DTIC
*Drone Vehicles; Surveillance*

**20040059246** Army Aeromedical Research Lab., Fort Rucker, AL
**Tactile Situation Awareness System Flight Demonstration**
McGrath, B. J.; Estrada, A.; Braithwaite, M. G.; Raj, A. K.; Rupert, A. H.; Mar. 2004; 49 pp.; In English
Report No.(s): AD-A422198; USAARL-2004-10; No Copyright; Avail: CASI; A03, Hardcopy

The Joint Strike Fighter (JSF) - Tactile Situation Awareness System (TSAS) flight demonstration project originated at the NASA Johnson Space Center and the Naval Aerospace Medical Research Laboratory with funding provided from the JSF Program Office. The JSF-TSAS project was conceived as a short-duration technology maturation and flight demonstration program. The JSF Flight Systems Integrated Product Team (IPT) provided overall project management and funding throughout the demonstration effort. The project integrated a tactile display, F-22 cooling vest, and GPS/INS technologies into a single synergistic system in a UH-60 helicopter. A 10-event test operation was conducted to demonstrate the utility of this advanced human-machine interface. Four demonstration pilots were selected to fly the flight events. Summary results showed that TSAS technologies have the potential to increase pilot situational awareness and reduce pilot workload when using the tactile display, especially during simulated shipboard operations in Instrument Meteorological Conditions (IMC). Prototype hardware development showed that tactile displays could be integrated into existing flight gear. The test pilots successfully performed all maneuvers with degraded outside visual cues, relying on tactile cues for the necessary information. Using TSAS, pilots demonstrated improved control of aircraft during complex flight conditions.
DTIC
*Flight Simulation; Flight Tests; Human-Computer Interface; Man Machine Systems; Situational Awareness*

**20040059250** Institute for Human Factors TNO, Soesterberg
**Augmenting Camera Images for Operators of Unmanned Aerial Vehicles**
Veltman, Hans; Oving, Arjen; Oct. 2003; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422204; No Copyright; Avail: CASI; A03, Hardcopy

Unmanned aerial vehicles (UAVs) do not have pilots on board, but operators are very important for the control of the system during operation. Due to a high level of automation, steering of the platform has become relatively easy and most often UAVs follow pre-programmed waypoints. However, manual camera steering is often required. To control the camera, a steering signal from a control station is sent to the camera. The camera then turns to the required position and the camera images are sent back to the control station. In many cases the images also must be coded and decoded. This loop may cause substantial time delays between the control input and changes of the camera pictures in the control room. The delays between steering input and display of the camera images may seriously hamper task performance. For instance, a delay of 0.3 5 already results in a substantial performance decrement. This is because the operator has to wait for the result of the steering input before the next input can be generated (Cooke, 1965; Wagenaar, 1971; Veldhuyzen & Stassen, 1973). Fast feedback about the results of the steering input is therefore essential for adequate steering performance.
DTIC
*Cameras; Pilotless Aircraft*

**20040059251** Army Aeromedical Research Lab., Fort Rucker, AL
**Insertion Loss of the HGU-84/P Rotary-Wing Helmet System with Oregon Aero Earcup Replacement Products**
Ahroon, William A.; Hill, Melinda E.; Gordon, Elmaree; Robinette, Martin B.; Feb. 2004; 279 pp.; In English
Report No.(s): AD-A422207; USAARL-2004-08; No Copyright; Avail: CASI; A13, Hardcopy

The sound attenuation of the H6U-84/P Rotary-Wing Helmet System with Oregon Aero earcup replacement products was evaluated in accordance with ANSI S12.42-1995 (R1999) Microphone-in-Real-Ear procedures. The differences in insertion losses between the various helmet modifications were generally quite small and unlikely to have an effect on operational considerations, especially if double hearing protection in the form of earplugs, the Communications Earplug (CEP), or Attenuating Custom Communications Earphone System for Aircrew (ACCES for Aircrew) is employed. The insertion loss of the helmet with the Oregon Aero HushKit earcup replacement foam was significantly poorer than the standard helmet system. Insertion losses with the SoftSeal (replacement earcup seal) with HushKit and the SoftSeal/HushKit Combo (soft replacement earcup) were statistically significantly greater than the standard helmet configuration at some frequencies, although the differences were marginal at the low frequencies at which rotary-wing noise hazards are the greatest. Caution is urged when considering the use of the SoftSeal or SoftSeal/HushKit Combo since, at the time of this writing, neither of these earcup replacement products has been evaluated for helmet retention or blunt impact protection in case of an aircraft mishap.
DTIC
*Acoustic Attenuation; Helmets; Insertion Loss; Replacing; Rotary Wings*

**20040059265** Naval Postgraduate School, Monterey, CA
**Modernizing the Army's Utility Helicopter Fleet to Meet Objective Force Requirements**
Bentzel, Thomas F.; Brzezinski, Jacek W.; Calhoun, John C.; Stiner, Mark T.; Mar. 2004; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422229; No Copyright; Avail: CASI; A06, Hardcopy

The purpose of this MBA Project was to recommend force development solutions in terms of capabilities to meet the USA Army's future utility helicopter requirements. The last thorough review of requirements for the utility helicopter feet of the future was constricted in 2000. This project focuses on changes that have occurred in the Army's since then, and the extent to which various alternative courses of action address those changes. The report begins by briefly considering changes in the Army's operational environment. Next the authors consider what the requirements will be for the utility helicopter as the Army transitions from its current posture to the Objective Force. The study then considers possible materiel alternatives to fulfill the Objective Force requirements. These alternatives are to develop a new aircraft, that an aircraft that is already in production, or to improve the UH-60. The authors conclude that it is technically risky but feasible and cost effective to improve the UH-60 so that it can meet minimum future requirements, while a new aircraft acquisition option offers better performance and suitability at incrementally increasing costs.
DTIC
*Helicopters; Utility Aircraft*

**20040059279** Air Force Research Lab., Wright-Patterson AFB, OH
**Uninhabited Military Vehicles: What Is the Role of the Operators?**
Reising, John M.; Oct. 2003; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422248; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
*Drone Vehicles; Man Machine Systems; Operators (Personnel)*

**20040059313** Naval Postgraduate School, Monterey, CA
**CROSSBOW. Volume 1**
Muldoon, Richard C.; Bauer, David; Carroll, Steven B.; Quast, Glen B.; Lantier, Lance; Dec. 2001; 143 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422295; SEI2-001; No Copyright; Avail: CASI; A07, Hardcopy
Distributing naval combat power into many small ships and unmanned air vehicles that capitalize on emerging technology offers a transformational way to think about naval combat in the littorals in the 2020 timeframe Project CROSSBOW is an engineered system of systems that proposes to use such distributed forces to provide forward presence, to gain and maintain access, to provide sea control, and to project combat power in the littoral regions of the world, Project CROSSBOW is the result of a yearlong, campus-wide, integrated research systems engineering effort involving 40 student researchers and 15 supervising faculty members This report (Volume I) summarizes the CROSSBOW project It catalogs the major features of each of the components, and includes by reference a separate volume for each of the major systems (ships, aircraft, and logistics) , It also presents the results of the mission and campaign analyses that informed the trade-offs between these components It describes certain functions of CROSSBOW in detail through specialized supporting studies, The student work presented here is technologically feasible, integrated, and imaginative This student project cannot by itself provide definitive designs or analyses covering such a broad topic, It does strongly suggest that the underlying concepts have merit and deserve further serious study by the Navy as it transforms itself.
DTIC
*Navy; Systems Engineering; Warfare*

**20040059316** Airbus Industrie, Blagnac
**Cockpit Automation Philosophy**
Tarnowski, Etienne; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422301; No Copyright; Avail: CASI; A03, Hardcopy
The civil aviation environment has rapidly evolved in the past decades. In the 70s, 500 billion passengers per kilometer were transported; in the 80s, that figure doubled, and in the 90s it doubled again reaching 2000 billion passengers per kilometer. The cargo demand, in parallel, increased at an average rate of 10% per year. This has enlarged the air traffic rate and created severely congested skies. At the same time, many new airlines have been born, a lack of pilots has forced operators to employ young cadets, and old aircraft have had to co-exist with new technology aircraft. These factors have created new risks in commercial aviation. On the other hand, flight safety criteria have become more stringent and the efficiency of the flight in all its aspects (e.g., fuel costs, maintenance and crew costs, minimum delays, etc.) has become a primary concern. All these contradictory objectives cannot be met on older generation aircraft. Automated systems have helped aircraft manufacturers upgrade the cockpit and provide the crew with the means to fulfill his/her role while keeping up with these new

constraints. This paper addresses the following topics: why automated systems are necessary; the human being's strengths and weaknesses and how automation can complement them; the principles of automation; automation as applied to operations and steering; the Autopilot and Autothrust systems; fly-by- wire computers and control laws; automation for fast computations related to navigation, flight planning, and performance, etc.; the primary flight display system, the navigation display, and the centralized aircraft monitoring system for engine and warning displays; how to adapt humans to automation; pilot training for automated systems; factors contributing to pilot errors; the necessity for active monitoring from the pilot; Autopilot, Autothrust, and Flight Director mode misuse; Flight Management System (FMS) workarounds; and data entry errors.
DTIC
*Automatic Pilots; Cockpits; Decision Support Systems; Fly By Wire Control; Man Machine Systems*

**20040059713** National Defense Univ., Washington, DC, USA
**Acquisition for the 21st Century: The F-22 Development Program**
Perry, William J.; Mar. 1999; 205 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421919; No Copyright; Avail: CASI; A10, Hardcopy

The Department of Defense has recently charted a new course to further improve the way in which it provides weapon systems for the war fighter. This path has seen a fundamental change in how members of the Government/industry acquisition team work together to develop America's arsenal for defense. These changes center around the use of Integrated Process and Product Development concepts and the use of empowered, multifunctional teams, called Integrated Product Teams. Integrated Product Teams have been used successfully in industry for a number of years. One particularly successful example has been the use of Integrated Product Teams on the Boeing 777 program. Now several programs in the Defense Department are operating under these concepts. The earliest, and the leader in these concepts, is the Air Force F-22 Advanced Tactical Fighter development program. In this book, Lieutenant Colonel Michael D. Williams, USAF, first describes the principles and the concepts of the F-22 program.
DTIC
*Fighter Aircraft*

**20040059752** Army Aviation and Missile Command, Redstone Arsenal, AL, USA
**Subsystem Acoustic Testing of a Vertical Takeoff and Landing Ducted Propeller Unmanned Aerial Vehicle**
Fidler, Kenneth R.; Mar. 2004; 52 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421644; TR-AMR-SS-04-05; No Copyright; Avail: CASI; A04, Hardcopy

By definition a Vertical Takeoff and Landing (VTOL) Ducted Propeller Unmanned Aerial Vehicle (UAV) is an aircraft that can take off in a vertical mode, hover in place, transition into horizontal flight, transition back to vertical flight, and land in a vertical mode. This type of flight capability makes a VTOL UAV ideal for operating in areas where runways are not accessible, and in confined areas such as within an urban environment. Despite this advantage, VTOL UAVs have exhibited high acoustic levels while in VTOL flight and in forward flight that may prohibit their use in confined areas. The primary objective of this VTOL UAV test was to measure the acoustic levels of each of the components that make up a VTOL UAV, and determine which components are the primary source of the VTOL UAV acoustic signature. The secondary objective was the measurement of an electric motor with a propeller to determine if the electric motor could be used in place of a nitro-fueled engine to reduce noise. The third objective was to measure the acoustics of a similarly powered helicopter to determine if a helicopter could be used as an alternative aircraft. And the fourth objective was to measure the acoustics of several muffler alternatives. Testing included measurement of the VTOL UAV's acoustic levels at different heights above the ground. The 48 acoustic tests were conducted on a variety of test devices. The test devices consisted of a VTOL ducted Propeller UAV, an O.S. .32 2-stroke engine, a Master Airscrew 2-bladed propeller, a Jeti electric motor, a Raptor 30 size radio-controlled helicopter with a Thunder Tiger .36 engine, and 4 different mufflers. The mufflers included a Mousse Can Muffler, a MACS Products Pretuned Muffled Tuned Pipe, an O.S. Universal Muffler Assembly, and an O.S. Stock Muffler. The testing consisted of a vertical test setup to simulate hover flight and a horizontal test setup to simulate horizontal flight. (49 tables, 38 figures, 3 refs.)
DTIC
*Acoustic Measurement; Acoustic Properties; Aircraft Noise; Pilotless Aircraft; Shrouded Propellers; Vertical Landing; Vertical Takeoff; Vertical Takeoff Aircraft*

**20040059813** Arizona State Univ., East Mesa, AZ, USA
**The Role of Individual and Team Cognition in Uninhabited Air Vehicle Command-and-Control**
Cooke, Nancy J.; DeJoode, Janie A.; Pedersen, Harry K.; Gorman, Jamie C.; Connor, Olena O.; Mar. 31, 2004; 259 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0024
Report No.(s): AD-A422050; AFRL-SR-AR-TR-04-0220; No Copyright; Avail: CASI; A12, Hardcopy

This report documents a three-year AFOSR-funded research effort designed to study individual and team cognition in Unmanned Aerial Vehicle command-and-control. Three experiments were conducted in the CERTT lab's UAV-STE (Unmanned Aerial Vehicle - Synthetic Task Environment). Experiments 1 and 2 had two main manipulations, dispersion (co-located vs. distributed) and workload low or high) and consisted of 20 teams flying multiple 40-minute missions. The results from these experiments indicate that team performance was affected by increased workload, but not impacted by the dispersion condition, although dispersion did affect knowledge and team process. In Experiment 3 data were collected in CERTT's UAV-STE from five expert teams in order to benchmark team performance. The task acquisition curve was accelerated for several of these teams. What differentiated the expert teams were their long histories of working together in a networked selling (e.g., internet video games). It appears that this background alone was enough to speed up their task acquisition in terms of both team process and performance. In addition to these three experiments, this report also documents archival analyses in which we identify individual and role-specific characteristics that are associated with team performance and find support for the utility of holistic and on-line knowledge elicitation in order to accurately assess team knowledge as it relates to team performance. The findings of this report can be summarized broadly by the implication for an increased focus on ongoing, coordinative and other process behaviors rather than focusing on static knowledge for improving applications, theory, and methodology, as they relate to team cognition.
DTIC
*Cognition; Command and Control; Drone Vehicles*

## 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*.

**20040056136** NASA Glenn Research Center, Cleveland, OH, USA
**Turbine Engine Stability/Instability With Rub Forces Axisymmetric Rotor-Support Stiffness**
Gallardo, Vicente; Lawrence, Charles; April 2004; 20 pp.; In English
Contract(s)/Grant(s): WBS 22-728-30-07
Report No.(s): NASA/TM-2004-212974; E-14450; No Copyright; Avail: CASI; A03, Hardcopy

The stability/instability condition of a turbine rotor with axisymmetric supports is determined in the presence of gyroscopic loads and rub-induced destabilizing forces. A modal representation of the turbine engine is used, with one mode in each of the vertical and horizontal planes. The use of non-spinning rotor modes permits an explicit treatment of gyroscopic effects. The two linearized modal equations of motion of a rotor with axisymmetric supports are reduced to a single equation in a complex variable. The resulting eigenvalues yield explicit expressions at the stability boundary, for the whirl frequency as well as the required damping for stability in the presence of the available rub-induced destabilization. Conversely, the allowable destabilization in the presence of the available damping is also given.
Author
*Stability; Destabilization; Turbine Engines; Rotation*

**20040059083** Southwest Research Inst., San Antonio, TX
**Design and Operation of a Device for Evaluating Shaft Seals in Dynamic Applications**
Johnson, James E.; Frame, Edwin A.; Moses, Clifford A.; Dec. 2003; 108 pp.; In English
Contract(s)/Grant(s): DAAE07-99-C-L053
Report No.(s): AD-A421849; TFLRF-371; No Copyright; Avail: CASI; A06, Hardcopy

This document covers the design and operation of a testing device for evaluating elastomeric seals under dynamic conditions at temperatures ranging from 15 degrees to 300 degrees F. Turbojet engine fuel control systems employ sealing surfaces that move or slide over an elastomer sealing material. These seals are generally referred to as dynamic seals, and the

usual configuration is an O-ring. Testing of seals under dynamic conditions is generally required to verify that seal materials are compatible with seals of varying composition. While this device is designed for testing dynamic seals that come in contact with liquid fuels, the device described herein can also be used for testing seals in the presence of other liquids and for applications other than turbojets.
DTIC
*Seals (Stoppers); Shafts (Machine Elements)*

**20040059195** Naval Postgraduate School, Monterey, CA
**Effect of Reynolds Number on Separation Bubbles on Controlled-Diffusion Compressor Blades in Cascade**
Hobson, Garth V.; Hensen, Denis J.; Schnorenberg, David G.; Grove, Darren V.; Feb. 2001; 13 pp.; In English
Report No.(s): AD-A422090; No Copyright; Avail: CASI; A03, Hardcopy

A detailed experimental investigation of second- generation, controlled-diffusion, compressor stator blades at an off-design inlet-flow angle was performed in a low-speed cascade wind tunnel primarily using laser- Doppler velocimetry (LDV). The object of the study was to characterize the off- design flowfield and to obtain LDV measurements of the suction surface boundary layer separation which occurred near mid chord. The effect of Reynolds number on the flow separation in the regime of 210,000 to 640,000 was investigated. Surface flow visualization showed that at the low Re. no. the mid- chord separation bubble started laminar and reattached turbulent within 20% chord on the suction side of the blade. The extent of the bubble compared very well with the measured blade surface pressure distribution which showed a classical plateau and then diffusion in the turbulent region. LDV measurements of the flow reversal in the bubble were performed. At the intermediate Re. no. the boundary layer was transitional before the bubble which had decreased significantly in size (down to 10% chord). At the highest Re. no. the flow was turbulent from close to the leading edge, and three-dimensional flow reversal as a result of endwall effects appeared at approximately 80% chord which did not reattach.
DTIC
*Bubbles; Compressor Blades; Compressors; Diffusion; Reynolds Number; Stators*

**20040059221** California Univ., Los Angeles, CA
**Aeroacoustic Optimization and Control**
Wei, Mingjun; Freund, Jonathan B.; Kim, John; Apr. 2, 2003; 152 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0105; Proj-2307
Report No.(s): AD-A422149; AFRL-SR-AR-TR-04-0226; No Copyright; Avail: CASI; A08, Hardcopy

Much attention has been given to the jet noise problem since the jet engine became a power plant for aircraft after the Second World War, but there has been little modeling progress for realistic geometries. Scaling laws such as Lighthill's famous P oc U8 sound-power scaling with jet exit velocity that are derived from these theories have been enormously successful in motivating higher bypass engines to reduce noise, but they have offered little further guidance for improvements through nozzle geometries or active flow control. The aircraft noise problem has recently become more pressing as both military and civilian use of air space increase. At present, the noise of some military aircraft is so intense that it can actually fatigue aircraft components. Airbase noise is becoming an important issue with several (some successful) lawsuits involved. Personnel are also affected - early predictions/results suggest that the JSF landing in vertical mode will be too loud for ground personnel to tolerate. The civilian aerospace sector faces their own serious aircraft noise problems. Technology transfer from the present work supports intense noise control efforts at domestic aerospace companies as well.
DTIC
*Aeroacoustics; Jet Aircraft Noise*

## 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*.

**20040059248** Cornell Univ., Ithaca, NY
**Robust and Optimal Control of Spatially Interconnected Systems, With Application to Coordinated Vehicle Control**
D'Andrea, Raffaello; Dec. 14, 2003; 9 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0119
Report No.(s): AD-A422201; AFRL-SR-AR-TR-04-0236; No Copyright; Avail: CASI; A02, Hardcopy

The research supported by this grant consisted of developing improved algorithms and theory for designing and analyzing robust control systems for spatially interconnected systems. There are many examples of such systems, including automated highway systems, airplane formation flight, satellite constellations, cross-directional control in paper processing applications, and micro-cantilever array control for massively parallel data storage. One can also consider lumped approximations of partial differential equations - examples include the deflection of beams, plates, and membranes, and the temperature distribution of thermally conductive materials. Spatially interconnected control systems were studied in the context of fractional transformations on temporal and spatial shift operators, leading to multidimensional system optimization. These techniques were tested in simulation, and on the Cornell Formation Flight test- bed, in order to assess the validity of these approaches and to motivate further research.
DTIC
*Optimal Control*

**20040059317** Mitre Corp., McLean, VA
**Technical Evaluation Report**
Sands, Jeffrey I.; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422302; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
*Artificial Intelligence; Decision Support Systems; Human Factors Engineering; Human-Computer Interface; Man Machine Systems; Military Technology*

## 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)*.

**20040058986** Army Engineer Waterways Experiment Station, Vicksburg, MS
**Occupational Survey Report, AFSC 1C0X1, Airfield Management**
Hector, Holly; Oct. 9, 2003; 39 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421548; No Copyright; Avail: CASI; A03, Hardcopy
Presentation of findings from Occupational Survey Report for AFSC 1C0X1, Airfield Management.
DTIC
*Airports; Armed Forces (United States); Personnel; Surveys; Tasks*

## 12
## ASTRONAUTICS (GENERAL)

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

**20040059110** Air Univ., Maxwell AFB, AL
**Beyond the Paths of Heaven. The Emergence of Space Power Thought**
DeBlois, Bruce M.; Sep. 1999; 598 pp.; In English
Report No.(s): AD-A421934; No Copyright; Avail: CASI; A25, Hardcopy
Major issues have plagued the US military space community for years. Foremost among these issues is the relationship between air and space. At a recent airpower conference, military leaders from the western powers presented discussions of airpower and space issues with a pervasive underlying assumption: that the next logical step from the exploitation of airpower and space capabilities was the merging of the two environments toward the exploitation of ‘aerospace’ power. The current distinction between air and space rests on the fiscal and technical inability to merge them an inability that is soon to be overcome. Conferees dismissed environmental distinctions between the two on the grounds that there is no absolute boundary between air and space In Paths of Heaven, the chapter titled Ascendant Realms: Characteristics of Air and Space Power,‘ I examine this assumption from the perspective of 21 different military characteristics and conclude it to be invalid. The reasons

extend well beyond an inability fiscally and technically to merge the two realms.
DTIC
*Warfare*

**20040059117** Naval War Coll., Newport, RI
**Corbett in Orbit: A Maritime Model for Strategic Space Theory**
Klein, John J.; Jan. 2004; 17 pp.; In English
Report No.(s): AD-A421953; No Copyright; Avail: CASI; A03, Hardcopy

Since the 1950s, there have been discussions concerning the need to develop a space power theory. In their attempts to formulate such a theory, strategists have noted the similarities of space operations to those of air and naval operations. Consequently, many have attempted to derive a clearly articulated, all-encompassing space theory through analogy and comparison to either airpower or sea-control models. These efforts, however, as observers like the contemporary historian and strategist Colin Gray have noted, have not produced a theory addressing space operations and associated national resources and military force will be applied poorly or even counter productively.
DTIC
*Space Missions; Warfare*

**20040062014** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Future Missions to the Moon**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062015 - 20040062023
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

This document contained the following topics: A Miniature Mass Spectrometer Module; SELENE Gamma Ray Spectrometer Using Ge Detector Cooled by Stirling Cryocooler; Lunar Elemental Composition and Investigations with D-CIXS X-Ray Mapping Spectrometer on SMART-1; X-Ray Fluorescence Spectrometer Onboard the SELENE Lunar Orbiter: Its Science and Instrument; Detectability of Degradation of Lunar Impact Craters by SELENE Terrain Camera; Study of the Apollo 16 Landing Site: As a Standard Site for the SELENE Multiband Imager; Selection of Targets for the SMART-1 Infrared Spectrometer (SIR); Development of a Telescopic Imaging Spectrometer for the Moon; The Lunar Seismic Network: Mission Update.
Derived from text
*Space Missions; Spectrometers; Chemical Composition; Lunar Composition*

## 13
## ASTRODYNAMICS

Includes powered and free flight trajectories; orbital and launching dynamics.

**20040058111** NASA Dryden Flight Research Center, Edwards, CA, USA
**Energy Management of Manned Boost-Glide Vehicles: A Historical Perspective**
Day, Richard E.; May 2004; 73 pp.; In English
Contract(s)/Grant(s): 036-00-00-GM-TT
Report No.(s): NASA/TP-2004-212037; H-2494; No Copyright; Avail: CASI; A04, Hardcopy

As flight progressed from propellers to jets to rockets, the propulsive energy grew exponentially. With the development of rocket-only boosted vehicles, energy management of these boost-gliders became a distinct requirement for the unpowered return to base, alternate landing site, or water-parachute landing, starting with the X-series rocket aircraft and terminating with the present-day Shuttle. The problem presented here consists of: speed (kinetic energy) - altitude (potential energy) - steep glide angles created by low lift-to-drag ratios (L/D) - distance to landing site - and the bothersome effects of the atmospheric characteristics varying with altitude. The primary discussion regards post-boost, stabilized glides; however, the effects of centrifugal and geopotential acceleration are discussed as well. The aircraft and spacecraft discussed here are the X-1, X-2, X-15, and the Shuttle; and to a lesser, comparative extent, Mercury, Gemini, Apollo, and lifting bodies. The footprints, landfalls, and methods developed for energy management are also described. The essential tools required for energy management - simulator planning, instrumentation, radar, telemetry, extended land or water range, Mission Control Center

(with specialist controllers), and emergency alternate landing sites - were first established through development of early concepts and were then validated by research flight tests.
Author
*Boostglide Vehicles; Potential Energy; Gliding; Spacecraft Reentry*

## 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)*.

**20040058962** Army Research Lab., Aberdeen Proving Ground, MD
**The Structure of Secondary 2-Azidoethanamines: A Hypergolic Fuel vs. a Nonhypergolic Fuel**
McQuaid, Michael J.; Apr. 2004; 46 pp.; In English
Contract(s)/Grant(s): Proj-611102H4311
Report No.(s): AD-A421464; ARL-TR-3176; No Copyright; Avail: CASI; A03, Hardcopy

In an attempt to find structural features of 2- azidoethanamines that correlate with their hypergolic ignition delays, density functional theory (DFT) -based quantum mechanics calculations were performed to characterize equilibrium configurations of two secondary 2-azidoethanamines: 2-azido-N-cyclopropylethanamine (CPAZ) and 2-azido-N- methylethanamine (MMAZ). The former is hypergolic with inhibited red fuming nitric acid, while the latter is not. Geometries and normal modes for 23 MMAZ conformers and 42 CPAZ conformers are presented, compared to each other, and compared to geometries and normal modes obtained previously for the hypergolic, tertiary 2-azidoethanamine 2-azido-N ,N- dimethylethanamine (DMAZ). The geometries of greater than N- CH(sub 2)-CH(sub 2)-N(sub 3) chains in analogous MMAZ and CPAZ conformers are found to be nearly identical, and the relative energies of MMAZ conformers as a function of this chain orientation are mimicked in the CPAZ conformers. Some minor differences between the secondary 2-azidoethanamines and DMAZ are noted, but no structural feature is found to be unique to the hypergolic compounds.
DTIC
*Fuels; Ignition*

## 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*.

**20040058114** NASA Langley Research Center, Hampton, VA, USA
**Thermal-Structural Optimization of Integrated Cryogenic Propellant Tank Concepts for a Reusable Launch Vehicle**
Johnson, Theodore F.; Waters, W. Allen; Singer, Thomas N.; Haftka, Raphael T.; March 25, 2004; 11 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 794-40-4M
Report No.(s): AIAA Paper 2004-1931; Copyright; Avail: CASI; A03, Hardcopy

A next generation reusable launch vehicle (RLV) will require thermally efficient and light-weight cryogenic propellant tank structures. Since these tanks will be weight-critical, analytical tools must be developed to aid in sizing the thickness of insulation layers and structural geometry for optimal performance. Finite element method (FEM) models of the tank and insulation layers were created to analyze the thermal performance of the cryogenic insulation layer and thermal protection system (TPS) of the tanks. The thermal conditions of ground-hold and re-entry/soak-through for a typical RLV mission were used in the thermal sizing study. A general-purpose nonlinear FEM analysis code, capable of using temperature and pressure dependent material properties, was used as the thermal analysis code. Mechanical loads from ground handling and proof-pressure testing were used to size the structural geometry of an aluminum cryogenic tank wall. Nonlinear deterministic optimization and reliability optimization techniques were the analytical tools used to size the geometry of the isogrid stiffeners and thickness of the skin. The results from the sizing study indicate that a commercial FEM code can be used for thermal analyses to size the insulation thicknesses where the temperature and pressure were varied. The results from the structural sizing study show that using combined deterministic and reliability optimization techniques can obtain alternate and lighter

designs than the designs obtained from deterministic optimization methods alone.
Author
*Cryogenics; Propellant Tanks; Reusable Launch Vehicles; Optimization; Mathematical Models; Thermal Analysis*

**20040058994** Air Force Research Lab., Wright-Patterson AFB, OH
**A Method for Estimating Control Failure Effects for Aerodynamic Vehicle Trajectory Retargeting**
Oppenheimer, Michael W.; Doman, David B.; Bolender, Michael A.; Feb. 2004; 12 pp.; In English
Report No.(s): AD-A421568; AFRL-VA-WP-TP-2004-302; No Copyright; Avail: CASI; A03, Hardcopy

Advance guidance and control utilizes control reconfiguration, guidance adaptation, trajectory reshaping, and an on-line mission/abort planner to achieve the best possible mission given that the vehicle's performance has been degraded by some sort of failure. Potential failures include actuator loss (locked, floating), engine out, damage to the vehicle, aerodynamic mismodelling, and so on. The trend towards the development of autonomous vehicles has placed more emphasis on requiring trajectory retargeting algorithms. One of the main difficulties of trajectory retargeting is predicting the effects of failures at future flight conditions. In this work, a method is presented that can generate critical information that is required to perform on-line trajectory retargeting.
DTIC
*Adaptive Control; Estimating; Failure; Trajectories*

**20040059015** National Defense Univ., Norfolk, VA
**Why Space Should Be a Separate Service**
Barber, Norman W.; Douglass, Richard J.; DuMond, John D.; Sep. 6, 2002; 19 pp.; In English
Report No.(s): AD-A421657; No Copyright; Avail: CASI; A03, Hardcopy

Technological change has continually transformed the way mankind fights its wars. Bronze and steel brought the defeat of barbarians and the ascendance of Greece and Rome. The stirrup allowed the development of the mounted knight, who was in turn brought down by the development of the English longbow. Gunpowder came next, forever changing the battlefield, and the dramatic alterations brought along with the tank, and then the airplane, further matured it. Nuclear weapons and terrorism are the latest technological transformations. Next is the weaponization of space, which will likewise have a dramatic effect on the defining principles of warfare. In parallel to the argument for the separation of the Air Force from the Army in the early 1900s, the debate over a separate Space Service has come to the forefront of military discussion. Space Vision 2020 is clear: 'During the early portion of the 21st century, space power will evolve into a separate and equal medium of warfare.' Key doctrinal, technological, and organizational reforms indicate the USA needs to establish a separate Space Service in order to completely and economically introduce space-generated effects into the joint fight.
DTIC
*Warfare*

**20040059113** Air Univ., Maxwell AFB, AL
**On Space Warfare: A Space Power Doctrine**
Lupton, David E.; Jun. 1998; 95 pp.; In English
Report No.(s): AD-A421942; No Copyright; Avail: CASI; A05, Hardcopy

Ever since President Ronald Reagan's speech on ballistic missile defense (BMD) in March 1983, the military use of space has become a hotly debated topic. President Reagan did not mention space, only a plan to place renewed emphasis on the development of a BMD technology. Nevertheless, the speech was promptly dubbed 'Star Wars' because the space environment seems to be the most likely place to deploy a ballistic missile defense system, and several administration officials mentioned space-based BMD systems as technological possibilities. Although Americans are accustomed to public debate concerning the merits of proposed weapon systems, the Star Wars controversy covers issues broader. Will space-based weapon systems allow a new strategy to replace assured destruction? Are we prepared to militarize space, an environment that has been treated as a war-free sanctuary since the Eisenhower administration? Are space-based weapons that have been proposed for BMD purposes technologically feasible? This paper provides exceptional insights into the various doctrines that do or would govern military affairs in the space environment. Its strengths are the author's ability to articulate the various doctrines, the historical perspective from which these doctrines are examined, and the broad context from which these doctrines are viewed. The prescription for the space power doctrine presented in this paper is not radically different from the path the USA has already taken. It calls for a complete space transportation system to augment the space shuttle, a system which includes space stations and a family of high-and low- thrust upper stages that will help maintain this nation's technological control of the

environment. While this space transportation system will support both civilian and military users, we should develop a separate and primarily military vehicle, the aerospace plane, as soon as possible.
DTIC
*Aerospace Environments; Antimissile Defense; Space Weapons; Warfare*

**20040059312** Amptek, Inc., Bedford, MA
**Small On-Board Environmental Diagnostic Sensor Package (SOBEDS)**
Redus, Robert; McGarity, John O.; Huber, Alan C.; Pantazis, John A.; Nov. 11, 2003; 4 pp.; In English
Contract(s)/Grant(s): F19628-95-C-0227; Proj-2822
Report No.(s): AD-A422291; AFRL-VS-HA-TR-2004-1020; No Copyright; Avail: CASI; A01, Hardcopy

This report contains the summary of the scientific and engineering work performed during the most recent year as part of the development of the High Energy Proton instrument (HEP) and of the Low Energy Particle and Dosimetry instrument (LEPDOS). These instruments are part of the SOBEDS suite of instruments being developed by Amptek, Inc. The purpose of the HEP instrument is to measure the energy spectrum of energetic protons, specifically to obtain a differential spectrum for 25 < E < 440 MeV and integral counts for E > 440 MeV. The purpose of the LEPDOS instrument is to measure: 1) the lower energy protons and electrons that may cause spacecraft anomalies, specifically protons from 0.7 to 80 MeV and electrons from 5 to > 250 keV, 2) the dose and dose rate experienced by spacecraft electronics, 3) particles causing single event effects, and 4) to provide real-time warnings to spacecraft and operators of environmental conditions likely to cause anomalies, such as surface charging and deep dielectric charging. During the most recent year, the seventh year of the contract effort, no spacecraft were selected for the remaining instruments. Since the bulk of the remaining effort is spacecraft specific, very little work was carried out on this contract.
DTIC
*Dosimeters; Protons*

## 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*.

**20040061969** California Univ., Los Angeles, CA, USA
**Space Debris in the Geosynchronous Earth Orbit: Debris Environmental Asssessment and its Implications on Cost and Benefit Analysis**
Takagi, Mari; Yasaka, Tetsuo; Lunar and Planetary Science XXXV: Human Occupation of Space: Radiation, Risk, and Refuse; 2004; 2 pp.; In English; See also 20040061967; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The increase of space junk and threats to commercial space activities in the Geosynchronous Earth Orbit (GEO) predictably caused concerns for the environmental consequences over the long term. A variety of work on space debris research, including on detection, modeling, protection and mitigation measures, has been clearly recognized and conducted over recent decades, however there are no international legislation or administrative regulations in place yet to impose specific debris mitigation requirements. Hence, there has been a gap between egotistical and altruistic utilization of space environment leading to a serious 'problems of commons' in the Geosynchronous Earth Orbit. This paper makes an attempt to explore the way to bridge this gap by conducting an environmental Cost-Benefit Analysis (CBA) in the specific context of proposed mitigation measures, including new legal standards such as lower satellite explosion rates, re-orbit maneuvering, and restrictions on the number of launches.
Author
*Geosynchronous Orbits; Earth Orbital Environments; Space Debris*

## 17
## SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

**20040062101** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**From Present Surveying to Future Prospecting of the Asteroid Belt**
Clark, P. E.; Curtis, S. A.; Rilee, M.; Cheung, C.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092
Contract(s)/Grant(s): NAS5-99189; ITMI-0299189EER; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have applied a future mission architecture, the Autonomous Nano-Technology Swarm (ANTS), to a proposed mission for in situ survey, or prospecting, of the asteroid belt, the Prospecting Asteroid Mission (PAM) as part of a NASA 2003 Revolutionary Aerospace Concept (RASC) study. ANTS architecture builds on and advances recent trends in robotics, artificial intelligence, and materials processing to minimize costs and maximize effectiveness of space operations. PAM and other applications have been proposed for the survey of inaccessible, high surface area populations of great interest from the standpoint of resources and/or solar system origin. The ANTS architecture is inspired by the success of social insect colonies, a success based on the division of labor within the colonies in two key ways: 1) within their specialties, individual specialists generally outperform generalists, and 2) with sufficiently efficient social interaction and coordination, the group of specialists generally outperforms the group of generalists. Thus systems designed as ANTS are built from potentially very large numbers of highly autonomous, yet socially interactive, elements. The architecture is self-similar in that elements and sub-elements of the system may also be recursively structured as ANTS on scales ranging from microscopic to interplanetary distances. Here, we analyze requirements for the mission application at the low gravity target end of the spectrum, the Prospecting Asteroid Mission (PAM), and for specialized autonomous operations which would support this mission. ANTS as applied to PAM involves the activities of hundreds of individual specialist 'sciencecraft'. Most of them, called Workers, carry and operate eight to nine different scientific instruments, as listed in the table, including spectrometers, ranging and radio science devices, and imagers. The remaining specialists, Messenger/Rulers, provide communication and coordination functions among specialists operating autonomously as individuals, team members, and subswarms.
Author (revised)
*Artificial Intelligence; Architecture (Computers); Nanotechnology; Spacecraft Control*

## 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*.

**20040059327** Army Research Lab., Aberdeen Proving Ground, MD
**Numerical Investigation of Aerodynamics of Canard- Controlled Missile Using Planar and Grid Tail Fins, Part II: Subsonic and Transonic Flow**
DeSpirito, James; Vaughn, Milton E., Jr.; Washington, W. D.; Mar. 2004; 104 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-1L162618AH80
Report No.(s): AD-A422334; ARL-TR-3162; No Copyright; Avail: CASI; A06, Hardcopy

Viscous computational fluid dynamic simulations were used to predict the aerodynamic coefficients and flow field around a canard-controlled missile in subsonic and transonic flow. Computations were performed at Mach 0.6 and 0. 9, six angles of attack between 0 deg and 10 deg, and with planar and grid tail fins. The computations were validated with wind tunnel data. Flow visualizations showed that the canard downwash produced a low-pressure region on the starboard side of the missile that produced a large induced side force. The canard trailing vortices interacted with the tail fins until alpha > 8 deg, producing a pressure differential on the leeward tail fin, leading to the adverse induced roll effects. Visualizations of the flow through the grid fin structure showed choking of the flow at Mach 0.9 and Mach 1.5. The validated simulations results showed that

grid fins did not improve the canard roll-control effectiveness at subsonic and transonic speeds as well as they did at the low supersonic speed.
DTIC
*Aerodynamics; Canard Configurations; Computational Fluid Dynamics; Fins; Missiles; Subsonic Flow; Transonic Flow; Viscous Flow*

## 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*.

**20040062093** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Calibration of the NEAR XRS Solar Monitor**
Lim, L. F.; Nittler, L. R.; Starr, R. D.; McClanahan, T. P.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The NEAR-Shoemaker X-ray spectrometer measured elemental abundance ratios for six elements (Mg, Al, Si, S, Ca, Fe) on the surface of 433 Eros by remote-sensing x-ray fluorescence spectroscopy (1,2). The fluorescent x-rays are excited by x-rays from the solar corona. Therefore, accurate knowledge of the incident solar spectrum was critically important to interpreting the fluorescence spectra received by the NEAR detectors in terms of elemental ratios on the asteroid's surface. NEAR, therefore, carried two additional X-ray spectrometers dedicated to monitoring the solar spectrum between 1 and 10 keV. One of these, a Si PIN photodiode, failed prior to orbit insertion. The second consisted of a gas-filled proportional counter similar to the asteroid-pointing detectors, but covered by a graded filter (3) intended to attenuate the incoming solar flux and increase the dynamic range of the detector. Unfortunately, the response of this filter as a function of solar incidence angle was not adequately determined in the laboratory prior to launch. The response function had to be calculated from the assumed properties of the graded filter.
Derived from text
*Near Earth Asteroid Rendezvous Mission; Calibrating; X Ray Spectrometers; X Ray Fluorescence; Remote Sensing; Spectroscopy*

**20040062095** NASA Johnson Space Center, Houston, TX, USA
**Characteristics and Current Status of Near Infrared Spectrometer for Hayabusa Mission**
Abe, M.; Takagi, Y.; Abe, S.; Kitazato, K.; Hiroi, T.; Ueda, Y.; Vilas, F.; Clark, B. E.; Fujiwara, A.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NIRS is a near infrared spectrometer on-boarded the spacecraft HAYABUSA (MUSESC), which aims to return samples from a near-earth asteroid, (25143) Itokawa (1998 SF36). HAYABUSA was successfully launched by Japanese M-V-5 rocket on May 19, 2003. After the earth swing-by in Jun 2004, the spacecraft will arrive at the asteroid in summer 2005. During the rendezvous phase with the asteroid, we will observe the asteroid surface using NIRS and obtain reflectance spectra of the surface materials across the wavelength range of 850nm to 2100nm. Based on ground-based observations [1],[2],[3], (25143) Itokawa appears to be an S(IV) type asteroid. NIRS can detect absorption bands due to olivine and pyroxene and investigate the mineralogical composition of the surface materials. Combining with the data from asteroid multiband imaging camera (AMICA) and X-ray spectrometer (XRS), we can reveal a relationship between asteroids and meteorites.
Derived from text
*X Ray Spectrometers; Imaging Techniques; Infrared Spectrometers; Near Infrared Radiation; Asteroids; Meteorites; Mineralogy; Pyroxenes; Olivine; Surface Properties*

## 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*.

**20040059001** Air Force Research Lab., Edwards AFB, CA
**Attachment 5 to PRDA 04-01 PKT: AFRL/PRSS Electric Propulsion Facilities and Capabilities**
Gulczinski, Frank; Jan. 26, 2004; 6 pp.; In English
Contract(s)/Grant(s): Proj-5033
Report No.(s): AD-A421602; AFRL-PR-ED-VG-2004-019; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
*Electric Propulsion*

**20040061965** Ohio Aerospace Inst., Brook Park, OH, USA
**The Use of Laser-Induced Fluorescence to Characterize Discharge Cathode Erosion in a 30 cm Ring-Cusp Ion Thruster**
Sovey, James S., Technical Monitor; Williams, George J., Jr.; April 2004; 170 pp.; In English
Contract(s)/Grant(s): NAG3-1572; NAG3-2216; WBS-22-982-10-02
Report No.(s): NASA/CR-2004-211296; E-13100; No Copyright; Avail: CASI; A08, Hardcopy
Relative erosion rates and impingement ion production mechanisms have been identified for the discharge cathode of a 30 cm ion engine using laser-induced fluorescence (LIF). Mo and W erosion products as well as neutral and singly ionized xenon were interrogated. The erosion increased with both discharge current and voltage and spatially resolved measurements agreed with observed erosion patters. Ion velocity mapping identified back-flowing ions near the regions of erosion with energies potentially sufficient to generate the level of observed erosion. Ion production regions downstream of the cathode were indicated and were suggested as possible sources of the erosion causing ions.
Author
*Hollow Cathodes; Erosion; Ion Engines; Laser Induced Fluorescence; Electric Propulsion; Electric Discharges*

**20040061966** NASA Glenn Research Center, Cleveland, OH, USA
**On-Board Chemical Propulsion Technology**
Reed, Brian D.; April 2004; 20 pp.; In English; Tenth International Workshop on Combustion and Propulsion, 21-25 Sep. 2003, La Spezia, Italy
Contract(s)/Grant(s): WBS-22-755-70-02
Report No.(s): NASA/TM-2004-212698; E-14201; No Copyright; Avail: CASI; A03, Hardcopy
On-board propulsion functions include orbit insertion, orbit maintenance, constellation maintenance, precision positioning, in-space maneuvering, de-orbiting, vehicle reaction control, planetary retro, and planetary descent/ascent. This paper discusses on-board chemical propulsion technology, including bipropellants, monopropellants, and micropropulsion. Bipropellant propulsion has focused on maximizing the performance of Earth storable propellants by using high-temperature, oxidation-resistant chamber materials. The performance of bipropellant systems can be increased further, by operating at elevated chamber pressures and/or using higher energy oxidizers. Both options present system level difficulties for spacecraft, however. Monopropellant research has focused on mixtures composed of an aqueous solution of hydroxl ammonium nitrate (HAN) and a fuel component. HAN-based monopropellants, unlike hydrazine, do not present a vapor hazard and do not require extraordinary procedures for storage, handling, and disposal. HAN-based monopropellants generically have higher densities and lower freezing points than the state-of-art hydrazine and can higher performance, depending on the formulation. High-performance HAN-based monopropellants, however, have aggressive, high-temperature combustion environments and require advances in catalyst materials or suitable non-catalytic ignition options. The objective of the micropropulsion technology area is to develop low-cost, high-utility propulsion systems for the range of miniature spacecraft and precision propulsion applications.
Author
*Chemical Propulsion; Technology Utilization; Microthrust; Liquid Rocket Propellants*

## 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*.

**20040056140** National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA
**Laser-Induced Breakdown Spectroscopy of Trace Metals**
Simons, Stephen, Technical Monitor; VanderWal, Randall L.; Ticich, Thomas M.; West, Joseph R., Jr.; April 2004; 14 pp.; In English
Contract(s)/Grant(s): NAC3-544; WBS 22-101-12-15
Report No.(s): NASA/CR-2004-212980; E-14455; No Copyright; Avail: CASI; A03, Hardcopy

An alternative approach for laser-induced breakdown spectroscopy (LIBS) determination of trace metal determination in liquids is demonstrated. The limits of detection (LOD) for the technique ranged from 10 ppb to 10 ppm for 15 metals metals (Mg, Al, Si, Ca, Ti, Cr, Fe, Co, Ni, Cu, Zn, As, Cd, Hg, Pb) tested.
Author
*Laser-Induced Breakdown Spectroscopy; Trace Elements; Metals*

**20040058991** Innovative Scientific Solutions, Inc., Dayton, OH
**Pressure-Sensitive-Paint Measurements in a Commercial Jet-Engine Test Stand**
Jordan, Jeffrey D.; Watkins, A. N.; Davis, John C.; Weaver, William L.; Sep. 1999; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-95-C-2507; F33615-98-C-2904; Proj-CRDF
Report No.(s): AD-A421561; AFRL-VA-WP-TR-1999-3065; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents the application of pressure- sensitive paint (PSP) measurement technology to a large-scale commercial turbine-engine test stand. In this work, the test article is the engine-inlet bell mouth. A sol-gel-based PSP is applied to the inlet and illuminated using the blue (460-nm) output of eleven LED arrays. PSP data are acquired using a scientific-grade CCD camera. The application of PSP measurements in the engine-test-stand environment requires test instrumentation to be fixed within a housing located upstream of the test article. Challenges associated with performing PSP measurements in this hostile environment are discussed, with focus on the strategies implemented to recover surface-pressure distributions on the engine-inlet bell mouth.
DTIC
*Engine Tests; Jet Engines; Paints; Pressure Sensitive Paints; Test Stands*

**20040059161** Arkansas Univ., Fayetteville, AR
**A Novel Technology for the Synthesis and Fabrication of Solid Lubricant and Hard Material Composite Coatings**
Malshe, Ajay P.; Brown, W. D.; Mar. 2, 2004; 30 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0268
Report No.(s): AD-A422032; AFRL-SR-AR-TR-04-0209; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this program was to design and develop a novel hybrid coating technology and related infrastructure for the synthesis of soft phase and hard phase nano particle composite coatings. The project successfully completed design, development and testing of the following two major technologies: (1) Electrostatic coating (ESC) set up for the deposition of solid lubricant as well as hard phase nano particles; (2) Chemical vapor infiltration (CVI) for depositing binder in the porous matrix. The investigators have successfully developed and tested the ESC system for coating lubricant as well as hard nano particles on large areas and complex shapes, and have completed fabrication and testing of the CVI set up. To demonstrate the success of completion of the project, the team has deposited ZnO (0-20 nm) as well as MoS2 (0-700 nm) nano particles as soft lubricant materials and cBN as hard phase material using ESC on complex geometries (carbide insert samples) and has demonstrated TiN infiltration. The research opened many new opportunities to realize practical combinatorial coatings for the next generation of Air Force, Department of Defense (DoD) devices and systems.
DTIC
*Coatings; Combinatorial Analysis; Composite Materials; Fabrication; Lubricants; Solid Lubricants*

**20040059164** Mississippi Univ., University, MS

**Electrodeposition of Transition Metal-Aluminum Alloys from Chloroaluminate Molten Salts**

Hussey, Charles L.; Jan. 31, 2004; 162 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0123

Report No.(s): AD-A422036; AFRL-SR-AR-TR-04-0218; No Copyright; Avail: CASI; A08, Hardcopy

The electrodeposition of transition metal aluminum alloys was investigated in the room temperature chloroaluminate ionic liquid, aluminum chloride-1-methyl-3 - ethylimidazolium chloride. Alloys that were investigated include the binary systems, Cu-Al, Ag-Al, Al-Ti, Al-V, Al-Mo, Al-Zr, Al-Nb, and Al-W, and the ternary system Al-Mo-Mn. Those alloys in which the transition metal predominates, Ag-Al and Cu-Al, were thermodynamically unstable in the plating bath and did not form chloride-free, compact coatings during electrodeposition. However, those alloys in which the transition metal was a minor component, e.g., Al-Ti, Al-V, Al- Mo, Al-Zr, Al-Nb, and Al-W, were electrodeposited as compact, nearly specular films. Many of these alloys, notably Al-Mo and Al-W, exhibited outstanding resistance to chloride-induced pitting corrosion, making them useful corrosion protective coatings for Air Force applications in high-salt environments.

DTIC

*Alloys; Aluminum Alloys; Corrosion Prevention; Electrodeposition; Molten Salts; Protective Coatings; Transition Metals*

**20040059267** Naval Air Warfare Center, China Lake, CA

**Strengthening of Glass and Pyroceram With Hydrophobic Coatings**

Johnson, Curtis E.; Harris, Daniel C.; Nelson, John G.; Kline, Clare F., Jr.; Corley, Brandy L.; Jul. 2003; 26 pp.; In English

Report No.(s): AD-A422231; NAWCWD-TP-8536; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study was to determine whether significant improvements in strength of soda-lime glass and Pyroceram 9606 could be obtained by applying thin hydrophobic coatings. Soda-lime glass slides were coated with a few different hydrophobic compounds (containing organosilicon groups) and then subjected to strength tests in flexure. The glass slides were acid etched to remove surface defects and to slightly mimic the outer fortified surface of Pyroceram. A hydrophobic coating of octadecyl dimethylchlorosilane on soda-lime glass slides led to doubling or more of the strength. The increase in strength is attributed to a reduced role of stress corrosion cracking that is promoted by moisture at the surface. Similar hydrophobic treatments were not effective on Pyroceram bars. Thick was coatings on dry Pyroceram surfaces were successful at improving the strength by about 40%, similar to the effects of dipping in silicone oil.

DTIC

*Glass; Hydrophobicity; Pyroceram (Trademark)*

**20040059741** Naval Research Lab., Washington, DC

**Validation of HVOF WC/Co Thermal Spray Coatings as a Replacement for Hard Chrome Plating on Aircraft Landing Gear**

Sartwell, Bruce D.; Legg, Keith O.; Schell, Jerry; Sauer, John; Natishan, Paul; Mar. 31, 2004; 275 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422266; NRL/MR/6170--04-8762; ESTCP-EPP-9608-FR; No Copyright; Avail: CASI; A12, Hardcopy

Hard chromium electroplating is extensively used by aircraft manufacturers and military maintenance depots to provide wear and/or corrosion resistance or to restore dimensional tolerance to components. However, chrome plating utilizes hexavalent chromium, which is a highly toxic carcinogen, and increasingly stringent environmental and worker-safety regulations are making chrome plating more expensive for the DoD. This document constitutes the final report on a project to quality high-velocity oxygen-fuel (HVOF) thermal spray WC/Co coatings as a replacement for hard chrome plating on landing gear components. Extensive fatigue, wear, corrosion, impact, and hydrogen embrittlement test results comparing the WC/Co coatings against hard chrome are presented. The results of rig and flight-testing of HVOF WC/Co coatings on landing gear components are also presented. in general, the performance of the WC/Co coatings was superior to hard chrome. Producibility issues such as stripping, grinding, and non-destructive inspection of the coatings were addressed. Cost/Benefit analyses indicate that military repair depots that overhaul landing gear can realize substantial savings by converting from hard chrome to HVOF. Specifications were developed for the WC/Co powder, the coatings deposition parameters, and the grinding of the WC/Co coatings.

DTIC

*Aircraft Landing; Chromium; Corrosion Resistance; Electroplating; Fuels; Hvof Thermal Spraying; Landing Gear; Plating; Replacing*

**20040059787** Clemson Univ., SC, USA
**Optical, Electronic, and Thermal Properties of Polymer Nano-Composites**
Carroll, David L.; Feb. 14, 2003; 12 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0173
Report No.(s): AD-A422224; AFRL-SR-AR-TR-04-0237; No Copyright; Avail: CASI; A03, Hardcopy

This program will focus on quantification of nanotube-polymer interactions. The objectives of the program are: 1) Characterize the polymer - carbon nanotube interaction in organic matrix composites. Classify interaction, and dispersion mechanisms of high aspect ratio nano-materials (ie. carbon nanotubes). Modify interactions to aid in dispersion of nano-materials to form a maximally-space filled matrix. 2) Determine structure - properties relationships for potential applications in several model nano-composite systems. Characterize thermal, optical, mechanical and electronic properties of the model systems. 3) Demonstrate optical and electronic applications through 'proof of principle' devices. Applications include: optical power mediation and optical limiting, organic light emitting diode and display technologies, thermally conductive organic coatings and optical filtering.
DTIC
*Electrical Properties; Nanotechnology; Optical Properties; Thermodynamic Properties*

**20040059985** Lawrence Livermore National Lab., Livermore, CA
**Programmable MicroFluidic Processor: Integrated and Hybrid Solutions**
Rose, K. A.; May 10, 2002; 120 pp.; In English
Report No.(s): DE2004-15006001; UCRL-LR-148382; No Copyright; Avail: Department of Energy Information Bridge

The Programmable Fluidic Processor (PFP), a device conceived of by researchers at MD Anderson Cancer Center, is a reconfigurable and programmable bio-chemical analysis system designed for handheld operation in a variety of applications. Unlike most microfluidic systems which utilize channels to control fluids, the PFP device is a droplet-based system. The device is based on dielectrophoresis; a fluid transport phenomenon that utilizes mismatched polarizability between a droplet and its medium to induce droplet mobility. In the device, sample carrying droplets are polarized by an array of electrodes, individually addressable by subsurface microelectronics. My research focused on the development of a polymer-based microfluidic injection system for injecting these droplets onto the electrode array. The first of two device generations fabricated at LLNL was designed using extensive research and modeling performed by MD Anderson and Coventor. Fabricating the first generation required several iterations and design changes in order to generate an acceptable device for testing. Difficulties in planar fabrication of the fluidic system and a narrow channel design necessitated these changes. The second generation device incorporated modifications of the previous generation and improved on deficiencies discovered during experimentation with the initial device. Extensive modeling of the injection channels and fluid storage chamber also aided in redesigning the device's microfluidic system. A micromolding technique with interlocking features enabled precise alignments and dimensional control, critical requirements for device optimization. Fabrication of a final device will be fully integrated with the polymer-based microfluidics bonded directly to the silicon-based microelectronics. The optimized design and process flow developed in the trial generations will readily transfer to this approach.
NTIS
*Electrodes; Design Analysis; Electrophoresis; Fluidics*

## 24
## COMPOSITE MATERIALS

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

**20040056115** Swedish Defence Research Establishment, Linkoeping
**Microwave Curing Polymer Composites**
Savage, S. J.; Dec. 2003; 20 pp.; In English
Report No.(s): PB2004-104135; FOI-R-1035-SE; No Copyright; Avail: CASI; A03, Hardcopy

This report briefly reviews the status of microwave hardening polymer composites. A survey of relevant activities in Sweden has been made, and it appears these are very limited. Some activity in the UK has been identified. Details of the contacts made during preparation of the report are given, and an annotated bibliography of relevant publications is included.

Microwave hardening of polymer composites is compared with industrial techniques for sintering (metal and ceramic powders) and timber drying.
NTIS
*Composite Materials; Polymers; Microwaves; Curing*

**20040059159** Johns Hopkins Univ., Baltimore, MD
**Processing and High Temperature Properties of Nb/Nb5Si3 Laminates**
Weihs, T. P.; VanHeerden, D.; Mar. 2004; 21 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0028; Proj-2306
Report No.(s): AD-A422030; AFRL-SR-AR-TR-04-0191; No Copyright; Avail: CASI; A03, Hardcopy

The primary objective of this project was to study the processing and high-temperature deformation of laminated Nb/Nb5Si3 composites. Our initial goal was to control the grain size and porosity present in the Nb5Si3 silicide phase of the composite by developing improved processing techniques. For this part of the project we investigated four processing routes including hot pressing during annealing, vapor deposition onto a heated substrate, annealing under a large thermal gradient, and hot pressmg elemental Nb/Si microlaminates. The final processing method proved most promising and demonstrated that full dense Nb/ Nb5Si3 microlaminates can be processed with large grains and no metastable phases. Our subsequent goal was to characterize the deformation of Nb/Nb5Si3 microlaminates at high temperatures and determine the controlling deformation mechanisms in both phases. We demonstrated that the creep rate of the silicide phase at 1000 degrees centigrade and 1100 degrees centigrade has a nonlinear dependence (or weak power law dependence) on stress and a very strong dependence on grain size, larger than the 1/d3 dependence expected for Coble creep, which is the predicted deformation mechanism at these temperatures and stresses (10-100MPa). For the Nb phase at 600 degrees centigrade power law creep is observed under high stresses with no grain size dependence, a expected. Under lower stresses, diffusional creep is observed, also as expected. However, unlike conventional diffusional creep, this data set shows a weak, 1/d, grain size dependence and an approximately linear stress dependence (1.0). The data support an earlier hypothesis that the rate of vacancy generation and annihilation controls diffusional creep in fine-grained samples, not the rate of vacancy diffusion.
DTIC
*High Temperature; Laminates*

**20040059216** Texas A&M Univ., College Station, TX
**The Characterization of the Structure-Property Relations of Electron Beam Cured Composites**
Morgan, Roger J.; Mar. 2004; 17 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0180
Report No.(s): AD-A422141; No Copyright; Avail: CASI; A03, Hardcopy

The ultimate objective of this program was to develop a fundamental understanding of the relations between the processing parameters, the resultant physical and chemical structure and the performance of E-beam cured polymer matrix composites for cryogenic fuel containment structures for future Air Force space operations vehicles. The S-beam induced cure mechanisms for cationic polymerized epoxides and free radical polymerized bismaleimides (BMI) were characterized in terms of processing variables, dissociation chemistry of the catalytic initiators, and inherent absorbed moisture. A general S-beam resin and composite cure model was developed as a function of S-beam processing variables. Stress-thermal cycling of BMI-Carbon fiber composites under cryogenic fuel simulated environments revealed that there is a high probability of microcracking with increasing number of thermo- cycles, higher pre-strain and humidity.
DTIC
*Electron Beams*

**20040059236** Utah Univ., Salt Lake City, UT
**Microstructure and Mechanical Behavior of In-Situ Ti-TiB Whisker Composites**
Ravichandran, K. S.; Dec. 4, 2003; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0281
Report No.(s): AD-A422169; ARO-38285.2-MS; No Copyright; Avail: CASI; A02, Hardcopy

This ARO-sponsored research was concerned with performing some pioneering work on synthesizing titanium- titanium boride composite materials by in situ reaction processes, modeling and evaluating their mechanical behavior. The research has demonstrated that low cost in situ titanium matrix composites with titanium boride whiskers can be made with properties comparable to some high strength steels. The research also has demonstrated that novel titanium boride coatings can be

engineered on to the surface of titanium. Further, functionally graded material architectures based on gradation of titanium versus titanium boride have been made with the idea of demonstrating the feasibility of making graded armor material for ballistic applications. Comprehensive investigations mechanical behavior of these composites were conducted. New approaches were used in fracture mechanical modeling of layered and graded materials. The over all research work was novel in each of the areas highlighted above and has resulted in new technologies and approaches in titanium composite material synthesis and mechanical behavior modeling.
DTIC
*Mechanical Properties; Microstructure; Titanium; Titanium Borides; Whisker Composites*

**20040059244** University of Southern California, Los Angeles, CA
**Processing of Metal Matrix Composites through Severe Plastic Deformation**
Langdon, Terence G.; Nov. 6, 2003; 8 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0488
Report No.(s): AD-A422186; ARO-40660.54-MS; No Copyright; Avail: CASI; A02, Hardcopy

This is the Final Progress Report for an ARO research program extending over a period of 3 years. The program was designed to evaluate the processing of materials using the procedure of Equal-Channel Angular Pressing (ECAP) in which a coarse-grained bulk solid is subjected to severe, but controlled, plastic deformation. Two metal matrix composites were investigated in detail: an aluminum 2009 alloy reinforced with 25% SiC particulates and an aluminum 6061 alloy reinforced with 10% alumina particulates. The results demonstrate the potential for achieving high strength and excellent mechanical properties in these two composites. Additional collaborations were established with other leading groups in the field and this led to many new insights in the field of ECAP processing. All of these new developments are described in detail in the publications arising from this program.
DTIC
*Metal Matrix Composites; Plastic Deformation*

**20040059738** Tuskegee Inst., AL
**Survivability of Affordable Aircraft Composite Structures. Volume 1: Overview and Ballistic Impact Testing of Affordable Woven Carbon/Epoxy Composites**
Hosur, Mahesh V.; Jeelani, Shaik; Vaidya, Uday K.; Nwosu, Sylvanus; Kelkar, Ajit D.; Apr. 2003; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-99-C-3608; Proj-2402
Report No.(s): AD-A421600; AFRL-VA-WP-TR-2003-3071; No Copyright; Avail: CASI; A03, Hardcopy

Future aircraft technology enhancements (FATE) develop revolutionary technologies that will become the foundation for the next generation of war fighters. The structures thrust of the Air Vehicles Directorate further supports the Air Force need toward a composite affordability initiative (CAI). Affordability and survivability are keys to air and space vehicles for higher performance, longer life, and cost effectiveness. In the current research project, issues of CAI were addressed. The technical work carried out is presented in three volumes. Volume 1 addresses the performance of carbon/epoxy composites that were manufactured using affordable vacuum assisted infusion molding (VARIM) process. Panels made of stitched/unstitched plain, satin, and twill weave of different thicknesses were subjected to high velocity impact loading using a gas-gun facility. Damage modes were evaluated through ultrasonic nondestructive evaluation (NDE). Effect of projectile geometry was studied. In all of the laminates, the damage was localized and was dominated by penetration rather than delamination. This resulted in laminates with lower damage size with increased residual mechanical properties as compared to the unidirectional laminates that are used in the current aircraft structures.
DTIC
*Aircraft Structures; Ballistics; Composite Structures; Epoxy Matrix Composites; Impact; Impact Tests; Terminal Ballistics; Woven Composites*

## 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*.

**20040056165** Westinghouse Savannah River Co., Aiken, SC, USA
**Study of Caustic Corrosiion of Carbon Steel Waste Tanks**
Jenkins, C. F.; 2000; 14 pp.; In English
Report No.(s): DE2003-44823; No Copyright; Avail: Department of Energy Information Bridge

Solution chemistry of wastes from US atomic weapons production is controlled to inhibit corrosion of carbon steel tanks used in containment and storage. The pH, nitrate ion and nitrite ion concentrations of fresh solutions are maintained within specified limits for this purpose. In the start up process for a new waste evaporator (RHLWE), non-radioactive solutions of similar chemistry will be circulated through carbon steel piping between a steel tank and the evaporator. The evaporator is fabricated from a corrosion resistant nickel base alloy. The equipment will be exposed continuously to the hot corrosive caustic solutions. Published corrosion rates for steel in pure caustic at the elevated temperatures indicate losses greater than 1.3 mm/y. Because the total test period for start up is relatively short, penetration will not occur. However, concern exists because the rust particles will probably circulate and precipitate throughout the system.
NTIS
*Hazardous Materials; Ion Concentration; Carbon Steels; Nitrates; Nitrites*

**20040056166** Westinghouse Savannah River Co., Aiken, SC, USA
**Suspending Zeolite Particles in Tanks**
Poirier, M. R.; Powell, M. R.; Gladki, H.; Rodwell, P. O.; 1999; 18 pp.; In English
Report No.(s): DE2003-44757; WSRC-MS-98-00893; No Copyright; Avail: Department of Energy Information Bridge

The Savannah River Site (SRS) is in the process of removing waste (sludge and salt cake) from million gallon waste tanks. The current practice for removing waste from the tanks is adding water, agitating the tanks with long shaft vertical centrifugal pumps, and pumping the sludge/salt solution from the tank to downstream treatment processes. This practice has left sludge heels (approx. 30,000 gallons) in the bottom of the tanks. SRS is evaluating shrouded axial impeller mixers for removing the sludge heels in the waste tanks. The authors conducted a test program to determine mixer requirements for suspending sludge heels using the shrouded axial impeller mixers. The tests were performed with zeolite in scaled tanks which have diameters of 1.5, 6.0, and 18.75 feet. The mixer speeds required to suspend zeolite particles were measured at each scale. The data were analyzed with various scaling methods to compare their ability to describe the suspension of insoluble solids with the mixers and to apply the data to a full-scale waste tank. The impact of changes in particle properties and operating parameters was also evaluated.
NTIS
*Zeolites; Shafts (Machine Elements); Sludge*

**20040056169** Westinghouse Savannah River Co., Aiken, SC, USA, Clemson Univ., SC, USA
**Non-Destructive Bulk Soil Analysis for a Chlorinated Compound using Prompt Gamma-ray Neutron Activation Analysis**
Howell, S. L.; Sigg, R. A.; Moore, F. S.; DeVol, T. A.; 1999; 16 pp.; In English
Report No.(s): DE2003-46112; WSRC-MS-99-00294; No Copyright; Avail: Department of Energy Information Bridge

A prompt gamma-ray neutron activation analysis (PGNAA) system was evaluated for the quantification of chlorinated compounds in soil. The system evaluation was divided into two phases. In phase one, the response of an n-type HPGe detector (20 percent relative efficiency) to point sources of 60Co and 152Eu was determined experimentally and used to calibrate an MCNP4a model of the detector. The refined MCNP4a detector model can predict the absolute peak detection efficiency within 7 percent in the energy range of 120 - 1400 keV. In phase two, a PGNAA system consisting of a light-water moderated 252Cf (1.06 mg) neutron source, and the shielded and collimated HPGe detector was used to collect prompt gamma-ray spectra from Savannah River Site (SRS) soil spiked with chlorine. The experimental system response was used to calculate the minimum detectable concentration of chlorine in the SRS soil for a 1800 sec. irradiation as 2200 mg/g based on the analysis of the 788 keV gamma-ray. MCNP4a was used to predict the PGNAA system response, which was accomplished by analyzing the neutron and gamma ray transport components separately. In the energy range of 788 to 6110 keV, the MCNP4a predictions

were generally within 60 percent of the calculated probability of detection of a prompt gamma ray based on the experimental data.
NTIS
*Neutron Activation Analysis; Chlorination; Gamma Ray Spectra; Probability Theory; Systems Analysis*

**20040058975** Stanford Univ., Stanford, CA
**Study of Ionic Structure and Ion Reaction Dynamics by Cavity Ring-Down Spectroscopy**
Zare, Richard N.; Wilbur, Marguerite B.; Jan. 2001; 20 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0019
Report No.(s): AD-A421521; No Copyright; Avail: CASI; A03, Hardcopy

Initially, we developed an ion spectrometer that could be used to study the spectroscopy and reactivity of small ions. For this purpose we characterized the discharge source, forming ions by combining an electrical discharge with a supersonic expansion from a pulsed nozzle. After expanding into a vacuum chamber, the ions were detected using cavity ring-down spectroscopy (CRDS), allowing the population of individual states to be determined on an absolute basis. The CRDS detection of the ions from this source was tested with N2+ by probing the B(2) sum sigma(+) - X(2) sum sigma (+)g electronic band system. We are also using Hadamard transform time-of-flight mass spectrometry as the basis for producing an instrument that could be used to analyze and identify the components of potentially contaminated samples.
DTIC
*Cavities; Chemical Reactions; Ionic Reactions; Molecular Ions; Spectroscopy*

**20040059002** North Carolina State Univ., Raleigh, NC
**Soot Morphology in Unsteady Counterflow Diffusion**
Roberts, William L.; Jan. 2000; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0429
Report No.(s): AD-A421603; ARO-40185.1-EG; No Copyright; Avail: CASI; A03, Hardcopy

Due to the resulting reduction of efficiency, providing an IR source for tracking and targeting, and its harmful effects on human health, soot emission from diesel engines continues to be of interest to the US Army. The broad focus of this three-year project has been to better understand the soot formation processes occurring in diesel engines though experimentation in simple unsteady counterflow diffusion flames. Specifically, we have developed a planar diagnostic technique to measure the morphology (fractal dimension, primary spherule diameter, number if spherules per aggregate, etc) of soot in a plane using optical techniques, measured soot volume fraction in high pressure jet diffusion flames (up to 30 atmospheres), and measured a range of PAR (three different size classes) in an unsteady counterflow diffusion flame.
DTIC
*Counterflow; Diffusion; Morphology; Soot*

**20040059082** Southwest Research Inst., San Antonio, TX
**Tactical Vehicle Engine Emissions Investigations**
Frame, Edwin A.; Dec. 2002; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAE07-99-C-L053
Report No.(s): AD-A421848; TFLRF-365; No Copyright; Avail: CASI; A03, Hardcopy

Emissions from tactical vehicle engines contribute to local and regional particulate matter (PM) air pollution. Emissions from these sources are not well-understood, and the Army requires methods/models to predict PM10 and PM2.5 emissions from these military-unique sources. To develop these methods/models, the mass and chemical speciation of tactical vehicle engine emissions need to be characterized, which may also be useful in a method to determine the Army's contribution to atmospheric PM concentrations at receptor sites of concern. Because much of the Army ground force uses JP-8 fuel (1), engine emissions from the tactical vehicle fleet may be established as a distinctive PM source category. The establishment of an Army-unique PM source is the first step in the development of a receptor- model-based method that can apportion the PM contribution from all sources, including the Army's. The objective of this program is to investigate procedures to be used in developing emissions factors for Army equipment. This project consists of the following tasks: 1. Perform a literature search to identify exhaust emissions data for JP-8 fuel used in Army engines and vehicles. 2. Examine the chemical and physical differences between JP-8 and diesel fuel (DF-2) (2). 3. Categorize groupings for Army wheeled and tracked vehicles to which

a single emission estimation method/model can be applied. 4. Develop a plan for emissions testing of representative Army tactical vehicles using appropriate test cycle(s).
DTIC
*Automobiles; Combustion Products; Exhaust Emission; Exhaust Gases*

**20040059158** Princeton Univ., NJ
**Physical and Chemical Processes in Flames**
Law, Chung K.; Feb. 29, 2004; 16 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0029; Proj-2308
Report No.(s): AD-A422029; AFRL-SR-AR-TR-04-0170; No Copyright; Avail: CASI; A03, Hardcopy

The objective of the present program was to study the structure and response of laminar premixed and nonpremixed flames with emphases on effects of high pressure, flame/flow unsteadiness, and chemistry. The investigations were conducted through laser-based experimentation, computational simulation with detailed chemistry and transport descriptions, and advanced mathematical analysis. Specific phenomena studied during the reporting period include the intrinsic pulsating instabilities of premixed and diffusion flames and the effects of stretch and radiation heat loss on the onset of pulsation and the associated extinction and flammability limits. laminar flame speed data were acquired for several fuel mixtures at atmospheric pressure and methane/air at elevated pressures. Directed relation graph theory and computational simulation were applied to develop automatic computational algorithms for the simplification of detailed mechanisms to skeletal mechanisms and of skeletal mechanisms to reduced mechanisms, respectively. These contributions are expected to be useful to the general interests of AFOSR in the fundamental and practical issues of flame dynamics and chemical kinetics, turbulent combustion, soot formation, radiation hear transfer, flame extinction, stabilization, flammability, and supersonic combustion.
DTIC
*Chemical Reactions; Flames*

**20040059162** California Inst. of Tech., Pasadena, CA
**Femtosecond Dynamics of Chemical Reactions**
Zewail, Ahmed H.; Mar. 29, 2004; 14 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0059
Report No.(s): AD-A422033; AFRL-SR-AR-TR-04-0202; No Copyright; Avail: CASI; A03, Hardcopy

We proposed to use this grant to undertake research in the following three major areas: (a) Dynamics of elementary steps in complex systems. (b) Dynamics of reactions under extreme environment (density, temperature, clustering, etc.). (c) New techniques for direct imaging of structural changes and chemical control of reactions yield and channel. In these studies, the basic approach is based on the development of ultrafast laser (and electron) and molecular beam techniques to examine in real time the nature of the dynamics and structures on the femtosecond time scale. Our goal was to relate these dynamics to features of bonding and mechanisms and to explore the effect of extreme solvation environment on reactivity. Probing and controlling reactions pathways %are key to validating any model of chemical reactivity in complex molecular 5 stems. Theoretical studies in our group and-in collaboration with colleagues elsewhere were an important part of this research activity during the entire period of the grant.
DTIC
*Chemical Reactions*

**20040059166** Delaware Univ., Newark, DE
**Development and Optimization of a Comprehensive Kinetic Model of Hydrocarbon Fuel Combustion**
Wang, Hai; Mar. 26, 2004; 12 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0144; Proj-2308
Report No.(s): AD-A422042; AFRL-SR-AR-TR-04-0188; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this research program was to develop a comprehensive, predictive, and detailed kinetic model of hydrocarbon combustion for aero propulsion simulations. Sensitivity analyses were performed to examine the influences of the uncertainty in binary diffusion coefficients on flame simulations. First-principles calculations were carried out to determine the molecular binary diffusion coefficients of H-He, H2-He, H-H2, and H-Ar gas mixtures. This study resulted in an updated transport property library commonly used in combustion simulations. A new class of radical-chain initiation reactions was discovered for the homogeneous oxidation of unsaturated hydrocarbons. This element of the study utilized advanced quantum chemistry tools, reaction rate theory, and the method of detailed kinetic modeling. This new class of initiation reactions was found to

be critical to reaction model development. A detailed reaction model of C1-C4 fuel combustion was updated. The foundation of this model, namely the H2/CO sub-model, was revised completely and optimized. A new method, termed the Sensitivity Analysis Based (SAB) method, was developed for rapid model optimization. The method was shown to be far more efficient than the factorial design method used in previous kinetic model optimization efforts.
DTIC
*Combustion; Fuel Combustion; Hydrocarbon Fuels; Hydrocarbons; Kinetics*

**20040059168** Pennsylvania Univ., Philadelphia, PA
**Oxidation Processes on Aluminum and Rhodium**
Rappe, Andrew M.; Mar. 17, 2004; 9 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0170; Proj-2303
Report No.(s): AD-A422045; AFRL-SR-AR-TR-04-0201; No Copyright; Avail: CASI; A02, Hardcopy

During the reporting period, we have made new discoveries in the areas of oxide-supported nanocatalysts, quantum Monte Carlo methodlolgy, subsurface vacancies in metals, fundamental understanding of chemisorption, and self- assembled monolayers. We have completed the first major theoretical study of Pt chemisorbed on alumina. We contrast Pt nanoparticle and layer adsorption, focusing on how oxide defects influence the Pt growth, and the CO chemisorption properties on the nanoparticles. We have completed an initial demonstration that our new formulation of atomic forces in quantum Monte Carlo is both efficient and accurate. We have extended this formalism to electronically more complex dimers, and to multiconfigurational wave functions. During the past year, we have developed a deep understanding of molecular chemisorption; we are now able to rationalize site preferences on different surfaces and different metals, as well as explain trends in saturation coverage. We find that vacancies below the surface of palladium have a significant effect on the surface. We have investigated thiol chemisorption on the noble metals, demonstrating how changes in metal electronic structure give rise to different overlayers. We also completed the first study of thiol chemisorption on aluminum, computationally demonstrating that thiols strongly inhibit O2 chemisorption on Al.
DTIC
*Aluminum; Aluminum Oxides; Chemisorption; Oxidation; Rhodium; Thiols*

**20040059169** Massachusetts Inst. of Tech., Cambridge, MA
**Optical Supramolecules for Chemical and Physical Sensing**
Nocera, Daniel G.; Apr. 2, 2004; 13 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0118
Report No.(s): AD-A422046; AFRL-SR-AR-TR-04-0214; No Copyright; Avail: CASI; A03, Hardcopy

This proposal seeks to bring to the AFOSR a strategy to use bio-inspired concepts of recognition and signal transduction to unite the areas of optical chemosensing and nanoscience to address diverse chemical and physical sensing needs of the USA Air Force. Luminescent molecule, supramolecule or materials have been synthesized for targeted sensing application. An intrinsic component of the program has been to define fundamental parameters that control the nonradiative and radiative energy flows so that the luminescence intensity and lifetime of the optical probe may be used for signal transduction. The following major achievements have been made by the research program (1) the development of the first microfluidic chemosensor for the detection and monitoring of chemical species of relevance to the Air Force on especially small length scales; (2) the development of new optical probes for accurate tempera ture& and pressure measurements at aerodynamic surfaces; and (3)the development of new materials for an optical diagnostic technique that we invented to detect and measure turbulence. Achievements have been transitioned to several research efforts in Air Force laboratories.
DTIC
*Detection; Optical Equipment*

**20040059180** Pennsylvania State Univ., University Park, PA
**Molecular Dynamics Simulations of Supercritical Sprays**
Micci, Michael M.; Mar. 12, 2004; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0432
Report No.(s): AD-A422064; AFRL-SR-AR-TR-04-0193; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this program was to develop an accurate and fast simulation methodology for supercritical injection and mixing using molecular dynamics (MD). The use of MD allows the supercritical mixing to occur naturally' without the need for tracking phase boundaries and intrinsically includes all physical processes, material properties and equations of state in

both subcritical and supercritical environments. MD also allows the tracking of injected liquid molecules into the chamber environment. Simulations of subcritical liquid nitrogen injection and atomization resulted in droplet sizes that matched Rayleigh theory. Subcritical breakup length as a function of pressure displayed behavior that matched experiments. Axial and radial density profiles for supercritical jet injection displayed the smooth transition of the density profiles from the high jet centerline to ambient chamber conditions and jet divergence angles that agreed in magnitude with steady state empirical models.
DTIC
*Molecular Dynamics; Simulation; Sprayers; Supercritical Flow*

**20040059189** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD
**Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Soil Screening Levels (ECO-SSL) Using Earthworm (Eisenia Fetida) Benchmark Values**
Simini, Michael; Checkai, Ronald T.; Kuperman, Roman G.; Phillips, Carlton T.; Speicher, Jason A.; Nov. 2002; 76 pp.; In English
Contract(s)/Grant(s): Proj-PE9KNM22
Report No.(s): AD-A422078; ECBC-TR-325; No Copyright; Avail: CASI; A05, Hardcopy

The U.S. Environmental Protection Agency (USEPA), in a collaborative effort with other Federal agencies, states, and private industry, is developing Ecological Soil Screening Levels (Eco-SSLs) for ecological risk assessment of contaminants at Superfund sites. Earthworm (Eisenia fetida) cocoon production and survival tests were conducted in a Sassafras sandy loam soil that supports relatively high bioavailability of barium (Ba), beryllium (Be), manganese (Mn), and antimony (Sb). For the metals tested, cocoon production was a more sensitive endpoint than was survival. Bounded Lowest Observed Effect Concentrations (LOECs) (mg kg-1) for cocoon production, as determined by analysis of variance (ANOVA), were 83, 86, 433, and 1236 for Be, Sb, Ba, and Mn, as compared to LOECs for survival of 110, 697, 1585, and 2222, respectively. Bounded No Observed Effect Concentrations (NOECs) (mg kg-1) for cocoon production, as determined by ANOVA, were 57, 60,258, and 1111 for Be, Sb, Ba, and Mn, as compared to NOECs for survival of 83, 617,1348, and 1444, respectively. Non-linear regression analysis of cocoon production data showed that the relative toxicity (EC20 mg kg- 1) of the four metals was in the order of Sb (30) = Be (52) > Ba (370) > Mn ( 629). These results will be submitted to the Eco-SSL Work ou for review and inclusion in their database.
DTIC
*Antimony; Barium; Beryllium; Manganese; Soils; Toxicity*

**20040059211** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD
**Characteristics, Sampling Efficiencies, and Possible Improvements to the Aerosol to Liquid Particle Extraction System (ALPES)**
Kesavan, Jana; Hottell, K. A.; Jan. 2004; 15 pp.; In English
Contract(s)/Grant(s): Proj-ACB2
Report No.(s): AD-A422129; ECBC-TN-017; No Copyright; Avail: CASI; A03, Hardcopy

Sampler characteristics and sampling efficiency measurements of the Aerosol to Liquid Particle Extraction System (ALPES) were determined wing monodisperse polystyrene latex (PSL) microspheres and fluorescent oleic acid droplets with fluorometer analysis. Sampling efficiency measurements of ALPES were determined using 0.5- and 1-micrometer PSL microspheres, and 5 micrometers sodium fluorescein tagged oleic acid (fluorescent oleic acid) particles. The results show that the ALPES has a peak efficiency of 57.4 +/- 5.1% for 5-micrometer particles. Tests conducted to determine possible improvements to the sampler showed that slowing the air flow rate of the sampler significantly increased the sampling efficiency, and washing the inside of the outer cylinder increased the collection efficiency. Dry versus wet collection tests showed that there is no difference in collection efficiency for these conditions.
DTIC
*Aerosols; Efficiency; Extraction; Sampling*

**20040059260** University of Southern California, Los Angeles, CA
**Energy-Efficient Transient Plasma Ignition and Combustion**
Gundersen, Martin; Apr. 15, 2004; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0322; Proj-2308
Report No.(s): AD-A422219; AFRL-SR-AR-TR-04-0239; No Copyright; Avail: CASI; A03, Hardcopy

Transient plasma discharges utilizing short (30 to 100 nsec), spatially distributed streamers energized by pulsed power were investigated as a potential new method for flame ignition. Experimental results showed shorter ignition delay and pressure rise time (typically by a factor of 3 for methane- air mixtures), as well as higher maximum pressure compared to conventional spark ignition. In all cases significant modification of initial combustion chemistry appeared to be occurring, leading to more effective combustion over a wider range of pressures and fuel composition rates.
DTIC
*Combustion; Gas Turbines; Ignition; Plasmas (Physics); Spark Ignition*

**20040059266** Massachusetts Inst. of Tech., Cambridge, MA
**Integrated Vacuum Growth System for Hybrid Organic- Inorganic Materials**
Bulovic, Vladimir; Mar. 17, 2004; 13 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0248
Report No.(s): AD-A422230; AFRL-SR-AR-TR-04-0181; No Copyright; Avail: CASI; A03, Hardcopy

Our recent demonstrations of efficient inorganic- quantum-dot light-emitting devices in molecular organic hosts indicate the vast potential of hybrid organic/inorganic nanostructured materials for development of practical active devices. Experience shows that essential to the high performance of such nano-structures is the high material purity and controlled device growth. Both can be improved through the use of the novel and versatile integrated materials deposition system developed in this program.
DTIC
*Organic Materials; Systems Integration; Vacuum Systems*

**20040059271** Vanderbilt Univ., Nashville, TN
**Fabrication, Metrology and Modeling of Protective Coatings on Metallic MEMS Components**
Weller, Robert A.; Nov. 7, 2003; 21 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0283
Report No.(s): AD-A422237; ARO-39512.9-MS; No Copyright; Avail: CASI; A03, Hardcopy

This project provided a proof-of-concept that indium tin oxide (ITO) thin films can be prepared on surfaces by pulsed laser deposition and configured as miniature strain gauges. The degree of piezoresistivity of the films is related to the oxygen content, with larger gauge factors correlated with oxygen excess. Typical gauge factors of order 10 were observed. Gauges as small as 20x 100 microns were fabricated by focused ion beam milling and characterized. Radiation effects from ion beam milling were observed and measured. Structures encapsulated with silicon dioxide protective films retailed their piezoresistive coefficient and were less susceptible to damage by focused ion beam imaging.
DTIC
*Fabrication; Indium Compounds; Metrology; Microelectromechanical Systems; Protective Coatings; Radiation Effects; Textiles*

**20040059325** Kansas State Univ., Manhattan, KS
**Fabrication and Optical Recombination in III- Nitride Microstructures and Devices**
Jiang, Hongxing; Lin, Jingyu; Oct. 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0410
Report No.(s): AD-A422324; ARO-40119.1-EL; No Copyright; Avail: CASI; A03, Hardcopy

The research program at Kansas State University is to develop innovative approaches for fabricating high quality III-nitride QWs, heterostructures, microstructures, and micro- devices and to study their optical and optoelectronic properties. By optimizing the epilayer mobilities and optical emission properties, we have produced GaN,Al(x)Ga(1-x)N (x up to 1), In(x)Ga(1-x)N (x<0. 3), and In(x)Al( y)Ga(1-x-y)N epilayers, III-nitride QWs with device qualities. We have successfully fabricated micro-size blue emitters and developed a bonding scheme that allows us to address micro-size pixels individually in an array comprising many 111-nitride micro- emitters/micro-detectors. We have demonstrated the operation of the first prototype blue microdisplay made from InGaN/GaN QWs. We have achieved highly conductive n-type Al(x)Ga(1-x)N alloys of high Al contents (for x up to 0.8). We have developed Mg-delta-doping for enhanced p-type doping efficiency in GaN and AlGaN. A 2-fold enhancement in lateral and a 5-fold enhancement in vertical p-type conductions have been achieved for AlGaN and AlGaN epilayers. We have also achieved AlN epilayers with very efficient band-edge PL emission the optical quality of AlN is comparable to that of GaN and determined the detailed band structure near the gamma point of wurtzite AlN,

including energy gap, optical selection rules, exciton binding energies and lifetimes, and acceptor/donor energy levels.
DTIC
*Display Devices; Fabrication; Heterogeneity; Microstructure; Nitrides; Optical Properties*

**20040059751** Cincinnati Univ., OH, USA
**Lightweight, High-Strength, Age-Hardenable Nanoscale Materials**
Vasudevan, Vijay K.; Sekhar, Jainagesh A.; Mar. 25, 2004; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0127
Report No.(s): AD-A422041; AFRL-SR-AR-TR-04-0198; No Copyright; Avail: CASI; A03, Hardcopy

Phase transformations and precipitation behavior in age-hardenable nanoscale materials, using binary aluminum alloys as model materials, were studied. Nanoparticles of Al- Cu and Al-Zn were synthesized by a plasma ablation process. The particles (50-100 nm dia) were found to be supersaturated f.c.c. and were enveloped by a 2-4 nm amorphous Al oxide layer. On aging the Al-Cu nanoparticles, a precipitation sequence comprising nearly pure Cu precipitates to theta' to the equilibrium theta was observed, with all three forming along the Al oxide-matrix interface. In the Al-Zn nanoparticles, a spinodal structure was noted in the as-synthesized state, which evolved into a striated, f.c.c. twinned platelet structure within which were contained hcp precipitates also in twin relation; nearly pure Zn- precipitates also formed along the Al oxide-matrix interface. Ultra fine Al-Cu nanoparticles were also synthesized by inert gas condensation; these were found to be quite stable against precipitation during aging. Finally, the results revealed that Al nanopowders could be processed into bulk structures, leading to interesting Al-Al oxide nanocomposites with full densification and high hardness.
DTIC
*Aluminum Alloys; Nanostructures (Devices); Precipitation Hardening*

**20040059952**
**Morocco Desalination Plant Feasibility Study. Final Report (Public Version)**
Feb. 2003; In English
Report No.(s): PB2004-104170; No Copyright; Avail: National Technical Information Service (NTIS)

This study, completed by Framatome ANP DE&S in 2003, evaluated the technical and economic feasibility of a desalination plant at the Jorf Lasfar Plant in Morroco. Installation of a 60,000 M3/day seawater desalination plant would supply both drinking and process water for the Jorf Lasfar Plant. The plant will utilize the waste heat from the existing sulfuric acid cooling system. Specific tasks addressed in this study included: (1) Technical feasibility; (2) Determination and analysis of alternative plans to meet water supply demands; (3) Process Sketch and flow diagrams; (4) Chemicals and catalyst treatment requirements; (5) Equipment lists and cost estimates; (6) Financial and economic analysis; (7) Implementation planning and budgeting; (8) Environmental impact study.
NTIS
*Economic Analysis; Cost Effectiveness; Catalysts*

**20040059989** Lawrence Livermore National Lab., Livermore, CA
**Evidence of Biogenic Corrosion of Titanium After Exposure to a Continuous Culture of Thiobacillus Ferrooxidans Grown in Thiosulfate Medium**
Horn, J. M.; Martin, S. I.; Materson, B.; Dec. 07, 2000; 22 pp.; In English
Report No.(s): DE2004-15006116; UCRL-JC-141910; No Copyright; Avail: Department of Energy Information Bridge

Experiments were undertaken to evaluate extreme conditions under which candidate materials intended for use in a proposed nuclear waste repository might be susceptible to corrosion by endogenous microorganisms. Thiobucillus ferrooxidans, a sulfur-oxidizing bacterium, was grown in continuous culture using thiosulfate as an energy source; thiosulfate is oxidized to sulfate as a metabolic endproduct by this organism. Culture conditions were optimized to produce a high-density, metabolically active culture throughout a period of long term incubation in the presence of Alloy 22 (a high nickel-based alloy) and Titanium grade 7 (Tigr7) material coupons. After seven months incubation under these conditions, material coupons were withdrawn and analyzed by high resolution microscopy and energy dispersive x-ray analyses. Alloy 22 coupons showed no detectable signs of corrosion. Tigr7, however, demonstrated distinct roughening of the coupon surface, and (presumably solubilized and precipitated) titanium was detected on Alloy 22 coupons incubated in the same T. ferrooxiduns culture vessel. Control coupons of these materials incubated in sterile thiosulfate medium did not demonstrate any signs of corrosion, thus showing that observed corrosive effects were due to the T. ferrooxidans metabolic activities. T. ferrooxidans intermediates of

thiosulfate oxidation or sulfate may have caused the corrosive effects observed on Tigr7.
NTIS
*Corrosion; Titanium; Biological Evolution*

**20040059994** Lawrence Livermore National Lab., Livermore, CA
**Automatic Extraction of Closed Pixel Clusters for Target Cueing in Hyperspectral Images**
Paglieroni, D. W.; Perkins, D. E.; Jun. 05, 2001; 18 pp.; In English
Report No.(s): DE2004-15006170; UCRL-JC-141883; No Copyright; Avail: Department of Energy Information Bridge

Traditional algorithms for automatic target cueing (ATC) in hyperspectral images, such as the RX algorithm, treat anomaly detection as a simple hypothesis testing problem. Each decision threshold gives rise to a different set of anomalous pixels. The clustered Rx algorithm generates target cues by grouping anomalous pixels into spatial clusters, and retaining only those clusters that satisfy target specific spatial constraints. It produces one set of target cues for each of several decision thresholds, and conservatively requires(Omicron)(K(sup 2)) operations per pixel, where K is the number of spectral bands (which varies from hundreds to thousands in hyperspectral images). A novel ATC algorithm, known as 'Pixel Cluster Cueing' (PCC), is discussed. PCC groups pixels into clusters based on spectral similarity and spatial proximity, and then selects only those clusters that satisfy target-specific spatial constraints as target cues. PCC requires only(Omicron)(K) operations per pixel, and it produces only one set of target cues because it is not an anomaly detection algorithm, i.e., it does not use a decision threshold to classify individual pixels as anomalies. PCC is compared both computationally and statistically to the RX algorithm.
NTIS
*Algorithms; Pixels; Clusters*

**20040059996** Lawrence Livermore National Lab., Livermore, CA
**Computational Theory of Warm Condensed Matter**
Barbee, T. W.; Surh, M. P.; Benedict, L. X.; Feb. 25, 2001; 12 pp.; In English
Report No.(s): DE2004-15006179; UCRL-ID-142612; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
*Condensed Matter Physics; Matter (Physics)*

## 26
## METALS AND METALLIC MATERIALS

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

**20040056104** Army Research Lab., Hampton, VA, USA
**Selective Reinforcement to Enhance the Structural Performance of Metallic Compression Panels**
Farley, Gary L.; March 18, 2004; 10 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 762-55-LE
Report No.(s): AIAA Paper 2004-2050; No Copyright; Avail: CASI; A02, Hardcopy

An experimental and analytical investigation of the influence of selective reinforcement on metallic panels with cutouts was conducted. Selective reinforcement was shown to be a weight effective concept for increasing structural performance of panels with cutouts designed to carry loads into the post-buckled regime. For instance, a selectively reinforced aluminum panel under shear load exhibited a 68 percent increase in specific-buckling load as compared to a geometrically comparable unreinforced aluminum panel. In comparison, a quasi-isotropic carbon-fiber-reinforced-polymer composite panel only produced a 45 percent higher specific-buckling load than the same unreinforced aluminum panel. Selective reinforcement offers the potential to tailor structural response through local strengthening and stiffening the structure for a broad range of structural application.
Author
*Aluminum Alloys; Metal Matrix Composites; Fiber Composites; Composite Structures*

**20040056134** National Jewish Medical and Research Center, Denver, CO, USA
**Beryllium Disease Natural History and Exposure-Response**
Newman, L. S.; Jan. 24, 2002; 24 pp.; In English
Report No.(s): PB2004-104522; No Copyright; Avail: CASI; A03, Hardcopy

This is the first natural history study to determine the progression from beryllium sensitization to disease, as well as the progression from sub clinical beryllium disease. In understanding how beryllium sensitization and disease progresses we will be better able to advise patients on their prognosis and advise industry on the impact that this disease has on their employees. In addition, understanding the natural history allows us to explore medical treatments for this disease. Characterizing exposures based on particle size distribution, particle number, and surface area allow us to study the factors influencing the deposition and retention of beryllium particles in the respiratory tract and the subsequent biological response in individuals. Understanding the tracking of beryllium outside the plant clarifies the need to monitor take-home exposures. In turn, this information will allow us to more fully understand exposures in the workplace and how we can control these exposures in an effort to reduce the occurrence of this occupational lung disease.
NTIS
*Beryllium; Occupational Diseases*

**20040056167** Westinghouse Savannah River Co., Aiken, SC, USA, Georgia Inst. of Tech., Atlanta, GA
**Mechanical Properties for Fracture Analysis of Mild Steel Storage Tanks**
Sindelar, R. L.; Lam, P. S.; Caskey, G. R.; Woo, L. Y.; 1999; 14 pp.; In English
Report No.(s): DE2003-44834; WSRC-MS-99-00215; No Copyright; Avail: Department of Energy Information Bridge

Mechanical properties of 1950's vintage, A285 Grade B carbon steels have been compiled for elastic-plastic fracture mechanics analysis of storage tanks (Lam and Sindelar, 1999). The properties are from standard Charpy V-notch (CVN), 0.4T planform Compact Tension (C(T)), and Tensile (T) specimens machined from archival steel from large water piping. The piping and storage tanks were constructed in the 1950s from semi-killed, hot-rolled carbon steel plate specified as A285 Grade B. Evaluation of potential aging mechanisms at both service conditions shows no loss in fracture resistance of the steel in either case. Site and literature data show that the A285, Grade B steel, at and above approximately 70 degrees Fahrenheit, is in the upper transition to upper shelf region for absorbed energy and is not subject to cleavage cracking or a brittle fracture mode. Furthermore, the tank sidewalls are 1/2 or 5/8-inch thick, and therefore, the J-resistance (JR) curve that characterizes material resistance to stable crack extension under elastic-plastic deformation best defines the material fracture toughness. The JR curves for several heats of A285, Grade B steel tested at 40 degrees Fahrenheit, a temperature near the average ductile-to-brittle (DBTT) transition temperature (CVN(at) 15 ft-lb), are presented. This data is applicable to evaluate flaw stability of the storage tanks that are operated above 70 degrees Fahrenheit since, even at 40 degrees Fahrenheit, crack advance is observed to proceed by ductile tearing.
NTIS
*Fracture Mechanics; Mechanical Properties; Microstructure; Carbon Steels*

**20040056168** Westinghouse Savannah River Co., Aiken, SC, USA
**J-Integral based Flaw Stability Analysis of Mild Steel Storage Tanks**
Lam, P. S.; Sindelar, R. L.; 1999; 10 pp.; In English
Report No.(s): DE2003-45301; WSRC-MS-99-00214; No Copyright; Avail: Department of Energy Information Bridge

The J-integral fracture methodology was applied to evaluate the stability of postulated flaws in mild steel storage tanks. The material properties and the J-resistance (JR) curve were obtained from the archival A285 Grade B carbon steel test data. The J-integral calculation is based on the center-cracked panel solution of Shih and Hutchinson (1976). A curvature correction was applied to account for the cylindrical shell configuration. A finite element analysis of an arbitrary flaw in the storage tank geometry demonstrated that the approximate solution is adequate.
NTIS
*Finite Element Method; Stability Tests; Carbon Steels*

**20040058073** NASA Glenn Research Center, Cleveland, OH, USA
**Effect of Sintering on Mechanical and Physical Properties of Plasma-Sprayed Thermal Barrier Coatings**
Choi, Sung R.; Zhu, Dong-Ming; Miller, Robert A.; April 2004; 34 pp.; In English; 28th Annual International Conference and Exposition on Advanced Ceramics and Composites, 25-20 Jan. 2004, Cocoa Beach, FL, USA
Contract(s)/Grant(s): WBS 22-714-30-19
Report No.(s): NASA/TM-2004-212625; E-14183; No Copyright; Avail: CASI; A03, Hardcopy

The effect of sintering on mechanical and physical properties of free-standing plasma-sprayed ZrO2-8 wt% Y2O3 thermal barrier coatings (TBCs) was determined by annealing them at 1316 C in air. Mechanical and physical properties of the TBCs, including strength, modes I and II fracture toughness, elastic modulus, Poisson s response, density, microhardness, fractography, and phase stability, were determined at ambient temperature as a function of annealing time ranging from 0 to 500 h. All mechanical and physical properties, except for the amount of monoclinic phase, increased significantly in 5 to 100 h and then reached a plateau above 100 h. Annealing resulted in healing of microcracks and pores and in grain growth, accompanying densification of the TBC s body due to the sintering effect. However, an inevitable adverse effect also occurred such that the desired lower thermal conductivity and good expansivity, which makes the TBCs unique in thermal barrier applications, were degraded upon annealing. A model was proposed to assess and quantify all the property variables in response to annealing in a normalized scheme. Directionality of as-sprayed TBCs appeared to have an insignificant effect on their properties, as determined via fracture toughness, microhardness, and elastic modulus measurements.
Author
*Mechanical Properties; Sprayed Coatings; Plasma Layers; Zirconium Oxides; Yttrium Oxides; Thermal Control Coatings*

**20040059096** Naval Postgraduate School, Monterey, CA
**Microtextural Characterization of Shear Textures in the Thermo-Mechanically Affected Zone of Friction Stir Processed Nickel Aluminum Bronze**
Walton, Charles F., Jr; Jun. 2003; 75 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421876; No Copyright; Avail: CASI; A04, Hardcopy

Cast nickel-aluminum bronze (NAB) is used in the production of the Navy's marine propellers for both surface and submersible platforms. Improving the properties of NAB will facilitate new designs. Friction Stir Processing (FSP) is a solid state, thermo-mechanical process to achieved surface hardening of cast NAB by use of a rotating tool that is plunged into and traversed across the material surface. The subsequent 'stirring' action produces local yielding/ softening of the material by frictional as well as adiabatic heating. The softened regions experience extensive shear deformations resulting in refinement and homogenization of the local microstructure. In essence, FSP can be used to achieve a wrought microstructure from as-cast nickel-aluminum bronze in the absence of macroscopic shape change. There is a region known as the Thermo-mechanically Affected Zone, or TMAZ, in material that has experienced FSP. This region, similar to the heat affected zone (HAZ) common in fusion welding, displays a microstructure characteristic of one affected by diffusion of heat, as well as deformation induced by the rotating tool resulting in the development of shear textures. Using Orientation Imaging Microscopy (OIM) these shear textures were analyzed and characterized for two separate FSP conditions. Through OIM, shear textures in the TMAZ were characterized to be of the C-type, with varied lattice orientations. Shear directions were predominately in the direction of tool advance for one processing condition, while tangent to the tool interface for the other.
DTIC
*Aluminum; Bronzes; Friction Stir Welding; Marine Propulsion; Nickel; Propellers; Textures*

**20040059331** Naval Postgraduate School, Monterey, CA
**Sample Fabrication and Experimental Design for Studying Interfacial Creep at Thin Film / Silicon Interfaces**
Thornell, Mark E.; Mar. 2004; 59 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422348; No Copyright; Avail: CASI; A04, Hardcopy

This thesis developed the sample fabrication and experimental design for studying interfacial creep at thin film / Silicon interfaces. The specific interface of study was the crystalline interface created by Positive Vapor deposition of a metallic thin film on a very smooth Silicon substrate. Emphasis was placed on development and refinement of the fabrication techniques necessary to produce test samples that provide valid reproduction of the interfacial stress state in isolation from other stresses inherent in the complete device. Test sample fabrication utilized traditional laboratory methods combined with leading edge methodology in two fabrication steps; namely diffusion bonding of an Silicon substrate / PVD Aluminum thin film / Silicon substrate composite structure and micro-machining Silicon through the use of a TMAH based etchant. In conjunction with the sample development a test platform was designed, fabricated, assembled, and aligned to provide for isolated parametric characterization of the proposed interfacial creep model. The results of this characterization are anticipated to be of significant utility in improving the design for fabrication and reliability of current and next generation microelectronic and microelectro-mechanical devices.
DTIC
*Composite Structures; Creep Properties; Diffusion Welding; Experiment Design; Fabrication; Metal Bonding; Metal Films; Silicon; Thin Films*

**20040059938** Bettis Atomic Power Lab., West Mifflin, PA, USA
**Results of High R-Ratio Fatigue Crack Growth Tests on 304 Stainless Steel in Low Oxygen Water**
Evans, W. M.; Wire, G. L.; 2002; 14 pp.; In English
Report No.(s): DE2004-805336; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
*Crack Propagation; Stainless Steels; Oxygen*

**20040059948** Massachusetts Inst. of Tech., Lexington, MA, USA
**Evolution of Surface Structure and Phase Separation in GaInAsSb**
Wang, C. A.; Calawa, D. R.; Vineis, C. J.; 2003; 20 pp.; In English
Report No.(s): DE2004-821366; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
*Alloys; Atomic Force Microscopy*

**20040059950** Helsinki Univ. of Technology, Espoo, Finland
**Activity Report 2003 of the Laboratory of Metallurgy Department of Materials Science and Rock Engineering, Helsinki University of Technology**
Pallaskallio, A.; 2003; In English
Report No.(s): PB2004-103316; Copyright; Avail: National Technical Information Service (NTIS)
The current research activities focus on physicochemical fundamentals and modeling of metallurgical operations. Processes that benefit from this research include modern extractive and refining processes for ferrous and non-ferrous metals, casting and solidification as well as materials synthesis and behavior at high temperatures. The main emphasis is to gain better understanding of metallurgical phenomena by combining experimental studies with computer simulation and modeling.
NTIS
*Metallurgy; Research Projects*

## 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*.

**20040056116** Swedish Defence Research Establishment, Linkoeping
**Defence Applications of New Forms of Carbon**
Savage, S. J.; Dec. 2003; 18 pp.; In English
Report No.(s): PB2004-104136; FOI-R-1103-SE; No Copyright; Avail: CASI; A03, Hardcopy
This report briefly reviews some applications of new forms of carbon (fullerenes, carbon nanotubes and nanofibers) in military technology. Selected reports are summarized and discussed, and a number of military applications suggested. The report contains recommendations for future studies.
NTIS
*Military Technology; Carbon*

**20040056138** NASA Glenn Research Center, Cleveland, OH, USA
**Oxide Ceramic Films Grown on 55Ni-45Ti for NASA and Department of Defense Applications: Unidirectional Sliding Friction and Wear Evaluation**
Miyoshi, Kazuhisa; Lukco, Dorothy; Cytron, Sheldon J.; March 2004; 26 pp.; In English
Contract(s)/Grant(s): WBS 22-708-04-04
Report No.(s): NASA/TM-2004-212979; E-14316; No Copyright; Avail: CASI; A03, Hardcopy
An investigation was conducted to examine the friction and wear behavior of the two types of oxide ceramic films furnished by the U.S. Army Research Laboratory, Development and Engineering Center (ARDEC) under Space Act Agreement SAA3 567. These two types of oxide ceramics were grown on 55Ni-45Ti (60 wt% Ni and 40 wt% Ti) substrates: one was a TiO2 with no other species (designated the B film) and the other was a TiO2 with additional species (designated the G film). Unidirectional ball-on-disk sliding friction experiments were conducted with the oxide films in contact with sapphire at 296 K (23 C) in approx. 50-percent relative humidity laboratory air in this investigation. All material

characterization and sliding friction experiments were conducted at the NASA Glenn Research Center. The results indicate that both films greatly improve the surface characteristics of 55Ni-45Ti, enhancing its tribological characteristics. Both films decreased the coefficient of friction by a factor of 4 and increased wear resistance by a two-figure factor, though the B film was superior to the G film in wear resistance and endurance life. The levels of coefficient of friction and wear resistance of both films in sliding contact with sapphire were acceptable for NASA and Department of Defense tribological applications. The decrease in friction and increase in wear resistance will contribute to longer wear life for parts, lower energy consumption, reduced related breakdowns, decreased maintenance costs, and increased reliability.
Author
*Oxide Films; Ceramics; Friction; Wear Tests*

**20040056170**
**Toxic Characteristic Leaching Procedure (TCLP) Testing of Waste Glass and K-3 Refractory: Revisited**
Jantzen, C. M.; Pickett, J. B.; Joseph, I.; 1999; 16 pp.; In English
Report No.(s): DE2003-46119; WSRC-MS-99-00335; No Copyright; Avail: Department of Energy Information Bridge
The U. S. Environmental Protection Agency (EPA) issued revised Resource Conservation and Recovery Act (RCRA) Phase IV Land Disposal Restrictions (LDR's) on May 26 1998. The new regulation requires that any waste characteristically hazardous for the metals As, Ba, Cd, Cr, Pb, Hg, Se, and Ag will have to be treated to meet the LDR Universal Treatment Standards (UTS) for each metal prior to land disposal. Since EPA regulations continue to become more stringent, here-to-fore unpublished TCLP data generated during testing of simulated High Level Waste (HLW) glass, including the Environmental Assessment glass and K-3 melter refractory, will be reviewed. The refractory TCLP data compilation includes K-3 refractory in contact with DWPF simulated glass in a pilot scale melter and K-3 refractory in contact with actual mixed waste glass in a 5 ton a day GTS Duratek melter.
NTIS
*Hazardous Wastes; Radioactive Wastes; Environment Protection*

**20040059022** Case Western Reserve Univ., Cleveland, OH
**Directionally Solidified Eutectic Ceramics; In- Situ Composites for High Temperature Structural Applications**
Sayir, Ali; Feb. 25, 2004; 111 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0048; Proj-2302
Report No.(s): AD-A421689; AFRL-SR-AR-TR-04-0140; No Copyright; Avail: CASI; A06, Hardcopy
Eutectics are multiphase structures formed by the cooperative growth of two or more phases. Although the internal structure can vary widely, the development of continuous rods or plates in a matrix can be achieved and, within limits, can be controlled or 'tailored' through directional solidification. The eutectic architecture of a continuous reinforcing phase within a higher volume phase or matrix, can be described as a naturally occurring in-situ composite. In-situ composites have been demonstrated to possess mechanical properties intermediate between monolithic materials and man-made composites and therefore may produce low cost high temperature structural material. Although several eutectic systems are currently being studied, two eutectics systems Al2O3/RE3Al5O12 (RE = Y, Er, Gd, Nd, Ho, Eu) and Al2O3/ZrO2(Y2O3) have been selected for the detailed examination of the advantages and the challenges associated with directional solidification. The Al2O3/Y3Al5Ol2 is comprised of two highly creep resistance oxides whereas Al2O3/ZrO2(Y2O3) combines a highly creep resistant material (Al2O3) with one having very poor creep properties (c- ZrO2(Y2O3)). To elucidate the potential of this family of materials for high temperature applications, parallel research efforts at different organizations are integrated. The ongoing research is closely coordinated with the efforts of Dr. S. C. Farmer at NASA glenn Research Center (GRC), Prof. A. S. Argon at Massachusetts Institute of Technology (MIT) and Prof. E. Dickey at Penn State University (PSU). The efforts at MIT focuses on the high deformation characteristics of directionally solidified AL2O3/ZrO2(Y2O3). The efforts a PSU focuses on the correlation of interface structure and bonding from the atomistic length scale.
DTIC
*Ceramics; Eutectics; High Temperature; Solidification; Structural Design*

**20040059147** Pennsylvania State Univ., University Park, PA
**X-ray Diffractometer for Texture and Residual Stress Studies of Advanced Materials**
Dickey, Elizabeth C.; Jul. 2003; 7 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0245
Report No.(s): AD-A422012; AFRL-SR-AR-TR-04-0005; No Copyright; Avail: CASI; A02, Hardcopy

Through AFOSR DURIP grant # F49620-00-1-0245, a four circle goniometer x-ray diffractometer outfitted with a high temperature stage was purchased from Philips Analytical. The instrumentation facilitates residual stress measurements in highly textured materials up to 900 deg C. The instrument has significantly enhanced the AFOSR funded research efforts of the Pl on directionally solidified ceramic eutectics. Initial studies have measured the residual stresses in highly textured AlO3-ZrO2(Y2O3) eutectics as a function of temperature. At room temperature, significant compressive stresses (^450 MPa) are present in Al2O3 with corresponding tensile stresses in ZrO2. Through high temperature studies, the stress-free temperature was found to be ^675 deg C.
DTIC
*Ceramics; Diffractometers; Residual Stress; Textures; X Rays*

**20040059185** Wayne State Univ., Detroit, MI
**Investigations of the Photo-Physical Properties of Novel Photo-Voltaic and Light Emitting Materials**
Goodson, Theodore, III; Mar. 22, 2004; 26 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0212; Proj-2303
Report No.(s): AD-A422072; AFRL-SR-AR-TR-04-0192; No Copyright; Avail: CASI; A03, Hardcopy

Understanding photophysical properties of optoelectronic materials and the discovery of new materials provide a great challenge for researches interested in applications. This report highlights the distinctive optical properties of dendrimers; branched chromophore systems as well as dendrimer encapsulated metal nanoparticles which provide a novel approach toward this challenge. Excitation energy transport properties in these materials were investigated by ultrafast fluorescence anisotropy decay. It was found that the strength of interactions among chromophore units determines the mechanism of the mode of energy transport. The synthesis of several novel branching structures, photoactive dendrimers as well as dendrimer encapsulated lanthanide and metal nanoparticles was achieved. Local field effects contributed strongly to the enhanced nonlinear properties in chromophore- functionalized dendrimer nanocomposites. The sensitized lanthanide emission suggested that this material was useful for light-emitting and optical amplifier. Correlation of anisotropy decay time with the enhanced two-photon absorption provided a new design criterion for large two-photon materials. Furthermore, various techniques including steady-state optical measurements, time-resolved upconversion spectroscopy, nonlinear absorption, transient absorption were used to characterize a variety of optical properties of the materials of interest.
DTIC
*Dendrimers; Optical Properties*

**20040059297** Clemson Univ., SC
**Clemson Apparel Research Demonstration Contract. Years 6 and 7**
Kernodle, Joseph W.; Sep. 22, 2003; 59 pp.; In English
Contract(s)/Grant(s): SP0100-95-D-1002; SP0100-95-D-0012
Report No.(s): AD-A422259; 2092883/4; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of this contract is to develop and demonstrate modern technologies and management practices that optimize the performance of the Department of Defense's Clothing and Textiles (C&T) supply chain. Specific objectives are as follows: (1) eliminate recruit training center clothing stockouts; (2) minimize operational and inventory investment costs across the entire supply chain; and (3) level production requirements placed on manufacturers. Clemson Apparel Research participates in the C&T supply chain as a model quick-response shirt manufacturer supporting Army and Marine Corps RTC. This paper presents a summary of the work and most important lessons learned for contract Years 1-7 and detailed results of all tasks in Years 6-7. Earlier reports covered years 1-3 and 4-5 in detail.
DTIC
*Clothing; Inventory Controls; Manufacturing; Supplying; Textiles*

## 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*.

**20040058106** Defence Science and Technology Organisation, Edinburgh, Australia
**An Introduction to Detonation and Blast for the Non-Specialist**
Wilkinson, Christopher R.; Anderson, Jeremy G.; November 2003; 23 pp.; In English
Report No.(s): DSTO-TN-0526; DODA-AR-012-974; Copyright; Avail: Other Sources

Blast effects can play a significant role in target damage. This report gives an overview of how blast waves are formed and describes methods for scaling blast overpressure. The aim is to provide a concise overview of blast for the non specialist. Author

*Blasts; Shock Waves; Explosives; Detonation*

**20040059163** Arizona Univ., Tucson, AZ

**Chronic Effects of JP-8 Jet Fuel Exposure on the Pulmonary System**

Witten, Mark L.; Mar. 26, 2004; 7 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0119; Proj-2312

Report No.(s): AD-A422035; AFRL-SR-AR-TR-04-0200; No Copyright; Avail: CASI; A02, Hardcopy

We have continued our pulmonary research for JP-8 toxicity over the past three years as well as continued our collaboration with other AFOSR-funded investigators by serving as the primary site for JP-8 jet fuel exposures. This research produced 13 published manuscripts over the past three years along with numerous abstracts. Additionally, we have commercialized our substance P research sponsored by the U.S. Air Force Office of Scientific Research with the formation of immuneRegen Biosciences, Inc., a public company that is listed on the NASDAQ stock market. The major scientific findings from this past three years of research in our laboratory are the establishment of a minimum dose of JP-8 jet fuel (50 mg/mg3) that demonstrates any evidence of pathological injury in the lung terminal bronchioles, co-cultures of pulmonary alveolar macrophages and alveolar type II epithelial cells caused significant differences in cytokine production, demonstration of vast differences in a young mouse lung - vs- old mouse lung in response to JP-8 fuel exposure, lung proteomic studies demonstrating significantly reduced alpha- 1-antitrypsin in mice after a moderate exposure of JP-8 jet fuel of 200 mg/m3 for one hour/day for seven days, and prior JP-8 jet fuel exposure before subsequent infection with the Hong Kong influenza virus significantly increases lung injury compared to Hong Kong virus-only controls.

DTIC

*Exposure; Jet Engine Fuels; Jp-8 Jet Fuel; Toxicity*

**20040059829** North Carolina State Univ., Raleigh, NC, USA

**Quantitating the Percutaneous Absorption of Mechanistically-Defined Chemical Mixtures**

Riviere, Jim E.; Monteiro-Riviere, Nancy A.; Baynes, Ronald E.; Xia, Xin-Rui; Smith, Charles; May 3, 2004; 33 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0080

Report No.(s): AD-A422081; AFRL-SR-AR-TR-04-0203; No Copyright; Avail: CASI; A03, Hardcopy

The focus of this research was to assess the dermal absorption and skin toxicity of topically applied jet fuels Jet A, JP-8, JP-8(100) using pigs, in vitro porcine skin and inert membrane models as well as human keratinocyte cell cultures. Our working hypothesis was that jet fuel dermal toxicity was secondary to its hydrocarbon components with differences between fuel types due to additive-modulation of hydrocarbon deposition. Consistent with previous JP-8 additive studies, individual JP-8(lOO) additives modulated hydrocarbon disposition. Combinations of multiple additives were not predictable from simpler mixtures. An in vivo porcine skin dose escalation study demonstrated dose-related dermal absorption of aromatics, but saturation of aliphatic components. Previous exposure to JP-8 constituents resulted in skin depot formation. Cell culture studies demonstrated divergent relations between structure and resulting cytotoxicity and irritation (11-8 release). Across S aliphatic and 6 aromatic hydrocarbons studied in vivo, tridecane, tetradecane and pentadecane produced gross and microscopic lesions similar to JP-8, suggesting they may be responsible for JP-8 irritation. Ultrastructural changes were characterized by alterations in the stratum corneum lipid bilayers. Finally, a novel membrane coated fiber technique was developed that was capable of rapidly determining physical chemical properties of all jet fuel hydrocarbon constituents as well as assessina additive and solvent effects on membrane diffusion and partitioning.

DTIC

*Jet Engine Fuels*

## 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*.

**20040056141** State Coll. of Central Connecticut, New Britain, CT, USA
**Effective Use of the ConnDOT GPS Base Station**
Bean, J. E.; Ferguson, C. R.; Feb. 2003; 64 pp.; In English
Report No.(s): PB2004-105102; JHR-03-289; No Copyright; Avail: CASI; A04, Hardcopy

This report presents the findings of an investigation of factors affecting GPS position accuracy using the ConnDOT base station. An empirical study was performed to evaluate the accuracy of carrier-phase Global Positioning System (GPS) as a function of: number of control points used, distance to control, observation time and number of frequencies observed. To facilitate the study, a 19-station control network was developed in Southeastern Connecticut and surveyed to High Accuracy Reference Network (HARN) standards using dual frequency, carrier-phase GPS. The network was controlled using existing HARN stations in Connecticut, Massachusetts and Rhode Island. GPS observations were subsequently taken independently and processed in various ways to measure the effect of the control variables on the positional accuracy obtained. Results showed the ability of carrier-phase GPS to deliver high accuracy results both vertically and horizontally in reasonable times, especially when using two GPS frequencies and having three base stations surrounding the study area.
NTIS
*Global Positioning System; Transportation Networks*

**20040059127** Air Univ., Maxwell AFB, AL
**Science and Technology: The Making of the Air Force Research Laboratory**
Duffner, Robert W.; Jan. 2000; 308 pp.; In English
Report No.(s): AD-A421978; No Copyright; Avail: CASI; A14, Hardcopy

This history documents a watershed event within the USA Air Force -- the creation of the Air Force Research Laboratory (AFRL). As the 'high technology' service, the Air Force has always searched for ways to continuously improve its science and technology enterprise. In that context, the making of AFRL was not a bureaucratic accident. Rather, it was the product of a complex mixture of historical forces and pressures at work that convinced people at all levels that the time was ripe to bring about fundamental reform in how the Air Force conducts its business of science and technology. In terms of significance, a wealth of past studies has focused on almost every aspect of the 'operational' side of the Air Force. But there has been a scarcity of available scholarly studies that address the far-reaching implications of science and technology. This book is a major contribution that helps fill that gap. Organization and infrastructure are critically important components of the total science and technology picture. Thus, the manner in which its laboratory system is organized is a critical factor in the Air Force's ability to assure that it is investing in and delivering the most relevant technologies possible. This book documents how the Air Force moved from 13 separate labs to one consolidated lab. The narrative is divided into two parts. Part one addresses the reasons why the Air Force decided to consolidate its far- flung science and technology enterprise into one lab. How the new lab was implemented is the focus of part two. This study is especially revealing because the reader is given access to the inner workings and struggles of a major Air Force organizational restructuring through interviews with key individuals who participated directly in the decision-making process to establish a single lab. A chronology of the lab's creation is included. (19 tables, 22 figures, 19 photographs)
DTIC
*Evolution (Development)*

**20040059235** Industrial Coll. of the Armed Forces, Washington, DC
**Transforming Joint Test and Evaluation Mindsets and Processes: Acquisition II**
Simpson, Brian A.; Jan. 2003; 14 pp.; In English
Report No.(s): AD-A422168; No Copyright; Avail: CASI; A03, Hardcopy

Over the past few decades, there have been numerous catchphrases describing visions for reform in the acquisition community. Commercial-off-the- Shelf Procurement; Cost as an Independent Variable, Situation-Based Acquisition, and Spiral Development are just a few. The latest such buzzword to hit the Department of Defense is Transformation. According to General Richard B. Myers, Chairman of the Joint Chiefs of Staff, transformation deals more with mindsets and processes than technologies and hardware. Certainly there have been numerous celebrated transformational technologies over the years: the machine gun, the tank, and aircraft - especially stealth - are three prime examples. So how can we incorporate this latest

buzzword into the acquisition world, and more specifically into test and evaluation? In this paper I'll offer some suggestions on how to apply transformation to test and evaluation mindsets and processes especially as they relate to the joint world. I'll tell some 'test stories' about things I think need to be fixed based on my ten years as an F- 16 test pilot. I'll also present some broader examples from the Department of Defense headlines to help support my points. Keep in mind that 'the ultimate objective of the acquisition process IS to provide the best and most capable weapon systems to our operational forces.' Although, the quote at the top of this page comes from the Blue Ribbon Defense Panel Report concluded over 30 years ago, unfortunately there is still some truth to it today. While we have an established Joint Test and Evaluation (JT&E) program, there are numerous intellectual and cultural obstacles that must be overcome in order to make it effective and efficient. But first a brief background on JT&E - is origin, set up, purpose, and current projects.
DTIC
*Evaluation; System Effectiveness*

**20040059953** State Univ. of New York, Buffalo, NY, USA
**Manual for Repair Methods of Civil Engineering Structures Damaged by Earthquakes**
Dec. 1986; 962 pp.; In English
Report No.(s): PB2004-104596; MCEER-88-JPML; Copyright; Avail: National Technical Information Service (NTIS)

This manual is designed for wide use in the repair of seismically damaged structures. It covers general information and discusses the following topics: river, shore, and erosion protection, road facilities, highway bridges, sewage pipe facilities, tunnels, and embankments. Much information on the effects of liquefaction, seismic intensity, earthquake preparedness, aftershocks, and tsunami are given. This manual is an English translation of the original Japanese publication, 'Doboku kozo butsu no shinsai fukkyu maniyuaru (an).'
NTIS
*Earthquake Damage; Geophysics; Earthquakes; Structural Engineering*

## 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*.

**20040043750** Air Univ., Maxwell AFB, AL
**Operational Control of Global Airpower**
Basham, Steven L.; Jun. 2002; 74 pp.; In English
Report No.(s): AD-A420539; No Copyright; Avail: CASI; A04, Hardcopy

This thesis examines operational control of bombers stationed in the USA but employed halfway around the world. When a contingency arises, operational control should be clear-cut from the beginning. Air Force doctrine concerning command and control is easily understood for assets that deploy into a theater. The mere issue of proximity to the commander makes control seem somewhat less confusing. However, when bombers generate under one combatant commander and execute their mission under the operational control of another combatant commander, the timing of when one commander relinquishes control and the other commander gains control is questionable. This study focuses on historic examples of bomber operational control and legislative influences on operational control. Determining when to change operational control comes down to identifying which combatant command has the mission that requires operational control and when CONUS bombers are ready for sustained operations under that command. Following an introductory chapter, Chapter 2 examines issues relating to the use of bombers from World War II to the present day. This examination traces how operational control of bombers until recently was guided by strategic nuclear imperatives. Chapter 3 provides a historical overview of the applicable legislation from the National Security Act of 1947 through the Goldwater-Nichols Act of 1986. This chapter demonstrates how operational control is tied to the mission given by the President, through the Secretary of Defense. The chapter also highlights the numerous command authorities resulting from this legislation, which would lead to confusion concerning operational control. Chapter 4 addresses the current unified command structure and issues that stem from the authority provided to combatant commanders by the Goldwater-Nichols legislation. Chapter 5 provides recommendations for when control of bombers should transfer between combatant commanders. (8 refs.)
DTIC
*Bomber Aircraft; Command and Control; Military Operations*

**20040056132** NASA Glenn Research Center, Cleveland, OH, USA

**Fiber-Optic Communication Links Suitable for On-Board Use in Modern Aircraft**

Nguyen, Hung; Ngo, Duc; Alam, Mohammad F.; Atiquzzaman, Mohammed; Sluse, James; Slaveski, Filip; April 2004; 19 pp.; In English; Defense and Security Symposium 2004, 12-16 Apr. 2004, Orlando, FL, USA

Contract(s)/Grant(s): WBS 22-727-01-05

Report No.(s): NASA/TM-2004-212971; E-14444; No Copyright; Avail: CASI; A03, Hardcopy

The role of the Advanced Air Transportation Technologies program undertaken at the NASA Glenn Research Centers has been focused mainly on the improvement of air transportation safety, with particular emphasis on air transportation communication systems in on-board aircraft. The conventional solutions for digital optical communications systems specifically designed for local/metro area networks are, unfortunately, not capable of transporting the microwave and millimeter RF signals used in avionics systems. Optical networks capable of transporting RF signals are substantially different from the standard digital optical communications systems. The objective of this paper is to identify a number of different communication link architectures for RF/fiber optic transmission using a single backbone fiber for carrying VHF and UHF RF signals in the aircraft. To support these architectures, two approaches derived from both hybrid RF-optical and all-optical processing methodologies are discussed with single and multiple antennas for explicitly transporting VHF and UHF signals, while the relative merits and demerits of each architecture are also addressed. Furthermore, the experimental results of wavelength division multiplexing (WDM) link architecture from our test-bed platform, configured for aircraft environment to support simultaneous transmission of multiple RF signals over a single optical fiber, exhibit no appreciable signal degradation at wavelengths of both 1330 and 1550 nm, respectively. Our measurements of signal to noise ratio carried out for the transmission of FM and AM analog modulated signals at these wavelengths indicate that WDM is a fiber optic technology which is potentially suitable for avionics applications.

Author

*Fiber Optics; Optical Communication; Pulse Communication; Millimeter Waves; Communication Networks*

**20040056137** Federal Trade Commission, Washington, DC, USA

**Complying with the Telemarketing Sales Rule**

2004; 62 pp.; In English

Report No.(s): PB2004-105130; No Copyright; Avail: CASI; A04, Hardcopy

Table of Contents: Introduction; The Amended TSR at a Glance; Charities and for-profit telemarketers calling on their behalf; Who must comply with the amended TSR; Exemptions to the amended TSR; Requirements for sellers and telemarketers; Assisting and facilitating sellers or telemarketers who violate the rule is prohibited; Credit card laundering is prohibited; Unauthorized billing; Protecting consumers'privacy; Fraudulent telemarketing operations; Recordkeeping requirements; Who can enforce the rule, and Additional Sources of Information.

NTIS

*Information Systems; Regulations*

**20040056139** NASA Glenn Research Center, Cleveland, OH, USA

**A Short Note on the Derivation of the Atmospheric Transfer Function for a Communications Channel and its Connection to Associated Propagation Parameters**

Manning, Robert M.; March 2004; 24 pp.; In English

Contract(s)/Grant(s): WBS 22-302-20-2F

Report No.(s): NASA/TM-2004-212975; E-14451; No Copyright; Avail: CASI; A03, Hardcopy

The systems engineering description of a wideband communications channel is provided which is based upon the fundamental propagation aspects of the problem. In particular, the well known time variant description of a channel is formulated from the basic multiple scattering processes that occur in a random propagation medium. Such a connection is required if optimal processing methods are to be applied to mitigate the deleterious random fading and multipathing of the channel. An example is given which demonstrates how the effective bandwidth of the channel is diminished due to atmospheric propagation impairments.

Author

*Transfer Functions; Wideband Communication; Optical Communication; Electromagnetic Radiation; Wave Propagation; Systems Engineering; Earth Atmosphere*

**20040056150** General Accounting Office, Washington, DC
**Project Safecom: Key Cross-Agency Emergency Communications Effort Requires Stronger Collaboration**
Apr. 2004; 32 pp.; In English
Report No.(s): PB2004-105140; GAO-04-494; No Copyright; Avail: CASI; A03, Hardcopy

As you know, the President has identified the expansion of e-government as one of five priorities in his management agenda; accordingly, the Office of Management and Budget (OMB) has sponsored 25 initiatives to implement this agenda. This report specifically reviews the progress made to date on one of these initiatives, Project SAFECOM, which has an overall objective of achieving national wireless communications interoperability among first responders and public safety systems at all levels of government. The Department of Homeland Security (DHS) is currently the federal managing partner for this project.

NTIS
*Interoperability; Security*

**20040058948** Department of Defense, Arlington, VA
**Acquisition: Acquisition of the Suite of Integrated Radio Frequency Countermeasures (D-2003-083)**
Apr. 29, 2003; 52 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421405; D-2003-083; No Copyright; Avail: CASI; A04, Hardcopy

Those who are specifically involved in the management, support, and oversight of the Suite of Integrated Radio Frequency Countermeasures (SIRFC) should read this report because it discusses acquisition issues that must be addressed before the SIRFC program progresses further through the acquisition process.

DTIC
*Countermeasures; Radio Frequencies*

**20040058955** Army Research Lab., Aberdeen Proving Ground, MD
**Combining and Filtering Telemetry Data**
Wilson, Michael J.; Mar. 2004; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-1L1622618H80
Report No.(s): AD-A421434; ARL-TR-3143; No Copyright; Avail: CASI; A03, Hardcopy

Multiple receiver telemetry systems are common in the aeroballistics test and evaluation community. These systems typically record telemetry data independently, requiring post-flight data processing to produce the most accurate combination of the available data. This report addresses the issues of time synchronization between multiple data sources and determination of the best choice for each data word. Additional filtering is also developed for the case when all available data are corrupted. The performance of the proposed algorithms is presented.

DTIC
*Receivers; Telemetry*

**20040059032** Harvard Univ., Cambridge, MA
**Complementary Beam-Forming**
Tarokh, Vahid; Choi, Yang-Seok; Alamouti, Siavash M.; Mar. 2003; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421707; No Copyright; Avail: CASI; A03, Hardcopy

Presentation on complementary beam-forming; including smart antenna enhancements to IEEE 802.11 systems, problems with conventional beam-forming in CSMA systems, and analysis of complementary beam-forming for silent and intended users.

DTIC
*Beamforming; Wireless Communication*

**20040059077** Space and Naval Warfare Systems Center, San Diego, CA
**Knowledge Engineering for Command and Control Transformation at USA European Command (USEUCOM)**
Pester-DeWan, Joanne; Moore, Ronald A.; Morrison, Jeffrey G.; Dec. 2003; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421841; SSC/SD-TR-1912; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the results of knowledge engineering conducted during the period 2031 October 2003 at the request of the USA European Command (USEUCOM), commonly referred to as 'EUCOM.' The work is intended to identify baseline

technology utilization and operational practices, which might then be used to assess the impact of changes brought about as they transform the command in accordance with guidance issued by the Office of the Secretary of Defense (OSD). The transformation can be characterized as a desire to move from a command organization focusing on the oversight and facilitation of communication and coordination among subordinate operational units to a concept of operations known as Standing Joint Force Headquarters (SJFHQ), which will involve network-centric, command and control (C2) capabilities, with increased speed of command, greater flexibility in addressing command operations, and more efficient use of limited staff manpower. The issues highlighted in this report are being provided to assist EUCOM in identifying opportunities for improvement and making strategic decisions in determining where limited resources might be most effectively applied.
DTIC
*Command and Control; Expert Systems; Knowledge Based Systems; Knowledge Representation; United States*

**20040059088** Michigan Univ., Ann Arbor, MI
**Channel Coding and Estimation for Ultra-Wideband Radios**
Satrk, Wayne E.; Mar. 18, 2004; 4 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0224
Report No.(s): AD-A421863; No Copyright; Avail: CASI; A01, Hardcopy

In order to access the viability of ultra-wideband communications for military applications, a framework for accurately analyzing system performance is required. This research project addresses the need for a tractable, outdoor ultra-wideband (UWB) channel model which will provide the foundation for performance evaluation an and the examination of various design tradeoffs that exist at the physical layer The other major thrusts of the research include channel estimation and error control coding which are essential to the successful realization of and implementation of UWB communication systems.
DTIC
*Antennas; Broadband; Coding; Radio Equipment; Telecommunication*

**20040059093** Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA
**Novice Versus Expert Command Groups: Preliminary Findings and Training Implications for Future Combat Systems**
Carnahan, Thomas J.; Lickteig, Carl W.; Sanders, William R.; Durlach, Paula J.; Lussier, James W.; Mar. 2004; 75 pp.; In English
Contract(s)/Grant(s): Proj-20262785A790
Report No.(s): AD-A421871; ARI-RR-1821; No Copyright; Avail: CASI; A04, Hardcopy

The U.S. Army's ongoing transformation to Future Combat Systems (FCS) requires a commensurate transformation in training, particularly in the area of command and control (C2). This paper describes research comparing novice versus expert command group performance to identify training recommendations and implications. The research was performed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) in conjunction with the FCS C2 program. Comparative results were based on objective measures of verbal and human- computer interaction (HCI) as well as subjective measures of workload, performance success, training, prototype effectiveness, and human system integration. Significant differences were identified between novice and expert command groups including lower verbalization and HCI rates by novices during enemy target identification, and higher rates of verbalization and HCI by novices in support of the destruction of enemy targets. Training examples were provided for more specific and tangible guidance to training developers and designers. Overall, the findings and training implications underscore the new training requirements for FCS, particularly embedded training, for transforming novices into experts in future command groups.
DTIC
*Combat; Command and Control; Education*

**20040059116** Air Univ., Maxwell AFB, AL
**Speaking Effectively: A Guide for Air Force Speakers**
Kline, John A.; Dec. 1989; 81 pp.; In English
Report No.(s): AD-A421952; No Copyright; Avail: CASI; A05, Hardcopy

Speaking Effectively presents techniques on how to speak successfully. It takes a 'how-to' approach to effective speaking in the Air Force and presents proven techniques as concisely and completely as possible. Experienced speakers will find little here that is new. Yet each speaker, no matter how skilled, needs to keep these basic techniques in mind. The content is organized chronologically according to the steps a speaker would normally follow: preparing, organizing, choosing appropriate support material, deciding how to begin and end, and finally presenting the actual talk. Although these basic steps

apply to any kind of speaking, some important variations exist to accommodate different types of Air Force speaking. Therefore, the book consistently makes distinctions among the three types of Air Force speaking: briefing, teaching lecture, and formal speech. The book should not become a straightjacket to thinking. Nearly every principle, technique, and suggestion has exceptions. In fact, the only principle that never changes is that an effective speaker is always willing to adjust to the audience. For this reason, the other principles can be modified if the needs of the audience so dictate. Speaking Effectively is written for the officers, enlisted personnel, and civilians who must speak in the course of performing their day-to-day Air Force business. However, the principles and techniques do not apply only to Air Force speaking. They work in all situations, and they are as old as those in Aristotle's Rhetoric or Cicero's De Oratore.
DTIC
*Lectures; Personnel*

**20040059149** Space and Naval Warfare Systems Center, San Diego, CA
**Command and Control for Mixed Manned and Unmanned Security Forces**
Carroll, Daniel; Gilbreath, Gary; Grant, Kelly; Day, Laura; Sep. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422019; No Copyright; Avail: CASI; A03, Hardcopy

The Multiple Resource Host Architecture (MRHA) performs Command and Control (C2) for security robots, The MRUA allows a single human guard to oversee and monitor up to 255 unmanned vehicles and/or sensors, Lessons learned from user testing have led to C2 improvements that optimize the integration of the Unmanned Vehicle Systems (UVS) with the manned guard force, The Mobile Detection Assessment Response System (MDARS) is ajoint Army-Navy development effort to field mobile robots at DoD sites for physical security and automated inventory missions Autonomous platforms patrol inside warehouses (Interior) and outside of storage facilities (Exterior), caflying payloads for intruder detection, inventory assessment, and barrier assessment The MDARS Control Station is based upon the MRUA This paper provides an overview of the concept of operations for MDARS with emphasis on the coordination between the manned and unmanned forces, Detail is provided on the recent MRHA development including integration with legacy fixed sensors systems, seamless communication of 'eyes and ears' data of the response force to the dispatcher, and resource management to handoff control of an unmanned vehicle from a remote dispatcher to an on-scene commander.
DTIC
*Command and Control; Remotely Piloted Vehicles; Security*

**20040059194** Naval Sea Systems Command, Washington, DC
**The Role of the Sailor as a Networked Element of Sea Power 21: Engineering Ships for the Sailor**
Huber, Steve; Bost, J. R.; Koscinski, Waldemar H.; Mar. 18, 2004; 9 pp.; In English
Report No.(s): AD-A422087; No Copyright; Avail: CASI; A02, Hardcopy

The Navy must design and engineer ships and systems for the Sailor at the onset of the design and acquisition cycle. A seamless and comprehensive fusion of people, hardware, and software is or must be- a principal goal of all engineers and designers, program managers and acquisition specialists, logisticians, and operators. If we seek to maximize operational effectiveness and ensure mission success as our ships go in harm's way, while at the same time we strive to minimize total ownership costs, we must design and engineer the total system for maximum warrior performance. Most fundamentally, that means ensuring that the human is taken into account, up front, in system and platform design and engineering. This paper addresses the charter, roles, tasks, and progress of NAVSEA O3 during the past year, as it proceeds to ensure the total integration of the Sailor into the systems and ships the Navy is designing, engineering, and acquiring.
DTIC
*Data Acquisition; Human Factors Engineering; Seas*

**20040059219** Air Force Research Lab., Wright-Patterson AFB, OH
**Performance Assessment of a COTS Speech Recognition System on the N4 Database**
Williamson, David T.; Snyder, Robin A., Jr; Dec. 2002; 17 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A422146; AFRL-HE-WP-TR-2002-0249; No Copyright; Avail: CASI; A03, Hardcopy

This report discusses the evaluation of a commercially available speech recognition system on the NATO Native and Non-Native (N4) database. Using the statistical language modeling techniques, trigram language models were generated for each of three countries in the database, CA, NL, and UK. Due to time constraints, the DE database was not evaluated. For each of the countries, two factors were assessed. The first was overall word accuracy and the second was callsign accuracy.

For this evaluation, only standard American English acoustic models were used. Results of each country evaluation are discussed.
DTIC
*Data Bases; Speech Recognition*

**20040059273** Air Force Research Lab., Wright-Patterson AFB, OH
**Evaluation of the Effects of Variable Helmet Weight on Human Response During Lateral +Gy Impact**
Perry, Chris E.; Buhrman, John R.; Doczy, Erica J.; Mosher, Stephen E.; Aug. 2003; 83 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A422239; AFRL-HE-WP-TR-2004-0013; ASC-04-0840; No Copyright; Avail: CASI; A05, Hardcopy

Helmet-mounted systems (HMS) are designed to enhance pilot performance, but may also affect pilot safety by increasing the potential for neck injury during ejection due to the change in helmet inertial properties. A series of tests was conducted by AFRL/HEPA on a horizontal impulse accelerator using human subjects to investigate the effects of helmet inertial properties on human response to short duration sideward impacts of variable magnitude. The effects of headrest contour and gender were also investigated. Maximum neck load values obtained in this study will be used to establish head/neck injury criteria for helmet-mounted systems and for the implementation of improvements in bracing techniques to minimize pilot injury during ejections.
DTIC
*Escape Systems; Flight Clothing; Goggles; Helmet Mounted Displays; Helmets; Human Reactions; Injuries; Neck (Anatomy); Night Vision; Safety*

**20040059296** Space and Naval Warfare Systems Command, San Diego, CA
**Transformation SPAWAR C4I Community Annual Report 2003**
Jan. 2003; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422257; No Copyright; Avail: CASI; A03, Hardcopy

This report concerns the SPAWAR Command, Control, Communications, Computers and Intelligence community and deals with the transforming network centric capabilities of warflghters, aligning to enable transformation, a culture of efficiency to build sea enterprise and recognizing the reason behind SPAWAR's success, people and challenges for the future.
DTIC
*Aerospace Systems; Command and Control*

**20040059326** Naval Postgraduate School, Monterey, CA
**Implementation of a Human Avatar for the MARG Project in Networked Virtual Environments**
Yildiz, Faruk; Mar. 2004; 78 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422327; No Copyright; Avail: CASI; A05, Hardcopy

The objective of the ongoing MARG project is to animate human motions captured by 15 MARG sensors in wireless networked virtual environment (NVES). Three avatars were developed previously, but none of them met all the desired requirements. The first one was overly simplistic and did not implement H-Anim standards. The other two were created using laser-scanned data and followed the H-Anim standards, but one had its adjacent joints broken and the other was capable of rotating only one joint. Therefore, the cartoon-type humanoid, Andy, was developed to meet the needs of the MARG project. The humanoid Andy implements H-Anim standards using built-in X3D humanoid nodes and is capable of controlling all its 15 joints in NVES. Another need of the MARG project was a wireless network interface for real-fl me data streaming. A concurrent client-server program implementing multitasking using TCP and UDP protocols was developed for this purpose. Using WiSER24OO. IP serial adapters between the MARG sensors and the server program adds a wireless capability to the project. The server program converts the raw MARG sensor data to quatelnions using the Quest algorithm. Multiple clients are supported by the system. Each client program receives the motion data and updates the humanoid Andy.
DTIC
*Communication Networks; Virtual Reality*

**20040059329** Naval Postgraduate School, Monterey, CA
**Free Space Optics Communication for Navy Surface Ship Platforms**
Timus, Oguzhan; Mar. 2004; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422340; No Copyright; Avail: CASI; A05, Hardcopy

Free Space Optics (FSO) technology is an alternative broadband technology, which provides fast, secure and reliable data transmission. The FSO systems are being used for commercial systems between fixed sites and are being considered for military systems because of their inherent benefits, which are security and high data rates. In military communications security is the first priority. The small divergence of the laser beam makes FSO systems more secure than the existing radio frequency (RF) based wireless systems, because it is highly difficult to detect and intercept a laser beam due to the nature of the laser and the small divergence angle of the transmitter. However, FSO implementation on mobile platforms such as ships is still challenging. This thesis analyzes the feasibility of deploying FSO system on navy surface ships. It discusses the FSO technology and the latest studies in maritime optical communication links. In addition, the benefits and challenges of FSO technology specific to this study are studied. The final section discusses the required systems to improve the performance of FSO systems on ships. The thesis concludes that FSO technology, while not ready for deployment, looks very promising for the near future.
DTIC
*Broadband; Data Transmission; Navy; Ships; Space Communication; Telecommunication*

**20040059337** Space and Naval Warfare Systems Center, San Diego, CA
**SSC San Diego - The World Is Our Platform**
Wernli, Robert L.; May 2000; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422368; No Copyright; Avail: CASI; A02, Hardcopy

Technology is changing the future for the U.S. Navy, and Ocean Engineering will play a major role. In the past, navy research concentrated on platforms such as surface ships and submarines, but the future will be driven by communications between bases and platforms whether on shore, afloat, submerged, or in the air. Immediate access to tactical information will be critical for successful mission planning and execution, and much of this information will be acquired and communicated by ocean-based systems. This paper will present on-going ocean engineering research at SSC San Diego and how that research will play on the world platform. The combination of acoustic and fiber optic communication links with remote or autonomous sensors has been demonstrated. The ability for them to achieve their full potential will require a considerable ocean engineering effort in the future. When such undersea sensor networks are optimized and combined with UAVs, UGVs, satellite communications, and other hybrid systems, the Navy will achieve an advanced and unparalleled maritime C4ISR capability. (6 figures, 3 refs.)
DTIC
*Command and Control; Communication Networks; Marine Technology*

**20040059706** National Defense Univ., Washington, DC, USA
**Chairman of the Joint Chiefs of Staff Strategy Essay Competition: Essays 1999**
Aug. 1999; 103 pp.; In English
Report No.(s): AD-A421819; No Copyright; Avail: CASI; A06, Hardcopy

Partial Contents: The Chairman of the Joint Chiefs of Staff Strategy Essay Competition, The Revolution in Media Affairs: Reinventing U.S. Strategic Communications in the Era of Slobodan Milosevic, NATO, the USA , and Russia; Flexible Security After the Cold War, and Operational Art and the Human Dimension of Warfare in the 21st Century. The 18th Annual Competition.
DTIC
*Security*

**20040059710** National Defense Univ., Washington, DC, USA
**Command, Control, and the Common Defense**
Allard, Kenneth; Oct. 1996; 371 pp.; In English
Report No.(s): AD-A421917; No Copyright; Avail: CASI; A16, Hardcopy

One of the challenges facing the writer is keeping up with developments in the information age. While Command, Control, and the Common Defense provides a historical perspective on a contemporary problem, it was written in the late l980s; since then, the end of the Cold War and the American experience in the Gulf War have provided some fundamentally new perspectives of their own. Re-written history has its own pitfalls; a better solution was to leave the original content intact and to add as an epilogue a chapter which originally appeared in a 1995 anthology on the Gulf War. Both works have, of course, been edited for consistency. Finally, there is reason to ponder in the light of more contemporary developments one of the major points in that original work: that the tight integration demanded by emerging command and control technologies

often runs afoul of existing command structures and theories of warfare. As I completed the revisions to this edition while serving on special assignment with the NATO Implementation Force in Bosnia, there were daily reminders of the truth of that statement.
DTIC
*Command and Control; Defense Program*

**20040059970** Office of Management and Budget, Washington, DC
**Implementation of the E-Government Act, FY2003 Report to Congress**
Mar. 2004; 78 pp.; In English
Report No.(s): PB2004-105218; No Copyright; Avail: CASI; A05, Hardcopy

As part of the institutionalization of the President's Management Agenda, and the continuing support of citizen-centric service delivery, President Bush signed the E-Government Act of 2002 (Public Law 107-347, 44 U. S.C. Ch. 36) into law on December 17, 2002. E-Government is the use of information technology (IT) and the Internet, together with the operational processes and people needed to implement these technologies, to deliver services and programs to constituents, including citizens, businesses and other government agencies. E-Government improves the effectiveness, efficiency, and quality of government services. The Administration sees this Act as a significant step forward in the way that the Federal agencies should consider using information technology (IT) to transform agency business into a more citizen-oriented and user-friendly process.
NTIS
*Commerce; Public Law*

**20040059983** Lawrence Livermore National Lab., Livermore, CA
**Development of Components for Wavelength Division Multiplexing Over Parallel Optical Interconnects**
Patel, R. R.; Jul. 05, 2001; 276 pp.; In English
Report No.(s): DE2004-15005999; UCRL-LR-144556; No Copyright; Avail: Department of Energy Information Bridge

Parallel optical interconnects based on multimode fiber ribbon cables are emerging as a robust, high-performance data link technology that enhances throughput by using parallel arrays of fibers. While this technology has primarily been implemented as single wavelength point-to-point links, it can be significantly enhanced by wavelength division multiplexing (WDM). WDM enables both increased point-to-point bandwidth as well as more complex interconnect topologies and routing approaches that are particularly attractive for massively parallel processing (MPP) systems. Exploiting the advantages of WDM interconnects requires multi-wavelength sources, a low loss routing fabric, and small footprint wavelength selective filter modules. The Lambda-connect project ((gamma)- Connect) at Lawrence Livermore National Laboratory is a technology development and proof-of-principle demonstration of the enabling hardware for WDM parallel optical interconnects for use in massively parallel processing systems and other high-performance data link applications. This dissertation demonstrates several key system components and technologies for(gamma)-Connect.
NTIS
*Parallel Processing (Computers); Massively Parallel Processors; Data Links*

## 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*.

**20040057961** Princeton Univ., NJ
**Engineering Analyses of NCSX Modular Coil and Its Supporting Structure for EM Loads**
Fan, H. M.; Williamson, D.; Oct. 2003; 12 pp.; In English
Report No.(s): DE2004-820121; PPPL-3897; No Copyright; Avail: Department of Energy Information Bridge

NCSX modular coil is a major parts of the NCSX coil systems that surround the highly shaped plasma and vacuum vessel. The flexible copper cable conductors are used to form modular coil on both sides of the 'tee' beam, which is cast inside the supporting shell structure. The Engineering analyses comprise sequentially coupled-field analyses that include an electromagnetic analysis to calculate the magnetic fields and EM forces, and a structural analysis to evaluate the structural responses. In the sequential EM-structural analysis, nodal forces obtained from the EM analysis were applied as 'nodal force'

loads in the subsequent stress analysis using the identical nodal points and elements. The shell model was imported directly from Pro/ENGINEER files in order to obtain an accurate structural representation. The Boolean operations provided by the ANSYS preprocessor were then applied to subdivide the solid model for more desirable finite element meshing. Material properties of the modular coil were based on test results. Analyses using the ANSYS program to evaluate structural responses of the complicated modular coil systems provided a clear understanding of the structural behaviors and the directions for improving the structural design.
NTIS
*Structural Analysis; Finite Element Method; Sequential Analysis*

**20040057968** National Renewable Energy Lab., Golden, CO
**Using an Advanced Vehicle Simulator (ADVISOR) to Guide Hybrid Vehicle Propulsion System Development**
Wipke, K. B.; Cuddy, M. R.; 2003; 10 pp.; In English
Report No.(s): DE2004-513501; No Copyright; Avail: Department of Energy Information Bridge

An advanced vehicle simulator model called ADVISOR has been developed at the National Renewable Energy Laboratory to allow system-level analysis and trade-off studies of advanced vehicles. Because of ADVISOR's fast execution speed and the open programming environment of MATLAB/Simulink, the simulator is ideally suited for doing parametric studies to map out the design space of potential high fuel economy vehicles (3X) consistent with the goals of the Partnership for New Generation of Vehicles (PNGV). Five separate vehicle configurations have been modeled including 3 lightweight vehicles (parallel, series, and conventional drivetrains) along with 2 vehicles with 1996 vehicle weights (parallel and conventional drivetrains). The sensitivity of each vehicle's fuel economy to critical vehicle parameters is then examined and regions of interest for the vehicles mapped out through parametric studies.
NTIS
*Simulation; Hybrid Propulsion; Systems Engineering*

**20040058102** NASA Langley Research Center, Hampton, VA, USA, Lockheed Martin Space Operations, Hampton, VA, USA
**A Novel, Real-Valued Genetic Algorithm for Optimizing Radar Absorbing Materials**
Deshpande, M. D., Technical Monitor; Hall, John Michael; March 2004; 35 pp.; In English
Contract(s)/Grant(s): NAS1-00135; WU 706-31-41-01
Report No.(s): NASA/CR-2004-212669; No Copyright; Avail: CASI; A03, Hardcopy

A novel, real-valued Genetic Algorithm (GA) was designed and implemented to minimize the reflectivity and/or transmissivity of an arbitrary number of homogeneous, lossy dielectric or magnetic layers of arbitrary thickness positioned at either the center of an infinitely long rectangular waveguide, or adjacent to the perfectly conducting backplate of a semi-infinite, shorted-out rectangular waveguide. Evolutionary processes extract the optimal physioelectric constants falling within specified constraints which minimize reflection and/or transmission over the frequency band of interest. This GA extracted the unphysical dielectric and magnetic constants of three layers of fictitious material placed adjacent to the conducting backplate of a shorted-out waveguide such that the reflectivity of the configuration was 55 dB or less over the entire X-band. Examples of the optimization of realistic multi-layer absorbers are also presented. Although typical Genetic Algorithms require populations of many thousands in order to function properly and obtain correct results, verified correct results were obtained for all test cases using this GA with a population of only four.
Author
*Genetic Algorithms; Artificial Intelligence; Antiradar Coatings; Dielectrics; Rectangular Waveguides*

**20040058947** Air Force Research Lab., Eglin AFB, FL
**SiC MEMS For Harsh Environments**
Bradley, Kenneth C.; Roberson, Scott L.; Wiff, Donald R.; Dec. 2003; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2305
Report No.(s): AD-A421390; AFRL-MN-EG-TR-2004-7025; AFRL-MN-EG-TR-2004-7025; No Copyright; Avail: CASI; A03, Hardcopy

This document is the final technical report for the SiC MEMS for Harsh Environments in-house research program jointly coordinated between AFRL/MNMF and AFRL/MLPS, and addresses the benefits of silicon carbide (SiC) as a material of choice for harsh environment applications, specifically at the scale of microelectromechanical systems (MEMS). The results from this program provide clear evidence of the benefit of SiC as a harsh environment (specifically high temperature) material

for both structural and electronic devices. Although shock testing of SiC MEMS devices under this program was not accomplished, subsequent work allowed for this testing to occur, with positive results. Furthermore, one of the key concerns with respect to SiC electronics was the need for good contact metallization for ohmic contacts. Rhenium was found to be an excellent material for providing ohmic contact metallization on SiC. These results provide a good foundation for the benefits of SiC for harsh environment (high temperature and high shock) applications
DTIC
*Microelectromechanical Systems; Silicon Carbides*

**20040058974** Army Engineer Research and Development Center, Vicksburg, MS
**Pulse-Power: A Possible Alternative to Chemicals for Zebra Mussel Control; Summary of 2000 Field Studies**
Smythe, Gary; Miller, Andrew; Sep. 2003; 11 pp.; In English
Report No.(s): AD-A421520; ERDC TN-ANSRP-03-2; No Copyright; Avail: CASI; A03, Hardcopy

Field studies Were conducted in 2000 to determine if the effects of pulse-power electric field systems could be evaluated by examining zebra mussel planktonic life stages. Evaluating plankton was a major variation from previous study methods and objectives. In the past, the older settlement stage was the target stage and a high control rate was the goal. In the 2000 studies, it was necessary only to have a consistent effect on plankton in the 20- to 60-percent range for them to be of value as a tool; high control of plankton was not expected or required. The first objective of the 2000 study was to evaluate effects of an electric field with a given set of electrical parameters on the behavior of planktonic zebra mussels. The second objective was to determine if the modified Megapulse electrical system would remain functional in a long-term settlement study.
DTIC
*Aquatic Plants; Electric Fields; Plankton; Pulse Rate*

**20040059014** Minnesota Univ., Minneapolis, MN
**Study of Linearization of Optical Polymer Modulators**
Gopinath, Anand; Schermer, Ross; Oh, Jaesang; Bereka, Desalegn; Feb. 2004; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-03-1-0013; Proj-6015
Report No.(s): AD-A421650; AFRL-SN-RS-TR-2004-44; No Copyright; Avail: CASI; A03, Hardcopy

To improve the Spur Free Dynamic Range of analog electro-optic modulators in the >10 GHz regime, techniques for improving the linearity of these devices must be developed. This report discusses an investigation into electro-optic directional couplers that use variable coupling in polymer- based waveguide structures. The approach begins with determining the desired response function, in this case a trapezoid. The Fourier transform method is then applied to synthesize the variable coupling function which results in the desired output response. This initial coupling function is iteratively modified using Newton's method to obtain a coupling design that can be implemented in a polymer waveguide. Approaches to achieving the variable coupling, including regions of negative coupling, are discussed.
DTIC
*Electro-Optics; Linearization; Modulators*

**20040059018** Massachusetts Inst. of Tech., Lexington, MA
**Robust MIMO Wireless Communications in the Presence of Interference Using Ad Hoc Antenna Arrays**
Bliss, Daniel W.; Chan, Amanda M.; Mar. 10, 2003; 39 pp.; In English
Contract(s)/Grant(s): F19628000-C-0002
Report No.(s): AD-A421671; No Copyright; Avail: CASI; A03, Hardcopy

MIMO provides robust communication links. New receiver design CONCEPTS(MCMUD) enable communication in complicated environments. Demonstrated dramatic performance advantages using experimental data. MCMUD enables coherent use of ad hoc distributed networks for MIMO communication.
DTIC
*Antenna Arrays; Communication Networks; Mimo (Control Systems); Telecommunication; Wireless Communication*

**20040059074** Ohio State Univ., Columbus, OH
**Elastic Properties of Hard Films Multi-Layer Protective Coatings by Light Scattering**
Sooryakumar, R.; Jan. 2000; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0396
Report No.(s): AD-A421815; 733962-01; ARO-41234.4-MS; No Copyright; Avail: CASI; A03, Hardcopy

Brillouin light scattering has been successfully applied to investigate the elastic properties of thin films and membranes. Highlights of the project include the first evidence for the existence of 'organ-pipe' type standing waves in supported films (silicon oxynitride and ZnSe) and free- standing membranes (SiN). These harmonics provide a direct means to investigate the longitudinal and transverse sound velocities and thereby to determine the C11 and C44 elastic constants. Evidence for excitations localized within a buried interface offers a previously unexplored approach to non- destructively characterize the elastic properties of sub- surface layers. The role of acoustic barriers offered by AIN in localizing elastic waves in GaN films and studies on amorphous ZrB3 films reveal its transformation to hard nano- crystallites of the boride layer with dramatic enhancement of the elastic properties upon high temperature anneal. Analysis of the results was based on calculating the associated elasto- dynamic Green's tensor enabling the local density of states as well as the acoustic mode dispersion(s) to be determined. The observation of a range of acoustic excitations including dilatational and flexural modes in freestanding membranes, open new opportunities in the non-destructive study of high frequency acoustics of laminar structures and coatings.
DTIC
*Elastic Properties; Light Scattering; Protective Coatings; Thin Films*

**20040059171** Ohio State Univ., Columbus, OH
**Non-Linear Radio-Frequency Research and Educational Laboratory**
Roblin, Patrick; Dec. 28, 2003; 15 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0268
Report No.(s): AD-A422051; AFRL-SR-AR-TR-04-0208; No Copyright; Avail: CASI; A03, Hardcopy

The AFOSR Durip grant was awarded to OSU in May 2003. The OSU Research Foundation account RF744774 was subsequently created. The target of this AFOSR Dtirip grant was to acquire a Large Signal Network Analyzer (LSNA). A brief description of the activities which took place in the calendar year 2003 following the award are described below the Summer 2003 establishing the specifications of the LSNA as required by the OSU bidding process. By the time of the award Agilent which initially developed the LSNA, had contracted with Nlaurv Microwaves to fabricate and distribute it. OSU being one of the first customer for this new product, no detailed specs were then available and the Pi worked with Maurv Microwaves to develop them. Attached to this report is the resulting list of specifications which were established for the fmal equipmert requisition.
DTIC
*Education; Frequency Analyzers; Nonlinearity; Radio Frequencies*

**20040059173** Industrial Coll. of the Armed Forces, Washington, DC
**Navy Research Project: A Projection of Moore's Law and Recommended Approaches to Manage and Mitigate Risks**
Burns, Greg; Marks, William C.; Apr. 2003; 34 pp.; In English
Report No.(s): AD-A422056; No Copyright; Avail: CASI; A03, Hardcopy

CAPT Gib Kerr, USN, PMS 435, is currently faced with the challenge of managing the cost and schedule impacts to submarine and surface ship procurements driven by the rapid tun-over of electronic technologies. These impacts include the costs and schedule implications of managing parts obsolescence on high technology Navy systems. This obsolescence occurs as commercial electronics manufacturers replace current component production with newer, more capable products. Navy ships are increasingly composed of complex electronics technology and rely almost totally on the commercial electronics industry for its parts. During the period required to develop and produce a Navy ship and its major systems, the electronic components will have gone through several life cycles, creating a tremendous workload for the ship's prime and subcontractors. Replacing these components over the life of the platform, when those components are no longer available commercially, magnifies the obsolescence impacts. CAPT Kerr specifically asked for students from the Electronics Seminar to study the phenomena of Moore's Law, the industry benchmark for the rate that electronic chip capability advances, and to provide a projection of how long this trend will continue. In addition, he asked the Electronics Seminar to assess the impacts to the commercial world's costs and schedules, and in turn, the cost and schedule impacts to Government systems.
DTIC
*Electronic Equipment; Life (Durability); Navy; Risk*

**20040059174** Industrial Coll. of the Armed Forces, Washington, DC
**Size Matters: Barriers to Entry in the Microelectronic Industry**
Stuart, Shannon; Jan. 2003; 9 pp.; In English
Report No.(s): AD-A422057; No Copyright; Avail: CASI; A02, Hardcopy

The semiconductor manufacturing industry is facing significant and growing barriers to entry that could drive certain market segments toward overcapacity or noncontestable oligopoly. Currently conditions warrant only limited government, action, but U.S. policy-makers should continue to monitor the industry.
DTIC
*Electronic Equipment; Industries; Microelectronics*

**20040059198** California Inst. of Tech., Pasadena, CA
**Quasi-Optical Power Combining**
Rutledge, David; Dec. 24, 2003; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-98-1-0001
Report No.(s): AD-A422101; ARO-37242.38-EL-MUR; No Copyright; Avail: CASI; A03, Hardcopy

We have developed the basic science underlying active quasi-optics. We have investigated power handling, noise, stability, efficiency and reliability, and developed the CAD tools necessary for industrial applications. In addition, we have demonstrated a single-chip output power of 5 W in the millimeter-wave frequency range, and developed practical waveguide packaging techniques for the devices. In the lower microwave frequency range we have developed a coaxial fin-line combiner that gives an output power of SOW with a 3:1 bandwidth. These demonstrations, together with the design techniques we have developed, should allow industry to solve the critical problems of multi-watt level solid-state power sources for millimeter waves, and broad-band high-power sources at lower microwave frequencies.
DTIC
*Microwave Frequencies; Millimeter Waves*

**20040059204** Office of Naval Research, Arlington, VA
**Distributed Machine Intelligence for Automated Survivability**
Drew, Katherine F.; Scheidt, David; Mar. 2004; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422118; No Copyright; Avail: CASI; A02, Hardcopy

Future Naval platforms face new dynamic operational scenarios that demand more flexible performance. At the same time, reduced manning and lower total ownership costs are now major design and acquisition objectives. Improved warfighting capability can be achieved by reducing vulnerability to damage and failure events. Rapid system recovery from unanticipated damage using current doctrine and practice conflicts with today's reduced manning objectives. Decentralized ship system architectures and agent-based technologies promise to enable the Navy to improve rapid system recovery and assist in meeting these affordability challenges. Decentralization of systems and resources improves both ship survivability and fight through capability. This is accomplished through rapid sensing and response and dynamic reconfiguration, which results in improved continuity of service of ship systems. Embedded intelligence at the component level insures rapid, effective autonomous reaction and response to local fault conditions. Agent-based technologies are utilized to provide autonomous cooperation between sensors and actuators, in which elements reason and react locally while achieving global objectives through agent-to-agent communications. While intelligent decision making is performed locally by autonomous agents, the sailor will direct these agents through comprehensive supervisory control with improved on-demand situational awareness. When fielded, these systems will provide increased situational awareness, increased fight through capability, and improved damage control. This paper describes Navy Science and Technology projects currently underway in academia, industry, and Navy laboratories to achieve these goals. (14 figures, 16 refs.)
DTIC
*Artificial Intelligence; Failure; Manpower; System Failures*

**20040059227** Naval Postgraduate School, Monterey, CA
**Acoustic Cymbal Transducers - Design, Hydrostatic Pressure Compensation, and Acoustic Performance**
Jenne, Kirk E.; Mar. 2004; 99 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422157; No Copyright; Avail: CASI; A05, Hardcopy

Continuing U.S. Navy interest in the development of light-weight, low-volume, broadband, underwater acoustic projectors and receivers is the principal motivation for this research topic. Acoustic cymbal transducers, so named for their geometric similarity to the percussion instruments, are miniature 'class V' flextensional transducers that consist of a piezoelectric ceramic drive element bonded to two opposing cymbal-shaped metal shells. Operating as mechanical transformers, the two metal shells convert the naturally large generative force of a piezoelectric ceramic in the radial mode into increased volume displacement at the metal shell surface to obtain usable source levels and sensitivities in a broad

frequency range. The magnified displacement makes the acoustic cymbal element a potential alternative to acoustic transduction technologies presently used to generate and receive Navy sonar frequencies. Potential benefits to utilizing the technology are generating or receiving broadband sound, at sonar frequencies in a thin, low volume, conformable package. Applications of this technology have been limited because air-backed acoustic cymbal elements undergo degradation in performance when exposed to elevated hydrostatic pressure (i.e., deep ocean and extreme littoral water applications). This research shows that consistent and reliable acoustic performance can be achieved with cymbal- based transducers at hydrostatic pressures of interest to the Navy.
DTIC
*Acoustic Properties; Electroacoustic Transducers; Hydrostatic Pressure; Piezoelectricity; Sound Transducers; Transducers; Underwater Acoustics*

**20040059233** Naval Postgraduate School, Monterey, CA
**Interdicting Electrical Power Grids**
Alvarez, Rogelio E.; Mar. 2004; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422163; No Copyright; Avail: CASI; A06, Hardcopy

This thesis explores Benders decomposition for solving interdiction problems on electric power grids, with applications to analyzing the vulnerability of such grids to terrorist attacks We refine and extend some existing optimization models and algorithms and demonstrate the value of our techniques using standard reliability test networks from IEEE Our implementation of Benders decomposition optimally solves any problem instance, in theory However, run times increase as Benders' cuts are added to the master problem, and this has prompted additional research to increase the decomposition's efficiency We demonstrate empirical speed ups by dropping slack cuts, solving a relaxed master problem in some iterations, and using integer but not necessarily optimal master-problem solutions These mixed strategies drastically reduce computation times For example, in one test case, we reduce the optimality gap, and the time that it takes to achieve this gap, from 16% in 75 hours to 5% in 16 minutes.
DTIC
*Computer Networks; Security*

**20040059238** Space and Naval Warfare Systems Center, San Diego, CA
**IEEE 802.11 Communications Test for Robotic Systems**
Manouk, Narek; Jul. 2002; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422172; No Copyright; Avail: CASI; A03, Hardcopy

Designing a robust communications structure needed in a robotic system often leads to many difficulties and compromises due to design constraints. Some of the capabilities of an 802.11 Ethernet radio modem can suffer as a direct result of compromises made to allow a robotic system to operate effectively within its established parameters. This was the case in the Man Portable Robotic System (MPRS) project, funded by the Army. The Urban Robot (URBOT) developed under this project had many specific user requirements, which led to challenging problems when designing the communications system. A communications test was conducted to determine the baseline capabilities of the BreezeNET PRO.11 modems that are currently being used in the URBOT. Tests conducted measured the received throughput under different circumstances, such as multi-hop, multi-node, multicast, and variable antenna height and range. Results show that under some circumstances throughput improvements are possible. Lessons learned from the outcome of the communications test will help in designing an improved communications system for future projects.
DTIC
*Evaluation; Modems; Robotics; Robots; System Effectiveness; Telecommunication*

**20040059700** North Carolina State Univ., Raleigh, NC, USA
**Solid-State Dynamics and Carrier Transport in Supervelocity Semiconductors**
Kim, Ki Wook; Littlejohn, M. A.; Apr. 2004; 6 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0801
Report No.(s): AD-A421810; No Copyright; Avail: CASI; A02, Hardcopy

We investigated a number of critical theoretical issues in two important research areas; namely, (1) spin polarized carrier transport and relaxation in low dimensional structures and (2) coupled quantum-based systems. In particular, we concentrated our efforts on building a fundamental understanding in the emerging field of spin- electronics and exploring new highly

functional quantum devices such as solid-state quantum computers based on quantum dots.
DTIC
*Charge Carriers; Semiconductor Devices; Semiconductors (Materials); Solid State*

**20040059757** Edgerton, Germeshausen and Grier, Inc., Santa Barbara, CA
**Aerial Radiological Monitoring System. Part 3: Electronic Processing of ARMS-II Data**
Hand, J. E.; Borella, H. M.; Sep. 1965; 70 pp.; In English
Report No.(s): AD-A422182; No Copyright; Avail: CASI; A04, Hardcopy

A method of utilizing electronic data-processing techniques for the reduction and presentation of airborne terrestrial-radiation measurements is presented. The instrumentation used by the Aerial Radiological Measuring Survey (ARMS-II) was developed by Edgerton, Germeshausen & Grier, Inc. (EG&G), under sponsorship of the Division of Biology and Medicine, Civil Effects Test Operations, U. S. Atomic Energy Commission. Systematic surveys of terrestrial radiation occurring over large land areas are performed throughout the USA by EG&G personnel. A nominal- sized area entails some 10,000 traverse miles of flying with the acquisition of nearly 100,000 data points. As a consequence, manual reduction and presentation of the raw data are highly impractical. For rapid reduction and early availability of the data, it is necessary that modern electronic techniques be adapted to the processing of ARMS-II data. The system described utilizes the IBM- 704 electronic computer as the principal processing machine. Peripheral gear includes the following IBM equipment: 1401 computer, 407 lister, 047 tape-to-card converter, 523 summary punch, and 082 card sorter. An Electronics Associates, Inc., model 3200 Dataplotter with a 30- by 30-in. plotting surface is employed to present the finished data graphically. Data are recorded in flight as binary entries onto punched tape. The data on the field tapes and the ground measurements necessary for computation are sent to the ARMS-II laboratory and converted to IBM card formats for entry into the computer. The data are taken to the computer center and processed; the computer provides the output information as a decimal tabulation of the radiation levels and their associated geocentric coordinates and converts the data to coordinates that are compatible with the X-Y plotter input requirements.
DTIC
*Computer Programs; Electronic Equipment; Monitors; Punched Tapes; Radiology*

**20040059811** Naval Postgraduate School, Monterey, CA, USA
**Multi-Agent Architecture for Integrating Remote Databases and Expert Sources With Situational Awareness Tools: Humanitarian Operations Scenario**
Ahciarliu, Cantemir; Mar. 2004; 95 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422233; No Copyright; Avail: CASI; A05, Hardcopy

Complex Humanitarian Emergencies are usually military conducted activities where participants must be able to react to a very dynamic and unfriendly environment. National and international participating forces require cooperation and coordination between civilian and military entities. The continuous need to share huge amounts of information requires a technological framework to allow legacy and new hardware and software interconnection, rapid network installation and flexible bandwidth availability. To improve the speed and the quality of the decision-making a scientific approach must be applied to the process. Maximizing both the effectiveness and efficiency in decision-making can be obtained by developing decision support systems capable of providing access to existing databases and expert systems. Databases usually contain raw information available for retrieval and processing according to the needs of the decision makers. Expert systems embed human expertise and allow the propagation of scarce expert resources throughout an organization to increase the consistency and quality of the decisions. Sharing access to these types of information within a Complex Humanitarian Emergency environment provides for better situational awareness and improves the decision-making process. This thesis will gather and combine the information from different sources and will suggest a model for integrating remote databases and expert sources with situational awareness tools.
DTIC
*Data Bases; Detection; Electric Connectors; Remote Sensing; Situational Awareness*

## 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*.

**20040056098** Lehigh Univ., Bethlehem, PA, USA
**Oscillations of a Turbulent Jet Incident Upon an Edge**
Lin, J. C.; Rockwell, D.; Sep. 19, 2000; 70 pp.; In English
Report No.(s): DE2004-821367; LN-00K079; No Copyright; Avail: Department of Energy Information Bridge

For the case of a jet originating from a fully turbulent channel flow and impinging upon a sharp edge, the possible onset and nature of coherent oscillations has remained unexplored. In this investigation, high-image-density particle image velocimetry and surface pressure measurements are employed to determine the instantaneous, whole-field characteristics of the turbulent jet-edge interaction in relation to the loading of the edge. It is demonstrated that even in absence of acoustic resonant or fluid-elastic effects, highly coherent, self-sustained oscillations rapidly emerge above the turbulent background. Two clearly identifiable modes of instability are evident. These modes involve large-scale vortices that are phase-locked to the gross undulations of the jet and its interaction with the edge, and small-scale vortices, which are not phase-locked. Time-resolved imaging of instantaneous vorticity and velocity reveals the form, orientation, and strength of the large-scale concentrations of vorticity approaching the edge in relation to rapid agglomeration of small-scale vorticity concentrations. Such vorticity field-edge interactions exhibit rich complexity, relative to the simplified pattern of vortex-edge interaction traditionally employed for the quasi-laminar edgetone. Furthermore, these interactions yield highly nonlinear surface pressure signatures. The origin of this nonlinearity, involving coexistence of multiple frequency components, is interpreted in terms of large- and small-scale vortices embedded in distributed vorticity layers at the edge. Eruption of the surface boundary layer on the edge due to passage of the large-scale vortex does not occur; rather apparent secondary vorticity concentrations are simply due to distension of the oppositely-signed vorticity layer at the tip of the edge. The ensemble-averaged turbulent statistics of the jet quickly take on an identity that is distinct from the statistics of the turbulent boundary layer in the channel. Large increases in Reynolds stress occur due to onset of the small-scale concentrations of vorticity immediately downstream of separation; substantial increases at locations further downstream arise from development of the large-scale vorticity concentrations.
NTIS
*Oscillations; Turbulent Flow; Vorticity*

**20040056125** Swedish Defence Research Establishment, Stockholm
**Optimization of Steady Wall Temperature for Disturbance Control**
Pralits, J.; Hanifi, A.; Oct. 2003; 46 pp.; In English
Report No.(s): PB2004-104140; FOI-R-0939-SE; No Copyright; Avail: CASI; A03, Hardcopy

We present a theory for computing the optimal study wall temperature distribution to suppress the growth of convectively unstable disturbances in compressible boundary layer flows on flat plates. A gradient based iterative procedure is used to minimize an objective function measuring the disturbance kinetic energy. The gradient of interest is obtain4ed from the solution of the ad joint of the boundary layer and parabolized stability equations, which are derived using a Lagrange multiplier technique. The study includes a comparison between the cases of minimizing the terminal, and an integrated value of the disturbance kinetic energy for different free stream Mach numbers and control magnitudes. A comparison is also made for the cases of zero and non-zero wall heat transfer outside the control domain.
NTIS
*Flat Plates; Boundary Layer Flow; Lagrange Multipliers*

**20040059039** Air Force Research Lab., Hanscom AFB, MA
**DTIC Information for AFOSR Task 2304CP Lattice-Gas Theory and Computation for Complex Fluid Dynamics**
Yepez, J.; Nov. 6, 1997; 6 pp.; In English
Report No.(s): AD-A421715; No Copyright; Avail: CASI; A02, Hardcopy

Aid the Air Force modeling community by developing a 'mid-level' approach to simulating the behavior of complex fluids, such as viscous incompressible fluids, hydrothermal fluids, inviscid fluids, multiphase fluids, and superfluids. Traditional approaches to complex fluid simulation include 'low-level' molecular dynamics or 'high-level' partial differential equation approximation schemes. MD suffers from insufficient spatial and temporal scales. The PDE schemes suffer from numerical instabilities and coarseness in the physical description. Lattice gases are a 'mid-level'approach that achieves greater

scales than MD while possessing unconditional stability due to its underlying physics-like microscopic dynamics while capturing in the macroscopic limit all relevant physics. A principle objective is to develop a general lattice theory and test is soundness and efficiency on novel fine-grained parallel computers architected along the lattice gas paradigm.
DTIC
*Computational Fluid Dynamics; Fluid Dynamics; Quantum Theory*

**20040059199** California Inst. of Tech., Pasadena, CA
**3D Particle Tracking Velocimetry on Transverse Injection in Supersonic Flow**
Hornung, H. G.; Ponchaut, N.; Mouton, C.; Dec. 30, 2003; 35 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0111
Report No.(s): AD-A422106; AFRL-SR-AR-TR-04-0227; No Copyright; Avail: CASI; A03, Hardcopy

The supersonic Ludwieg Tube at the Graduate Aeronautical Laboratories of the California Institute of Technology was completed and taken into operation. A smaller Ludwieg Tube with the purpose of providing a transverse jet in the main flow was constructed and taken into operation, thus completing a compact, inexpensive supersonic flow/injection facility. The implementation of three-component, three- dimensional particle image velocimetry in supersonic air flows from the instrument existing for low speed water flows at the time of inception of the program required a much greater development effort than had been anticipated at the outset. Major redesign of the hardware and new software development as well as experimentation with particle generating systems produced an instrument that is now able to fulfill the tasks demanded of it for the project with good accuracy and spatial resolution. Velocities parallel to the camera face can be measured to an accuracy of 0.25% and the component normal to the camera face to 2.5%.
DTIC
*Injection; Supersonic Flow; Velocity Measurement*

**20040059206** Michigan Univ., Ann Arbor, MI
**Particle Computations of Hypersonic Shock Interaction Flows**
Boyd, Iain D.; Mar. 2004; 7 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0003
Report No.(s): AD-A422121; AFRL-SR-AR-TR-04-0230; No Copyright; Avail: CASI; A02, Hardcopy

Development is described of a hybrid DSMC/CFD code for physically accurate and numerically efficient computation of hypersonic, viscous-interaction flows. Recent studies focus on the application and assessment of a hybrid code to a blunted cone configuration and to improvement of physical models used in the code.
DTIC
*Bow Waves; Hypersonic Flow; Hypersonic Shock; Shock Wave Interaction; Shock Waves*

**20040059207** Illinois Univ., Urbana, IL
**Optimal Large Eddy Simulation of Turbulence**
Moser, R. D.; Balachandar, S.; Adrian, R. J.; Mar. 29, 2004; 92 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0181
Report No.(s): AD-A422122; AFRL-SR-AR-TR-04-0223; No Copyright; Avail: CASI; A05, Hardcopy

Optimal LES modeling is a new approach to the development of subgrid models of turbulence. It has been found to produce accurate LES simulations when based on reliable statistical information. Now, the primary effort in optimal model development is the determination of this statistical information from theoretical considerations, with minimal empirical input. The validity of the theoretically determined statistics is being tested against experimental and DNS data. When small-scales are isotropic, Kolmogorov theory, the quasi- normal approximation and a dynamic procedure allow optimal models to be constructed with no empirical input. Such models have been found to perform well, though the dynamic procedure has not yet been tested in this context. Tests using channel flow DNS show that, except for a region very near the wall, the quasi-normal approximation is valid. Further, for the log- region, a representation for the anisotropy and inhomogeneity of the statistics is being developed. Thus, the above modeling approach can be adapted to near-wall turbulence, except for the thin viscous region. To handle this wall layer, a filtered boundary optimal LES model is being developed and tested.
DTIC
*Fluid Mechanics; Large Eddy Simulation; Turbulence; Vortices*

**20040059228** Michigan State Univ., East Lansing, MI
**Simulation of Moving Boundary Flow Using Overset Adaptive Cartesian/Prism Grids and DES**
Wang, Z. J.; Zhang, Laiping; Sep. 2003; 22 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0202
Report No.(s): AD-A422158; AFRL-SR-AR-TR-04-0225; No Copyright; Avail: CASI; A03, Hardcopy

Development of improved weapon systems requires better understanding of the complex aerodynamics created by moving boundaries. Carriage and release of conventional weapons from aircraft and aerial refueling fall in this category. The flow problem involving moving boundaries are very challenging to compute because the resultant flow field is intrinsically unsteady. Modeling such flow problems is made even more difficult due to the complex geometries and the highly turbulent nature of the unsteady flows. Under an exploratory grant from the AEOSR, a new simulation environment for moving boundary problems is being developed. This environment is designed to advance the state-of-the-art for moving boundary flow problems in the following areas: I. Improve the solution accuracy and efficiency through the use of overset adaptive Cartesian/prism grids. Key flow features will be automatically captured with solution based grid adaptations; 2. Improve the accuracy for highly turbulent unsteady separated flows encountered in moving boundary problems with a hybrid RANS/LES (Reynolds Averaged Navier Stokes/Large Eddy Simulation) a roach named Detached Eddy Simulation (DES).
DTIC
*Aerodynamic Forces; Boundary Layer Flow; Cartesian Coordinates; Computational Grids; Prisms; Simulation*

**20040059232** Naval Postgraduate School, Monterey, CA
**Modeling Optical Turbulence with COAMPS During Two Observation Periods at Vandenberg AFB**
Horne, Jimmy D., Jr; Mar. 2004; 163 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422162; No Copyright; Avail: CASI; A08, Hardcopy

The objective of this thesis is to investigate the forecastability of optical turbulence using the U.S. Navy's Coupled Ocean Atmosphere Mesoscale Prediction System (COAMPS). First, a detailed synoptic study was performed over the Eastern Pacific region for observation periods in October 2001 and March 2002 to focus on mesoscale features affecting Vandenberg AFB. Second, a modified version of COAMPS version 2. 0.16 model output was evaluated to ensure reasonable modeling of the mesoscale. Next, temperature and dewpoint temperature vertical profiles of COAMPS, modified with the Turbulent Kinetic Energy (TKE) Method, were compared with balloon- launched rawinsondes, initially, then with higher resolution thermosondes. Optical turbulence parameters were then calculated from the data and a comparison between synthetic profiles and thermosonde-derived profiles were qualitatively and quantitatively studied. Then the vertical resolution of the model was increased for selected forecasts to determine the potential for forecast improvement.
DTIC
*Kinetic Energy; Optical Properties; Turbulence*

**20040059314** Stanford Univ., Stanford, CA
**Scaled-Up Nonequilibrium Air Plasmas**
Kruger, Charles H.; Laux, Christophe O.; Machala, Zedenko; Candler, Graham V.; Jan. 2004; 88 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0389
Report No.(s): AD-A422298; AFRL-SR-AR-TR-04-0215; No Copyright; Avail: CASI; A05, Hardcopy

Experimental investigations of flow/plasma interactions in a DC discharge placed in a transverse preheated air flow confirm the role of the gas heating effect. The volume of plasma produced by the discharge is found to decrease when the air flow increases. This counterintuitive result is analyzed through measurements of the reduced field strength E/N profile in the discharge. When the flow velocity increases, the gas traversing the discharge region has less time to undergo vibrational-translational energy transfer and therefore it does not heat up as much. Lower temperature results in higher gas density N, thereby decreasing the E/N further downstream the flow. Since the rate coefficients of electron-impact processes are controlled by the E/N, the discharge volume tends to be larger in the slower flows.
DTIC
*Air Flow; Nonequilibrium Flow; Nonequilibrium Plasmas; Plasmas (Physics); Pulse Rate; Scalers*

**20040059323** Wichita State Univ., Wichita, KS
**An Integrated Computational Tool for Hypersonic Flow Simulation**
Hoffmann, Klaus A.; Jan. 2000; 265 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0219
Report No.(s): AD-A422319; AFRL-SR-AR-TR-04-0232; No Copyright; Avail: CASI; A12, Hardcopy

The development of a computational tool for the solution of turbulent magnetohydrodynamic (MHD) equations, including turbulence or chemically reacting flows is presented. For the MHD solver, option is provided to solve either the full MHD equations or the low magnetic Reynolds number equations. For turbulence, the Reynolds Averaged approach is considered for its low requirement in terms of computational resources. Six turbulence models, ranging from simple algebraic model to more sophisticated two-equation models are considered to evaluate the eddy viscosity. Since the turbulence models were originally designed for non-magnetic flows, they require some modifications to account for the presence of a magnetic field. The governing equations are numerically solved by a modified Runge-Kutta scheme augmented with a Total Variation Diminishing scheme for accurate shock capturing. The numerical solutions are compared with available experimental data and existing analytical solutions. For the simulation of hypersonic high-temperature effects, two chemical models are utilized, namely a nonequilibrium model and an equilibrium model. A loosely coupled approach is implemented to communicate between the magnetogasdynamic equations and the chemical models. The nonequilibrium model is a one-temperature, five-species, seventeen-reaction model solved by an implicit flux-vector splitting scheme. The effectiveness of the chemical models for hypersonic flow over blunt body is examined in various flow conditions. It is shown that the proposed schemes perform well in a variety of test cases, though some limitations have been identified.
DTIC
*Computational Fluid Dynamics; Hypersonic Flow; Magnetohydrodynamics*

**20040059749** State Univ. of New York, Stony Brook, NY, USA
**Experimental Data Acquisition and Quantitative Visualization of Turbulent Jet Mixing Layers**
George, William K.; Feb. 20, 2004; 14 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0244; Proj-3484
Report No.(s): AD-A422039; AFRL-SR-AR-TR-04-0189; No Copyright; Avail: CASI; A03, Hardcopy

This AFOSR/DURIP sponsored funding was used to upgrade the data acquisition, graphics and image processing capabilities of the Turbulence Research Laboratory (TRL) of the State University of New York at Buffalo. The proposed upgrades were of immediate benefit to the research sponsored by AFOSR (Investigation into the Dynamics of the Jet Mixing Layer) as well as a number of on-going and anticipated investigations. The AFOSR sponsored effort enhanced on-going research using 138 hot-wire probes to investigate the dynamics of the jet mixing layer. The hot-wires are used to obtain simultaneous data at 138 positions so that the instantaneous velocity profiles can be reconstructed using the proper orthogonal decomposition (POD). The complexity of the data acquisition required for this number of probes has been considerably simplified. In spite of this, the demands on the data acquisition system and the experimenter are enormous, especially with regard to calibration and post-data- acquisition validation, visualization and processing of the data. The equipment purchased both addressed the immediate research needs, and considerably enhanced the ability of the Turbulence Research Laboratory to meet the needs of the university and regional technical community.
DTIC
*Data Acquisition; Decomposition; Flow Visualization; Fluid Jets; Jet Mixing Flow; Turbulent Flow; Turbulent Jets*

**20040059980** NASA Langley Research Center, Hampton, VA, USA
**Analysis of Extensive Cross-Flow Separation using Higher-Order RANS Closure Models**
Morrison, J. H.; Panaras, A. G.; Gatski, T. B.; Georgantopoulos, G. A.; [2003]; 11 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Contract(s)/Grant(s): RTO Proj. G107
Report No.(s): AIAA Paper 2003-3532; Copyright; Avail: CASI; A03, Hardcopy

The turbulent flow fields associated with the incompressible flow over a 6:1 prolate spheroid at high angle of attack, and the supersonic flow over an ogive cylinder are studied. Both these flows are characterized by large separation and vortical flow regions and therefore provide a challenging database for comparison of turbulent closure models. Of interest is the ability to predict the effects of separation and associated vortical motion common to both flows. Two turbulent models are investigated that each represent the class of linear eddy-viscosity models (LEVMs) and explicit algebraic stress models (EASMs). Since the EASM accounts for anisotropic effects, the influence of these effects on flow field predictions can be assessed. The EASM model is shown to both improve the separation location prediction and pressure trough under the secondary vortex on the 6:l prolate spheroid at high angle of attack and high Reynolds number, and improve the prediction of the separation location on a supersonic ogive cylinder.
Author
*Reynolds Averaging; Navier-Stokes Equation; Cross Flow; Prolate Spheroids; Separated Flow; Turbulence Models*

**20040059998** Lawrence Livermore National Lab., Livermore, CA
**Higher-Order Semi-Implicit Projection Methods**
Minion, M. L.; Sep. 06, 2001; 26 pp.; In English
Report No.(s): DE2004-15006303; UCRL-JC-145295; No Copyright; Avail: Department of Energy Information Bridge

A semi-implicit form of the method of spectral deferred corrections is applied to the solution of the incompressible Navier-Stokes equations. A methodology for constructing semi-implicit projection methods with arbitrarily high order of temporal accuracy in both the velocity and pressure is presented. Three variations of projection methods are discussed which differ in the manner in which the auxiliary velocity and the pressure are calculated. The presentation will make clear that project methods in general need not be viewed as fractional step methods as is often the practice. Two simple numerical examples re used to demonstrate fourth-order accuracy in time for an implementation of each variation of projection method.
NTIS
*Navier-Stokes Equation; Incompressible Flow*

## 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*.

**20040058012** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA, Wesleyan Univ., Middletown, CT, USA
**Effect of Palagonite Dust Deposition on the Automated Detection of Carbonate Vis/NIR Spectra**
Gilmore, Martha S.; Merrill, Matthew D.; Castano, Rebecca; Bornstein, Benjamin; Greenwood, James; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Currently Mars missions can collect more data than can be returned. Future rovers of increased mission lifetime will benefit from onboard autonomous data processing systems to guide the selection, measurement and return of scientifically important data. One approach is to train a neural net to recognize spectral reflectance characteristics of minerals of interest. We have developed a carbonate detector using a neural net algorithm trained on 10,000 synthetic Vis/NIR (350-2500 nm) spectra. The detector was able to correctly identify carbonates in the spectra of 30 carbonate and noncarbonate field samples with 100% success. However, Martian dust coatings strongly affect the spectral characteristics of surface rocks potentially masking the underlying substrate rock. In this experiment, we measure Vis/NIR spectra of calcite coated with different thicknesses of palagonite dust and evaluate the performance of the carbonate detector.
Author
*Dust; Detection; Carbonates; Chemical Detection*

**20040058981** Hawaii Univ., Honolulu, HI
**Design and Commissioning of a Hi-Resolution Visible/Near-IR Echelle Spectrograph (HI-VIS) for the AEOS Telescope**
Thornton, Robert J.; Kuhn, Jeffrey R.; Hodapp, Klaus W.; Mickey, Donald L.; Stockton, Alan N.; Jan. 2002; 11 pp.; In English
Contract(s)/Grant(s): F29601-00-D-0204; F29601-96-C-0125; Proj-4868; Proj-4983
Report No.(s): AD-A421535; AFRL/DET-15-0222; No Copyright; Avail: CASI; A03, Hardcopy

The Institute for Astronomy has developed and recently installed a high-resolution cross-dispersed echelle spectrograph for use at one of the coude foci of the AEOS 3.7- meter telescope, operated by the Air Force Space Command atop Mt. Haleakala on the island of Maui. The spectrograph features an optical arm for the wavelength range 0.5-1.0 urn and an infrared arm for the range 1.0 - 2.5 microns We review the spectrograph design and present commissioning results obtained with both the visible and infrared arms. Both channels use a white-pupil collimator design to maximize grating efficiency and to limit the size of the camera optics. The visible arm of the spectrograph uses deep-depletion CCDs optimized for operation near 1.0 urn. The infrared detector is a 2048 x 2048 HGCdTe array (HAWAII-2) that has been developed by Rockwell Science Center for this project. Both channels are equipped with slit-viewing cameras for object acquisition and control of a fast guiding tip-tilt mirror located in a pupil image in the spectrograph fore optics.
DTIC
*Infrared Detectors; Near Infrared Radiation; Spectrographs; Telescopes*

**20040058999** California Univ., Santa Barbara, CA
**Optical Properties of Bound Antigen Monolayers for Biomolecular Microsensors**
Cohen, Daniel A.; Feb. 2004; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-2-0538; Proj-E117
Report No.(s): AD-A421593; AFRL-IF-RS-TR-2004-38; No Copyright; Avail: CASI; A03, Hardcopy

The formalism of molar refraction was extended to cover the wavelength range of 200 nm - 2500 nm, in order to predict the index of refraction and index increment of a wide range of molecules of biochemical interest. Data for the model was obtained using a unique interferometer cell within a standard laboratory spectrophotometer. The resulting models for protein index increment suggest that both the sensitivity and specificity of refractometric sensors may be improved by operating at ultraviolet wavelengths and that measurement at two wavelengths may be used to quantify the total protein present and distinguish between similar proteins, of potential use to reduce false positive responses in affinity assays. The impact of refractive index and particle size on semiconductor- based evanescent field sensors was analyzed, along with the magnitude of optical scattering. The results are particularly important in quantitatively explaining the benefits of using a nanoparticle-enhanced assay, and of using high-index nanoparticles for enhancement. For particles below 100 nm in diameter, optical scattering will be negligible. For particles larger than 100 nm, scattering becomes measurable, and single one-micron diameter particles were detected in a novel monolithic evanescent field sensor.
DTIC
*Antigens; Microinstrumentation; Optical Properties; Sensors*

**20040059000** Boeing Co., Kihei, HI
**Maui Space Surveillance System Phased Array**
Roberts, Lewis C.; Feb. 2004; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-00-D-0204/0009; Proj-4868; Proj-4983
Report No.(s): AD-A421597; AFRL-DE-PS-TR-2004-1020; No Copyright; Avail: CASI; A03, Hardcopy

Long baseline Interferometry is a technique where light from two or more telescopes is combined, creating interference fringes. Analysis of the interference fringes allows information to be exacted that has the angular resolution of a telescope with the diameter of the separation of the two telescopes. Since it is currently unfeasible to build telescopes with diameters of hundreds of meters, this is the only method to achieve resolution on the order of micro arcseconds. If interferometry could be applied to space surveillance it would offer the potential for sub-centimeter resolution of low-Earth objects. This report investigates the feasibility of constructing an instrument to observe satellites and of placing that instrument at the Maui Space Surveillance System.
DTIC
*Phased Arrays*

**20040059027** Massachusetts Inst. of Tech., Lexington, MA
**Detection and Classification from Hyperspectral Imagery Using the Normal Compositional Model**
Stein, David; Mar. 2003; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A421702; No Copyright; Avail: CASI; A03, Hardcopy

Presentation on detection and classification from hyperspectral imagery using the normal compositional model.
DTIC
*Image Classification; Imagery*

**20040059028** Washington Univ., Saint Louis, MO
**Active Testing Surveillance Systems, or, Playing Twenty Questions with a Radar**
Fuhrmann, Daniel R.; Mar. 13, 2003; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421703; No Copyright; Avail: CASI; A03, Hardcopy

Presentation of testing methods for surveillance systems, with emphasis on radar systems.
DTIC
*Doppler Radar; Surveillance*

**20040059033** Massachusetts Inst. of Tech., Lexington, MA
**Space-Time Codes for an Invariant Detector of Frequency-Hopped MIMO communications**
Forsythe, Keith W.; Mar. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A421708; No Copyright; Avail: CASI; A03, Hardcopy
Presentation of space-time codes for an invariant detector of frequency-hopped MIMO communications.
DTIC
*Coding; Frequencies; Frequency Hopping; Mimo (Control Systems)*

**20040059035** Veridian Systems Div., Ann Arbor, MI
**MIMO Capacity of Radar as a Communications Channel**
Bidigare, Patrick; Mar. 2003; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421710; No Copyright; Avail: CASI; A03, Hardcopy
Presentation of Multiple Input Multiple Output (MIMO) capacity of radar as a communications channel.
DTIC
*Mimo (Control Systems)*

**20040059076** Raytheon Co., Lexington, MA
**Resolution of Mainlobe and Sidelobe Detections using Model Order Determination**
Jaffer, Amin G.; Chen, Joe C.; Miller, Thomas W.; Mar. 2001; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421821; No Copyright; Avail: CASI; A03, Hardcopy
Presentation on resolution of mainlobe and sidelobe detections using model order determination.
DTIC
*Antennas; Detection; Sidelobes; Target Acquisition*

**20040059091** Air Force Inst. of Tech., Wright-Patterson AFB, OH
**Multisensor Image Registration Utilizing The LoG Filter and FWT**
Walli, Karl C.; Jun. 2003; 148 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421868; AFIT-CI04-124; No Copyright; Avail: CASI; A07, Hardcopy
This thesis examines the utility of automated image registration techniques developed by the author. The major thrusts of this research include using the Laplacian of Gaussian (LoG) filter to automatically determine ground control points (GCPs) and wavelet theory for multiresolution analysis. Additionally, advances in both composite and predictive transformations will be covered. The defense will include an overview of the processes involved in general image registration and specifically how they pertain to automation with the techniques utilized in this thesis. Use of the LoG filter to extract semi-invariant GCPs, development of automated point matching schemas, and the use of matrix transformations for efficient management of affine image relationships will be explained in detail. Additionally, the ability to apply statistical analysis to both local and image wide sets of GCPs will be discussed. The student developed software application, LoG Wavelet Registration (LoGWaR). will demonstrate the utility of these techniques for processing large datasets such as LANDSAT and how integration of these features can provide both power and flexibility when registering multiresolution and/or multisensor images. Automation techniques will be highlighted, demonstrating the strengths and weaknesses when applied to images with high degrees of parallax, cloud-cover, and other types of temporal change. Specific applications, such as wavelet sharpening and spectral unmixing will be addressed as it pertains to current research.
DTIC
*Image Processing; Pattern Registration*

**20040059213** Space and Naval Warfare Systems Center, San Diego, CA
**Underwater Platforms for Chemical Detection**
Fletcher, Barbara; Jul. 2001; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422133; No Copyright; Avail: CASI; A02, Hardcopy
Chemical detection underwater is playing increasingly important roles for both military and environmental applications. Use of unmanned underwater vehicles as sensor platforms allow extended ranges and greater area coverage with minimal risk to personnel and high-value assets. There are a variety of underwater platform types available including remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), and crawlers. The benefits and tradeoffs of each platform type will

be discussed with regard to the specific mission and environments. ROVs are the most mature of the platforms, with a wide range of systems in use in the Fleet and commercially. AUVs are becoming available and will provide extended capabilities in the future. State of the art systems and directions will be presented.
DTIC
*Chemical Detection; Underwater Vehicles; Remotely Ploted Vehicles*

**20040059298** Defence Research and Development Canada, Dartmouth, Nova Scotia
**The Roles of Human Operator and Machine in Decision Aid Strategies for Target Detection**
Allen, Nancy J. M.; Kessel, Ronald T.; Oct. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422262; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
*Command and Control; Decision Support Systems; Detection; Man Machine Systems; Operators (Personnel); Target Acquisition*

**20040061976** California Univ., Los Angeles, CA, USA
**A High Energy Secondary Ion Mass Spectrometer for the Analysis of Captured Solar Wind**
McKeegan, K. D.; Coath, C. D.; Mao, P. H.; Jarzebinski, G.; Burnett, D.; Lunar and Planetary Science XXXV: Genesis Mission; 2004; 2 pp.; In English; See also 20040061973; 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. It will accomplish this by returning samples of the solar wind (SW), captured in ultra-pure target materials, for analysis in terrestrial laboratories. The two most important scientific objectives of GENESIS are the analysis of the isotopic abundances of SW oxygen and nitrogen with an accuracy of approx. 1% and 10%, respectively. The spacecraft carries an electrostatic mirror designed to enhance the signal-to-background as well as depth of implantation of these SW elements in target materials (SiC, (13)C CVD diamond, diamond-like C film) chosen for their low intrinsic backgrounds and lack of native surficial oxide layers. The concentrator also rejects >90% of the protons, but most of the atoms collected will still be H. Even with the concentrator, only small amounts, approx. 8 and 0.8 ng of O and N, respectively, will be captured per sq cm of target and those SW atoms will be not very far removed from possible surface contaminants (mean implantation depth, approx. 500 A). Such relatively small amounts of O and N have been measured with good precision in extraterrestrial materials, e.g. by secondary ion mass spectrometry (SIMS) in dust particles, but not in such dilute concentrations spread over a relatively large area. In order to address these analytical challenges, we are constructing a new instrument that combines the unsurpassed capabilities of SIMS for high-resolution depth-profiling of semiconductor materials (like the GENESIS collectors) with those of accelerator mass spectrometry for overcoming limitations in isotopic abundance measurements caused by molecular ion interferences. Here we report the major design criteria and performance goals for this new micro-analytical instrument, termed the UCLA 'MegaSIMS.'
Author
*Mass Spectrometers; Solar Wind; Isotope Ratios; Abundance*

**20040061982** Northwestern Univ., Evanston, IL, USA
**Topographic Analysis with a Stereo Matching Tool Kit**
Andre, S. L.; Robinson, M. S.; Andre, T. C.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; 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
Digital elevation models (DEMs) are invaluable products for planetary interpretation. Typically, stereo matching programs require a user-selected set of homologous points (seed points) in the left and right images to initiate automated stereo matching routines. Relying on the set of initial seed points, the program then finds matching points between the two images. User input of seed points for each stereo pair can be a tedious and timeconsuming step. An automated stereo matching tool for planetary images is useful in reducing or eliminating the need for human interaction (and potential error) in choosing initial seed points. We present a set of stereo matching tools that can (1) automatically generate seed points, (2) perform the stereo matching process, (3) apply the camera intersection model, and (4) produce DEMs.
Author
*Image Processing; Planetary Mapping; Stereoscopy*

**20040061988** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Autonomous Vegetation Cover Scene Classification of EO-1 Hyperion Hyperspectral Data**

Lee, R. J.; Davies, A. G., et al.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Autonomous Sciencecraft Experiment (ASE) is a JPL-led, New Millennium Program mission containing new technology in the form of software to be flown on the Earth Observer-1 (EO-1) satellite in early 2004. This new technology will facilitate an artificially intelligent machine with autonomous science-driven capabilities. Among the ASE flight software is a set of onboard science algorithms designed for autonomous data processing, primarily based on change detection from observation to observation. Using the output from these algorithms, ASE has the ability to autonomously modify the EO-1 observation plan, retargeting itself for a more in-depth observation of a scientific event in progress. Furthermore, intelligent and selective information down-linking will maximize return of the most valuable scientific data. Among the algorithms developed for use on ASE is a Lava-Vegetation (L-V) detection algorithm. This algorithm can effectively identify the initial location and extent of lava and vegetation coverage based on spectral shape. Comparison of several different observations, all classified via this algorithm, can make change detection possible.

Author

*Algorithms; Applications Programs (Computers); Flight Control*

**20040062016** Bern Univ., Bern, Switzerland

**A Miniature Mass Spectrometer Module**

Whitby, J. A.; Rohner, U.; Schultz, R.; Romstedt, J.; Wurz, P.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Described here is the most recent version of the miniature mass analyzer, suitable for deployment on board a planetary rover with very limited resources. Although we call the instrument LMS (Laser Mass Spectrometer) and have designed and tested it with a laser ablation ion source for the analysis of solids, the mass analyzer is a versatile instrument that could be used with other ion-sources, and for the measurement of fluids as well as solids. Described here is the potential use of such a miniature mass spectrometer in conjunction with chemically selective separation techniques such as gas-chromatography. Similar approaches have been proposed elsewhere. The original version of the instrument, LMS 1.0, was intended for deployment on a stationary lander and was a simple time-of-flight mass analyzer using a linear reflection with a total design mass of 0.5 kg. Subsequent versions have been intended for deployment as part of a suite of geochemical instruments either on a mobile rover or by a robotic arm. The instrument described here, LMS 3.2, is a flight-like prototype intended to demonstrate proof-of-principle and to allow us to experiment with various laser sources and to begin a calibration program. By flight-like means that the mass, volume and power requirements of all components are compliant with foreseen requirements (e.g. for the Geochemical Instrumentation Package Facility under study by the European Space Agency), but that they have not necessarily been flight qualified.

Derived from text

*Mass Spectrometers; Miniaturization; Elastic Properties; Laser Spectrometers*

**20040062017** Institute of Space and Astronautical Science, Sagamihara, Japan

**X-Ray Fluorescence Spectrometer Onboard the SELENE Lunar Orbiter: Its Science and Instrument**

Okada, T.; Shirai, K.; Yamamoto, Y.; Arai, T.; Ogawa, K.; Kato, M.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; 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 been developing an X-ray fluorescence spectrometer, XRS, for the SELENE mission to map major elemental composition of the Moon as well as to understand the mechanism of X-ray excitation in the nightside and physical properties caused by surface materials. We present here scientific objectives and instrumentation of the XRS, since a critical design review has been finished and the flight model is in preparation. The SELENE (SELenological and ENgineering Explorer) mission is a lunar polar orbiter organized by the ISAS/JAXA to be launched in 2006 and conducts global mapping of composition, geology, surface and subsurface structure, gravity, and magnetic field as well as studying plasma physics of lunar environments. Mission duration is scheduled to conduct in calibration phase for two months, nominal mission phase for ten months, and extended mission phase for six months.

Derived from text

*X Ray Fluorescence; Spectrometers; Lunar Environment; Mapping; Magnetic Fields; Geology*

**20040062023** Akita Univ., Japan

**Development of a Telescopic Imaging Spectrometer for the Moon**

Saiki, K.; Nakamura, R.; Ichikawa, F.; Akiyama, H.; Takeda, H.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ALIS (Akita Lunar Imaging Spectrometer) is a telescopic imaging spectrometer which we developed for Space Station Lunar Observatory project. A future purpose of this project is to establish the photometric model of the moon as a spectral radiance standard of space-borne imaging instruments by repeated observation of the moon with VIS/NIR (Visible and Near Infra-red light) from the International Space Station. McEven derived the visible photometric functions for the entire moon by utilizing the images taken by SSI onboard Galileo. The improved version was applied to the photometric normalization of lunar images from Clementine UVVIS camera. Robotic Lunar Observatory (ROLO) provides photometric models for 32 bands, including nine SWIR bands, that are position and phase dependent. The primary advantage of ALIS, compared with these previous datasets, lies in the continuous wavelength coverage between 380 and 1700 nm (2400nm in the future). A ground-based model of ALIS has been developed through a Phase-IA research of 'Ground-based Research Announcement for Space Utilization' promoted by Japan Space Forum. Within this near-term project, telescopic imaging spectrometers have been developed and examined through groundbased observation of the moon. The study of photometric characteristics of rocks and minerals has been started for getting a better photometric model of the lunar surface.

Author

*Cameras; Imaging Spectrometers; Imaging Techniques; Lunar Surface; Minerals*

## 36
## LASERS AND MASERS

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

**20040058964** Iowa Univ., Iowa City, IA

**Electronic, Optical and Structural Properties of 6. 1 Angstrom III-V semiconductor Heterostructures for High-Performance Mid-Infrared Lasers**

Boggess, Thomas F.; Dec. 2003; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F29601-01-C-0229; Proj-2301

Report No.(s): AD-A421467; AFRL-DE-PS-TR-2004-1002; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this program was to develop new insight into the physics of 6. 1-angstrom heterostructures through combined experiment and theoretical efforts. Specifically, time-resolved ultrafast optical and scanning- tunneling microscopy (STM) experimental techniques were used to study the electronic, optical, and structural properties

DTIC

*Electrical Properties; Infrared Lasers; Lasers; Optical Properties; Semiconductor Lasers; Semiconductors (Materials)*

**20040059252** Naval Research Lab., Washington, DC

**Design of a Compact Optically-Guided Pinched Megawatt Class FEL**

Sprangle, Phillip; Hafizi, Bahman; Apr. 9, 2004; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422208; NRL/MR/6790--04-8769; No Copyright; Avail: CASI; A03, Hardcopy

A conceptual design for a compact megawatt class FEL operating at 1 micro is presented. The proposed FEL consists of an optically guided, pinched amplifier configuration driven by an RF linac. The gain length, efficiency, electron pulse slippage and the distance between the wiggler and first relay mirror are determined for a megawatt class design. Of particular concern in the design is the overall length of the optical system, i.e., wiggler length and distance to the first relay mirror. In the present design the wiggler length is ^1 meter, and the distance between the first relay mirror and the wiggler is determined by the average intensity damage threshold on the mirror. By focusing the electron beam, the optical beam can be pinched upon exiting the wiggler. The pinched optical beam has a reduced Rayleigh length, which permits the first relay mirror to be relatively close to the wiggler. By pinching the optical beam and employing grazing incidence, the first relay mirror can be located within ^3 meters of the wiggler.

DTIC

*Free Electron Lasers*

**20040059258** Massachusetts Inst. of Tech., Cambridge, MA
**Femtosecond Photonics: Fundamental Phenomena and Advanced Devices**
Ippen, Erich; Haus, Herman; Fujimoto, James; Kaertner, Franz; Apr. 12, 2004; 52 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0084
Report No.(s): AD-A422217; AFRL-SR-AR-TR-04-0219; No Copyright; Avail: CASI; A04, Hardcopy

Ultrashort pulse laser technology is an active field of research that has had a powerful impact in many areas of science. Applications of ultrafast technology range from biomedical optical imaging such as optical coherence tomography (OCT), to high-speed communications, investigation of ultrafast nonlinear process in semiconductor materials and devices, optical frequency metrology, the design of optical clocks, and micro-machining.
DTIC
*Pulsed Lasers*

**20040059619** International Society for Optical Engineering, Bellingham, WA, USA
**Proceedings of Photon Processing in Microelectronics and Photonics II**
Pique, Alberto; Sugioka, Koji; Herman, Peter R.; Fieret, Jim; Jul. 18, 2003; 705 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0108
Report No.(s): AD-A422270; AFRL-SR-AR-TR-04-0216; No Copyright; Avail: CASI; A99, Hardcopy

Laser processing of materials, once largely curiosity driven, is now an established technology for micromachining, thin film synthesis, device packaging, rapid prototyping, and even nanoscale synthesis and processing of materials. The main driving force behind these developments is the seemingly limitless adaptability of lasers in providing unique material processing solutions, manufacturing of otherwise unattainable devices and structures, and the implementation of cost- effective solutions to complex manufacturing processes. The use of lasers for manufacturing microelectronic, optoelectronic, and MEMS devices is now becoming an established enabling technology; meanwhile, applications to nanotechnology are rapidly evolving. These proceedings on Photon Processing in Microelectronics and Photonics II consist of papers presented at three conferences: A. Laser Applications in Microelectronics and Optoelectronic Manufacturing VIII (LAMOM-VIII) B. Laser-Based Packaging in Microelectronics and Photonics II (LPMP-ll) C. Synthesis and Photonics of Nanoscale Materials (SPNM).
DTIC
*Conferences; Electro-Optics; Laser Applications; Microelectronics; Photonics; Photons*

**20040059788** Titan Corp., San Diego, CA, USA
**Fiber Laser Array**
Simpson, Thomas B.; Jan. 2004; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-01-C-0233; Proj-4866
Report No.(s): AD-A422225; D04-018; AFRL-DE-PS-TR-2004-1028; No Copyright; Avail: CASI; A05, Hardcopy

Experiments have been conducted to investigate the feasibility and scalability of coherent laser output from an array of fiber lasers with strong intracavity coupling flexible reconfigorable experimental apparatus has been modified and configured for these investigations. Measurements taken with this apparatus during this program showed that without polarization selection. the lasers were likely to exhibit spectra that showed the effects of polarization mode dispersion. .Arrays of 2-5 amplifer elements coupling using the 2 x 2 fiber couplers were constructed with emphasis on a unidirectional ring configuration. A theoretical prediction that for a range of pump powers more power can be coherently coupled not of an any than is available at all outputs of an incoherently coupled array was verified experimentally. A novel pulsating behavior was observed over a range of operating conditions for the two-element array. An extensive series of runs was made where the overall cavity length or the lengths of individual element paths were varied over a wide range. Stable output from a four-laser array could only be observed when there was significant length mismatch between the array elements. Spectral features related to the mismatch in cavity length for the only elements were identified. A transition in the spectral characteristics indicated that cross coupling between optical modes was the first significant nonlinear optical interaction in the array. There appears to be a complex interplay between the spectral.
DTIC
*Fiber Lasers; Laser Arrays; Nonlinear Systems; Optical Properties*

# 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*.

**20040058095** NASA Langley Research Center, Hampton, VA, USA
**Constitutive Modeling of Crosslinked Nanotube Materials**
Odegard, G. M.; Frankland, S. J. V.; Herzog, M. N.; Gates, T. S.; Fay, C. C.; [2004]; 13 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-762-55-LC
Report No.(s): AIAA Paper 2004-1606; No Copyright; Avail: CASI; A03, Hardcopy

A non-linear, continuum-based constitutive model is developed for carbon nanotube materials in which bundles of aligned carbon nanotubes have varying amounts of crosslinks between the nanotubes. The model accounts for the non-linear elastic constitutive behavior of the material in terms of strain, and is developed using a thermodynamic energy approach. The model is used to examine the effect of the crosslinking on the overall mechanical properties of variations of the crosslinked carbon nanotube material with varying degrees of crosslinking. It is shown that the presence of the crosslinks has significant effects on the mechanical properties of the carbon nanotube materials. An increase in the transverse shear properties is observed when the nanotubes are crosslinked. However, this increase is accompanied by a decrease in axial mechanical properties of the nanotube material upon crosslinking.
Author
*Carbon Nanotubes; Continuum Modeling; Crosslinking*

**20040058116** Smithsonian Astrophysical Observatory, Cambridge, MA, USA
**Test of the Equivalence Principle in an Einstein Elevator**
Shapiro, Irwin I.; Glashow, S.; Lorenzini, E. C.; Cosmo, M. L.; Cheimets, P. N.; Finkelstein, N.; Schneps, M.; April 2004; 84 pp.; In English
Contract(s)/Grant(s): NAG3-2881; No Copyright; Avail: CASI; A05, Hardcopy

The scientific goal of the experiment is to test the equality of gravitational and inertial mass (i.e., to test the Principle of Equivalence) by measuring the independence of the rate of fall of bodies from their compositions. The measurement is accomplished by measuring the relative displacement (or equivalently acceleration) of two falling bodies of different materials which are the proof masses of a differential accelerometer spinning about an horizontal axis to modulate a possible violation signal. A non-zero differential acceleration appearing at the signal frequency will indicate a violation of the Equivalence Principle. The goal of the experiment is to measure the Eotvos ratio og/g (differential acceleration/common acceleration) with a targeted accuracy that is about two orders of magnitude better than the state of the art (presently at several parts in 10(exp 13). The analyses carried out during this first grant year have focused on: (1) evaluation of possible shapes for the proof masses to meet the requirements on the higher-order mass moment disturbances generated by the falling capsule; (2) dynamics of the instrument package and differential acceleration measurement in the presence of errors and imperfections; (3) computation of the inertia characteristic of the instrument package that enable a separation of the signal from the dynamics-related noise; (4) a revised thermal analysis of the instrument package in light of the new conceptual design of the cryostat; (5) the development of a dynamic and control model of the capsule attached to the gondola and balloon to define the requirements for the leveling mechanism (6) a conceptual design of the leveling mechanism that keeps the capsule aligned before release from the balloon; and (7) a new conceptual design of the customized cryostat and a preliminary valuation of its cost. The project also involves an international cooperation with the Institute of Space Physics (IFSI) in Rome, Italy. The group at IFSI is in charge of prototyping the differential accelerometer and carrying out precursor laboratory measurements. During this grant year, our partners analyzed and then designed a new prototype of differential accelerometer that has several characteristics in common with the flight accelerometer at this point of the instrument development. The highlights of these activities are documented in a section of this report.
Derived from text
*Equivalence; Earth Gravitation; Mechanical Engineering; Einstein Equations; Numerical Analysis*

**20040059322** Naval Postgraduate School, Monterey, CA
**Processing of NiTi Reinforced Adaptive Solder for Electronic Packaging**
Wright, William L.; Mar. 2004; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422317; No Copyright; Avail: CASI; A04, Hardcopy

Solder joints provide both electrical and mechanical interconnections between a silicon chip and the packaging substrate in an electronic application. The thermomechanical cycling (TMC) in the solder due to the mismatch of the coefficient of thermal expansion (CTE) between the silicon chip and the substrate causes numerous reliability challenges. This situation is aggravated by the ongoing transition to lead-free solders worldwide, and the trend towards larger, hotter-running chips. Therefore, improved solder joints, with higher resistance to creep and low-cycle fatigue, are necessary for future generations of microelectronics. This study reports in the development a process to fabricate solder joints with a fine distribution of shape memory alloys (SMA) niTi particulates. The microstructure and interface zone of the as-reflowed solder- SMA composite has been characterized.
DTIC
*Binary Alloys; Electronic Packaging; Nickel Alloys; Soldered Joints; Solders; Titanium Alloys*

**20040059730** Oakland Univ., Rochester, MI, USA
**Bearing Friction Torque in Bolted Joints**
Nassar, Sayed A.; Barber, G. C.; Zuo, Dajun; Feb. 12, 2004; 17 pp.; In English
Contract(s)/Grant(s): DAAE07-03-C-L110
Report No.(s): AD-A421463; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, formulas are developed for the calculation of the effective radius of the bearing friction forces on the rotating contact surface in threaded fasteners. These formulas provide a more accurate estimation of the underhead bearing friction torque component in threaded fastener applications. This enhances the reliability, safety, and the quality of bolted assemblies, especially in critical applications. It is well known that the torque-tension correlation in threaded fasteners, and the resulting joint clamping force, is highly sensitive to friction torque components: under the turning head and between threads. This analysis focuses on the bearing friction torque component under the turning head of a threaded fastener. Further, it analyzes the error contained in the current practice when an approximate value, equal to the mean contact surface radius, is used instead of the actual bearing radius. The new formulas for the bearing friction radius are developed for a mathematical model of a bolted joint using four different scenarios of the contact pressure distribution under the rotating fastener head or nut. The effect of the radially varying sliding speed over the rotating contact surface is analyzed and compared with a constant friction coefficient scenario. Numerical results and error analysis are presented in terms of a single non-dimensional variable; namely, the radii ratio between the outside and the inside bearing area.
DTIC
*Bolted Joints; Friction; Torque*

## 38
## QUALITY ASSURANCE AND RELIABILITY

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

**20040062033** NASA Glenn Research Center, Cleveland, OH, USA
**Future Issues and Approaches to Health Monitoring and Failure Prevention for Oil-Free Gas Turbines**
DellaCorte, Christopher; April 2004; 18 pp.; In English; 58th Meeting of the Society for Machinery Failure Prevention Technology (MFPT), 26-30 Apr. 2004, Virginia Beach, VA, USA
Contract(s)/Grant(s): WBS 714-09-17
Report No.(s): NASA/TM-2004-213058; E-14447; No Copyright; Avail: CASI; A03, Hardcopy

Recent technology advances in foil air bearings, high temperature solid lubricants and computer based modeling has enabled the development of small Oil-Free gas turbines. These turbomachines are currently commercialized as small (<100 kW) microturbine generators and larger machines are being developed. Based upon these successes and the high potential payoffs offered by Oil-Free systems, NASA, industry, and other government entities are anticipating Oil-Free gas turbine propulsion systems to proliferate future markets. Since an Oil-Free engine has no oil system, traditional approaches to health monitoring and diagnostics, such as chip detection, oil analysis, and possibly vibration signature analyses (e.g., ball pass frequency) will be unavailable. As such, new approaches will need to be considered. These could include shaft orbit analyses, foil bearing temperature measurements, embedded wear sensors and start-up/coast down speed analysis. In addition, novel,

as yet undeveloped techniques may emerge based upon concurrent developments in MEMS technology. This paper introduces Oil-Free technology, reviews the current state of the art and potential for future turbomachinery applications and discusses possible approaches to health monitoring, diagnostics and failure prevention.
Author
*Systems Health Monitoring; Turbomachinery; Gas Turbines; Technology Assessment*

## 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*.

**20040058058** NASA Langley Research Center, Hampton, VA, USA
**Static Testing of an Inflatable/Rigidizable Hexapod Structure**
Berger, K. T.; Horta, L. G.; Taleghani, B. K.; April 02, 2004; 6 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 755-06-00
Report No.(s): AIAA Paper 2004-1801; No Copyright; Avail: CASI; A02, Hardcopy

Scientific application of large space antennas and telescopes is fostering the study of ultralightweight and inflatable structures. These so-called gossamer structures are tightly packaged for launch and subsequent deployment. Of particular interest is a hexapod configuration often found in vehicle ride simulators, ground-based telescopes, and antennas. One such configuration was modeled and tested at NASA Langley. Discrepancies between dynamic test data and predictions from a finite element model prompted additional static testing. This paper discusses static tests that were conducted to update stiffness parameters in the finite element model.
Author
*Inflatable Structures; Large Space Structures; Static Tests; Rigid Structures; Dynamic Structural Analysis; Mathematical Models*

**20040058113** NASA Dryden Flight Research Center, Edwards, CA, USA
**Debonding Stress Concentrations in a Pressurized Lobed Sandwich-Walled Generic Cryogenic Tank**
Ko, William L.; May 2004; 34 pp.; In English
Contract(s)/Grant(s): 090-50-00-SE-RR
Report No.(s): NASA/TP-2004-212849; H-2548; No Copyright; Avail: CASI; A03, Hardcopy

A finite-element stress analysis has been conducted on a lobed composite sandwich tank subjected to internal pressure and cryogenic cooling. The lobed geometry consists of two obtuse circular walls joined together with a common flat wall. Under internal pressure and cryogenic cooling, this type of lobed tank wall will experience open-mode (a process in which the honeycomb is stretched in the depth direction) and shear stress concentrations at the junctures where curved wall changes into flat wall (known as a curve-flat juncture). Open-mode and shear stress concentrations occur in the honeycomb core at the curve-flat junctures and could cause debonding failure. The levels of contributions from internal pressure and temperature loading to the open-mode and shear debonding failure are compared. The lobed fuel tank with honeycomb sandwich walls has been found to be a structurally unsound geometry because of very low debonding failure strengths. The debonding failure problem could be eliminated if the honeycomb core at the curve-flat juncture is replaced with a solid core.
Author
*Cryogenic Cooling; Debonding (Materials); Fuel Tanks; Honeycomb Structures; Sandwich Structures; Stress Concentration; Pressurizing; Walls*

**20040058115** Boeing Co., Mesa, AZ, USA
**Test and Analyses of a Composite Multi-Bay Fuselage Panel Under Uni-Axial Compression**
Li, Jian; Baker, Donald J.; March 10, 2004; 10 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): DAAH10-02-2-0002; 762-55-LE
Report No.(s): AIAA Paper 2004-2056; No Copyright; Avail: CASI; A02, Hardcopy

A composite panel containing three stringers and two frames cut from a vacuum-assisted resin transfer molded (VaRTM)

stitched fuselage article was tested under uni-axial compression loading. The stringers and frames divided the panel into six bays with two columns of three bays each along the compressive loading direction. The two frames were supported at the ends with pins to restrict the out-of-plane translation. The free edges of the panel were constrained by knife-edges. The panel was modeled with shell finite elements and analyzed with ABAQUS nonlinear solver. The nonlinear predictions were compared with the test results in out-of-plane displacements, back-to-back surface strains on stringer flanges and back-to-back surface strains at the centers of the skin-bays. The analysis predictions were in good agreement with the test data up to post-buckling. Author

*Fuselages; Panels; Composite Structures; Axial Compression Loads; Mathematical Models; Mechanical Properties*

## 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*.

**20040056088** Pittsburgh Univ., Pittsburgh, PA, USA

**Radar Backscatter Characteristics of Basaltic Flow Fields: Results for Mauna Ulu, Kilauea Volcano, Hawaii**

Byrnes, Jeffrey M.; Crown, David A.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This study is part of an ongoing field and remote sensing analysis of the development of basaltic flow fields on planetary surfaces. On Earth, basaltic flow fields are emplaced in a complicated sequence of interfingering and overlapping lava flows and tubes, resulting in composite surfaces of numerous flow units emplaced in different styles and at different times during flow field evolution. Previous analyses of the Mauna Ulu flow field (Kilauea Volcano, Hawaii) have related emplacement parameters, such as flow regime and surface crust spallation, to visible and thermal-wavelength characteristics. The objective of the current research is to relate radar backscatter characteristics to flow field surface characteristics to allow the distribution of different emplacement and modification processes to be mapped, analyzed, and used to constrain flow field evolution. Author

*Backscattering; Radar Scattering; Basalt; Lava; Volcanoes; Geomorphology*

**20040059792** Houston Univ., TX, USA

**Magnetic Investigations of Breccia Veins and Basement Rocks from Roter Kamm Crater and Surrounding Region, Namibia**

Rajmon, D.; Hall, S. A.; Reid, A. M.; Miller, R. McG.; Robertson, D. J.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Earlier investigation of (40)Ar/(39)Ar isotopic system of breccia veins and basement rocks from 3.7 +/- 0.3 m.y. old Roter Kamm crater revealed no influence of frictional heating on the veins and indicated that the highest temperatures both veins and basement rocks experienced as a result of the impact event were 230-290 C and were induced by shock heating. This investigation did not include samples unaffected by the impact, which could provide information whether all of the observed Ar loss from the crater samples is due to impact or some of it is a regional signature. Thus the established temperature range is an upper limit only. Selected field oriented samples of vein and host rock material were drilled and cut to obtain thin sections for petrographic description and cores 2.5 cm in diameter for magnetic analyses. Two cores for magnetic analyses were obtained from each sample. The sample RK115 containing 1-cm-wide breccia vein provided two cores of the host rock and two cores with the vein. One set of cores was subjected to a stepwise demagnetization by an alternating field (AF) with intensity within 0.5-100 mT. The other set of cores was thermally (TH) demagnetized within 50-650 C. The magnetic susceptibility (MS) was monitored throughout the thermal demagnetization experiment in order to check for any changes in mineral assemblage produced while heating. All cores were measured for anisotropy of magnetic susceptibility (AMS). AMS measurements were performed after the AF but before the TH demagnetizations.
Author

*Meteorite Craters; Breccia; Veins (Petrology); Magnetic Measurement; Demagnetization; Meteoritic Composition*

**20040059793** State Univ. of New York, Stony Brook, NY, USA

**Petrologic Complexities of the Manicouagan Melt Sheet: Implications for Ar-40 - Ar-39 Geochronology**

Winslow, F. D., III; Rasbury, E. T.; Hemming, S. R.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Manicouagan melt sheet is comprised of a coarsening upward sequence of three units (lower, middle and upper) that reflect its formation as a result of different stages of the crater formation process that involved the rapid melting of target rock, the turbulent mixing of xenocrysts with melt, and a relatively slow cooling rate. This process allowed for a complex intergrowth of xenocrysts and melt derived K-bearing phases of interest in geochronologic studies. Here we present the results of petrographic analysis of the Manicouagan melt sheet to illustrate the complex relationship between the K-bearing phases. We evaluate this in light of the implication for sampling for Ar-Ar geochronology.

Author

*Argon Isotopes; Geochronology; Impact Melts*

**20040059794** New Brunswick Univ., Fredericton, New Brunswick, Canada

**Late Paleocene Spherules from the North Sea: Probable Sea Floor Precipitates - A Silverpit Provenance Unproven**

Whitehead, J.; Jutson, D.; Grieve, R. A. F.; Spray, J. G.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Spherules 170 to 740 microns in diameter have been identified in drill cutting samples of Late Paleocene age from exploration and production wells drilled in the Danish sector of the North Sea. These spherule occurrences occur approximately 250 km to the NE of the Silverpit structure, which is an unconfirmed impact structure. The close proximity of the spherule-bearing layer with the Silverpit event, and their occurrence at a stratigraphic level contemporaneous with the Silverpit structure are not inconsistent with the spherules having been derived by ejection from Silverpit. Here we describe the spherules from one of these locations (Dan MFB-4b: Lat 55 deg 28 min 10.4 sec N, Long 5 deg 8 min 1.5 sec E), in order to test whether they may be impactogenic. A discovery of spherules comprising fusion glass or quench crystallisation features is important, as it would be the first external evidence that the unusual Silverpit structural depression was formed by impact.

Author

*Spherules; Precipitates; Impact Melts; Ocean Bottom*

**20040059888** State Univ. of New York, Plattsburgh, NY, USA

**Chemical and Mineralogical Size Segregation in the Impact Disruption of Anhydrous Stone Meteorites**

Flynn, G. J.; Durda, D. D.; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 2 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Interplanetary dust particles (IDPs), which are approx. 5 to 35 m in size, are enriched in carbon and the moderately volatile elements by factors of 2 to 4 over the CI meteorites, while the slightly larger polar micrometeorites, approx. 50 m to millimeters in size, have significant depletions in Ni and several moderately volatile elements (e.g., S and Se). To test the idea that this chemical difference might result from the response of an inhomogeneous target, consisting of strong olivine chondrules in a weak, porous matrix, to impact cratering or disruption, we performed impact experiments on seven different chondritic meteorites.

Derived from text

*Meteoritic Composition; Interplanetary Dust; Chondrule; Chondrites; Mineralogy; Cratering*

**20040059891** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Effusion Cell Measurements of the Vapor Pressure of Cobalt at Temperatures up to 2000K; Comparisons with Iron and Nickel**

Nuth, J. A.; Ferguson, F. T.; Johnson, N. M.; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 2 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It has become increasingly clear over the past decade that high temperature processes played important roles in the Primitive Solar Nebula. Unfortunately, basic data, such as the vapor pressures of Fe, Ni, Co or SiO have not been measured over the appropriate temperature range (near T approx. 2000K), but must be extrapolated from lower temperature

measurements often made more than 50 years ago. The extrapolation of the available data to higher temperatures can be quite complex (e.g., see [1] for SiO vapor pressures) and can depend on other factors such as the oxygen fugacity or the presence of hydrogen gas not accounted for in the original measurements. Moreover, modern technology has made possible more accurate measurements of such quantities over a wider temperature range. We have acquired a commercial Thermo-Cahn Thermogravimetric system capable of vacuum operation to 1700C and measurement of a 10g change in sample mass using up to a 100g sample, with microgram accuracy. With this new system we have initiated a series of basic vapor pressure measurements on simple metals such as Fe[2] and Ni[3] with the intention to extend such measurements to more complex systems once we gain sufficient experience.
Derived from text
*Cobalt; Nickel; Iron; Pressure Measurement; Vapor Pressure; High Temperature*

**20040062047** Witwatersrand Univ., Johannesburg, South Africa
**Geochemical Characteristics of Impactites from the Yaxcopoil-1 ICDP Drill Core, Chicxulub Impact Structure, Mexico**
Tuchscherer, M. G.; Reimold, W. U.; Koeberl, C.; Gibson, R. L.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045
Contract(s)/Grant(s): ACSPR-37299-AC-8; FWF Proj. Y58-GEO; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Current geochemical results, major and trace elements, are presented from the Yaxcopoil-1 impactites. Major element compositions indicate that the impactites represent variable carbonate and siliceous target rock mixtures from the Yucatan subsurface. Heterogeneity is observed on a subsample scale. Volatiles and trace element analyses indicate that the upper and lower units have been the most affected by high water to rock interactions.
Author
*Geochemistry; Impact Melts; Meteorite Craters*

**20040062048** Washington Univ., Seattle, WA, USA
**From Simple to Complex Craters: The Mechanics of Late-time Crater Adjustments**
Holsapple, K. A.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 1 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The primary remaining puzzle about impact cratering is how and why all large craters have a broad and shallow complex morphology, and all small ones have simple bowl shapes. Code and theoretical modelers believe that all craters go through a simple transient crater shape during their formation, but then readjust (collapse) during the latter stages of formation into the very broad and shallow complex shapes observed. It is commonly now accepted that the transformation is gravitationally driven. However, geologists study the very structured lithology of a terrestrial crater with, say, 100 km diameter, and have a tough time believing that it was ever in a transient excavation stage with a depth of many 10's of kilometers, only to reconstruct itself with nearly its original structure.
Author
*Cratering; Craters; Morphology; Geodynamics; Topography; Impact Damage*

**20040062051** NASA Johnson Space Center, Houston, TX, USA
**Potential of Radar Imaging and Sounding Methods in Mapping Heavily Eroded Impact Craters: Mapping Some Structural Elements of the Hico Crater, TX**
Heggy, E.; Horz, F.; Reid, A. M.; Hall, S. A.; Chan, C.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Shuttle Radar Topography Mission (SRTM) and Ground Penetrating Radar (GPR) data collected over an area north of the town of Hico, central Texas, have been used to map disturbances in the surface topography and subsurface stratigraphy. The Radar topography results confirm the presence of multiple rings suggestive of an impact crater. Correlation between the orbital SRTM and on-the-ground GPR field data are affected by different biases related to variations in terrain and vegetation cover. Nevertheless, the correspondence of the two data sets supports the earlier conclusions that a complex, multiple ring impact structure is reflected in the topography of this area. The SRTM data reveal three previously unrecognized rings; with the outermost ring some 5-6 km in diameter. The crater appears to be significantly larger than the size (2.5 km diameter) previously inferred on the basis of aerial images. In addition, the GPR data suggest the presence of subsurface faulting that

spatially coincides with the two inner rings of the crater. This suggests that the topographic rings are structurally controlled by faulting.
Author
*Imaging Radar; Meteorite Craters; Topography; Geological Faults; Ground Penetrating Radar*

**20040062052** Arizona Univ., Tucson, AZ, USA
**Impactites of the Haughton Impact Structure, Devon Island, Nunavut, Canada**
Osinski, G. R.; Spray, J. G.; Lee, P.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The presence, distribution and characteristics of impact melt rocks have provided valuable information on the cratering process. Coherent impact melt rocks are known from a number of well-studied impact sites such as the West Clearwater Lake, Manicouagan, and Mistastin structures in Canada. These lithologies often display classic igneous features and textures, and are easily recognizable as products of crystallization from a melt. It is widely accepted that coherent impact melt rocks only form in impact structures developed in predominantly crystalline or mixed crystalline sedimentary targets. In the latter case, the impact melt rocks and glasses are apparently derived entirely from the crystalline basement. In impact structures formed in predominantly sedimentary (principally carbonate-rich) target rocks, impact melt rocks have not generally been recognized. The resultant impactites have been referred to as lithic breccias, clastic matrix breccias, or fragmental breccias that are supposedly melt free. Indeed, it has been widely documented that the volume of impact melt rocks found in sedimentary targets is about two orders of magnitude less than for crystalline targets in comparably sized impact structures. This anomaly has been attributed to the generation and/or release of enormous quantities of sediment-derived volatiles (e.g., H2O, CO2, SOx), resulting in the wide dispersion of the shock-melted sedimentary rocks. However, Osinski and Spray have recently presented evidence from the Haughton impact structure that conflicts with previous models of the response of sedimentary rocks to hypervelocity impact. Combined field and analytical SEM studies reveal that the calcite, silicate glass, and anhydrite in the groundmass of crater-fill impactites at Haughton represent a series of impact-generated melts that were molten at the time of, and following, deposition. The purpose of this study is to extend earlier investigations of the groundmass of the crater-fill impactites at Haughton. New data on the modal abundance and composition of groundmass phases will be presented. Detailed field work has also revealed the presence of a series of additional impactite types, including previously unrecognized ejecta deposits, that provide insight into the processes and products of hypervelocity impact into sedimentary targets.
Author (revised)
*Impact Melts; Meteorite Craters; Earth Surface*

**20040062053** Imperial Coll. of Science, Technology and Medicine, London, UK
**Investigation of the Ries Impact Crater Based Upon Old and New Geophysical Data and Numerical Modeling**
Wuennemann, K.; Morgan, J. V.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The lack of consistency between similar-sized craters on Earth makes it difficult to define typical structural elements for a given size range. The fact that most terrestrial craters are not pristine might be one reason for the lack of similarities. Postimpact modifications like erosion and tectonic overprinting can prevent, in many cases, an accurate reconstruction of the original crater morphology. Another reason might be varying material properties at different impact sites. The composition of the upper crust on Earth is presumably more complex than on any other planetary body. We assume that this has an essential effect on the formation process and we suppose that it is at least partially responsible for the lack of structural similarity between similar-sized craters. In order to evaluate the size of terrestrial craters and to understand the formational process it is crucial to know whether a particular crater is a relatively typical example for its size range or whether the formation of the structure was heavily influenced by local target conditions. Considering the Ries crater as an example for middle-sized complex impact structures on Earth we use geophysical data to examine the structure underneath the crater. In order to investigate the influence of varying target compositions on the cratering process and the final crater morphology we utilize numerical modeling technique to simulate the formation process and to evaluate whether Ries was formed under normal conditions.
Author
*Meteorite Craters; Earth Surface*

**20040062166** Geological Survey of Japan, Tsukuba, Japan
**The Al-26-Mg-26 Chronology of a Type C CAI and POIs in Ningqiang Carbonaceous Chondrite**
Kita, N. T.; Lin, Y.; Kimura, M.; Morishita, Y.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As a part of systematic study of Ca, Al-rich inclusions (CAIs) in the Ningqiang carbonaceous chondrite (CC), we carried out the 26Al-26Mg isotopic measurements on a plagioclasepyroxene rich (type C) inclusion and plagioclaseolivine- rich (POI) inclusions. Previous mineralogical studies on various CAIs in Ningqiang indicated that precursor of type C and POI might be anorthitespinel- rich (ASI) inclusion and amoeboid olivine aggregates (AOA), respectively. Our main purpose is to give a time constraint of the melting events that formed type C and POIs.
Author
*Carbonaceous Chondrites; Mineralogy; Meteoritic Composition*

## 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*.

**20040058117** Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
**Band-Moment Compression of AVIRIS Hyperspectral Data and its Use in the Detection of Vegetation Stress**
Estep, L.; Davis, B.; August 28, 2001; 26 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-06-00030-SSC; No Copyright; Avail: CASI; A03, Hardcopy

A remote sensing campaign was conducted over a U.S. Department of Agriculture test farm at Shelton, Nebraska. An experimental field was set off in plots that were differentially treated with anhydrous ammonia. Four replicates of 0-kg/ha to 200-kg/ha plots, in 50-kg/ha increments, were set out in a random block design. Low-altitude (GSD of 3 m) Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) hyperspectral data were collected over the site in 224 bands. Simultaneously, ground data were collected to support the airborne imagery. In an effort to reduce data load while maintaining or enhancing algorithm performance for vegetation stress detection, band-moment compression and analysis was applied to the AVIRIS image cube. The results indicated that band-moment techniques compress the AVIRIS dataset significantly while retaining the capability of detecting environmentally induced vegetation stress.
Author
*Infrared Spectrometers; Remote Sensing; Vegetation; Airborne Equipment; Detection; Infrared Imagery; Stress Analysis*

**20040059315** Woods Hole Oceanographic Inst., MA
**Conceptual Models of the Climate 2003 Program of Study: Non-Newtonian Geophysical Fluid Dynamics**
Balmforth, NeiI J.; Hinch, John; Feb. 2004; 287 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0934; OCE 98-10647
Report No.(s): AD-A422300; WHOI-2004-03; No Copyright; Avail: CASI; A13, Hardcopy

Non-Newtonian fluids occur commonly in our world. These fluids, such as toothpaste, saliva, oils, mud and lava, exhibit a number of behaviors that are different from Newtonian fluids and have a number of additional material properties. In general, these differences arise because the fluid has a microstructure that influences the flow. In section 2 we will present a collection of some of the interesting phenomena arising from flow nonlinearities, the inhibition of stretching, elastic effects and normal stresses. In section 3 we will discuss a variety of devices for measuring material properties, a process known as rheometry.
DTIC
*Climate; Fluid Dynamics; Geophysics; Nonnewtonian Fluids*

**20040059606** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Visit to an Ocean Planet**
[1998]; In English; No Copyright; Avail: CASI; C01, CD-ROM; Available on CD-ROM only

'Visit to an Ocean Planet' is an interactive, educational CD-ROM that reveals the importance of our oceans to global climate and life. It is designed to complement middle and high school science curricula, as well as to be enjoyed by the general

public. The CD-ROM allows users to explore the Gulf of Mexico with satellite data, investigate the 1997-1998 El Nino, discover 'what's up' with Earth-orbiting satellites, and learn about the real life oceanographers. The curriculum background material are arranged in the context of widely accepted teaching themes. The CD-ROM also highlights results from the TOPEX/Poseidon satellite launched by NASA and the Centre National Etudes Spatiales (CNES). It has been measuring our oceans since 1992. This product is a result of NASA's commitment to involve the educational community in endeavors to inspire America's students, create learning opportunities, and enlighten inquisitive minds.
Author
*Topex; Poseidon Satellite; Scientific Satellites; Oceanography; Satellite Observation; Maritime Satellites*

**20040059748** Louisiana State Univ., Baton Rouge, LA, USA
**Paleofaunal and Environmental Research on Miocene Fossil Sites TVOR SE and TVOR S on Fort Polk, Louisiana, with Continued Survey, Collection, Processing, and Documentation of other Miocene Localities**
Schiebout, Judith A.; Ting, Suyin; Williams, Michael; Boardman, Grant; Gose, Wulf; Apr. 2004; 59 pp.; In English
Contract(s)/Grant(s): DACA63-00-D-006
Report No.(s): AD-A422018; FORT POLK MIOCENE-4; No Copyright; Avail: CASI; A04, Hardcopy

Focus of paleontological research on the Miocene of Fort Polk is currently the marine locality TVOR SE, which also has yielded large and small terrestrial Miocene vertebrates, and a single Cretaceous dinosaur tooth, reworked from older beds outside the local area. Other sites have continued to be productive. The two beautifully preserved tortoises from DISC have been identified as Hesperotudo. The first venomous snake from the Fort Polk Miocene is from TVOR. Sample sizes from screening have risen to levels which permit examination of variation. Copernys from Stonehenge form a single size cluster and the TVOR SE Copemys fall well within the range, so only one species can be recognized. New emphases of this phase of research has included more work on lower vertebrates, reevaluation of paleomagnetic dating with study of additional samples, production of short videos on the ancient animals, and a revision of the educational booklet for youngsters.
DTIC
*Fossils; Paleontology; Surveys; Vertebrates*

**20040059837** Duke Univ., Durham, NC, USA
**Desert Pavement Studies**
Haff, P. K.; Nov. 30, 2003; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0191
Report No.(s): AD-A422105; ARO-39218.8-EV; No Copyright; Avail: CASI; A03, Hardcopy

Combining plan view information from aerial photography showing details of stream channels on desert pavement surfaces with process-based erosion models, a high- resolution, 'synthetic topography' DEM (with resolution similar to that of the photograph) is constructed. This topographic information is used to route water to small channels (usually unresolved on standard topographic maps) on the pavement surface that support most of the vegetation. Estimates of water discharge in these channels are combined with field data to estimate quantitatively the response of vegetation to specified changes in infiltration, climate, or other causes of changes in runoff. A regional riparian response index is derived.
DTIC
*Deserts; Pavements; Topography*

**20040061987** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Autonomous Sciencecraft Experiment (ASE) Operations on EO-1 in 2004**
Davies, A. G.; Baker, V.; Castano, R.; Chien, S.; Cichy, B.; Doggett, T.; Dohm, J. M.; Greeley, R.; Lee, R.; Sherwood, R.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; 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 Autonomous Sciencecraft Experiment (ASE) has been selected for flight demonstration by NASAs New Millennium Program (NMP) as part of the Space Technology 6 (ST6) mission. NASA has identified the development of an autonomously operating spacecraft as a necessity for an expanded program of missions exploring the Solar System. The versatile ASE spacecraft command and control software, image formation software, and science processing software will be uploaded to the Earth Observer 1 (EO-1) spacecraft in early 2004 to detect surface modification related to volcanism, ice formation and retreat, and flooding.
Derived from text
*Autonomy; Aerospace Engineering; Earth Observing System (Eos); Classifiers; Thermal Emission*

**20040062182** Los Alamos National Lab., NM, USA
**Contributions from Hydrated States of MgSO4 to the Reservoir of Hydrogen at Equatorial Latitudes on Mars**
Feldman, W. C.; Mellon, M. T.; Maurice, S.; Prettyman, T. H.; Carey, J. W.; Vaniman, D. T.; Fialips, C. I.; Kargel, J. S.; Lawrence, D. J.; Tokar, R. L., et al.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Significant deposits of hydrogen have been observed within large areas near the equator of Mars. The molecular associations of this hydrogen are not known. Several possibilities have been suggested: 1) buried water ice, 2) water molecules adsorbed on the surfaces of soil grains, 3) structural OH and interlayer H2O in clays, 4) water associated with extra-framework cations in zeolites, and 5) structural OH and H2O in salt hydrates. In order to help sort through these possibilities we examine the stability of the various hydration states of MgSO4 because the typical mass percent of anhydrous MGSO4 is estimated to be about 10%, and MgSO4 has three stable hydration states; kieserite (MgSO4.1H2O), hexahydrite (MgSO4.6H2O) and epsomite (MgSO4.7H2O). Where these minerals are stable, the water mass fraction they contain would be about 1.5% for kieserite, 8.3% for hexahydrite, and 9.5% for epsomite, comparable to the abundances of hydrogen observed near the equator of Mars.
Author
*Mars Surface; Magnesium Sulfates; Hydrates; Abundance; Hydrogen*

## 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*.

**20040058995** Michigan Univ., Ann Arbor, MI
**Power Analyzer for Pocket Computing (PAPC)**
Mudge, Trevor; Kim, Nam S.; Ringenberg, Jeffrey; Kgil, Taeho; Jan. 2004; 58 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-00-C-1678; Proj-ARPI
Report No.(s): AD-A421586; AFRL-IF-WP-TR-2004-1505; No Copyright; Avail: CASI; A04, Hardcopy

Under this contract researchers at the Universities of Michigan and Colorado have developed an innovative and practical power evaluation tool, Power Analyzer, suitable for calculating power consumption for complete computer systems. Power Analyzer will be initially targeted to pocket computers where computing and communication place strong demands on the portable power supply.
DTIC
*Energy Consumption; Microcomputers; Portable Equipment*

**20040059068** Office of Naval Research, Arlington, VA
**Science and Technology Text Mining: Electric Power Sources**
Kostoff, Ronald N.; Tshiteya, Rene; Pfeil, Kirstin M.; Humenik, James A.; Karypis, George; Apr. 2004; 80 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421789; No Copyright; Avail: CASI; A05, Hardcopy

Database Tomography (DT) is a textual database analysis system consisting of two major components: 1) algorithms for extracting multi-word phrase frequencies and phrase proximities (physical closeness of the multi-word technical phrases) from any type of large textual database, to augment 2) interpretative capabilities of the expert human analyst. DT was used to derive technical intelligence from a Power Sources database derived from the Science Citation Index (SCI). Phrase frequency analysis by the technical domain experts provided the pervasive technical themes of the Power Sources database, and the phrase proximity analysis provided the relationships among the pervasive technical themes. Bibliometric analysis of the Power Sources literature supplemented the DT results with author/ journal/ institution/ country publication and citation data.
DTIC
*Data Bases; Information Retrieval; Research and Development; Technologies; Texts*

**20040059186** Eidgenoessische Technische Hochschule, Lausanne
**Development of a Flexible Molecular Photocell With Up to 20% Conversion Efficiency**
Thampl, K. R.; Graetzel, M. G.; Jan. 2004; 134 pp.; In English
Contract(s)/Grant(s): F61775-00-C0003
Report No.(s): AD-A422073; AFRL-ML-TY-TR-2004-4517; No Copyright; Avail: CASI; A07, Hardcopy

This document reports on the main activities and outputs originated under this research project over a period of 3 years. The program was targeted at first realizing a molecular photovoltaic cell based on a dye sensitized nanocrystalline semiconductor film employing a hole conductor, a conducting polymer or a polymer electrolyte reaching an AM 1. 5 solar-to electric conversion efficiency of at least 2.5 %, within the first 9 months itself. This milestone was achieved within 9 months by producing solid-state solar cells containing hole conductors, with 2.56% efficiency. Further, a new type of solar cell based on polymer electrolytes was also developed. A typical cell of this type showed 5.06% solar conversion efficiency. All efficiency figures were certified by NREL, USA. In the second and the third years the aims were to reach conversion efficiencies reaching 5 and 10% respectively and these targets have been achieved. Three annual progress meetings to review the progress of the project have been organized during the project duration.
DTIC
*Energy Conversion Efficiency; Photoelectric Cells; Solar Cells*

**20040059704** National Defense Univ., Washington, DC, USA
**'Oil for the Lamps of China' - Beijing's 21st- Century Search for Energy**
Cole, Bernard D.; Oct. 2003; 100 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421818; No Copyright; Avail: CASI; A05, Hardcopy

In l933, Alice Tisdale Hobart wife of the Standard Oil Company of New Jersey manager in Nanking, published Oil for the Lamps of China. Hobart had traveled widely in China and proved to be a very observant imperialist. Her fictional account of her experiences, not surprisingly focused on the role played by Western businessmen, especially those engaged in importing and selling petroleum products. One thread that runs through her work is Chinese dependence on foreign sources of energy supplies, which remains the case today. This dependence on foreign-controlled sources means that Beijing's efforts to ensure the availability of energy resources adequate to fuel the nation's economic growth have important national security implications.
DTIC
*China; Industries; Luminaires*

**20040059974** National Renewable Energy Lab., Golden, CO
**U.S. On-Grid Photovoltaic Capacity: A Baseline for the National Energy Modeling System**
Price, S.; Herig, C.; Goldstein, H. L.; Gillette, L.; Boedecker, E.; May 2002; 14 pp.; In English
Report No.(s): DE2004-15000426; NREL/CP-620-32104; No Copyright; Avail: Department of Energy Information Bridge

How much photovoltaics (PV) is installed in the USA. This basic question poses a data collection challenge, as PV systems are generally small and there is no systematic, nationwide reporting scheme for electric plants under 1 MW in size. This paper presents results and methods from an effort to arrive at an accurate estimate of grid-connected PV capacity and a database of installations underlying this number. Two main products resulted from these efforts, the first being a spreadsheet summarizing knowledge of PV capacity in the U.S. The second product, presented in this paper, is a database of PV installations, yielding a total on-grid capacity of 26.6 MW at the end of 2000. Compared to sources giving an upper bound of between 30 and 40 MW for cumulative on-grid PV capacity in the U.S. , 26.6 MW is still low, but this number is the largest to date that is based on a database of installations.
NTIS
*Photovoltaic Conversion; Capacity*

**20040062140** Oxford Univ., Oxford, UK
**Understanding Rock Breakdown on Earth and Mars: Geomorphological Concepts and Facet Mapping Methods**
Heslop, E. E. M.; Viles, H. A.; Bourke, M. C.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The big questions about boulders at Mars Lander sites are: What are their lithologies? What transport processes moved them to their present location? How have the boulders subsequently been modified in situ? There has been much interest in

how boulder morphology might be used to infer process regime histories, and thus contribute to understanding the forces that have shaped Martian geomorphology. Boulder morphologies are produced by rock breakdown, i.e. the action of a range of weathering, erosive and crusting processes, acting upon varied initial clast shapes and lithologies which have been transported and altered by a range of processes. Previous studies on Mars have proposed that aeolian abrasion, rock coating formation and a range of weathering processes may be operating now, or have operated in the past to produce the observed morphologies. Such studies are hampered by the difficulty of providing objective descriptions of boulder breakdown morphologies, and by the problem of clearly linking individual process to form. This paper addresses these problems. Firstly, we discuss how recent conceptual improvements in understanding rock breakdown on Earth might be applied to interpreting boulder morphologies on Mars. Secondly we consider how facet mapping methods, used successfully in the Northern Atacama Desert, might aid objective description and quantification of Mars boulder morphologies.
Author
*Rocks; Mars (Planet); Earth (Planet); Geomorphology; Mapping; Structural Properties (Geology)*

## 45
## ENVIRONMENT POLLUTION

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

**20040056097** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
**Indoor Carbon Dioxide Concentrations and Sick Building Syndrome Symptoms in the Base Study Revisited: Analyses of the 100 Building Dataset**
Eerdmann, C. A.; Steiner, K. C.; Apte, M. G.; 2003; 10 pp.; In English
Report No.(s): DE2004-820782; No Copyright; Avail: Department of Energy Information Bridge

In previously published analyses of the 41-building 1994-1996 USEPA Building Assessment Survey and Evaluation (BASE) dataset, higher workday time-averaged indoor minus outdoor CO2 concentrations (dCO2) were associated with increased prevalence of certain mucous membrane and lower respiratory sick building syndrome (SBS) symptoms, even at peak dCO2 concentrations below 1,000 ppm. For this paper, similar analyses were performed using the larger 100-building 1994-1998 BASE dataset. Multivariate logistic regression analyses quantified the associations between dCO2 and the SBS symptoms, adjusting for age, sex, smoking status, presence of carpet in workspace, thermal exposure, relative humidity, and a marker for entrained automobile exhaust. Adjusted dCO2 prevalence odds ratios for sore throat and wheeze were 1.17 and 1.20 per 100-ppm increase in dCO2 ($p < 0.05$), respectively. These new analyses generally support our prior findings. Regional differences in climate, building design, and operation may account for some of the differences observed in analyses of the two datasets.
NTIS
*Air Pollution; Environmental Quality*

**20040056100** National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
**Evaluation of Factors that Might Influence Exhaust Stack Performance to Prevent Carbon Monoxide Poisonings from Houseboat Generator Exhaust**
Hammond, D. R.; Earnest, G. S.; Hall, R. M.; Campbell, D.; Jan. 2004; In English
Report No.(s): PB2004-104083; No Copyright; Avail: National Technical Information Service (NTIS)

On August 4 through 7, 2003, National Institute for Occupational Safety and Health (NIOSH) researchers evaluated control of carbon monoxide (CO) emissions and exposures on houseboats at Lee's Ford Marina on Lake Cumberland, Kentucky. This work was conducted following a request from the Houseboat Industry Association (HIA) to more closely evaluate several additional parameters related to exhaust stack performance. These parameters included high temperature/high humidity environments, temperature inversions, generator loading, and houseboat trim angles. Evaluations involved 2 houseboats, each equipped with exhaust stack systems connected to gasoline-powered generators.
NTIS
*Carbon Monoxide; Exhaust Gases; Gas Generators; Boats*

**20040056114** National Inst. of Standards and Technology, Gaithersburg, MD, Nebraska Univ., Lincoln, NE, USA
**Simulations of Indoor Air Quality and Ventilation Impacts of Demand Controlled Ventilation in Commercial and Institutional Buildings**
Persily, A.; Musser, A.; Emmerich, S.; Taylor, M.; Aug. 2003; In English
Report No.(s): PB2004-104061; NISTIR-7042; No Copyright; Avail: National Technical Information Service (NTIS)

Carbon-dioxide (CO2) based demand controlled ventilation (DCV) offers the potential for more energy efficient building ventilation compared with constant ventilation rates based on design occupancy levels. A number of questions related to CO2-based DCV have been raised concerning the indoor air quality impacts, primarily with respect to contaminants with source strengths that are not dependent on the number of occupants. In addition, questions exist regarding potential energy efficiency benefits, optimal control strategies for different building types, and sensor performance and deployment. In order to obtain some insight into the issue of IAQ impacts of CO2-based DCV, a simulation study was performed in six commercial and institutional building spaces using the multizone airflow and IAQ model CONTAMW. These simulations compared seven different ventilation strategies, four of which used CO2 DCV. The simulations, performed for six U.S. cities, were used to compare ventilation rates, indoor CO2 levels, indoor concentrations of a generic voltage organic compound (VOC) as an indicator of non-occupant contaminant sources, and energy impacts. The results indicate that these impacts are dependent on the details of the spaces including occupancy patterns, design ventilation rate and ventilation system operating schedule, as well as the specific assumptions used in the analysis including contaminant source strengths and system-off infiltration rates.
NTIS
*Air Quality; Ventilators*

**20040056118** Swedish Defence Research Establishment, Stockholm, Sweden
**Quarterly Report on Measurements of Radionuclides in Ground Level Air in Sweden. Second Quarter 2003**
Soederstsroem, C.; Arntsing, R.; Jansson, P.; Lindh, K.; Vintersved, I.; Sep. 2003; 12 pp.; In English
Report No.(s): PB2004-104137; FOI-R-0918-SE; No Copyright; Avail: CASI; A03, Hardcopy

Filtering of ground level air is performed weekly at seven different locations in Sweden: Kiruna, Umea, Gavle, Ursvik, Grindsjon, Visby and Ljungbyhed. The filters are compressed and the contents of different radionuclides are measured by gamma spectroscopy. Precipitation is also collected at four of the stations: Kiruna, Gavle, Ursvik and Ljungbyhed, the samples are ashed and the contents of radionuclides measured. The levels of 7Be and 137Cs in air and deposition are presented for the different stations. Other anthropogenic radionuclides detected, if any, are also presented.
NTIS
*Radioactive Isotopes; Sweden; Air Pollution*

**20040056121** Swedish Defence Research Establishment, Stockholm, Sweden
**Xenon Air Activity Concentration Analysis from Coincidence Data**
Axelsson, A.; Ringbom, A.; Sep. 2003; 30 pp.; In English
Report No.(s): PB2004-104138; FOI-R-0913-SE; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: Introduction; Air concentration of xenon radioactivity; Formula for net numbers of counts in ROIs of interest; Formula for background-subtracted numbers of counts; Calculation of minimum detectable concentrations (MDCs); Example of the analysis procedure: 50 mBq/m3 133Xe atmospheric sample.
NTIS
*Xenon; Radiation Sources*

**20040057967** National Renewable Energy Lab., Golden, CO
**Applications and Benefits of Catalytic Converter Thermal Management**
Burch, S. D.; Keyser, M. A.; Colucci, C. P.; Potter, T. F.; Benson, D. K.; May 1996; 10 pp.; In English
Report No.(s): DE2004-266686; No Copyright; Avail: Department of Energy Information Bridge

A catalytic converter thermal management system (TMS) using variable-conductance vacuum insulation and phase-change thermal storage can maintain the converter temperature above its operating temperature for many hours, allowing most trips to begin with minimal 'cold-start' emissions. The latest converter TMS prototype was tested on a Ford Taurus (3.0 liter flex-fuel engine) at Southwest Research Institute. Following a 24-hour soak, the FTP-75 emissions were 0. 031, 0.13, and 0.066 g/mile for NMHC, CO, and NOX, respectively. Tests were also run using 85% ethanol (E85), resulting in values of 0.005, 0.124, and 0.044 g/mile, and 0.005 g/mile NMOG. Compared to the baseline FTP levels, these values represent reductions of 84% to 96% for NMHC, NMOG, and CO.
NTIS
*Thermal Analysis; Hydrocarbons*

**20040058954** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**A Simulation Study of the Effects of Operating Room Noise on the Performance of Anesthesia Providers**
Lembo, Heather A.; Oct. 1999; 68 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421433; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of this study was to add to the current research on the effects of noise and environmental stimuli on provider performance. The secondary purpose of the study was to determine whether using an anesthesia simulator is effective for studying the effects of environmental stimuli, such as noise, on performance. The study was designed using a test- retest format. The subjects were thirteen senior nurse anesthesia residents. Each student was given a scenario and asked to perform a standard induction sequence on the anesthesia simulator. The subjects performed an induction sequence in a quiet, controlled environment and were then asked to return to the simulator a week later to perform a similar scenario in a noisy environment. The average noise levels in the control scenario were 24.8db(A) and the average for the noisy scenario was 50.5 db(A). All scenarios were recorded and analyzed using Chi-Square statistical testing, with a significance level of $p<.05$. After all scenarios had been completed, the subjects subjectively evaluated the degree of realism that the simulator provided as well as their perceptions of noise in the operating room. Based on the data collected in this study, it could not be concluded that noise had either a positive or negative impact on the performance of anesthesia providers. This study did, however, demonstrate that the use of anesthesia patient simulators is a practical, educational method as performance was improved by repeat training on the simulator.
DTIC
*Anesthesia; Noise (Sound); Simulation*

**20040059699** Able Engineering Co., Inc., Washington, DC, USA
**Norfolk - Peninsula Area (ARMS-11)**
Guillou, R. B.; Jul. 10, 1963; 25 pp.; In English
Report No.(s): AD-A421790; No Copyright; Avail: CASI; A03, Hardcopy

An Aerial Radiological Measuring Survey (ARMS) of the Norfolk-Peninsula area was made for the Civil Effects Test Operations, Division of Biology and Medicine, U. S. Atomic Energy Commission, by Edgerton, Germeshausen & Grier, Inc., between Oct. 16 and 29, 1961. The survey was part of a nationwide program to measure present environmental levels of gamma radiation. Approximately 5000 traverse miles were flown, at an altitude of 500 ft above the ground, in the area, which consists of a 100-mile square centered south of mid way between Williamsburg and Norfolk, Va., and a small extension on the north to overlap the ARMS-I Fort Belvoir survey. The EG&G ARMS-II instrumentation was used in the survey. The data are presented in aeroradloactivity units, or areas with similar gamma radiation rates at 500 ft, at two map scales: (1) generalized at about 1:1,000,000 and (2) detailed at 1: 250,000. The aeroradloactivity in the area is less than 800 counts/sec except for four small areas in the northwest part of the area where it is less than 1200 counts/sec. In much of the area the radioactivity is less than 400 counts/sec. Aerial measurements of ground radioactivity in the ARMS-lI Norfolk- Peninsula area were everywhere consistent with what was expected, considering the geology of the area. Most of the area has a low radioactivity and the surficial materials are mostly sands and gravels, which are commonly weakly radioactive. The western part of the area is slightly more radioactive, which would be expected from the older sedimentary rocks of the coastal plain exposed there in valleys. Artificial radionuclides are probably present in only small quantities because the maximum background gamma radioactivity in many places is less than 200 counts/sec.
DTIC
*Gamma Rays; Nuclear Weapons; Peninsulas; Radioactivity*

**20040059955** National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
**NIOSH Health Hazard Evaluation Report: HETA No. 2003-0275-2926, U.S. Department of Interior, Denver, CO**
Lee, S. A.; Jan. 2004; 18 pp.; In English
Report No.(s): PB2004-104742; HETA-2003-0275-2926; No Copyright; Avail: CASI; A03, Hardcopy

This NIOSH Health Hazard Evaluation (HHE) was requested by management at Rocky Mountain National Park (RMNP) in north-central Colorado. It was conducted in July and September 2003, to evaluate exposure to respirable crystalline silica among trail builders who use rock drills.
NTIS
*Silicon Dioxide; Crystallinity*

**20040059956** National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
**NIOSH Health Hazard Evaluation Report: HETA No. 2000-0041-2796, OmniSource Corporation, Precious Metal Recycling Facility, Ft. Wayne, Indiana**
Gwin, K. K.; Nemhauser, J. B.; May 2000; 34 pp.; In English
Report No.(s): PB2004-104734; HETA-2000-0041-2796; No Copyright; Avail: CASI; A03, Hardcopy

On November 1, 1999, the National Institute for Occupational Safety and Health (NIOSH) received a management request from OmniSource Corporation to conduct a health hazard evaluation (HHE) to evaluate occupational exposure to silver at their companys precious metal recycling (PMR) facility in Ft. Wayne, Indiana. The request was prompted by concerns about one employee who had been diagnosed as having argyria, a blue-grey discoloration of the skin, mucous membranes, and/or eyes resulting from prolonged silver exposure. Management also expressed concern about worker exposure to the fixer solution from which the silver is recovered. A site visit, conducted on January 10-11, 2000, consisted of an environmental and medical component. The environmental evaluation included a full-shift personal breathing-zone (PBZ) air sample to assess worker exposure to silver and 26 other metals and minerals and full-shift area air sampling to assess exposure to 26 different metals and minerals, glutaraldehyde, hydroquinone, and hydrogen cyanide. Qualitative ventilation measurements were also performed to determine airflow patterns. The medical evaluation consisted of a record review, employee interviews to assess a medical and occupational history, and focused physical examinations of each of the three PMR facility employees.
NTIS
*Health; Safety; Environmental Surveys*

**20040059962** National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
**NIOSH Health Hazard Evaluation Report: HETA No. 2003-0229-2923, Ward Brodt Music Mall, Madison, Wisconsin**
Finley, M.; Tapp, L.; Feb. 2004; 28 pp.; In English
Report No.(s): PB2004-104755; HETA-2003-0029-2923; No Copyright; Avail: CASI; A03, Hardcopy

On October 18, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a confidential employee request for a health hazard evaluation (HHE) at Ward Brodt Music Mall in Madison, Wisconsin. The request centered on workers exposures to acids and solvents during musical instrument repair operations, the adequacy of the ventilation in the chemical room, and reported symptoms of sore throat, sinus headaches, congestion, asthma, persistent cough, allergies, sneezing, and watery eyes. On January 14, 2003, NIOSH investigators conducted an exposure assessment and interviewed repair shop workers. Between the time of the HHE request and the site visit, local exhaust ventilation was installed in the chemical room.
NTIS
*Health; Safety; Environmental Surveys*

**20040059964** National Inst. of Standards and Technology, Gaithersburg, MD, USA
**CONTAM 2.1 Supplemental User Guide and Program Documentation**
Walton, G. N.; Dols, W. S.; 2004; 110 pp.; In English
Report No.(s): PB2004-105176; NISTIR-7049; No Copyright; Avail: CASI; A06, Hardcopy

CONTAM is a general purpose, multi-zone (nodal) airflow and contaminant transport analysis tool that can be used to determine inter-zone pressure differences, airflow rates and contaminant transport in complex building structures. This tool was developed by the Building and Fire Research Laboratory of the National Institute of Standards and Technology (NIST) for the analysis of building ventilation systems and has evolved and adapted to accommodate a wide range of building engineering disciplines from indoor air quality analysis to smoke management system design. This report serves two purposes: as a supplement to the CONTAMW 2.0 User Manual with explanations of the most recent enhancements to the program and to document the program. The documentation addresses both the graphical user interface (referred to herein as ContamW) and the numerical solver (referred to herein as ContamX) of version 2.1 of the program, collectively referred to as CONTAM.
NTIS
*Management Systems; Air Flow; Air Quality*

**20040059971** Minnesota Pollution Control Agency, Saint Paul, MN, USA
**Options and Strategies for Reducing Mercury Releases. Report to the Advisory Council of the Minnesota Pollution Control Agency, Mercury Contamination Reduction Initiative**
Apr. 2000; 20 pp.; In English
Report No.(s): PB2004-105220; No Copyright; Avail: CASI; A03, Hardcopy

One is that, as presented, all of the cost of control could mistakenly be attributed to mercury removal. Many of these controls achieve reductions of other pollutants as well (e.g., acid gases, dioxin, other metals). In some cases (e.g., the emission guidelines for MWI (medical waste incinerators)), the choice of control technology or control strategy is aimed at reducing pollutants other than mercury. In these cases, there is a co-control benefit of mercury reduction. The benefits of reducing other pollutants should be considered when interpreting the mercury control costs. Second, the technologies available for mercury

control represent relatively new applications of these technologies. Thus, in the future, it is likely that as new or emerging technologies develop, the cost-effectiveness of control will improve. Air pollution control and prevention techniques are continuously under development and improvement. There is a fairly rapid pace of innovation in the air pollution control sector. The demand for cleaner products and cleaner processes that lower overall costs, combined with the necessity for improved air and water quality, create strong incentives for technological innovation and a growing market for such innovations.
NTIS
*Mercury (Metal); Waste Management; Contaminants; Air Pollution; Cost Effectiveness*

**20040059981** Lawrence Livermore National Lab., Livermore, CA
**Isotopic Tracing of Fuel Components in Particulate Emissions from Diesel Engines using Accelerator Mass Spectrometry (AMS)**
Buchholz, B. A.; Mueller, C. J.; Garbak, J.; Aug. 02, 2001; 14 pp.; In English
Report No.(s): DE2004-15005712; UCRL-ID-144771; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
*Isotopes; Diesel Fuels; Mass Spectroscopy; Exhaust Emission*

## 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*.

**20040055609** Geophysical Inst. of Israel, Holon
**Improvements in Monitoring the CTBT in the Middle East by the Israel Seismic Network**
Gitterman, Yefim; Pinsky, Vladimir; Shapira, Avi; Oct. 2003; 198 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DSWA01-97-C-0151; Proj-CD
Report No.(s): AD-A421509; DTRA-TR-01-35; No Copyright; Avail: CASI; A09, Hardcopy
The Israel Seismic Network (ISN), operated by the Geophysical Institute of Israel, is continuously monitoring the seismicity of the Middle East, and in that capacity provides crucial information to the International Monitoring System (IMS) for monitoring the Comprehensive Nuclear Test Ban Treaty (CTBT). This report presents reliable seismic information, primarily obtained by the ISN, that improves event detection, location, and discrimination in the Middle East. For the sake of IMS calibrations, more accurate information is now available for 61 earthquakes (GT2-GT5) and 26 explosions (GT0), including five controlled quarry blasts, three large-scale Dead Sea underwater calibration tests, and three India and Pakistan nuclear tests recorded by Israeli IMS stations. Several M(sub L)>4 earthquakes from Lebanon and Cyprus were used to characterize different propagation paths. The highlight of this project was the detonation of a 5-ton explosion in the Dead Sea that was used in the process of travel time calibration of IMS stations in the Middle East and farther. The experiment provided important information that characterizes the phenomenology of underwater explosions. The authors estimated the threshold magnitudes of detection by the ISN system for different seismic zones in the Middle East and evaluated the efficiency of the detection methods: Johnson STA/LTA, Murdock & Hutt, and the Statistically Optimal Detector. Improvements in location were provided by the development of a new automatic location method (Pinsky 2000), which is based on a combination of the optimal statistical time series analysis and robust statistical phase identification. Spectral semblance and ratio discriminants applied to the India and Pakistan nuclear test recordings showed good performance. The same methods proved reliable for identifying the Dead Sea calibration explosions and the controlled industrial blasts at the Arad phosphate quarry in the Negev desert. (44 tables, 111 figures, 76 re7
DTIC
*Earthquakes; Israel; Middle East; Nuclear Explosions; Underwater Explosions*

**20040058014** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Relationships Between Paterae, Mountains, and Hotspots on Io from a Global Database**
Radebaugh, J.; Jaeger, W. L.; Keszthelyi, L. P.; Turtle, E. P.; Milazzo, M. P.; Perry, J.; McEwen, A. S.; Lopes, R.; Davies, A. G.; Geissler, P.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
Now that the Galileo spacecraft s tour of the Jupiter system is over, we seek to integrate all available datasets in the hopes of understanding Io as completely as possible. We have compiled information about the morphologies and locations of paterae

(volcano-tectonic depressions), mountains, and hotspots on Io in a single database. It is our hope that an analysis of the spatial and temporal relationships between these features will provide more indications of the nature of the crust of Io and the mechanisms leading to these features formation. Since Io s tidal heat escapes through its crust, more knowledge about the crust will lead to an understanding of internal processes, such as magma generation and delivery to the surface, and magnitude and orientation of internal stresses.
Derived from text
*Io; Mountains; Volcanoes; Tectonics; Spatial Distribution; Crusts*

**20040058015** Minnesota Univ., Minneapolis, MN, USA
**The Effect of Large Melt Fraction on the Deformation Behavior of Peridotite: Implications for the Rheology of Io' Mantle**
Scott, T.; Kohlstedt, D. L.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013
Contract(s)/Grant(s): NAG5-10509; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One key constraint needed for refinement of the interior geochemical and geodynamic models of Io is the viscosity of the convecting partially- molten silicate mantle. To date, laboratory studies of partially molten mantle rocks have reached melt fractions up to approx.0.12, a value much smaller than thought to be appropriate for the asthenosphere of Io where the degree of partial melting may be 0.15 0.40 or higher. Therefore, we have performed a series of high temperature, triaxial compressive creep experiments on dry synthetic peridotites in a gas medium apparatus at a confining pressure of 300 MPa and temperatures from 1473 to 1573 K in order to understand the influence of large amounts of melt (0.15 < phi < 0.40) on the rheological behavior of partially molten rocks.
Derived from text
*Deformation; Io; Melting; Rheology; Peridotite; Creep Properties*

**20040058016** Texas Univ., Austin, TX, USA
**Matching Various Observations of Io with DSMC Modeling: Plume, Plume Shadow, Sodium Field Around Pele**
Zhang, J.; Goldstein, D. B.; Varghese, P. L.; Trafton, L.; Moore, C.; Miki, K.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Volcanic plumes on Jupiter's moon Io are modeled using the direct simulation Monte Carlo (DSMC) method. A parametric study on the 'effective' vent gas temperature and velocity is performed to constrain the gas properties at the vent by observables, particularly the plume height and the surrounding condensation deposition ring radius. Also, the flow of refractory 1 nm - 1 micron particulates entrained in the gas is modeled with 'overlay' techniques which assume that the background gas flow is not altered by the particulates. The column density along the tangential line-of-sight and the shadow cast by the plume are calculated and compared with Voyager and Galileo images. The possible ejection of sodium from a vent into the circumplanetary region is examined.
Derived from text
*Io; Plumes; Sodium; Volcanoes; Gas Temperature; Vents; Computerized Simulation*

**20040058018** Arizona Univ., Tucson, AZ, USA
**Lithospheric Recycling on Io: The Role of Delamination**
Jaeger, W. L.; Keszthelyi, L. P.; Turtle, E. P.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Jupiter's moon Io is both volcanically and tectonically active, but it does not appear to recycle its lithosphere by plate tectonics. Instead, Io seems to displace lithospheric material primarily vertically rather than horizontally. Igneous processes remove magma from the interior of Io and add it to the lithosphere either as surface flows or as intrusive bodies. This transfer of material from Io s interior to its exterior drives lithospheric subsidence and, in doing so, causes a net compression of the lithosphere. The mechanics of subsidence, coupled with the associated thermal stress, is thought to drive the uplift of many ionian mountains via reverse faulting [1, 2]. If lithospheric volume is conserved, the amount of material added to the lithosphere by igneous processes must be equivalent to the amount that is destroyed. High eruptive temperatures derived from NIMS and SSI data suggest mafic to ultramafic volcanism on Io [e.g., 3, 4], and global similarities in the SSI spectra of

recently emplaced lava flows indicate that lava compositions are broadly uniform [5]. These data suggest that Io does not have a chemically evolved lithosphere [6]; therefore, it seems inevitable that lithospheric recycling must involve a wholesale reincorporation of material into the asthenosphere. This study attempts to better understand the mechanism(s) by which Io recycles its lithosphere and to place new constraints on lithospheric thickness.
Derived from text
*Io; Lithosphere; Delaminating; High Temperature; Volcanoes; Tectonics*

**20040058019** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Lava Lakes on Io: New Perspectives from Modeling**
Gregg, Tracy K. P.; Lopes, Rosaly M.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ionian paterae are a class of volcanic feature that are characterized by irregular craters with steep walls, flat floors, and arcuate margins that may or may not exhibit nesting. Loki (310 W, 12 N) is Io's largest patera at approx.200 km in diameter (Figure 1), and may account for 15% of Io's total heat flow. Earth-based infrared data, as well as information collected using the Galileo Near-Infrared Mapping Spectrometer (NIMS) and the Photopolarimeter Radiometer (PPR) have been used to interpret Loki s eruption style. Debate continues over whether Loki s occasional (periodic or not) temperature increases are due to an overturning lava lake within the patera, or to an eruption of surface flows on the patera floor. Interpretation of model results and comparisons with active terrestrial lava lakes suggest that Loki behaves quite differently from active lava lakes on Earth, and that surface flows (rather than an overturning lava lake) are a more likely explanation of Loki's thermal brightening.
Derived from text
*Lakes; Lava; Io; Volcanoes; Calderas; Craters; Heat Transmission*

**20040058020** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Global Distribution of Active Volcanism on Io as Known at the End of the Galileo Mission**
Lopes, Rosaly M. C.; Kamp. Lucas W.; Smythe, W. D.; Radebaugh, J.; Turtle, E.; Perry, J.; Bruno, B.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hot spots are manifestations of Io s mechanism of internal heating and heat transfer. Therefore, the global distribution of hot spots and their power output has important implications for how Io is losing heat. The end of the Galileo mission is an opportune time to revisit studies of the distribution of hot spots on Io, and to investigate the distribution of their power output.
Derived from text
*Galileo Project; Heat Transfer; Io; Volcanoes*

**20040058021** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**'Active' and 'Passive' Lava Resurfacing Processes on Io: A Comparative Study of Loki Patera and Prometheus**
Davies, A. G.; Matson, D. L.; Leone, G.; Wilson, L.; Keszthelyi, L. P.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Studies of Galileo Near Infrared Mapping Spectrometer (NIMS) data and ground based data of volcanism at Prometheus and Loki Patera on Io reveal very different mechanisms of lava emplacement at these two volcanoes. Data analyses show that the periodic nature of Loki Patera s volcanism from 1990 to 2001 is strong evidence that Loki s resurfacing over this period resulted from the foundering of a crust on a lava lake. This process is designated passive , as there is no reliance on sub-surface processes: the foundering of the crust is inevitable. Prometheus, on the other hand, displays an episodicity in its activity which we designate active . Like Kilauea, a close analog, Prometheus s effusive volcanism is dominated by pulses of magma through the nearsurface plumbing system. Each system affords views of lava resurfacing processes through modelling.
Derived from text
*Lava; Infrared Imagery; Crusts; Volcanoes; Galileo Spacecraft; Near Infrared Radiation; Io*

**20040058022** Arizona Univ., Tucson, AZ, USA
**Building Mountains on Io: Implications for Io's Lithosphere**
Turtle, E. P.; Jaeger, W. L.; Mulazzo, M.; Keszthelyi, L. P.; McEwen, A. S.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Io's mountains are intimately linked to its lithospheric processes and properties, and therefore provide insight into its interior. The mountains' heights, up to 17.5 3 km, imply that they have a significant silicate component. However, Io's numerous plumes must deposit extensive layers of volatile-rich material resulting in weak zones that facilitate massive landslides as may have happened at Euboea Mons and Gish Bar Mons. Many mountains appear to be collapsing outwards by means of slumping and landsliding. Indeed, in some places (e.g., Telegonus Mensae) both styles of mass wasting occur within a few kilometers of each other, perhaps indicating a spatial variation in material properties or composition. The impressive heights of Io's mountains also require a lithospheric thickness of at least a few tens of kilometers, not only to provide support but also to provide sufficient building material. O'Reilly and Davies demonstrated that a high subsidence rate makes localized advective heat transfer so effective that the lithosphere can be arbitrarily thick despite Io's high heat flow.
Derived from text
*Heat Transfer; Io; Mountains; Lithosphere; Spatial Distribution; Heat Transmission*

**20040058023** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Volcanic Activity at Tvashtar Catena, Io**
Milazzo, M. P.; Keszthelyi, L. P.; Radebaugh, J.; Davies, A. G.; McEwen, A. S.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Tvashtar Catena (63 N, 120 W) is one of the most interesting features on Io. This chain of large paterae (caldera-like depressions) has exhibited highly variable volcanic activity in a series of observations. Tvashtar is the type example of a style of volcanism seen only at high latitudes, with short-lived Pele-type plumes and short-lived by intense thermal events. Evidence for a hot spot at Tvashtar was first detected in an eclipse observation in April 1997 (orbit G7) by the Solid State Imager (SSI) on the Galileo Spacecraft. Tvashtar was originally targeted for observation at higher resolution in the close flyby in November 1999 (I25) because of its interesting large-scale topography. There are relatively few but generally larger paterae at high latitudes on Io. I25 images revealed a 25 km long, 1-2 km high lava curtain via a pattern of saturation and bleeding in the CCD image, which requires very high temperatures.
Derived from text
*Io; Volcanoes; Lava; Topography; Flyby Missions; Galileo Spacecraft; Charge Coupled Devices; Calderas*

**20040058024** Lunar and Planetary Inst., Houston, TX, USA
**A Deep Lava Channel on Io**
Schenk, P. M.; Williams, D. A.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lava channels are an important aspect of effusive volcanism on any planet, and Io should be no exception. Due to mechanical failure, Galileo's imaging coverage of Io was severely limited and few lava channels were observed at high resolution or even identified. We have identified a lava channel on Io in images acquired during Galileo orbit I25 and obtained at low sun, allowing us to characterize its morphology in unprecedented detail.
Derived from text
*Galileo Spacecraft; Io; Lava; Volcanology; Imaging Techniques*

**20040058025** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Characterization of Activity at Loki from Galileo and Ground-based Observations**
Howell, R. R.; Lopes, R. M.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013
Contract(s)/Grant(s): NAG5-11730; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

While Loki is the most active volcanic center on Io, major questions remain concerning the nature of that activity. Rathbun et al. showed that the activity was semi-periodic, and suggested it was due to a resurfacing wave which swept across a lava lake as the crust cooled and become unstable. However in 2001 new observations showed that an intermediate level, less periodic mode of activity had apparently begun. Galileo-NIMS observations of Loki clearly show that the highest temperatures are found near the edge of the patera, consistent with disruption of a lava lake at the margins. NIMS observations also show gradients in temperature across the patera which, when modeled in terms of lava cooling models, are generally consistent with ages expected for the resurfacing wave but may also be consistent with spreading flows. We present a further analysis of NIMS

data from I24 and I32 which help define the nature of the temperature variations present in Loki patera, along with Galileo-SSI images from the G1-I32 flybys which show albedo changes apparently correlated with the 'periodic' activity measured from ground-based observations.
Derived from text
*Galileo Spacecraft; Volcanoes; Io; Atmospheric Temperature; Volcanology*

**20040058029** NASA Johnson Space Center, Houston, TX, USA
**A First Look at the Mineralogy and Geochemistry of the MER-B Landing Site in Meridiani Planum**
Morris, Richard V.; Squyres, S.; Arvidson, R. E.; Bell, J. F., III; Christensen, P. C.; Gorevan, S.; Herkenhoff, K.; Klingelhoefer, G.; Rieder, R.; Farrand, W., et al.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The second MER rover (Opportunity) landed on Meridiani Planum on January 24, 2004 inside a shallow crater. The science rational for the selection of the landing site centered on detection of the mineral hematite from martian orbit by the Mars Global Surveyor Thermal Emission Spectrometer (MGS-TES) [1,2]. Other smaller occurrences of hematite are in Aram Chaos and several isolated spots in Valles Marineris. Proposed formation pathways for martian hematite include both aqueous (e.g., low temperature precipitation of Fe oxides/oxyhydroxides in a lacustrine environment, laterite-style weathering, and precipitation from fluids having a hydrothermal origin) and dry (e.g., oxidation of magnetite rich ash) processes [e.g., 1,2,3]. The crystallographic c-face of martian hematite must be exaggerated to account for the thermal emissions spectra and it must be gray in color so as to account for the absence of the characteristic spectral signature of red hematite at visible wavelengths
Derived from text
*Mineralogy; Geochemistry; Landing Sites; Hematite; Craters*

**20040058031** Washington Univ., Saint Louis, MO, USA
**Geology of Meridiani Planum as Inferred from Mars Exploration Rover Observations**
Arvidson, R. E.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; 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 Exploration Rover, Opportunity, landed in a 22 m wide by 3 m deep crater in Meridiani Planum on January 25, 2004 (UTC). The landing site is located within the plains that show significant quantities of hematite based on mineral retrievals from MGS TES data. Further, analysis of MOC and MOLA data that show the hematite-bearing plains are the top stratum of a 200 to 300 m section of layered rocks that are draped disconformably onto the dissected Noachian cratered terrain. In this abstract we discuss initial observations and findings from Opportunity and formulate tests of hypotheses that focus on the origin and evolution of the plains materials and implications for the role of water.
Derived from text
*Mars Exploration; Geology; Craters; Landing Sites; Mars Surface; Hematite*

**20040058032** Cornell Univ., Ithaca, NY, USA
**Initial Results from the MER Athena Science Investigation at Gusev Crater and Meridiani Planum**
Squyres, S. W.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; 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 on January 4 (UTC), 2004. It was followed 21 days later by the rover Opportunity, which landed on Meridiani Planum. Each rover carries a copy of the Athena science payload. The topography, morphology, and mineralogy of the scene around each rover are revealed by two remote sensing instruments called Pancam and Mini-TES. Pancam is a stereo camera whose filters provide 14 color spectral bandpasses over the spectral region from 0.4 to 1.1 mm. Pancam's angular resolution is 0.28 mrad/pixel. Mini-TES produces high spectral resolution (10/cm) infrared image cubes with a wavelength range of 5-29 mm and angular resolution modes of 20 and 8 mrad.
Derived from text
*Craters; Topography; Morphology; Payloads; Mars Exploration; Mineralogy; Infrared Imagery*

**20040058033** Tennessee Univ., Knoxville, TN, USA

**Preliminary Mineralogy and Geochemistry Results at the MER-A Landing Site in Gusev**

McSween, H.; Arvidson, R.; Bandfield, J.; Bell, J.; Blaney, D.; Calvin, W.; Christensen, P.; Clark, B.; Crisp, J.; Economou, T., et al.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

MER-A (Spirit) landed within Gusev Crater, hypothesized to have been a site of intermittent fluvial and possibly lacustrine sedimentation. A key to documenting aqueous processes is the mineralogical and chemical compositions of sedimentary deposits. Data bearing on the mineralogy and geochemistry of rocks and soils at the landing site have been limited so far, in part because of flash memory problems that restricted rover operations for many sols. The Spirit landing site is situated within the low albedo thermophysical unit mapped by (low albedo smooth unit of), the thermal inertia of which is consistent with sand-sized particles. MOC images of this unit show numerous dark (possibly dust devil) tracks and some blanketing materials. The ephemeral nature of this unit suggests that it is a deflation surface of the Plains surface unit (Gusev Crater Formation Member), a flat, high-albedo unit that dominates western Gusev and is distinguished by craters with hot ejecta in nighttime THEMIS imagery. Rocks: The site is littered with angular, Significantly, all of the rocks that have been imaged by Mini-TES at the Gusev landing site appear to be spectrally similar, although a few white rocks seen in Pancam images might be different. However, detailed Pancam observations suggest that the white rocks are actually dark rocks mantled with high albedo dust and/or a cemented coating or weathering rind. To date, the only dark rock studied in any detail is Adirondack, a possibly faceted (ventifact?) rock that is partly coated by high albedo material. Pancam images indicate that the coating is more pervasive toward the base of the rock. Adirondack Mini-TES spectra do not show the scattering at short thermal infrared wavelengths that is characteristic of fine particulates, so the coating is either coherent (an alteration rind or a cemented coating), or else a thin (<5-10 microns thick) veneer of unconsolidated dust. This conclusion is supported by Mini-TES thermal mapping which shows that rock temperature variations do not correlate with coating thickness.
Derived from text

*Landing Sites; Mineralogy; Geochemistry; Sediments; Deposits; Chemical Composition; Particulates*

**20040058040** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Mini-TES Observations of the Gusev and Meridiani Landing Sites**

Christensen, Philip; Arvidson, Raymond; Bandfield, Joshua L.; Blaney, Diana; Budney, Charles; Calvin, Wendy; Ciccolella, Sandra; Fallacro, Alicia; Fergason, Robin; Glotch, Timothy, et al.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Miniature Thermal Emission Spectrometer (Mini-TES) has provided remote measurements of the mineralogy and thermophysical properties of the scene surrounding the Mars Exploration Rovers. The specific scientific objectives of this investigation are to: (1) determine the mineralogy of rocks and soils; (2) determine the thermophysical properties of surface materials; and (3) determine the temperature profile, dust and water-ice opacity, and water vapor abundance in the lower atmospheric boundary layer.
Derived from text

*Roving Vehicles; Thermophysical Properties; Surface Properties; Mineralogy; Miniaturization; Spectrometers; Rocks; Soils*

**20040058074** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe**

Kyte, F. T.; Koeberl, C.; March 19, 2004; In English; See also 20040058075 - 20040058086
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

This document discusses the following topics: Zircon as a Shock Indicator in Impactites of Drill Core Yaxcopoil-1, Chicxulub Impact Structure, Mexico; Experimental Investigation of Shock Effects in a Metapelitic Granulite; Experimental Reproduction of Shock Veins in Single-Crystal Minerals; Post-Shock Crystal-Plastic Processes in Quartz from Crystalline Target Rocks of the Charlevoix Impact Structure; Shock Reequilibration of Fluid Inclusions; How Does Tektite Glass Lose Its Water?; Assessing the Role of Anhydrite in the KT Mass Extinction: Hints from Shock-loading Experiments; A Mineralogical and Geochemical Study of the Nonmarine Permian/Triassic Boundary in the Southern Karoo Basin, South Africa; Extraterrestrial Chromium in the Permian-Triassic Boundary at Graphite Peak, Antarctica; Magnetic Fe,Si,Al-rich Impact Spherules from the P-T Boundary Layer at Graphite Peak, Antarctica; A Newly Recognized Late Archean Impact Spherule Layer in the Reivilo Formation, Griqualand West Basin, South Africa; Initial Cr-Isotopic and Iridium Measurements

of Concentrates from Late Eocene Cpx-Spherule Deposits; An Ordinary Chondrite Impactor Composition for the Bosumtwi Impact Structure, Ghana, West Africa: Discussion of Siderophile Element Contents and Os and Cr Isotope Data.
Derived from text
*Impact Melts; Mineralogy; Boundary Layers; Single Crystals; Spherules; Impactors; Chondrites*

**20040058075** New Brunswick Univ., Fredericton, New Brunswick, Canada
**Post-Shock Crystal-Plastic Processes in Quartz from Crystalline Target Rocks of the Charlevoix Impact Structure**
Trepmann, Claudia A.; Spray, John G.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; 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 extraordinary stress and temperature conditions, that prevail in target rocks during and after hypervelocity impact, change abruptly, causing complex and dynamic effects. The activated deformation mechanisms can result in specific microstructures, which may provide crucial information on the rheological behaviour of the rocks. The microfabric of shocked quartz from crystalline target rocks of the Charlevoix impact structure has been investigated by optical microscopy, scanning electron microscopy, combined with electron backscatter (EBSD) techniques, cathodoluminescence (CL) microscopy and transmission electron microscopy (TEM).
Derived from text
*Hypervelocity Impact; Rocks; Deformation; Microstructure; Rheology; Crystallinity; Quartz*

**20040058076** NASA Johnson Space Center, Houston, TX, USA
**Shock Re-equilibration of Fluid Inclusions**
Madden, M. E. Elwood; Horz, F.; Bodnar, R. J.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; Original contains color illustrations
Contract(s)/Grant(s): NSF EAR-0125918; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Fluid inclusions (microscopic volumes of fluid trapped within minerals as they precipitate) are extremely common in terrestrial minerals formed under a wide range of geological conditions from surface evaporite deposits to kimberlite pipes. While fluid inclusions in terrestrial rocks are nearly ubiquitous, only a few fluid inclusion-bearing meteorites have been documented. The scarcity of fluid inclusions in meteoritic materials may be a result of (a) the absence of fluids when the mineral was formed on the meteorite parent body or (b) the destruction of fluid inclusions originally contained in meteoritic materials by subsequent shock metamorphism. However, the effects of impact events on pre-existing fluid inclusions trapped in target and projectile rocks has received little study. Fluid inclusions trapped prior to the shock event may be altered (re-equilibrated) or destroyed due to the high pressures, temperatures, and strain rates associated with impact events. By examining the effects of shock deformation on fluid inclusion properties and textures we may be able to better constrain the pressure-temperature path experienced by terrestrial and meteoritic shocked materials and also gain a clearer understanding of why fluid inclusions are rarely found in meteorite samples.
Derived from text
*Inclusions; Sedimentary Rocks; Mineral Deposits; Meteorites; Metamorphism (Geology)*

**20040058077** California Univ., Los Angeles, CA, USA
**Initial Cr-Isotopic and Iridium Measurements of Concentrates from Late Eocene Cpx-Spherule Deposits**
Kyte, Frank T.; Shukolyukov, Alex; Hildebrand, Alan R.; Lugmair, Guenter W.; Hanova, Jana; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this study we attempt to constrain the provenance of the late Eocene impactor that produced global ejecta containing clinopyroxene-bearing (cpx) spherules. The late Eocene (approx.35 Ma) was a time of multiple impacts. At least two spherule layers are in deep sea sediments: North American (NA) microtektites and the slightly older cpx spherules. The two largest impact structures in the Cenozoic, the 100 km Popigai structure and the 45 km Chesapeake Bay structure formed at this time. NA microtektites have a regional distribution - restricted to an area extending from the western N. Atlantic to the Caribbean Sea. They are not associated with anomalous PGEs, and their Nd and Sr isotopic compositions are consistent with derivation from Chesapeake Bay. The cpx-spherule strewnfield was extended from numerous low-latitude sites to the sub Antarctic, where cpx and glassy spherules were found with an Ir anomaly in ODP Hole 689B. This implies that the cpx-spherule layer is global in extent. Glassy spherules in 689B are isotopically similar to cpx-spherules, and not NA microtektites. Their isotopic

abundances are consistent with Popigai as the source crater. Ir anomalies have been reported at 17 cpx-spherule localities and the average Ir fluence at these sites is approx. 11 ng Ir/sq cm. By comparison, the average for the K/T boundary is approx. 55 ng Ir/sq cm.
Derived from text
*Iridium; Spherules; Deposits; Isotopes*

**20040058078** Scripps Institution of Oceanography, La Jolla, CA, USA
**An Ordinary Chondrite Impactor Composition for the Bosumtwi Impact Structure, Ghana, West Africa: Discussion of Siderophile Element Contents and Os and Cr Isotope Data**
Koeberl, Christian; Shukolyukov, Alex; Lugmair, Guenter; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Osmium isotope data had shown that Ivory Coast tektites contain an extraterrestrial component, but do not allow distinction between chondritic and iron meteorite contamination. PGE abundances of Ivory Coast tektites and impactites and target rocks from the Bosumtwi crater, the source crater of the Ivory Coast tektites, were all relatively high and did not allow to resolve the presence, or identify the nature, of the meteoritic component. However, Cr isotope analyses of an Ivory Coast tektite yielded a distinct 53Cr excess of 0.30+/-0.06, which indicates that the Bosumtwi impactor was an ordinary chondrite.
Author
*Chondrites; Impactors; Osmium Isotopes; Contamination; Tektites; Iron Meteorites*

**20040058079** Witwatersrand Univ., Johannesburg, South Africa
**Experimental Investigation of Shock Effects in a Metapelitic Granulite**
Ogilvie, P.; Gibson, R. L.; Reimold, W. U.; Deutch, A.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Shock experiments were performed on a high-grade, migmatitic, garnetcordierite metapelite from the Etive aureole, Scotland, to (1) characterise shock effects in a complex polymineralic rock with a significant proportion of hydrous ferromagnesian minerals, both as a function of variable shock pressure and pre-shock temperature, and (2) explore the effects of shock impedance contrast between component minerals on the distribution of these features. Shock experiments were performed at 12, 25, 30 and 60 GPa at 25 C, and at 25 GPa at 400 C. Observations will be central to the characterisation of shock and post-shock metamorphic effects in the Steynskraal metapelites from the Vredefort dome, South Africa.
Derived from text
*Petrology; Metamorphism (Geology); Minerals; Rocks; Temperature Effects*

**20040058080** NASA Johnson Space Center, Houston, TX, USA
**Assessing the Role of Anhydrite in the KT Mass Extinction: Hints from Shock-loading Experiments**
Skala, R.; Lnagenhorst, F.; Hoerz, F.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; 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

Various killing mechanisms have been suggested to contribute to the mass extinctions at the KT boundary, including severe, global deterioration of the atmosphere and hydrosphere due to SO(x) released from heavily shocked, sulfate-bearing target rocks. The devolatilization of anhydrite is predominantly inferred from thermodynamic considerations and lacks experimental confirmation. To date, the experimentally determined shock behavior of anhydrite is limited to solid-state effects employing X-ray diffraction methods. The present report employs additional methods to characterize experimentally shocked anhydrite.
Derived from text
*Extinction; Anhydrides; Sulfates; Earth Hydrosphere; Deterioration*

**20040058081** Witwatersrand Univ., Johannesburg, South Africa
**A Mineralogical and Geochemical Study of the Nonmarine Permian/Triassic Boundary in the Southern Karoo Basin, South Africa**
Coney, L.; Reimold, W. U.; Hancox, P. J.; Koeberl, C.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; 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

Mineralogical and geochemical investigations across two nonmarine Permian-Triassic (P/Tr) boundary sections in the southern part of the main Karoo Basin have been undertaken in order to aid in our understanding of this complex extinction event.
Derived from text
*Mineralogy; Geochemistry; Extinction*

**20040058082** Arizona Univ., Tucson, AZ, USA
**How Does Tektite Glass Lose Its Water?**
Melosh, H. J.; Artemieva, Natalia; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; 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

One of the enduring puzzles in the tektite story is the extreme dehydration exhibited by tektite glass. Whereas typical rhyolitic glass from volcanoes contains roughly 0.2 wt % of water, tektites typically possess only 0.01 to 0.005 wt % of water. Although few scientists presently adhere to J. A. O'Keefe's view that tektites originated on the moon, O'Keefe did highlight the still unsolved problem of just how the tektites lost their water. Indeed, he argued persuasively that, at typical silicate melting temperatures, water diffusion takes so long that that it would be impossible for tektites to dehydrate in this fashion. In the years since O'Keefe's original proposal, much has been learned about the mechanics of impact and the thermal history of glass ejected from terrestrial impact craters. A recent computation convincingly demonstrated that the melts that became Moldavites were ejected from the Ries impact crater. These melts originated from the upper rock units exposed at the site at the time of the impact. The thermal history of these melts is very different from the approach to melting envisaged by O'Keefe, and may account for the rapid water loss in a natural way.
Derived from text
*Tektites; Glass; Dehydration; Water Loss; Rocks; Rhyolite*

**20040058083** Bayreuth Univ., Germany
**Experimental Reproduction of Shock Veins in Single-Crystal Minerals**
Langenhorst, F.; Poirier, J. -P.; Deutsch, A.; Hornemann, U.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; Original contains color and black and white illustrations
Contract(s)/Grant(s): DFG-De-401/15; DFG-Ho-1446/3; DFG-La 830/4; Copyright; Avail: CASI

Thin black veins, so-called shock veins or pseudotachylites, occur in heavily shocked meteorites and in target rocks in terrestrial impact structures. The presence of the veins is not only restricted to polymineralic rocks, they also irregularly pervade monomineralic rock. The veins are particularly interesting for high-pressure mineralogy because they are the carriers of high-pressure phases (e.g. ringwoodit, majorite, and stishovite), occurring otherwise only in the deep Earth s interior such as the transition zone and lower mantle. The origin of these high-pressure phases can only be understood if formation and evolution of the veins occurs in the very short time-span between shock compression and the end of decompression. There is general consensus that such shock veins represent localized melt zones that were quenched during unloading when still high pressures were present. Shear mechanisms and/or pressure heterogeneities resulting from density gradients are discussed as potential heat sources for localised melting. To simulate frictional melting, welding apparatus have been previously used but there were only few experimental attempts to use shock techniques. Here, we present experimental methods, capable to reproduce shock-induced shear melting in single-crystal minerals.
Derived from text
*Veins (Petrology); Meteorites; Single Crystals; Minerals; Impact Melts; Shock Loads*

**20040058084** Oberlin Coll., OH, USA
**A Newly Recognized Late Archean Impact Spherule Layer in the Reivilo Formation, Griqualand West Basin, South Africa**
Simonson, B. M.; Sumner, D. Y.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; 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

Spherule layers, particularly those hosted by deeper-water Precambrian successions, are emerging as important sources of information on large terrestrial impacts. Searches in the late Archean to early Paleoproterozoic Hamersley basin of Western Australia have been especially fruitful as spherule layers from a minimum of 3 large impacts have already been found. Strata

of comparable age and deposited in similar environments are preserved over large areas in the Transvaal Supergroup of South Africa. An initial search resulted in the discovery of a late Archean layer in the Griqualand West basin hosted by the Monteville Formation of the Campbellrand Subgroup. Here we report the discovery of a second late Archean spherule layer 250 to 300 m above the Monteville layer stratigraphically. Preliminary data will be presented with an eye to comparing the new layer to known spherule layers of roughly comparable age.
Derived from text
*Spherules; Precambrian Period; Strata*

**20040058085** Humboldt Univ., Berlin, German Democratic Republic
**Zircon as a Shock Indicator in Impactites of Drill Core Yaxcopoil-1, Chicxulub Impact Structure, Mexico**
Wittmann, A.; Stoeffler, D.; Schmitt, R. T.; Tagle, R.; Kenkmann, T.; Hecht, L.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; Original contains color and black and white illustrations
Contract(s)/Grant(s): DFG-KE-732/8-2; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We examined zircons in thin sections of suevitic rocks, brecciated impact melt rock, and dike breccias from drill core Yaxcopoil-1 (Yax-1) of the Chicxulub impact structure, Mexico. Zircon was used as an indicator of crystalline host rocks and of the formation conditions of the various types of impact melts formed from crystalline basement rocks in these units. This study presents information about the shock state and spatial distribution of zircon in Chicxulub.
Derived from text
*Breccia; Impact Melts; Rock Intrusions; Crystallinity; Rocks*

**20040058086** Scripps Institution of Oceanography, La Jolla, CA, USA
**Extraterrestrial Chromium in the Permian-Triassic Boundary at Graphite Peak, Antarctica**
Shukolyuko, A.; Lugmair, G. W.; Becker, L.; Macisaac, C.; Poreda, R.; Lunar and Planetary Science XXXV: Effects of Impacts: Shock and Awe; 2004; 2 pp.; In English; See also 20040058074; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The cause of the catastrophic mass extinction at the end of the Permian has been the focus of considerable debate. Becker et al. and others have presented evidence that a major impact was associated with the destruction of > 90% of marine taxa. The evidence includes fullerenes with extraterrestrial helium and argon, Fe-Ni-Si metamorphosed grains of probable meteoritic origin, Fe-Ni metals with impact spherules and shocked quartz. The implication of these findings is that the P/T mass extinction may have been associated with a meteorite impact.
Derived from text
*Extinction; Meteorite Collisions; Argon; Spherules; Quartz; Metamorphism (Geology); Chromium; Graphite*

**20040059024** Lamont-Doherty Geological Observatory, Palisades, NY
**Attenuation Of LG Waves in the Eastern Tibetan Plateau**
Xie, Jiakang; Oct. 2001; 8 pp.; In English
Contract(s)/Grant(s): DSWA01-98-1-0006
Report No.(s): AD-A421691; No Copyright; Avail: CASI; A02, Hardcopy

In the past year I have been processing a large amount of regional/ teleseismic data from various broadband seismic stations in eastern Eurasia. Fourier spectra of Pn, Lg and Pg waves were computed for many events and paths to study path attenuations. Among the data collected and processed are Lg spectra collected from the 1991-1992 Tibetan Plateau Passive Experiment. Using these spectra and a standard two- station method that virtually eliminates source and site effects, I obtain a model of Q0 = (126+/- 9) and eta = (0.37 + -0.02) in a frequency range between 0.2 and 3.6 Hz, where Q0 and hare Lg Q at 1 Hz and its power-law frequency dependence, respectively. The estimated Q0 value is among the lowest ever reported for continental areas; it qualitatively supports the observation by McNamara et al. (1996) that Lg cannot be observed inside the plateau beyond about 700 km, a limiting distance that is much shorter than those in the other low Q0 (^ 200) regions, such as Iran and the western U.S. Quantitatively, the estimated Q0 value is lower by a factor of 3 than the values of 366 estimated by McNamara et al. (1996), who used data from the same experiment. Since there are several differences in the data processing and inversion procedures used in this and the previous studies, I investigated the effects of these differences on the Q estimates. I conclude that the most probable cause of the discrepancy is in the different inverse methods used. This is so because the previous inversion allowed the source and site terms to be free parameters solved for. Since 20 events, 8 stations and 5

frequency bands were used, the unknown source and station terms should be more than 100. In this study only two free parameters (Q0 and h) are solved for, thus avoiding the instability caused by parameter trade-offs.
DTIC
*Plateaus; Wave Attenuation*

**20040059109** New Mexico Univ., Albuquerque, NM
**High Power Microwave Research, Atmospheric Plasma Phenomena, Ultra-Wideband Propagation and Generation**
Prather, William; Scholfield, David W.; Gahi, John M.; Sep. 2001; 9 pp.; In English
Contract(s)/Grant(s): F29601-98-K-0185; Proj-4867
Report No.(s): AD-A421932; AFRL-DE-TR-2001-1061; No Copyright; Avail: CASI; A02, Hardcopy

The primary objectives of this effort were to investigate gas breakdown, plasma antennas, and laser induced plasmas in the atmosphere. The contractor investigated the electrical breakdown of different types of gas under very fast transient voltage excitation. The research addresses different types of gas under different conditions of pressure, temperature, and electrical field stress as expressed on a Paschen curve. The contractor also investigated the feasibility of generating and shaping conducting plasma to be used as an antenna and generating a conducting path in the atmosphere using a high power laser.
DTIC
*Broadband; Lasers; Microwaves; Plasmas (Physics)*

**20040059192** Naval Research Lab., Chesapeake Beach, MD
**NRL Atmospheric Correction Algorithms for Oceans: Land, Cloud, and Cirrus Mask User's Guide**
Montes, Marcos J.; Gao, Bo-Cai; Davis, Curtiss 0.; Mar. 22, 2004; 16 pp.; In English
Report No.(s): AD-A422084; NRL/MR/7230-04-8759; No Copyright; Avail: CASI; A03, Hardcopy

Many ocean color processing algorithms often need to have an additional module to mask out the non-oceanic objects, such as clouds or land. We have constructed a program that produces land, cirrus, low-altitude cloud, and bad-pixel masks. This document describes the usage of the executable application derived from these algorithms.
DTIC
*Algorithms; Atmospheric Correction; Masks; Oceans*

**20040059196** Air Force Research Lab., Hanscom AFB, MA
**Climatological Fit to the Ionospheric Parameters f0F2 and hmF2 for the High Latitude Stations at Sondrestrom, Greenland, and Qaanaaq, Greenland**
Dandekar, Balkrishna S.; Jul. 11, 2002; 23 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A422091; ERP-1251; AFRL-VS-TR-2002-1682; No Copyright; Avail: CASI; A03, Hardcopy

Ionospheric data from the high latitude stations Sondrestrom, Greenland, and Qaanaaq, Greenland, for a period of 8 years, covering a good range of solar cycle variation, are used to derive empirical algorithms for the prediction of foF2 and hmF2. The algorithm connects these two parameters with diurnal, seasonal, 90-day averaged solar flux at 2800 MHz and the planetary geomagnetic activity index Kp. The Sondrestrom station sees foF2 inhancement due to the tongue of ionization, and the Qaanaaq station experiences foF2 enhancement due to the occurrence of the polar cap patch activity. Therefore, empirical algorithms are derived for predicting the distribution of foF2 during the presence (or absence) of the polar cap patch (or tongue of ionization) activity. This algorithm connects the average and average plus or minus one sigma values of foF2 with season and 90-day averaged solar flux at 2800 MHz for the respective category. The prediction errors from these algorithms are smaller than those from the IONCAP and PRISM models. These algorithms would be very useful for filling the gaps in the real time ionospheric data needed to support USAF operational systems.
DTIC
*Atmospheric Models; Climatology; Critical Frequencies; Earth Ionosphere; F 2 Region; Greenland; Polar Caps; Polar Regions*

**20040059283** Tsukuba Univ., Japan
**Dust Size Distribution in Solar Nebula Inferred from Shock-Wave Heating Model for Chondrule Formation**
Miura, H.; Nakamoto, T.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chondrules have a typical size distribution between about a few tens microns to a few mm, though it is not clear what is the origin of chondrule size distribution. Three possibilities can be considered as stages when the size selection effects have occurred: (i) before the chondrule forming event, (ii) during the chondrule forming event, and (iii) after the chondrule forming event. The shock wave heating model is one of the most plausible models for chondrule formation. Many authors have shown that the precursor grain particles can melt, solidify, and form chondrules by this mechanism. Moreover, this model naturally includes mechanisms of size selection. The maximum size of chondrules can be determined by the balance between the drag force of ambient gas and the surface tension of molten particles. The minimum size of precursor grain particles which can form chondrules exists, below which the grain particles evaporate completely in the postshock hot gas. It is very meaningful to reproduce the chondrule size distribution in consideration of above effects and compare it with measured chondrule size distribution. The purpose of our study is to obtain conditions for reproducing chondrule size distribution by shock wave heating model.
Derived from text
*Chondrule; Meteoritic Composition; Size Distribution; Shock Waves; Dust; Gas-Solid Interfaces*

**20040059284** NASA Johnson Space Center, Houston, TX, USA
**The Vaguries of Pyroxene Nucleation and the Resulting Chondrule Textures**
Lofgren, G. E.; Le, L.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Original contains black and white illustrations
Contract(s)/Grant(s): RTOP 344-31-20-20; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Pyroxene is a major phase in chondrules, but often follows olivine in the crystallization sequence and depending on the melting temperature and time may not nucleate readily upon cooling. Dynamic crystallization experiments based on total or near total melting were used to study PO (porphyritic olivine) and PP (Porphyritic pyroxene) compositions as defined by. The experiments showed that pyroxene nucleated only at subliquidus temperatures in the PP melts and rarely in the PO melts. Porphyritic chondrules with phenocrysts of both olivine and pyroxene (POP chondrules) were not easily produced in the experiments. POP chondrules are common and it is important for deciphering their formation that we understand pyroxene nucleation properties of chondrule melts.
Derived from text
*Chondrule; Textures; Pyroxenes; Nucleation; Crystallization; Meteoritic Composition*

**20040059285** Physical Research Lab., Ahmedabad, India
**Al-Mg Isotopic Systematics in Ferromagnesian Chondrules from the Unequilibrated Ordinary Chondrite Adrar 003: Time Scale of Chondrule Formation**
Rudraswami, N. G.; Deomurari, M. P.; Goswami, J. N.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Meteoritic chondrules are considered to be a product of high-temperature transient events taking place during the very early evolution of the solar system. Although a nebular setting is generally favored, the exact locale and formation mechanism of chondrules are still being debated. A determination of the time and duration of chondrule formation is an important step towards understanding the origin of this enigmatic component of all chondritic meteorites. Several efforts focusing on the use of the short-lived nuclide Al-26 as a chronological tool and the analysis of plagioclase or plagioclase-rich mesostasis in chondrules from unequilibrated ordinary chondrites (UOCs) for their 26Al records have already been made. These studies revealed the following important features: (i) the highest initial value for Al-26/Al-27 [(Al-26/Al-27) sub 0] in UOC chondrules is much lower than the canonical value of 5x10(exp -5) seen in CAIs in these meteorites; (ii) (Al-26/Al-27) sub 0 values in UOC chondrules vary from approx. 10(exp -5) to <5x10(exp -7). While the first observation is generally attributed to formation of CAIs prior to chondrules, the large variation in (Al-26/Al-27) sub 0 in chondrules from UOCs has been attributed to both differences in crystallization age of more than 3 Ma and Mg isotope redistribution accompanying metamorphic processing. Recent studies of chondrules in carbonaceous chondrites having varying degree of thermal and petrographic alteration records tend to favour an extended duration of chondrule formation. We have initiated a systematic study of unequilibrated chondrites of various metamorphic grades to get further insight in this regard. In this paper we present our initial data based on studies of chondrules from the unequilibrated (LL3.2) ordinary chondrite Adrar 003. We note here that this meteorite was bracketed with the unequilibrated ordinary chondrite Bishunpur belonging to the LL3.1 group based

on the abundance of presolar grains that may also be used as an indicator of thermal metamorphism in meteorite parent body. Derived from text

*Magnesium Isotopes; Carbonaceous Chondrites; Meteoritic Composition; Chondrule; Crystallization; Aluminum Isotopes*

**20040059286** Portland State Univ., OR, USA

**Forsterite and Olivine in Sahara-97210 (LL3.2) and Chainpur (LL3.4) Chondrules: Compositional Evolution and the Influence of Melting**

Ruzicka, A.; Floss, C.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Original contains color illustrations

Contract(s)/Grant(s): NAG5-13044; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is generally accepted that chondrules contain relict grains that did not crystallize in situ, and that forsterite is one type of relict grain which is a likely precursor for chondrules. Chemically and morphologically similar forsterite is also found as 'isolated grains', especially in carbonaceous chondrites. Using SIMS, we analyzed forsterite, ferrous overgrowths around forsterite, and coexisting normal olivine in 5 chondrules and 2 isolated grains in the Sahara-97210 ('Sahara') LL3.2 chondrite. We earlier used the same methods to study olivine in 3 Chainpur chondrules that contain relict forsterite. Our new data for Sahara provide additional insight into the processes affecting chondrules and their precursors.

Derived from text

*Carbonaceous Chondrites; Meteoritic Composition; Melting; Chondrule*

**20040059287** California Univ., Los Angeles, CA, USA

**Evaporation During Chondrule Formation, Recondensation as Fine Particles, and the Condensation of S and Other Volatile Elements**

Wasson, John T.; Trigo-Rodriquez, Josep M.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are two key assumptions in the classic model of nebular condensation: a) that the nebula was initially hot enough for most elements to have been vaporized; and b) that the cooling rate was slow enough to permit equilibrium between solids and gases to be approached, and trace elements to diffuse into the interiors of host phases. Here I examine a very different picture that follows the volatilization associated with the heating of chondrules, and the rapid condensation that occurred immediately following these flash heating events. This condensation occurred rapidly and produced smoke-like solids. This may have been the dominant process that produced the fine (less than or equal to 1 micron) nebular solids preserved as matrix in primitive chondrites, and may have provided the mechanism for converting metallic Fe to FeO and FeS. For a nebula with a solar composition and a partial pressure of H2 (pH2) of 10(exp -5) atm the equilibrium 50%- condensation temperatures of the three common elements Mg, Si and Fe are around 1300 K . This temperature is about 600 K lower than typical 90%-melting temperatures of common chondrules. A number of chondrule-formation processes have been proposed, but the majority involve the melting of preexisting nebular solids, the precursor materials. The majority of chondrules contain FeS in their interiors; thus it is reasonable to assume that the nebula had cooled to =600 K, i.e., below the 50% condensation temperature of S as FeS by the time most chondrules were formed.

Derived from text

*Evaporation; Chondrule; Meteoritic Composition; Trace Elements; Vaporizing; Iron Oxides*

**20040059288** Rutgers Univ., Piscataway, NJ, USA

**Fe Isotopes and the Formation of Chondrules**

Cohen, B. A.; Levasseur, S.; Zanda, B.; Halliday, A. N.; Hewins, R. H.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; 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

Chondrules exhibit an Fe-isotopic mass fractionation range of a few delta-units. These fractionations were interpreted as the result of Fe depletion from metal-silicate fractionation during chondrule formation. On the other hand, concluded that these compositions reflect those of chondrule precursors based on the lack of correlation with textures or metal content. Calculations have shown that the iron isotope mass fractionations measured in chondrules are too low to explain chondrule formation by extensive free evaporation. Work by concluded that extensive Fe-loss during the formation of Renazzo chondrules was

followed by its re-condensation. As the loss of Fe is mostly driven by FeO-evaporation from the silicate melt, metal grains should exhibit lighter isotopic signatures relative to the silicates. This is however not observed so far, as preliminary results by indicate that metal is heavier than silicates by approximately 0.2 for 57Fe, similarly to what is observed in pallasites. In order to better understand the iron isotopic compositions of chondrules we conducted experiments to study the effects of reduction and evaporation of iron on iron isotope systematics.
Derived from text
*Chondrule; Iron Isotopes; Iron Oxides; Fractionation; Meteoritic Composition; Melts (Crystal Growth)*

**20040059289** Cologne Univ., Germany
**Pristine and Processed Metal in CR Chondrites: Condensation in the Solar Nebula and Partial Reequilibration During Chondrule Formation**
Schoenbeck, T. W.; Palme, H.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

CR chondrites are carbonaceous chondrites with comparatively high contents of FeNi metal coexisting with a heavily altered phyllosilicate-rich matrix and thus indicating extreme disequilibrium. Metal can be found in three environments: (a) within chondrules as large, rounded grains, (b) on chondrule rims and (c) as large metal grains within the fine-grained matrix. Some authors believe that trace elements in metal grains of CR chondrules reflect equilibration with silicates during chondrule formation and/or were established by reduction. Alternatively, the trace element composition of CR metals could reflect nebular condensation. Evidence for condensed metal grains in CH- and CB-meteorites was recently provided by. In order to distinguish between these two possibilities we analyzed about 60 different metal grains in the CR chondrite Acfer 209 where metal is rather pristine and unaffected by weathering processes
Derived from text
*Carbonaceous Chondrites; Chondrule; Meteorites; Meteoritic Composition; Trace Elements*

**20040059290** Tokyo Univ., Japan
**Variation of the Condensation Path of Supercooled Silicate Melt**
Nagahara, H.; Ozawa, K.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Contrary to CAIs, the diversity of chondrule compositions has been attributed to be that of the precursors and/or change due to evaporation. The diversity, however, has been satisfactorily explained neither equilibrium condensation nor evaporation in vacuum. In the present study, we develop a new kinetic model to describe composition change of a multicomponent condensed phase during condensation as well as evaporation under kinetic conditions. It is applied to investigate the path of condensing silicate melt by using parameters available from evaporation experiments. Based on the results, the diversity of chondrule compositions in primitive ordinary chondrites is considered.
Derived from text
*Chondrule; Silicates; Melts (Crystal Growth); Meteoritic Composition; Condensing; Evaporation*

**20040059291** Imperial Coll. of Science and Technology, London, UK
**Volatile and Moderately Volatile Trace Element Composition of Chondrules and Matrix from CM Chondrites: Implications for Chondrule Formation**
Bland, P. A.; Alard, O.; Gounelle, M.; Benedix, G. K.; Kearsley, A. T.; Rogers, N. W.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; 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 this study we compare trace element volatile data from Mighei chondrules to matrix in CM chondrites and other CCs, as part of ongoing work to contribute to the discussion on possible chondrule/matrix complimentarity, and the thermal environment of the early Solar System. Our results suggest that both volatile-enriched matrix and volatile-depleted chondrules have experienced a process of incomplete condensation, but to differing degrees. Previously, we described laser ablation and solution ICP-MS analysis of the trace element chemistry of chondrite matrix in 18 carbonaceous chondrite falls, spanning the range of compositional types. The data showed that matrix is variable in composition on the micrometer scale, with the degree of variability increasing from CO/CV to CI. In the CI chondrites, our analyses revealed an order of magnitude variation in

the abundance of volatile and moderately volatile trace elements over distances of a few hundred micrometers. Importantly, although their overall abundance varied, the ratio of volatiles with differing chemical affinities remained approximately constant, suggesting that the heterogeneity did not arise through secondary processing. Matrix was also found to be enriched in volatile and moderately volatile elements compared to the bulk meteorite, with the degree of enrichment tending to increase with volatility. The overall depletion in matrix volatile contents from CI followed a similar sequence to that observed in the bulk meteorite, with CV the most depleted, and CM the least. We found that average matrix composition is significantly different between different groups, and in several cases, we also saw differences in matrix composition between meteorites within the same group.
Derived from text
*Volatility; Trace Elements; Carbonaceous Chondrites; Chondrule; Meteoritic Composition*

**20040059292** Tsukuba Univ., Japan
**Collisional Destruction of Chondrules in Shock Waves and Inferred Dust to Gas Mass Ratio**
Nakamoto, T.; Miura, H.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chondrules are thought to have formed through some heating events in the early solar nebula. Although no heating mechanism proposed to date has been widely accepted, one of the most plausible models is shock wave heating. For example, the shock-wave heating model can explain the heating and melting of chondrules with appropriate shock waves, the stability of liquid droplets in the solar nebula, the cooling rate of the chondrules inferred from laboratory experiments, and the maximum size of chondrules. Basic mechanism of the shock wave heating is simple. When a shock wave is generated in the solar nebula, which is a mixture of gas and dust particles, gas is decelerated by the gas pressure while the dust particles tend to keep their initial velocity. Because of this different dynamical behavior behind the shock wave front, a relative velocity between gas and the dust particle is generated. And dust particles are decelerated by the gas drag force caused by the relative velocity with the gas, and are heated by the drag heating.
Derived from text
*Chondrule; Mass Ratios; Dust; Meteoritic Composition; Shock Waves; Melting; Destruction*

**20040059293** Arizona Univ., Tucson, AZ, USA
**Opaque Mineral Assemblages at Chondrule Boundaries in the Vigarano CV Chondrite: Evidence for Gas-Solid Reactions Following Chondrule Formation**
Lauretta, Dante S.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; See also 20040059282; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-11355; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent studies of opaque minerals in primitive ordinary chondrites suggest that metal grains exposed at chondrule boundaries were corroded when volatile elements recondensed after the transient heating event responsible for chondrule formation. Metal grains at chondrule boundaries in the Bishunpur (LL3.1) chondrite are rimmed by troilite and fayalite. If these layers formed by gas solid reaction, then the composition of the corrosion products can provide information on the chondrule formation environment. Given the broad similarities among chondrules from different chondrite groups, similar scale layers should occur on chondrules in other primitive meteorite groups. Here I report on metal grains at chondrule boundaries in Vigarano (CV3).
Derived from text
*Gas-Solid Interactions; Meteoritic Composition; Mineral Deposits; Corrosion; Fayalite; Chondrule*

**20040059758**
**Coupling Simulated Ocean Reflectance to the Atmospheric Correction of Hyperspectral Images**
Bissett, W. P., III; Mar. 31, 2004; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-1-0514
Report No.(s): AD-A421739; No Copyright; Avail: CASI; A03, Hardcopy

Ocean hyperspectral remote sensing is more difficult than terrestrial hyperspectral remote sensing. The difficulties stem from two major differences between oceanic and terrestrial systems. The first is in the ‘darkness’ of the ocean target versus the terrestrial target. The second is in the spectral differences in the reflectance, particularly in the near infrared (NIR). While

these factors were known qualitatively, this program focused on the quantification of the importance of these factors in the characterization, calibration, deployment, atmospheric correction, product generation, and product delivery of coastal ocean hyperspectral information.
DTIC
*Atmospheric Correction; Imagery; Ocean Models; Oceans; Reflectance; Simulation*

**20040059795** Geological Survey, Flagstaff, AZ, USA
**Triassic Cratered Cobbles: Shock Effects or Tectonic Pressure?**
Chapman, M. G.; Evans, M. A.; McHone, J. F.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Triassic age marked a global mega-monsoonal climate and large river systems that distributed gravels, mostly eroded from older metamorphosed Precambrian or Paleozoic rocks, across Pangea. Possible shock deformation fabric elements have been suggested to occur in conglomeratic deposits of the Upper Triassic Shinarump of northern Arizona [1], in the Lower Triassic Buntsandstein of northeastern Spain [2], and in the Upper Triassic Quaco Formation of the New Brunswick, Canada [3]. All 3 conglomerates contain quartzite clasts having percussion marks or brittle deformation features of millimeter- to centimeter-sized bright circular marks (halos), surrounded by radial fractures that trail away from the halo. The interpretations that Shinarump and Quaco cobble halos are shock effects were based on their similarity to those in Buntsandstein cobbles. Buntsandstein cobble marks previously had been attributed to post-depositional clast-to-clast impact deformation during proposed Azuara and Rubielos de la C rida impact events [2]. Shinarump percussion marks were suggested as impact damage from nearby Meteor (Barringer) Crater [1] and Quaco marks were linked to the Manicouagan impact event [3]. Conglomerates of many ages worldwide show these same types of marks and there are several problems with the interpretation of shock effects in these specific conglomerates. For example, Bundsandstein conglomerates with pitted cobbles (1) occur not only in the vicinity of both proposed Spanish impact structures, but also in large areas up to 70 km away, (2) the depth of clast indentations does not vary systematically with distances from the impact structures, and (3) underneath clast indentation sites there is no confirmation of internal deformation within quartz grains [4]. Additionally, although both Azuara and Rubielos de la C rida basins were suggested to be Late Tertiary impact structures [5], compelling impact evidence is unconfirmed [6, 7] and they no longer appear on the Earth Impact Database [8]. However, as halo marks on cobbles are continuing to be used as evidence of impact [1, 3], we decided to investigate these claims and begin our study with the Shinarump cobbles.
Derived from text
*Tectonics; Climatology; Deformation; Metamorphism (Geology); Meteorite Craters; Millimeter Waves; Impact Damage*

**20040059796** California Inst. of Tech., Pasadena, CA, USA
**Evidence for a Lightning-Strike Origin of the Edeowie Glass**
Macdonald, F. A.; Mitchell, K.; Cina, S. E.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 1 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report radiating tubular forms in the Edeowie glass and associated baked sediments that are characteristic of lightning-strike fusion. Along with the tubular morphologies, the Edeowie Glass is commonly highly vesicular or in sheet-like forms. These melts are typically found together with baked sandy clays that are tens of centimeters thick and similar in appearance to fired bricks. The Edeowie glass was first described by Haines et al. as a possible impact melt on the basis of Planar Deformation Features (PDFs) in quartz grains that were imbedded within the vesicular melts, and the presence of lechatelierite. However, the morphology and distribution of the glasses are inconsistent with an impact origin. The presumed PDFs are probably planar cracking, and lechatelierite, baddeleyite, and perhaps even coesite and schtishovite can occur in fulgurites.
Derived from text
*Lightning; Silica Glass; Coesite; Impact Melts; Morphology*

**20040059799** Witwatersrand Univ., Johannesburg, South Africa
**Laser Argon Dating of Melt Breccias from the Siljan Impact Structure, Sweden: Implications for Possible Relationship to Late Devonian Extinction Events**
Reimold, W. U.; Kelley, S. P.; Sherlock, S.; Henkel, H.; Koeberl, C.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy

A well defined laser argon age of 376.8 1.7 Ma (95% confidence limits) is presented for impact melt breccias from the Siljan impact structure (Sweden). This impact event has been previously related to a mass extinction event at the Frasnian/Fammenian boundary (End-Devonian), but these new results clearly separate the Siljan event from the 364 Ma [1] F/F boundary.
Derived from text
*Impact Melts; Breccia; Chronology; Argon; Lasers; Time Measurement*

**20040059800** Wien Univ., Austria
**Lonar Impact Crater, India: Occurrence of a Basaltic Suevite?**
Koeberl, Christian; Bhandari, Narendra; Dhingra, Deepak; Suresh, P. O.; Narasimham, V. L.; Misra, Saumitra; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790
Contract(s)/Grant(s): FWF Proj. Y-58; Copyright; Avail: CASI; A01, Hardcopy

The Lonar crater (1.8 km diameter) is a well-preserved simple impact crater in basaltic target rocks (Deccan Traps). A variety of shock metamorphic features have previously been described, including the presence of shocked plagioclase with PDFs, maskelynite, and impact glass. In a recent field trip to Lonar, we documented the occurrence of glass in situ within polymict breccia outcrops (to the N and W of the crater rim), which would warrant the interpretation of these units as a (basaltic) suevite.
Derived from text
*Breccia; Feldspars; Metamorphism (Geology); Meteorite Craters; Basalt*

**20040059801** Arizona Univ., Tucson, AZ, USA
**Low Velocity Ejection of Boulders from Small Lunar Craters: Ground Truth for Asteroid Surfaces**
Bart, Gwendolyn D.; Melosh, H. J.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We are characterizing the size and ejection velocity of boulders distributed around lunar craters 100 m to 1 km in diameter using high resolution, low sun angle Lunar Orbiter III images. While much is known about the impact cratering process [1], the distribution of boulders ejected from an impact crater has not yet been characterized through direct observation. Studies by Vickery et. al. indirectly found the distribution of ejecta from large craters by analyzing the size and distribution of their secondary craters [2, 3]. Our preliminary results from observations of boulders around small craters are consistent with those results found for large craters.
Derived from text
*Lunar Craters; Rocks; Ejection; Asteroids; Cratering; Ground Truth*

**20040059802** California Univ., Los Angeles, CA, USA
**Regional Variations of Trace Element Composition Within the Australasian Tektite Strewn Field**
Huber, H.; Wasson, J. T.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Australasian tektite strewn field is the largest of the four known strewn fields of tektites on earth. Although numerous modeling attempts have been made within the last 4 decades, there is still the question remaining, how they were formed and where the associated impact [1-3] has happened. Various models of formation were established including lunar origins, one or multiple terrestrial impact sites [4], and aerial burst deposits [5]. The Australasian strewn field is the youngest with an age of 770 ka and appears to be somehow special compared to the others. At this place all possible features of tektite shapes such as layered, splash, and ablated splash-form tektites and microtektites are found at all other fields some types are missing. Nevertheless, since the source crater is still missing the formation remains enigmatic. One of the key features are layered tektites since these underwent lower formation temperatures and have significantly different size and shape [6]. The splash-form tektites are widely distributed throughout Southeast Asia, Indochina, and Australia. Microtektites are found in deep-sea drill cores in the Pacific Ocean, Indian Ocean, and the South China Sea covering ~10% of the Earth s surface. In a recent study the Australasian microtektite strewnfield was differentiated in the already known groups of high-Ca and high-Mg, and a new high-Ni group [7]. The purpose of this study was to determine the regional differences to help constrain the different mechanisms of the tektite-producing event.
Derived from text
*Trace Elements; Tektites; Deposits; Earth Surface*

**20040059806** National Museum of Natural History, Paris, France

**Age of the Lonar Impact Crater, India: First Results from Fission Track Dating**

Storzer, Dieter; Koeberl, Christian; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790

Contract(s)/Grant(s): FWF Proj. Y-58; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Lunar crater (1.8 km diameter) is a well-preserved simple impact crater in basaltic target rocks (Deccan Traps). Its age is not well defined, with previous age determinations ranging from ca 10 to 50 ka, the latter one being a thermoluminescence age that is commonly quoted as the age of the structure. In an attempt to refine the crater age, we began a fission track investigation of impact glass from Lonar. The first results from this study indicate an age of about 15 ka, but with a fairly high error. Further fission track work to refine this age is in progress.

Derived from text

*Chronology; Rocks; Thermoluminescence; Time Measurement*

**20040059807** Auburn Univ., AL, USA

**Cretaceous-Tertiary Boundary Microtektite-bearing Sands and Tsunami Beds, Alabama Gulf Coastal Plain**

King, D. T., Jr.; Petruny, L. W.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Cretaceous-Tertiary boundary (i.e., Chicxulub impact-related) microtektite bed/tsunami sand couplets and other microtektite-bearing beds are known from approximately 20 localities spanning parts of the marine Western Interior, Gulf Coastal Plain, Atlantic Coastal Plain, and Mexican Coastal Plain, as well as Atlantic and Gulf of Mexico DSDP and ODP sites. At Shell Creek stratigraphic section, Wilcox County, Alabama, outcrop characteristics that are intermediate in character between Atlantic and Mexican Coastal Plain sites are displayed. The density of microtektites at Shell Creek is remarkable and so is their preservation state.

Derived from text

*Cretaceous-Tertiary Boundary; Tektites; Tsunami Waves; Stratigraphy; Sands*

**20040059808** Lamont-Doherty Geological Observatory, Palisades, NY, USA

**Sand Lobes on Stewart Island as Probable Impact-Tsunami Deposits**

Abbott, Dallas; Pekar, Stephen; Kumar, Mohi; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

About 500 years ago, a cosmogenic tsunami produced a minimum run-up of 130 meters in Jervis Bay near Sydney Australia. The probable source crater for this event is Mahuika crater at 48.3 deg. S, 166.4 deg. E on the western edge of the New Zealand shelf. Mahuika impact crater is 20 2 km in diameter and is less than 1000 years old. It has a tektite field that is found in surface sediments located to the southeast of the crater. Tektites are prima facie evidence of impact origin. Although Jervis Bay is over 1500 km from Mahuika crater, Stewart Island is only about 200 km northeast of Mahuika crater. Consequently, the tsunami run-ups from the Mahuika impact should be higher on Stewart Island than in Jervis Bay. We are conducting a field survey in February 2004 to determine if the maximum elevations of the sand lobes represent tsunami run-up or windblown deposition. We will have our results at the meeting.

Derived from text

*Tsunami Waves; Sediments; Craters; Cosmology; Wind Effects; Sands*

**20040059809** Arizona Univ., Tucson, AZ, USA

**Fe-57 Moessbauer Spectroscopy of Fulgurites: Implications for Chemical Reduction**

Sheffer, A. A.; Dyar, M. D.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790

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

The high temperature (superliquidus) processing of silicates often results in very reduced products, such as Si-bearing Fe metal in type-1 chondrules and in lunar regolith agglutinates. Previous work on fulgurites (the glassy products of the lightning strike fusion of sand, soil, or rock) found silicon metal and iron-silicon alloys inside the silicate glass. The mechanism for this

extreme reduction is not yet understood. In this work, we begin a Fe-57 Moessbauer spectroscopy study as well as continuing a microprobe study of several fulgurites in order to better constrain the extent and process of Fe reduction.
Derived from text
*Meteoritic Composition; Iron 57; Iron Alloys; Microanalysis; Silicon Alloys; High Temperature*

**20040059810** New Brunswick Univ., Fredericton, New Brunswick, Canada
**Ca-Metasomatism in Crystalline Target Rocks from the Charlevoix Structure, Quebec, Canada: Evidence for Impact-related Hydrothermal Activity**
Trepmann, Claudia A.; Goette, Thomas; Spray, John G.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 1 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this study, the mineralogy and the microfabric of Ca-rich zones, comprising mainly prehnite, quartz and calcite, in crystalline target rocks from the 54 km-diameter Charlevoix impact structure have been investigated by optical microscopy, analytical scanning electron microscopy and cathodoluminescence microscopy. The results reveal a Ca-metasomatic event caused by the reaction of a hot fluid (250-380C) with host gneisses. Secondary prehnite, quartz and calcite crystallized and partly replaced feldspar, pyroxene and quartz of the charnockitic host gneisses. The components that have been introduced by the fluid into the charnockitic gneisses are mainly CaO, H2O and CO2. The components SiO2, Al2O3 and Fe2O3 which were also in solution, were probably mainly inherited from the host gneiss. Open, as well as filled, vesicles occur exclusively in the Ca-metasomatic modified zones. This indicates the release of volatiles by boiling or decompression, as well as successive precipitation. Comminution of the host gneiss at the contact with the Ca-rich zones and cataclastic deformation of remnant clasts within the Ca-rich zone are proposed to be due to a sudden and violent injection of the fluid. The composition, the microstructures, as well as the high temperatures of the fluid and the restriction of the Ca-rich zones to the impact structure, indicate that the metasomatism is impact-related. The fluid is proposed to have been released and mobilized due to a reaction of the products of impact-induced degassing and/or melting of carbonaceous Ordovician target rocks with surface and/or ground water. The fluid was injected into the underlying shock-fractured and shock-heated basement. A short lived but widespread post-shock hydrothermal activity can explain both the scarcity of the Ca-rich zones in most localities and their general occurrence in the Charlevoix structure.
Derived from text
*Carbonaceous Rocks; Quartz; Calcite; Silicon Dioxide; Reaction Products; Metamorphism (Geology)*

**20040059887** Museum of Natural History, London, UK
**FT-IR Micro-spectroscopy of Fine-grained Planetary Materials: Further Results**
Morlok, A.; Jones, G. C.; Grady, M. M.; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 2 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dust is the basic building block of all bodies formed in the solar system, including planets, comets and asteroids. Information about the composition of the dust is available from two sources. The first is from grains that can be analysed in the laboratory (e.g., meteorites, presolar grains in meteorites, IDPs (interplanetary dust particles) and GEMS (glass with embedded metal and sulfides) within IDPs). Dust also occurs in many astrophysical environments around stars, ejecta from supernovae, in the interstellar medium, in dust clouds, so another source of data comes from astronomical observations, e.g. the ISO satellite. To identify certain mineral phases in astronomical spectra, IR spectra obtained in laboratories of pure minerals are needed for comparison. So far mainly amorphous glasses or fine grained smokes have been used as standard materials, rather than natural minerals. These studies also mostly concentrated on pure end members, which are rare in nature. Minerals from meteorites are probably a better fit for the astronomical analyses, since they formed in a similar environment to the dust grains. The aim of this project is to compile a database of infrared and optical spectra of well characterized minerals from representative meteorites. In addition to whole grain and powder analyses, we also try to obtain spectra in situ from bigger samples (e.g. thin sections) to get information from mineral phases in their petrological context.
Derived from text
*Interplanetary Dust; Asteroids; Astrophysics; Meteorites; Glass*

**20040059890** Calgary Univ., Alberta, Canada
**Compressional and Shear Wave Velocities in Meteorites**
Hons, M. S.; Hildebrand, A. R.; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 2 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Elastic properties of asteroids govern much of their response to impact events, and are germane to mitigation and exploitation strategies. From pioneering efforts dating to a half century ago [e.g. 1] density, porosity, elastic wave velocities, thermal conductivity, specific heat, and magnetic susceptibility have been increasingly studied during the last decade. Of these quantities the elastic wave velocities have been one of the least explored quantities probably due to the slightly more specialized equipment required. To date we are aware of only approx. 30 determinations of elastic wave velocities in meteorites [2]. Velocities measured to date show a range of several for both compression and shear wave velocities, possible anisotropies, and a strong dependence upon porosity [2]. The latter apparently enables model determination of thermal properties from seismic response. We have measured compressional and shear wave velocities in 72 additional meteorites.
Derived from text
*Compression Waves; Elastic Waves; Meteorites; Thermal Conductivity; Elastic Properties; Asteroids; Thermodynamic Properties*

**20040059892** Virginia Univ., Charlottesville, VA, USA
**Impacts of Ions and Micrometeorites on Mineral Surfaces: Reflectance and Chemical Changes Found in Ordinary Chondrites**
Loeffler, M. J.; Dukes, C. A.; Baragiola, R. A.; Sasaki, S.; Kurahashi, E.; Ueda, Y.; McFadden, L. A.; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 1 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We are conducting a research program to study the effects of ion and micrometeorite bombardment on mineral surfaces of airless bodies such as asteroids, the Moon, and Mercury. We use 4 keV He+ and 1 keV H+ ions to simulate the solar wind and nanosecond laser pulses to simulate micrometeorite impacts. We have studied the change in the visible and near-infrared reflectance and chemical properties of a fractured olivine sample after ion irradiation, while maintaining UHV conditions. Chemical characterization is performed with X-ray photoelectron spectroscopy (XPS). We will present the results on changes in infrared reflectance and chemical composition induced by laser irradiation of the ordinary chondrite. In addition, we will give a progress report of the in situ reflectance measurements and XPS chemical analysis of olivine, a high iron material: fayalite, and a low iron material: fosterite before and after 4 keV He+ ion bombardment.
Derived from text
*Ion Irradiation; Micrometeorites; Minerals; Asteroids; Moon; Mercury (Planet); Hypervelocity Impact*

**20040059893** Arizona State Univ., Tempe, AZ, USA
**Shock Pressures of Impacts vs. Crystallization Pressures of Shock-induced Melt Veins of the Chondrites**
Xie, Zhidong; Sharp, Thomas G.; DeCarli, Paul S.; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 2 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Shock metamorphism, resulting from hypervelocity collisions, is a fundamental process in the early solar system. A widely used shock classification scheme for chondrites was proposed by Stoeffler et al.. This shock classification system is easy to apply and correctly represents the progressive shock-pressure sequence from weak to strong. However, pressure calibration based on shock recovery experiments is problematic for some shock features, such as phase transformations, which depend on reaction kinetics. Phase transformations that occur during shock are generally reconstructive and are strongly dependent on duration and temperature.
Derived from text
*Chondrites; Reaction Kinetics; Veins (Petrology); Metamorphism (Geology); Calibrating; Hypervelocity Impact*

**20040059894** Ithaca Coll., Ithaca, NY, USA
**Deconvolving Terrestrial Alteration Mineral Spectral Signatures from Meteorite Reflectance Measurements**
Shah, Sweta; Clark, Beth Ellen; Hiroi, Takahiro; Zolensky, Michael; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 2 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

When a meteorite enters into the earth's atmosphere, it is immediately subjected to various chemical reactions between its minerals and the elements in our thick atmosphere. These reactions alter the mineralogy of the meteorites. Some examples of the altered minerals in some meteorites are summarized. If meteorites can be linked to their corresponding parent body asteroid in space, we can improve our understanding of the solar system. Spectroscopy has been used in determining the links between asteroids and meteorites. However, meteorite weathering in the Earth s atmosphere also has an effect on meteorite

spectra, and altered spectra can easily confuse asteroid connections. The goal of this project is to study the mineral and spectral changes due to Earth's environment and to design a computer simulation to correct meteorite spectra for the effects of terrestrial weathering.
Derived from text
*Spectral Signatures; Meteorites; Asteroids; Chemical Reactions; Minerals*

**20040059895** Los Alamos National Lab., NM, USA
**The Suitability of Laser Induced Breakdown Spectroscopy for Determining the Compositions of Extraterrestrial Material**
Thompson, J.; Wiens, R. C.; Cremers, D. A.; Barefield, J.; Wetteland, C.; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 2 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Laser Induced Breakdown Spectroscopy (LIBS) has been proposed as a new method for standoff detection of geological samples for use on landers and rovers on planetary surfaces. LIBS is a method of elemental analysis that uses a powerful laser pulse focused on the target sample to form a laser spark or plasma. Material within the spark is vaporized/ atomized and the resulting atoms are excited to emit light. The spark light contains the emission spectra of the elements within the plasma. The plasma light is collected, spectrally resolved and detected to determine elements in the target by their unique spectral signatures.
Derived from text
*Extraterrestrial Matter; Chemical Analysis; Planetary Surfaces; Laser-Induced Breakdown Spectroscopy*

**20040059908** Arizona Univ., Tucson, AZ, USA
**Thermal Metamorphism in L Chondrites: Implications of Percent Mean Deviation in Olivine and Pyroxene**
Marsh, C. A.; Lauretta, D. S.; Domanik, K. J.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We are developing a new technique to quickly and accurately measure the degree of homogeneity in the composition of olivines and pyroxenes in a suite of L-chondrites. Homogeneity of ferromagnesian silicates has been used to measure the degree of heating to which an ordinary chondrite (OC) has been exposed since the introduction of petrologic type. However, even recent publications of the petrologic type classification system have lumped the homogenization of olivine and pyroxene as a single event used to separate type 3 from type 4 OCs. Observations from many authors have noted that pyroxene takes longer to equilibrate than olivine, and recent studies of pyroxene in ordinary chondrites have found compositionally defined lamellae in petrologic types 3.8-4. With our dataset we plan to improve understanding of pyroxene equilibration and the thermal histories of L chondrites.
Derived from text
*Olivine; Pyroxenes; Chondrites; Classifications; Metamorphism (Geology); Meteoritic Composition*

**20040059909** Chicago Univ., Chicago, IL, USA
**The Distribution of Molybdenum in the Indarch EH4 Chondrite**
Cook, D. L.; Humayun, M.; Campbell, A. J.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The enstatite chondrites are highly reduced meteorites, characterized by abundant Fe-Ni metal, nearly Fe-free silicates, and unusual sulfides. Due to the extreme degree of reduction, elements more siderophile than Fe should be expected to be wholly contained in the metal phase. However, abundance data for bulk metal separates from EH and EL chondrites reported by showed that the siderophile elements Ir, Os, Ru, and Mo were depleted, whereas W was enriched. Equilibrium condensation of these elements from a gas of solar composition is not predicted to form an Fe-Ni alloy enriched in W yet depleted in Ir, Os, Ru, and Mo, which are all more refractory than Ni and Fe. Thus, a volatility controlled process is unlikely to be solely responsible for the observed pattern in enstatite chondrite metal. Furthermore, W and Mo, which have nearly identical redox behavior, were fractionated by a factor of approximately 1.7. suggested the Mo depletion in the metal may be due to a sulfide host phase. Molybdenum was detected in troilite separates from the Khairpur EL6 chondrite, but the absolute abundances were unknown. Moreover, sulfide-silicate partitioning experiments showed that Mo does not behave as a strongly chalcophile element and that partitioning into iron sulfide decreased with increasing S and Ni contents of the sulfide phase. Thus, it is

unclear whether the sulfide phases in enstatite chondrites provide a significant sink for Mo. In order to determine if the Mo depletion and the W-Mo fractionation observed in the bulk metal phase of enstatite chondrites is due to chalcophile behavior of Mo, we performed in-situ analyses of potential host phases in the Indarch EH4 chondrite using laser ablation ICPMS. We report abundances of Mo in Fe-Ni metal, troilite (FeS), niningerite ((Mg,Mn,Fe)S), oldhamite (CaS), and pyroxene.
Derived from text
*Chondrites; Molybdenum; Volatility; Meteoritic Composition*

**20040059912** Geological Survey of Canada, Ottawa, Ontario, Canada
**Preliminary Mineralogical Data from the Saratov (L4) Primitive Ordinary Chondrite**
Herd, R. K.; Hunt, P. A.; Venance, K. E.; Killgore, M. B.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Saratov fell September 6, 1918, total known weight (TKW) 328 kilograms [1]. A detailed description of its mineralogy and texture is not available, although it has been analyzed in some important studies and is widely available in collections and from dealers. Research on Saratov has been undertaken in conjunction with research on another primitive ordinary chondrite [2,3] to compare textures and petrologic grade.
Derived from text
*Chondrites; Collection; Mineralogy*

**20040059913** New Mexico Univ., Albuquerque, NM, USA
**Modification of the Van Schmus and Wood Petrologic Classification for Lithic Fragments in the Chondritic Breccia Rumuruti**
Berlin, J.; Stoeffler, D.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Van Schmus & Wood petrologic types 1 to 6 are commonly used to indicate the degree of aqueous alteration and thermometamorphism which chondritic meteorites experienced on their asteroidal parent body [1-3]. Ordinary as well as enstatite chondrites occur in petrologic types 3 to 6, with type 3 representing the most primitive (and therefore precursor?) material and type 6 representing the most strongly metamorphosed material. Features associated with aqueous alteration (type 2 and 1) are observed in carbonaceous chondrites; only the CK chondrites are thermally metamorphosed [4, 5]. To make the Van Schmus & Wood petrologic types applicable to the latter, slight modifications of some criteria were suggested by [4]. In this study, we want to show similarly how the petrologic types can be applied to lithic fragments in the breccia Rumuruti which represents the R chondrite group (only fall of this group [6]).
Derived from text
*Metamorphism (Geology); Chondrites; Breccia; Fragments; Wood*

**20040059914** Arizona Univ., Tucson, AZ, USA
**Phosphate Minerals in Semarkona (LL3.0)**
Goreva, J. S.; Lauretta, D. S.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy

Direct observations of phosphates in unequilibrated ordinary chondrites (UOC) indicate that prior to metamorphism, phosphorus was associated with the metal phase. The alloying of P in Fe-Ni metal is a predicted consequence of calculations of gas-solid equilibrium under solar nebular conditions. Parent body conditions appear to have been sufficiently oxidizing that phosphates formed early even in the most primitive chondrites. Presumably, P reacts with an external source of Ca and O on the metal grain boundaries to form Ca-phosphates. Both apatite and merrillite are observed in UOC. However, the conditions and timing of the phosphate nucleation is not constrained.
Derived from text
*Phosphates; Minerals; Chondrites; Metamorphism (Geology); Calcium Phosphates; Meteoritic Composition*

**20040061989** State Univ. of New York, Stony Brook, NY, USA
**Long-Term Continental Areal Reduction Produced by Tectonic Processes**
Hahn, B. C.; Holt, W. E.; Kreemer, C.; Silver, P. G.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Continental area is reduced during continental collision events and increased during rifting and extension. But what is the net effect: reduction, expansion, or neither? We use a global strain-rate model and a finite-element approach with over 24,000 grid elements to define the velocity gradient tensor field within all plate boundary zones. Using GPS velocity vectors and Quaternary fault-slip rates, we define the deformation field within the deforming plate boundary zones and define spherical cap motions. After corrections for elastic strain near subduction zones we determined a present-day areal rate of change in continental area as well as the spreading rates of oceanic ridges and back-arc basins. We found a negative change rate indicating a loss of continental area due to tectonic processes. This reduction holds long term if current plate velocities are similar to velocities of the geologic past. If past velocities were higher than they were today, we expect a greater rate of reduction.
Derived from text
*Tectonics; Continental Drift; Geological Faults; Boundaries; Subduction (Geology); Global Positioning System*

**20040062054** Boeing Co., Seattle, WA, USA
**Collisional Fragmentation of Rotating Bodies**
Housen, K. R.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Many asteroids rotate sufficiently fast that they are at or near the rotational stability limit for a cohesionless material [1-4]. This observation raises a question: does the centrifugal force in a spinning asteroid significantly affect the conditions required for collisional disruption? In principle, a minor collision that would result in simple crater formation on a non-rotating body could disrupt an asteroid spinning near its stability limit. This abstract describes preliminary experiments designed to study the effect of rotation on collisional fragmentation.
Derived from text
*Centrifugal Force; Rotating Bodies; Asteroids; Fragmentation; Collisions; Cratering*

**20040062055** Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain
**Experiments with Explosives and Ordnance Disposal Devices for the Simulation of Specific Processes During Shallow-Marine Impacts**
Ormoe, Jens; Martinez-Frias, Jesus; Diaz-Martinez, Enrique; Lepinette-Malvitte, Alain; Lindstroem, Maurits, et al.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Most impacts on Earth strike a target covered by water. With increased interest in hazards from impact tsunamis, improved simulation softwares, and the discoveries of the now famous Chicxulub (Mexico) and Chesapeake Bay (USA) craters, the deep sea impact site of Eltanin (South Pacific), and the puzzling Alamo Breccia (USA), the interest for marine impact cratering has grown rapidly in recent years. Well-preserved marine-target craters such as Mjolnir (Norway) and Lockne (Sweden) have shown that marine impacts differ in many ways from land impacts (e.g., crater morphology, melt and ejecta distribution, lithologies). The analysis of these differences often requires 3D modeling of oblique impacts into layered targets, something that is just beginning to be possible [1]. However, numerical modeling needs simplifications; on the other hand, some of the special features of the marine-target crater have complex origins. Hence, the analysis must be based on a combination of methods, all of which have their own limitations (e.g., geological and geophysical studies, numerical modeling, laboratory experiments). In this paper we present preliminary results from experiments aiming to illustrate the formation of some of the special features noticed at Lockne and other marine-target craters.
Derived from text
*Craters; Explosives; Breccia; Cratering; Ejecta*

**20040062056** NASA Ames Research Center, Moffett Field, CA, USA
**Non-Ballistic Vapor-Driven Ejecta**
Wrobel, K. E.; Schultz, P. H.; Heineck, J. T.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045
Contract(s)/Grant(s): NAG5-11538; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact-induced vaporization is a key component of early-time cratering mechanics. Previous experimental [1,2] and computational [e.g., 3] studies focused on the generation and expansion of vapor clouds in an attempt to better understand

vaporization in hypervelocity impacts. Presented here is a new experimental approach to the study of impact-induced vaporization. The three-dimensional particle image velocimetry (3D PIV) system captures interactions between expanding vapor phases and fine particulates. Particles ejected early in the cratering process may be entrained in expanding gas phases generated at impact, altering their otherwise ballistic path of flight. 3D PIV allows identifying the presence of such non-ballistic ejecta from very early times in the cratering process.
Derived from text
*Vaporizing; Cratering; Ejecta; Gas Expansion; Particle Image Velocimetry*

**20040062061** Brown Univ., Providence, RI, USA
**Early-Time Temperature Evolution of the Impact Flash and Beyond**
Ernst, C. M.; Schultz, P. H.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

When a hypervelocity projectile impacts a target, a light flash is produced at the moment of first contact. Time-resolved light intensity curves can be used to determine the starting conditions of the observed impacts [1,2]. For impacts into metal targets, the peak intensity of the flash occurs during the initial projectile penetration, with the signal quickly decaying [3,4]. Impacts into particulate targets produce a source of blackbody radiators in addition to the initial flash. This source extends the resulting light intensity profile well beyond the time of initial contact. A time-resolved temperature profile is an additional useful tool for analyzing the early-time evolution of an impact based solely on its emitted light. Observed thermal signatures indicate that the increase in light intensity to a peak value is dependent on an expanding radiating source area, not on an increasing temperature. Impact temperature profiles evolve differently for various angles and projectile diameters.
Derived from text
*Hypervelocity Projectiles; Temperature Profiles; Time Temperature Parameter; Luminous Intensity; Particulates*

**20040062062** California Univ., Los Angeles, CA, USA
**Complex, Contrasting Behavior of Chromium During Late-Stage Processes in Ureilites**
Warren, Paul H.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 1 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ureilites are ultramafic asteroidal mantle samples with remarkably high proportions of graphite (or, more commonly, amorphous carbon and diamonds that may originally have been graphite). At a late stage in their evolution, a sudden change in intensive or extensive parameters (possibly a sudden drop in pressure, leading to destabilization of graphite in favor of COx gas) triggered an abortive redox process that partially converted their olivines into 'reduced rims' consisting mainly of extremely high-mg olivine and tiny blebs of Fe-metal [1,2,3].
Derived from text
*Ureilites; Amorphous Materials; Asteroids; Graphite; Olivine; Destabilization*

**20040062066** Arizona Univ., Tucson, AZ, USA
**Thermal History of the Lodranite Yamato 74357: Constraints from Compositional Zoning and Fe-Mg Ordering**
Stimpfl, M.; Ganguly, J.; Princivalle, F.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lodranites are a group of primitive achondrites that are closely related to acapulcoites, but are more coarse-grained (average mafic mineral size approx. 500-600 microns) and depleted in plagioclase and troilite. These mineralogical differences are the results of different degrees of melting. Reconstruction of the thermal histories of primitive achondrites has been a subject of interest towards the understanding of planetary processes. To this end, we have undertaken a detailed study of the cooling history of the lodranite Yamato74357 on the basis of the compositional properties of its minerals at two different scales: (a) compositional zoning within individual grains and (b) Fe(2+) - Mg ordering in orthopyroxenes.
Author
*Achondrites; Coarseness; Grain Size; Meteoritic Composition*

**20040062067** Kobe Univ., Japan

**Late Thermal Evolution of Acapulcoites-Lodranites Parent Body: Evidence from Sm-Nd Isotopes and Trace Elements of the LEW 86220 Acapulcoite**

Nakamura, N.; Ohashi, S.; Kida, E.; Morikawa, N.; Yamashita, K.; Okano, O.; Kobayashi, T.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Acapulcoites and lodranites are similar in mineralogy, major element and oxygen isotopic compositions [1,2]. They are considered to have been produced by partial melting [3] and are thus may provide important information about the early melting histories of the meteorite parent bodies. Except for a few cases, however, the chronological and detailed trace element data for these meteorites are still limited. We present here results of Sm-Nd isotopic and lithophile element analyses for four bulk acapulcoites-lodranites samples as well as mineral separates from one of the acapulcoites,

Derived from text

*Isotopes; Meteoritic Composition; Neodymium Isotopes; Samarium Isotopes; Meteorites*

**20040062068** Vermont Univ., Burlington, VT, USA

**Partial Melting Under Reducing Conditions: How are Primitive Achondrites Formed?**

Ford, R.; McCoy, T. J.; Rushmer, T.; Benedix, G. K.; Corrigan, C. M.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Early planetary differentiation occurred under a variety of conditions (e.g. T, fO2) and it is possible that this process can change the geochemistry, both elemental and isotopic, such that the end products and parental material cannot be easily related. Preliminary experiments demonstrated modification of mineral compositions during partial melting under reducing conditions [1]. From isotopic and geochemical studies of chondrites, it is known that an oxidation 'gap' exists between E and H type chondrites yet some meteorite groups, notably the primitive achondrites, seem to fill the gap (e.g. pallasites, acapulcoites, lodranites, winonaites, and IAB and IIE irons). In comparison to ordinary chondrites, primitive achondrites exhibit: (a) textural equilibration (b) lower FeO silicate and chromite compositions [2,3] (c) chromite richer in Cr2O3 and MgO and poorer in FeO [2,3], (d) evidence for more extensive heating, including partial melting of both silicates and metal [2,3] and (e) transition of some elements from lithophile to chalcophile behavior (e.g., Cr in sulfide). Determining the conditions under which these modifications occurred and tying them to specific processes (i.e. partial melting or solid state reduction) is important to assess how much the conditions affect the chemistry and/or morphology of mineral and metal phases. Currently, we are testing the effect of reducing conditions during melting of an ordinary chondrite.

Derived from text

*Achondrites; Melting; Geochemistry; Meteoritic Composition; Chromium Oxides; Iron Oxides; Magnesium Oxides*

**20040062069** NASA Johnson Space Center, Houston, TX, USA

**Evolution of the Ureilite Parent Body**

Hudson, P.; Romanek, C.; Paddock, Lindy; Mittlefehldt, D. W.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ureilites are ultramafic achondrites composed primarily of olivine and pyroxene with intergranular fine-grained metal, sulfides, and silicates. Ureilites contain significant amounts of carbon (up to about 6.5 wt%) as graphite, lonsdaleite, and/or diamond. It has been shown that carbon-silicate redox (i.e. 'smelting') reactions are responsible for the negative FeO-MnO (or positive Fe/Mn-Fe/Mg with constant Mn/Mg) trend seen in the mineral and bulk compositions of ureilites and for the positive correlation between modal percent pigeonite and mg#. Carbon redox reactions are strongly exothermic and pressure dependent; so ureilites with the largest mg# are the most reduced, experienced the highest temperatures, and formed at the lowest pressures, i.e. near the surface of the ureilite parent body. Ureilites with the largest mg# have the smallest the delta(sup 18)O and the largest Delta(sup 17)O. To explain this, Singletary and Grove proposed that heterogeneous accretion took place on the ureilite parent body, which lead to a radial distribution of the oxygen isotopes. To further investigate possible relationships, we performed carbon isotope and electron probe measurements on a suite of 27 ureilites in order to see the type of correlation that exists between mg#, oxygen isotopes, and carbon.

Author

*Achondrites; Evolution (Development); Carbon Isotopes; Heterogeneity; Oxygen Isotopes*

**20040062070** NASA Johnson Space Center, Houston, TX, USA

**Sahara 99555 and D'Orbigny: Possible Pristine Parent Magma of Quenched Angrites**

Mikouchi, T.; McKay, G. A.; Jones, J. H.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Angrites constitute a small, but important group of basaltic achondrites showing unusual mineralogy and old crystallization ages. The currently known angrites are divided into two subgroups. Angra dos Reis (ADOR) and LEW86010 show slow cooling histories ('slowly-cooled' angrites) and differ from the later found angrites (LEW87051, Asuka 881371, Sahara 99555, D Orbigny, NWA1670, NWA1298). This second group has textures that suggest rapid cooling histories ('quenched' angrites). The petrogenesis of angrites has been controversial, partly due to the small number of available samples. In this abstract, we suggest a possible parent melt composition for the quenched angrites and its relationship to the partial melts of carbonaceous chondrites.

Author

*Achondrites; Basalt; Carbonaceous Chondrites; Meteoritic Composition; Crystallization*

**20040062073** Chicago Univ., Chicago, IL, USA

**Compositions of the Group IVB Iron Meteorites**

Campbell, A. J.; Humayun, M.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The IVB group is the most refractory-rich and volatile-poor of the iron meteorites, and it is therefore important to understand its origin as a limiting case of core formation processes in protoplanetary bodies. Various fractionation processes have been proposed to explain the compositional range of IVB irons. Scott [1] and Kelly and Larimer [2] favored nebular condensation as the principal mechanism for enriching IVB irons in refractories and depleting them in volatile elements. Grossman and Olsen [3] maintained that some aspects of the IVB metal compositions were not satisfactorily explained by such a mechanism. Rasmussen et al. [4] promoted parent body outgassing, rather than nebular processes, as the means of volatile loss. Both Scott [1] and Rasmussen et al. [4] mentioned oxidation during equilibration with a silicate as possible contributors to the IVB metal formation process.

Derived from text

*Iron Meteorites; Fractionation; Silicates; Oxidation; Outgassing; Enrichment*

**20040062094** Hawaii Univ., Honolulu, HI, USA

**Asteroid Modal Mineralogy Using Hapke Mixing Models: Validation with HED Meteorites**

Lawrence, S. J.; Lucey, P. G.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The mineralogical characterization of asteroid surfaces is accomplished through the interpretation of terrestrial or space-based visible/nearinfrared reflectance (VNIR) spectroscopy. This is the most sensitive technique for asteroid remote sensing and has been widely used to estimate the surface mineralogy for many asteroids. The spectral properties of asteroid surfaces are governed by the properties of the asteroid regolith, including the mineralogy, physical properties, the amount of impact-produced glass, and the degree of space weathering. Hapke s formulations [1,2,] and the recent work of [3] has permitted the creation and utilization of a model designed to produce a simulated spectrum of a given asteroid surface given a modal mineralogy, within simplifying assumptions. In [4], Clark and coworkers employed this model to make determinations about the composition and degree of space weathering on the bright and dark regions in and adjacent to Pysche crater on asteroid 433 Eros. Here, we share results of our efforts to validate the model using published mineral modes and spectra from eucrites and diogenites.

Derived from text

*Achondrites; Regolith; Mineralogy; Meteorites; Asteroids*

**20040062135** Brown Univ., Providence, RI, USA

**Fast Anorthite Dissolution Rates in Lunar Picritic Melts: Petrologic Implications**

Morgan, Z.; Liang, Y.; Hess, P.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar mare basalts and picritic magmas must pass through the anorthite rich crust (anorthosite, troctolite, and norite) to be erupted on the surface of the moon. These magmas traveled in dikes through the crust and undoubtedly assimilated some of the host anorthite. Assimilation of anorthite has the potential to significantly affect the major and trace element chemistry of magma within the dike as well as the host rock. Jones and Delano argued the CaO and Al2O3 variations in the picritic glasses are the result of anorthite assimilation. Others suggested that the high thermal energy requirements of assimilation (by melting) prevent the magma from assimilating much anorthite. Furthermore it has been argued that simple linear mixing of anorthite into the picritic glasses is insufficient to explain the picritic glass trends because anorthite does not fall along a linear mixing trend defined by the picritic glasses.
Derived from text
*Crusts; Basalt; Magma; Melting; Anorthosite; Trace Elements; Energy Requirements; Lunar Maria*

**20040062136** New Mexico Univ., Albuquerque, NM, USA
**Oxygen Fugacity of Mare Basalts and the Lunar Mantle Application of a New Microscale Oxybarometer Based on the Valence State of Vanadium**
Shearer, C. K.; Karner, J.; Papike, J. J.; Sutton, S. R.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ability to estimate oxygen fugacities for mare basalts and to extend these observations to the lunar mantle is limited using bulk analysis techniques based on buffering assemblages or the valence state of iron. These limitations are due to reequilibration of mineral assemblages at subsolidus conditions, deviations of mineral compositions from thermodynamic ideality, size requirements, and the limits of the iron valence at very low fO2. Still, these approaches have been helpful and indicate that mare basalts crystallized at fO2 between the iron-w stite buffer (IW) and the ilmenite breakdown reaction (ilmenite = rutile + iron). It has also been inferred from these estimates that the lunar mantle is also highly reduced lying at conditions below IW. Generally, these data cannot be used to determine if the mare basalts become increasingly reduced during transport from their mantle source and eruption at the lunar surface and if there are differences in fO2 among mare basalts or mantle sources. One promising approach to determining the fO2 of mare basalts is using the mean valence of vanadium (2+, 3+, 4+, 5+) determined on spots of a few micrometers in diameter using synchrotron x-ray absorption fine structure (XAFS) spectroscopy. The average valence state of V in basaltic glasses is a function of fO2, temperature, V coordination, and melt composition. Here, we report the initial results of this approach applied to lunar pyroclastic glasses.
Derived from text
*Oxygen; Basalt; Lunar Mantle; Vanadium; Valence; Absorption Spectroscopy; Crystallization*

**20040062152** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Relaxation of the Martian Crustal Dichotomy Boundary in the Ismenius Region**
Guest, A.; Smrekar, S. E.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The origin of the Martian crustal dichotomy remains a puzzle that when solved can provide an insight to the geological and geophysical evolution of Mars. In this study we model crustal relaxation in order to better constrain the original topographic shape, rheology, and temperature of the Martian crust. Our approach is to model the detailed geologic history of the Ismenius region of Mars, including slope, strain, and timing of faulting [1]. This region may contain the best preserved section of the dichotomy boundary as it is relatively unaffected by large impacts and erosion. So far the only study Martian crustal relaxation [2] suggests that the original topographic shape of the dichotomy is preserved. However, in this area strain from faulting implies at least some relaxation [1].
Derived from text
*Dichotomies; Planetary Crusts; Mars Surface; Paleontology; Planetary Geology*

**20040062162** Brown Univ., Providence, RI, USA
**Thermal Stresses and Tharsis Loading: Implications for Wrinkle Ridge Formation on Mars**
Boroughs, L. L.; Parmentier, E. M.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Global cooling could be a major contributor to stresses on Mars, resulting in stresses large enough to cause compressional

faulting of the upper portion of the crust. Compressional features found globally on Mars including wrinkle ridges [1,2,3], could therefore be explained largely by the cooling of the planet. We formulate models including stresses resulting from both contraction of the interior and differential contraction within the lithosphere, a source of stress neglected in previous thermal stress models. We predict compressional thermal stresses that are large compared to stresses due to the loading of Tharsis, particularly at large distances from Tharsis. Thus thermal stresses may offer a viable explanation for wrinkle ridges concentric to Tharsis which cannot be explained by Tharsis loading alone.
Derived from text
*Cooling; Thermal Stresses; Stress Analysis; Mars Surface*

**20040062164** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Geologic Evolution of the Martian Dichotomy and Plains Magnetization in the Ismenius Area of Mars**
Smrekar, S. E.; McGill, G. E.; Raymond, C. A.; Dimitriou, A. M.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The global dichotomy divides the northern lowlands from the southern highlands, except where interrupted by relatively young volcanic provinces and impact basins. An elevation change of 2-4 km is typical across the dichotomy, and more than 6 km locally, over distances of several 100s km to as much as 1300 km [1,2]. A variety of exogenic and endogenic formation models have been proposed. Distinguishing between these models would help constrain the overall thermal evolution of the planet, possibly timing of core formation, and the associated mantle heat flux over time. A first step is to determine whether or not gravitational relaxation plays a role in modifying the boundary. Nimmo and Stevenson [3] examined 10 profiles across the dichotomy and used models of gravitational relaxation to conclude the relaxation has not occurred. In this study we begin by considering the geologic history in detail as inputs for modeling [4].
Derived from text
*Dichotomies; Magnetization; Mars Surface; Paleontology; Planetary Geology; Structural Basins*

**20040062167** National Museum of Natural History, Washington, DC, USA
**Bulk Compositions of CAIs and Al-rich Chondrules: Implications of the Reversal of the Anorthite/Forsterite Condensation Sequence at Low Nebular Pressures**
MacPherson, G. J.; Petaev, M.; Krot, A. N.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The bulk compositions of calcium-aluminum- rich inclusions (CAIs) differ slightly but systematically from the predictions of thermodynamic equilibrium for condensation from a hot nebular gas [e.g. 1,2]. The fit is best for melilite-rich (Type A) and hibonite-rich CAIs, but progressively worse for pyroxene-rich (Type B) and, especially, feldspar-rich (Type C) varieties. In essence, Types B and C CAIs are forsterite-deficient relative to predictions. This has led to recent models for Type B CAIs [3, 4] in which melting of condensate precursors is accompanied by distillation of magnesium. Yet even these models do not explain the compositions of plagioclase-rich Type C CAIs. Our recent work on a very different variety of CAI, the so-called fine-grained spinel-rich inclusions (FGIs), has revealed an alternative explanation for the bulk composition problem. FGIs are generally regarded as condensates: most FGIs in the CV3 chondrites are characterized by volatility-fractionated trace element patterns (Group II) that can only have originated through condensation, not evaporation; and, their internal structures are not consistent with igneous crystallization.
Derived from text
*Inclusions; Thermodynamic Equilibrium; Forsterite; Crystallization; Low Pressure; Magnesium; Chondrites*

**20040062169** Chicago Univ., Chicago, IL, USA
**Elemental and Isotopic Fractionation by Diffusion-limited Evaporation**
Richter, F. M.; Davis, A. M.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The diffusion-limited evaporation regime arises whenever the time it takes to chemically and isotopically homogenize an evaporating material by diffusion is comparable or long compared to the time it takes for significant evaporation of the species of interest to take place. The degree of diffusive limitation can be characterized by a nondimensional number E, called the evaporation number, defined as the ratio of the diffusive time scale tau(sub D) to the evaporation time scale tau(sub evap.).

The evaporation number for a species i is E(sub i) = tau(sub D) / tau(sub evap.) = LJ(sub i) / C(sub i)D, where L is a typical dimension (e.g., cm) of the condensed phase, J(sub i) is the evaporation rate of species i, (e.g., in moles /sq cm s), C(sub i) is the molar density of i (in moles / qu cm) and D is the diffusion coefficient of i (in/ sq cm s). The larger the evaporation number, the more diffusion-limited the system will be. The best-studied case of diffusion-limited evaporation involves evaporation of solid forsterite, which corresponds to the limit much greater than 1 and was studied both experimentally and theoretically by Wang et al. Forsterite evaporates congruently, thus there is no chemical fractionation. Isotopic fractionation is restricted to a very narrow boundary layer at the surface of dimensions L/E. Here we will focus on the more complicated problem of diffusion limited evaporation of a multicomponent system in which both elemental and isotopic fractionations can arise. The key issue we address is how diffusive effects alter the relationship between elemental and isotopic fractionation of evaporation residues.
Author
*Evaporation Rate; Diffusion; Fractionation*

**20040062173** Cambridge Univ., Cambridge, UK
**(Al-26/Al-27)0 of the Solar Nebula Inferred from Al-Mg Systematic in Bulk CAIs from CV3 Chondrites**
Galy, A.; Hutcheon, I. D.; Grossman, L.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Al-26 decays to Mg-26 with a short half-life of 0.73 Ma; an Al-26/Al-27 canonical value of 5x10(exp -5) has been inferred by studies of CAIs among many different meteorites [1-3]. This canonical value is, however, determined by internal isochron in CAIs and relies on a) relatively few data bulk data [4] and b) the average of punctual analyses [5]. On that basis, the evidence for 1) possible heterogeneity in the isotopic composition of Mg of solar system material, and 2) the dating of the segregation of the CAI precursor material from the solar nebula has been elusive. Because of isotopic and elemental diffusion, the internal isochron and inferred (Al-26/Al-27)0 corresponds to the last thermal event affecting each individual CAI. This interpretation has led to the determination of the timing of multistage formation events of some CAI [6], and also implies that (Al-26/Al-27)0 values of > 5x10(exp -5) are artifacts resulting from the local redistribution of Mg-26 excesses. The aim of this study is to investigate the Mg isotope composition in bulk CAIs and determine when the CAI precursor material has been segregated from the rest of the solar nebula.
Derived from text
*Magnesium Isotopes; Aluminum Isotopes; Half Life; Solar Nebula; Meteorites; Chondrites*

**20040062174** National Museum of Natural History, France
**Synthesis of Refractory Minerals by High-Temperature Condensation of a Gas of Solar Composition**
Toppani, A.; Libourel, G.; Robert, F.; Ghanbaja, J.; Zimmermann, L.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Condensation processes are often proposed to explain the formation of the first objects of our solar nebula, i.e., Ca-Al-rich inclusions (CAIs) [1]. Indeed, CAIs show (i) refractory minerals whose formation and compositions have been predicted by theoretical calculations of condensation from a cooling solar gas [2] and (ii) peculiar fluffy textures, which have no terrestrial equivalent [3]. Even if volatilization of chondritic objects or crystallization from a melt could form some of the refractory minerals of CAIs [4,5], these processes do not explain, for example, these fluffy textures or the mineralogical rimming of the fine-grained CAIs.
Derived from text
*Refractories; Minerals; High Temperature Gases; Meteoritic Composition; Vaporizing; Chondrites*

**20040062180** MacQuarie Univ., New South Wales, Australia
**Hyperspectral and Field Mapping of an Archaean Komatiite Unit in the Pilbara Craton, Western Australia: Applications for CRISM Mission**
Brown, A. J.; Walter, M. R.; Cudahy, T.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent VNIR-SWIR airborne hyperspectral investigations of the Early Archaean East Pilbara Granite-Greenstone Terrane have mapped hydrothermal alteration minerals in a predominantly mafic volcanic terrane. The investigation has identified a

previously unrecognized aqueously altered komatiite flow. Results of this project are of direct relevance to the forthcoming hyperspectral investigation of the Martian surface by the CRISM instrument, scheduled to launch on MRO in 2005.
Derived from text
*Igneous Rocks; Minerals; Volcanoes; Petrology; Mineralogy*

**20040062181**
**Barite and Celestine Detection in the Thermal Infrared: Possible Application to Determination of Aqueous Environments on Mars**
Burt, D. M.; Kirkland, L. E.; Adams, P. M.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Two minerals commonly cited as possible indicators of former aqueous environments on Mars are 1) calcite, calcium carbonate, as an indicator of calcium weathered from mafic igneous rocks reacting with carbon dioxide in the martian atmosphere, presumably in the presence of water, and 2) coarselycrystalline or gray hematite (specularite, ferric iron oxide) as an indicator of former hydrothermal activity, which would promote the growth of larger than normal crystals (finely crystallized hematite has been proposed for hundreds of years as the cause of the red color of Mars). Problems with these approaches are 1) that the surface of weathered calcite can become pitted and rough, owing to its softness and relatively high solubility in water, thus making spectroscopic detection difficult [1], and 2) that finely crystallized hematite can occur as an extremely thin, shiny (specular) coating, whose spectrum closely matches that of the coarsegrained hematite [2]. Another, more general problem is that Ca and Fe are both extremely abundant in igneous rocks, so that calcite and hematite can form in the presence of not very much water, under a huge variety of conditions. These problems imply unavoidable ambiguity for claims involving either the detection or non-detection of the above minerals, and problems of interpretation even if they are detected unambiguously.
Derived from text
*Barite; Calcite; Calcium Carbonates; Hematite; Mars Surface; Crystallization; Iron Oxides*

**20040062183** Arizona State Univ., Tempe, AZ, USA
**Emission Spectroscopy of Smectites: Implications for the TES Andesite-weathered Basalt Debate**
Michalski, Joseph R.; Kraft, Michael D.; Sharp, Thomas G.; Williams, Lynda B.; Christensen, Philip R.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; 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 have revealed two major surface types on Mars [1]. Surface type-1 (ST1) is interpreted as basalt [1-4] and surface type-2 (ST2) as basaltic andesite [1,3] or altered basalt [4-6]. If the ST2 represents andesitic materials, it would have major implications for petrologic evolution of the Martian crust [7]. If ST2 represents weathered basaltic materials, it could provide key insight for understanding surface processes. The geological interpretation of ST2 is dependent on which materials are used to model the ST2 spectrum. The ST2 spectrum can be modeled with spectra of plagioclase feldspars, pyroxene, and spectrally amorphous material [1-4]. Interpretations of the spectrally amorphous material include obsidian glass [1,3], smectite clays [4], palagonite [6], zeolites [8], or silica-rich rock coatings [5]. In this study, we consider the hypothesis that ST2 may represent smectite clays. One of the reasons for controversy on this subject is the difficulty in characterizing clay minerals, both spectrally and mineralogically.
Derived from text
*Amorphous Materials; Basalt; Andesite; Feldspars; Montmorillonite; Planetary Crusts; Thermal Emission; Emission Spectra; Mars Surface; Minerals*

**20040062184** Planetary Science Inst., Tucson, AZ, USA
**Thermal Emission Spectroscopy of Sulfates: Possible Hydrous Iron-Sulfate in the Soil at the MER-A Gusev Crater Landing Site**
Lane, Melissa D.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Sulfates are likely to be present on Mars as indicated by the sulfur abundances measured at the Viking and Pathfinder landing sites (approx. 5-10% by weight SO3) [1-3] and because of Mars strongly oxidizing environment. Telescopic observations of Mars tentatively identified weak sulfate bands in near infrared [4] and thermal infrared [5] data. The currently

orbiting midinfrared instruments (TES, THEMIS) and the Mini-TES on the Mars Exploration Rover landers may enable a positive identification [6] and determination of the chemistry of the sulfates. Critically important to the identification of these minerals is the presence of their spectra in a spectral library. There exist approximately 370 sulfate-mineral species [7]. Sulfate minerals occur in volcanic, hydrothermal, evaporitic, and chemical-weathering environments.
Derived from text
*Landing Sites; Emission Spectra; Thermal Emission; Soils; Mars Exploration; Craters; Weathering; Sulfur Oxides*

**20040062185** Institut d'Astrophysique, Paris, France
**Sulfate-cemented Soils Detected in TES Data Through the Application of an Automated Band Detection Algorithm**
Gendrin, A.; Mustard, J. F.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We apply an automatic band detection algorithm, based on the wavelet transform [1], to the TES dataset. This algorithm detects the wavelength positions of bands in spectra and then classifies together spectra with similar absorption band positions. Using this algorithm we show that an absorption band at 1120 cm-1 is systematically present in spectra corresponding to the regions of high sulfate concentration according to [2]. This result addresses again the question of the detectability of cemented sulfates in TES dataset, despite the low concentration resulting from the application of a linear unmixing method. Elemental sulfur was identified in the Martian soil by the Viking and Pathfinder landers, in relatively high concentrations (~5-9 %) [3, 4, 5]. These landers also revealed that the soil was indurated in places. Comparative measurements in the indurated and normal soil showed that the concentration of sulfates is higher in the indurated soil. These observations led to the hypothesis that the duricrust on Mars contains cemented sulfates [4, 6, 7].
Derived from text
*Soils; Cementation; Algorithms; Absorption Spectra; Mars Surface; Sulfates; Detection*

**20040062186** Hawaii Univ., Honolulu, HI, USA
**Volcanism and/or Aqueous Alteration on Mars: Constraints on Distinguishing Glass and Phyllosilicate in the Thermal Infrared**
Koeppen, W. C.; Hamilton, V. E.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Interpretation of Thermal Emission Spectrometer (TES) data requires a detailed investigation of different minerals that show apparently similar spectral properties. For example, the TES experiment has identified surface materials (Surface Type 2) interpreted as andesitic based on the detection of a glassy component in the spectra [1,2]. Following work [3], however, has suggested that phyllosilicate minerals may be an alternative to the glassy component of [1].
Derived from text
*Volcanology; Surface Properties; Mars Surface; Minerals; Thermal Emission*

**20040062187** State Univ. of New York, Stony Brook, NY, USA
**Olivine Weathering on Mars: Getting Back to Basics**
Tosca, N. J.; Hurowitz, J. A.; Meltzer, L.; McLennan, S. M.; Schoonen, M. A. A.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

With recent advances in remote sensing (e.g. MGS-TES, -MOC, Odyssey THEMIS and GRS), it has become possible to obtain detailed physical and chemical information from the Martian surface. Therefore, mineralogical markers existing on the surface may provide clues to the history of water on Mars. Recently, it has been suggested that olivine may be one mineralogical marker providing such information [1]. The detection of specific olivine-rich areas on the Martian surface has led to several interpretations on the history of water in these areas as well as the nature of olivine weathering on the surface of Mars. In order to apply what is currently known about the behavior of olivine weathering in terrestrial systems to Mars, it is important to highlight some of the fundamentals of olivine weathering. Here, based on experimental investigations of olivine weathering, we report that distinction between weathered and unweathered olivine on Mars may be more difficult than previously thought. With this complication introduced, the use of olivine as a mineralogical marker on Mars relies heavily on

the kinetics of dissolution under Martian conditions, which, as discussed below, can be exceedingly complicated.
Derived from text
*Weathering; Olivine; Mars Surface; Mineralogy; Chemical Analysis*

**20040062188** NASA Ames Research Center, Moffett Field, CA, USA
**Search for Evaporite Minerals in Flaugergues Basin, Mars**
Dalton, J. B.; Sutter, B.; Kramer, M. G.; Stockstill, K. R.; Moersch, J.; Moore, J. M.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Studies of Martian surface geomorphology and detection of near-surface water ice by the Mars Odyssey gamma ray spectrometer suggest that Mars may have had a water-rich past. While 2 to 5 wt.% of carbonate has been detected in the Martian dust [1,2], no spectral evidence for significant deposits of carbonates or sulfates has been found to date. Most investigations into Mars aqueous mineralogy have been global in scope with only a few regional studies (e.g., [3]). We are searching for localized deposits in putative lacustrine basins utilizing a basin flow model to identify basins with large drainage areas. Such basins are more likely to accumulate high concentrations of aqueous minerals than deep basins which drain only small regions.
Derived from text
*Geomorphology; Mars Surface; Planetary Geology; Surface Water; Ice; Mineral Deposits*

**20040062216** Oregon State Univ., Corvallis, OR, USA
**Olivine Alteration on Earth and Mars**
Fisk, M. R.; Popa, R.; Storrie-Lombardi, M. C.; Vicenzi, E. P.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Olivine, an iron-magnesium silicate (generic formula (Mg,Fe)2SiO4), is abundant and widely distributed on Earth and in the solar system. On Earth it is 3% to 5% of the basaltic crust and it is the most abundant mineral in the mantle. Iron in olivine is present as Fe(II). The atomic ratio Mg/(Mg + Fe) in olivine can vary from 0 to 1, but typical values for olivine in a basalt magma are 0.5 to 0.9. In addition to the four elements in olivine's generic formula, it contains minor amounts of Al, Ca, Mn, Co, and Ni but little else. Olivine is unstable in aqueous environments, it is the most soluble silicate mineral in certain organic acids [1], and at least one microorganism, Acidithiobacillus ferrooxidans, oxidizes Fe(II) from olivine in culture and produces pits on the surface of the mineral [2, 3]. Volcanic glass when altered by microorganisms has distinctive textures that differ from abiotic alteration [4, 5], and laboratory abiotic and biotic alteration of olivine produces different alteration textures [6]. We have examined natural samples for distinctive textures that may be used to indicate extant or fossil microbial activity in olivine bearing rocks.
Derived from text
*Olivine; Magnesium; Minerals; Silicates; Crusts; Basalt*

**20040062247** NASA Ames Research Center, Moffett Field, CA, USA
**Explaining the Mid-Latitude Ice Deposits with a General Circulation Model**
Mischna, M. A.; Richardson, M. I.; Wilson, R. J.; Zent, A.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Though plausible explanations for the high latitude subsurface hydrogen features on Mars have been put forth, there still lacks a consensus on the nature of the low-latitude hydrogen features found in Arabia Terra and Daedalia Planum. While equivalent water mass fractions in these regions are low enough to potentially be explained by the presence of hydrated minerals, it still remains possible that such features are the remnants of ice deposits left from a previous period of high obliquity and which is now thermally unstable and subliming. In order to explore the thermal stability of putative ice deposits at low latitudes, we use the Geophysical Fluid Dynamics Laboratory (GFDL) Mars GCM with a newly integrated subsurface scheme to trace the deposition and sublimation rates of water ice, adsorbate and vapor across the planet at varying obliquities. In addition, these results help resolve the question of the dominant means of ice emplacement in the near surface, whether such ice is the result of buried surface deposits, or in situ emplaced ice due to vapor diffusion.
Derived from text
*Atmospheric General Circulation Models; Deposits; Ice; Mars Surface; Planetary Geology; Thermal Stability*

**20040062249** Los Alamos National Lab., NM, USA

**Enhanced Water-Equivalent Hydrogen on the Western Flanks of the Tharsis Montes and Olympus Mons: Remnant Subsurface Ice or Hydrate Minerals?**

Elphic, R. C.; Feldman, W. C.; Prettyman, T. H.; Tokar, R. L.; Lanza, N.; Lawrence, D. J.; Head, J. W., III; Mischna, M. A.; Richardson, M. I.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Odyssey gamma ray and neutron spectrometer (NS) observations have revealed surprisingly high water-equivalent hydrogen abundances at the equatorial and mid-latitudes of Mars [1]. Studies indicate that at these latitudes water ice should not be stable at the depths to which the spectrometers are sensitive (< 1 m) [2,3]. Consequently these water enhancements are a puzzle: do they represent stable, hydrated minerals or regions where special soil and stratigraphic conditions permit remnant shallow water ice deposits? Here we focus on the water enhancements on the west slopes of the Tharsis Montes, Olympus Mons and Alba Patera, where landforms to the west and northwest suggest the possible presence of cold-based mountain glaciers [4,5]. We investigate the possibility that significant snow/ice deposits could have formed in these locations during periods of high obliquity within the last 500 kyr [6], and that presentday remnant water may be locked up in stable hydrate minerals or (less likely) shallowly buried ice in glacial and periglacial landforms.

Derived from text

*2001 Mars Odyssey; Gamma Ray Spectrometers; Neutron Spectrometers; Abundance; Hydrogen; Mars Surface*

**20040062268** Maryland Univ., College Park, MD, USA

**New Constraints on the Origin of the Highly Siderophile Elements in the Earth's Upper Mantle**

Becker, H.; Horan, M. F.; Walker, R. J.; Gao, S.; Lorand, J.-P.; Rudnick, R. L.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264

Contract(s)/Grant(s): NSF EAR-02-07107; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The origin of the highly siderophile elements (HSE) Re, Os, Ir, Ru, Pt, Rh. Pd and Au in the Earth's mantle remains a contentious topic. Relatively high abundances of these elements in the mantle suggest that mantle and core are not in equilibrium regarding the HSE. Hypotheses proposed to explain the HSE excess and near-chondritic HSE ratios in the mantle include: (1) Late accretion of 0.1-1 mass % chondritic material after core formation (Late veneer hypothesis [1-3]). (2) Decrease of metal-silicate partition coefficients at high pressures and metal-silicate equilibration at the bottom of a magma ocean [4]. (3) Incomplete metal-silicate separation during core formation [5]. (4) Contamination of the mantle with outer core material [6]. Each of these models has its problems. More precise estimates of the HSE composition of the primitive upper mantle (PUM) may provide further clues. Here, we present new high-precision data for Re, Os, Ir, Ru, Pt and Pd in mantle peridotites, using improved analytical techniques. New estimates for the HSE in PUM are obtained and the results compared with new high-precision data for HSE in chondrites [7] and in lunar impact melt breccias [8].

Derived from text

*Earth Mantle; Peridotite; Abundance; Chondrites; Contamination; Impact Melts*

**20040062271** Tokyo Univ., Hongo, Japan

**Partial Resetting on Hf-W System by Giant Impacts**

Sasaki, T.; Abe, Y.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hafnium and tungsten are both highly refractory elements, and hafnium is a lithophile element whereas tungsten is a moderately siderophile element that should strongly partitioned into metal phases during metal/silicate segregation. Hf-W chronometry provides constraints on the timing of planetary accretion and differentiation, as the segregation of a metal core from silicates should induce strong fractionation of hafnium from tungsten. In previous studies, it was assumed a giant impact raise up perfect resetting on Hf-W chronometer. Recently the effect of partial resetting on Hf-W system is starting to be considered [1, 2].

Derived from text

*Hafnium; Tungsten; Fractionation*

**20040062274** Case Western Reserve Univ., Cleveland, OH, USA
**Solid Metal-Liquid Metal Partitioning of Pt, Re, and Os: The Effect of Carbon**
Chabot, N. L.; Campbell, A. J.; Humayun, M.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264
Contract(s)/Grant(s): NAG5-12831; NAG5-13133; NAG5-11122; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

If the measured Os isotopic ratios are a signature from the Earth's outer core, understanding them is a unique opportunity to understand more about the Earth's core. The distribution of elements between the Earth's solid inner core and the liquid outer core will depend on their solid metal-liquid metal partition coefficients (D). Solid metal-liquid metal partitioning data are loosely consistent with the needed fractionations between Re-Os and Pt-Os to account for the Os isotopic signature; D(Os) is greater than both D(Re) and D(Pt), and the magnitude of the partition coefficients are similar to those needed [e.g. 7, 8]. The pressure in the core, the composition of the core, and the crystal structure of the solid Fe alloy in the inner core may influence the specific values of the partition coefficients. It may thus be possible to use these sensitivities of the partition coefficients to gain insight into the conditions within the Earth's core. In this abstract, we focus on the compositional influence of C, a potential component of the light element in the Earth's core [9], on the partitioning behaviors of Pt, Re, and Os.
Derived from text
*Crystal Structure; Fractionation; Light Elements; Liquid Metals; Carbon*

**20040062313** Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse, Orsay, France
**Micrometeoritic Neon in the Earth's Mantle**
Maurette, M.; Sarda, P.; Lunar and Planetary Science XXXV: Terrestrial Planets; 2004; 2 pp.; In English; See also 20040062312; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Two major problems with the distribution of noble gases on the Earth are quoted in the literature [1]. They concern: w the light noble gases, with atmospheric neon showing a 20Ne/22Ne ratio much smaller than that locked in rocks from the upper mantle; w the marked depletion of xenon relatively to Ar and Kr, observed in both the atmosphere and the upper mantle, and which defines the mystery of the 'missing' xenon.
Derived from text
*Micrometeorites; Xenon; Rare Gases; Earth Mantle; Rocks*

**20040062319** Academy of Sciences (Russia), Moscow, Russia
**Reduction of W, Mn, and Fe, During High-Temperature Vaporization**
Gerasimov, M. V.; Dikov, Y. P.; Yakovlev, O. I.; Lunar and Planetary Science XXXV: Terrestrial Planets; 2004; 2 pp.; In English; See also 20040062312; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Earlier we reported about an efficient reduction of iron in silicate melts at impact related high-temperature conditions with subsequent removal of metallic iron particles into the vapor outflow [1,2]. The formation and efficient loss of metallic iron particles is a possible mechanism which provides scavenging of siderophile elements (SE) from silicate melts during an impact. The same behavior was observed for other SE. Experiments with Pt-rich and Ni-rich targets have shown that Pt and Ni tended to form separated metallic phases and were removed from silicate melts [2,3,4]. The reduction and loss of SE during impact-related high-temperature processing provide not-magmatic SE differentiation which can be a valuable mechanism of formation of SE budget during the accretion period. One of the aims of the present experiment was to investigate the behavior of W, Mn, and Fe at impact-related high-temperature conditions.
Derived from text
*Iron; Melts (Crystal Growth); High Temperature; Vaporizing; Metal Particles*

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## METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

**20040056117** Wageningen Univ., Wageningen, Netherlands
**Effect of Climate Change on the Hydrology of the River Meuse**
de Wit, M. J. M.; Warmerdam, P. M. M.; Uijlenhoet, R.; Torfs, P. J.; 2003; In English
Report No.(s): PB2004-102664; Copyright; Avail: National Technical Information Service (NTIS)

This study describes historical observations and future estimates of the discharge regime of the river Meuse, with reference to climate change. It specially deals with low flows and integrates results obtained from analyses of observed performed with hydrological models.
NTIS
*Climate Change; Hydrology*

**20040059099** National Center for Atmospheric Research, Boulder, CO
**Determination of Mesoscale Predictability Limits with Respect to Uncertainty in the Larger-Scale Environment**
Tribbia, Joseph; Baumhefner, David; Mar. 31, 2004; 5 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0017
Report No.(s): AD-A421893; No Copyright; Avail: CASI; A01, Hardcopy

An examination of the scale interactions in predictability experiments is made using the NCAR Community Climate Model Version 3 (CCM3) at various horizontal resolutions ranging from T42 to Ti 70. Both identical-model and imperfect-model twin experiments are analyzed, and they show distinctive differences from the classical inverse cascade picture of predictability error growth. In the identical-model twin framework, error growth experiments using initial errors confined to long and short scales are compared and contrasted. In these cases, error growth eventually asymptotes to an exponential growth of baroclinically active scales. In the imperfect-model twin experiments, errors rapidly disperse from scales technically beyond model resolution to a small amplitude, spectrally uniform distribution of errors in resolved scales. The errors in resolved scales further amplify in a quasi-exponential growth of the baroclinically active scales. Finally, the implications of these growth mechanisms for the necessary resolution in short- to medium-range numerical weather prediction are given under the assumption that the accuracy of current initial state
DTIC
*Mesoscale Phenomena; Numerical Analysis; Predictions*

**20040059100** Naval Research Lab., Stennis Space Center, MS
**Advanced Techniques in Delivering Data to the Warfighter in a Distributed Information System**
Warner, Elizabeth G.; Ladner, Roy; Petry, Fred; Shea, John J.; Mar. 10, 2004; 10 pp.; In English
Report No.(s): AD-A421897; No Copyright; Avail: CASI; A02, Hardcopy

The future requires military operations and intelligence communities to more heavily rely on Internet- based solutions for the delivery of MetOc data and products to the warfighter in an automated manner. These issues are being addressed by TEDServices (TEDServices). TEDServices is being engineered by the Naval Research Laboratory, the Naval Oceanographic Office and the Naval Undersea Warfare Center, with sponsorship from Space and Naval Warfare Systems Command (SPAWAR) PMW-150. TEDServices was successfully demonstrated during April 2004, in FBE-Kilo, and is in transition to the US Navy this fiscal year. This paper will describe how TEDServices has been engineered to provide solutions to issues routinely confronted by warfighters. These solutions include, but are not limited to, better bandwidth usage, automated data ordering, simplification of data management, automated data transformations, forward deployed data caching, simplified integration with legacy tactical decision aids and support for joint interoperability.
DTIC
*Data Systems; Information Systems; Meteorological Parameters*

**20040059154** Naval Postgraduate School, Monterey, CA
**LDV Measurements in the Endwall Region of an Annular Turbine Cascade Through an Aerodynamic Window**
Hobson, G. V.; Donovan, W. H.; Spitz, J. D.; Jan. 1997; 9 pp.; In English
Report No.(s): AD-A422025; No Copyright; Avail: CASI; A02, Hardcopy

Laser-Doppler velocimetry measurements through a one millimeter hole in the casing of an annular turbine cascade were performed in the endwall region downstream of the blade row. Complementary three-hole pressure probe measurements were also taken downstream of the nozzle blades, as well as blade surface pressure measurements. The object of this study was to devise methods for the measurement close to an endwall and to overcome the problems associated with optical access window contamination. The eventual aim of the project was to perform laser anemometry measurements in the tip leakage region of an operating turbine of comparable size. Good comparisons with numerical predictions of the flowfield were also obtained.
DTIC
*Annular Flow; Cascade Flow; Laser Anemometers; Laser Doppler Velocimeters; Stagnation Pressure; Static Pressure; Turbines; Windows (Apertures)*

**20040059256** Naval Postgraduate School, Monterey, CA
**Factors Influencing the Structure of the Monterey Bay Sea Breeze**
Duvall, Emily M.; Mar. 2004; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422212; No Copyright; Avail: CASI; A05, Hardcopy

The sea breeze is a thermally induced circulation that arises along essentially every coastline. However, the Monterey Bay circulation associated with the sea breeze varies day to day because of the influence of features such as inversions, clouds, synoptic-scale flow, and topography. Understanding the sea breeze is important because it impacts fire weather, air pollution, agriculture, and aviation operations, among other things. Analyses are conducted using a multi-quadric based program to investigate the Monterey Bay sea breeze during 01-31 August 2003. This program incorporates aircraft data, surface observations, and profiler data. Outputs from the analysis program are plotted in VISUAL to characterize the structure of the sea breeze. Factors including inversions, cloud cover, amount of heating, distribution of heating, synoptic-scale flow, and topography are studied to determine their influence on the sea breeze. Six days are presented in this thesis that best illustrate the factors that influence the structure of the Monterey Bay sea breeze. Results show that offshore flow weakened the strength of the sea breeze and decreased the depth, as expected. A cooling trend in surface temperatures at the end of the month also weakened the strength of the sea breezes and decreased the depth. Clouds are present during this period, which influenced the amount of heating, and consequently, the sea breeze response. The presence of a marine layer weakened the thermal gradient that in turn, weakened the sea breeze circulation.
DTIC
*Monterey Bay (Ca); Sea Breeze*

**20040059301** Naval Research Lab., Monterey, CA
**A Technical Description of the NAVDAS Adjoint System**
Langland, Rolf H.; Baker, Nancy L.; Mar. 16, 2004; 66 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422269; NRL/MR/7530--04-8746; ONR-JON-8556-04; No Copyright; Avail: CASI; A04, Hardcopy

This report provides a technical description of the adjoint code for the NRL Atmospheric Variational Data Assimilation System (NAVDAS). The output of the NAVDAS adjoint is an array that contains the sensitivity of a user-defined forecast cost function with respect to the complete set of observations assimilated by NAVDAS at a particular time. The input for the NAVDAS adjoint is an analysis sensitivity vector provided by the adjoint of a forecast model such as NOGAPS. Step by step guidelines for using the NAVDAS adjoint system to compute observation sensitivity are given. The basic theory of observation sensitivity is outlined, and features of the adjoint code and main subroutines are described in detail. Examples of observation sensitivity applications are provided, including the impact of innovations on short-range forecast error, and targeted observing.
DTIC
*Meteorological Parameters; Weather Forecasting*

**20040060000** Lawrence Livermore National Lab., Livermore, CA
**Development and Performance of a Scalable Version of a Nonhydrostatic Atmospheric Model**
Mirin, A. A.; Sugiyama, G. A.; Chen, S.; Hodur, R. M.; Holt, T. R.; Jun. 07, 2001; 18 pp.; In English
Report No.(s): DE2004-15006297; UCRL-JC-142797; No Copyright; Avail: Department of Energy Information Bridge

The atmospheric forecast model of the Naval Research Laboratory's (NRL) Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) has been developed into a parallel, scalable model in a joint collaborative effort with Lawrence Livermore National Laboratory (LLNL). The new version of COAMPS has become the standard model of use at NRL and in LLNL's Atmospheric Science Division. The main purpose of this enterprise has been to take advantage of emerging scalable technology, to treat finer spatial and temporal resolutions needed in complex topographical or atmospheric conditions, as well as to allow the utilization of improved but computationally expensive physics packages. The parallel implementation facilitates the ability to provide real-time, high-resolution, multi-day numerical weather predictions for forecaster guidance, input to atmospheric dispersion simulations, and forecast ensembles.
NTIS
*Weather Forecasting; Prediction Analysis Techniques; Real Time Operation; Temporal Resolution*

**20040062242** California Inst. of Tech., Pasadena, CA, USA
**Interpreting Martian Paleoclimate with a Mars General Circulation Model**
Richardson, M. I.; Mischna, M. A.; Basu, S.; Fenton, L. K.; Wilson, R. J.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Geophysical Fluid Dynamics Laboratory (GFDL) Mars GCM has been used extensively to study the evolution of martian climate over recent obliquity timescales. A variety of results are discussed here exploring the range of capabilities of this model. In particular, the GCM has been used to investigate orbital change as a cause of surface wind changes, the cycles of CO2 and water, and variations in the spatial distribution of net dust deposition / erosion. Over the model s evolution, significant capabilities have been added, including the incorporation of dust and water cycles, an active regolith and radiatively active clouds.
Derived from text
*Atmospheric General Circulation Models; Mars (Planet); Climate; Mars Atmosphere*

**20040062243** NASA Ames Research Center, Moffett Field, CA, USA
**History and Progress of GCM Simulations on Recent Mars Climate Change**
Haberle, R. M.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 1 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Global Surveyor and Odyssey spacecraft reveal evidence that Mars may have experienced significant climate change in the recent past (105-106 Myr ago). Examples include gullies [1], cold-based tropical glaciers [2], paleolakes [3], and youthful near-surface ice [4]. Except for the gullies, the evidence for recent climate change requires ice and/or liquid water at low latitudes. An obvious question, therefore, is how is it possible for ice and/or liquid water to exist at low latitudes which is not possible in the present climate system? There are several mechanisms to consider. An episode of intense volcanic activity could alter the mean composition of the atmosphere and, therefore, the climate system. Impacts, depending on the size, composition, and velocity of the impactor are another way to dramatically alter the climate system. Polar wander and solar variability are also possibilities. However, the most promising way to change the climate is through changes in orbital properties. Mars, because of its proximity to Jupiter and lack of a large stabilizing moon, experiences much greater changes in its orbit properties than the Earth.
Derived from text
*Mars Global Surveyor; Climate Change; Mars Environment; Glaciers; Ice*

**20040062244** Brown Univ., Providence, RI, USA
**Periods of Active Permafrost Layer Formation in the Recent Geological History of Mars**
Kreslavsky, M. A.; Head, J. W.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Estimation of the summer day average surface temperature on inclined surfaces on Mars has been done in [1] with a global climate model (GCM) for different obliquities. These calculations showed that starting from approx. 35deg obliquity, the maximal day-average temperature reaches the ice melting point at high latitudes; for even higher obliquity, the day average temperature exceeds 0deg C at lower latitudes, up to 40deg latitude at 45deg obliquity, but only at 20-30deg - steep pole-facing slopes. In [1, 2] this fact was used to explain formation of the recent gullies as debris flows formed at the periods of high obliquity, when melting of snow and a permafrost layer could occur. High day average temperatures suggest that summer thawing/winter freezing cycle can occur on Mars during some periods of geological history, which could lead to the existence of an active layer and formation of a number of geomorphological features characteristic of terrestrial permafrost regions.
Derived from text
*Permafrost; Geomorphology; Surface Temperature; Climatology; Freezing; Melting Points; Climate Models; Mars Surface*

**20040062245** Boston Univ., Boston, MA, USA
**Microclimate Zones 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 XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; 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 Earth s polar deserts make for compelling comparisons to a dry and cold Mars. Among polar deserts on Earth, the Dry Valleys region of Antarctica has long been featured as the most Mars-like. Classified broadly as a cold and hyper-arid region, the valleys feature a diverse suite of surface landforms that provide a geomorphological framework for interpreting features on Mars. New climate and

geomorphological data from the Dry Valleys show that the region is best subdivided into a series of narrow climatological zones. Each microclimate zone differs from the next by slight variations in atmospheric temperature and soil-moisture. Along microclimate boundaries, subtle variations in temperature and soil-moisture are sufficient to produce remarkable variations in surface topography. As is the case for most polar deserts, the geomorphic impact of minor variations in moisture and temperature is disproportionately large when compared to similar shifts in atmospheric temperature and soil moisture in humid-temperate latitudes. Insight gained from the distribution and temporal migration of microclimate zones in the Dry Valleys may help shed light on the origin and, in particular, the evolution of periglacial features and climate change on Mars. Author

*Microclimatology; Antarctic Regions; Landforms; Evolution (Development); Climate Change; Mars Surface*

**20040062246** NASA Johnson Space Center, Houston, TX, USA

**Geomorphic Evidence for Martian Ground Ice and Climate Change**

Kanner, L. C.; Allen, C. C.; Bell, M. S.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent results from gamma-ray and neutron spectrometers on Mars Odyssey indicate the presence of a hydrogen-rich layer tens of centimeters thick in the uppermost meter in high latitudes (>60 ) on Mars. This hydrogen-rich layer correlates to regions of ice stability. Thus, the subsurface hydrogen is thought to be water ice constituting 35+/- 15% by weight near the north and south polar regions. We refine the location of subsurface ice deposits at a < km scale by combining existing spectroscopy data with surface features indicative of subsurface ice. A positive correlation between spectroscopy data and geomorphic ice indicators has been previously suggested for high latitudes. Here we expand the comparative study to northern mid latitudes (30 deg.N- 65 deg.N).

Derived from text

*Climate Change; Deposits; Geomorphology; Hydrogen; Ice; Mars Surface*

**20040062254** Brown Univ., Providence, RI, USA

**Geological Evidence for Climate Change on Mars**

Head, J. W.; Mustard, J. F.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A wide variety of geological evidence indicates that the climate on Mars has changed during its past history. Evidence for these changes ranges in physical scale from layering in the polar caps and sediments, to meters-thick layers extending from high to mid-latitudes, to kilometers-thick polar and circumpolar deposits. The evidence is found throughout the geologic record of Mars, ranging from interpreted Amazonian tropical mountain glaciers to much longer term trends implied by the temporal distribution of geological features such as valley networks and outflow channels. Furthermore, there is strong evidence for changes in the hydrological cycle of Mars that reflects long-term climate change. For the last approx. 80% of Mars history, Mars appears to have been a very cold, hyper-arid polar desert. The hydrologic system has been horizontally layered with the hydrologic cycle consisting of a globally continuous cryosphere with liquid water occasionally emerging to the surface during magmatic events that cracked the cryosphere. Most of the surface water was tied up in the polar caps and in the regolith, and variations in orbital parameters caused significant surface redistribution of ice and dust. In the first 20% of Mars history, many believe that Mars was 'warm and wet', there was no global cryosphere, and that the hydrological cycle was vertically integrated.

Derived from text

*Climate Change; Mars Environment; Hydrological Cycle; Ice Environments; Planetary Geology*

**20040062255** California Inst. of Tech., Pasadena, CA, USA

**Interpreting Martian Paleoclimate with a Mars General Circulation Model**

Richardson, M. I.; Mischna, M. A.; Basu, S.; Fenton, L. K.; Wilson, R. J.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Geophysical Fluid Dynamics Laboratory (GFDL) Mars GCM has been used extensively to study the evolution of martian climate over recent obliquity timescales. A variety of results are discussed here exploring the range of capabilities of this model. In particular, the GCM has been used to investigate orbital change as a cause of surface wind changes, the cycles

of CO2 and water, and variations in the spatial distribution of net dust deposition / erosion. Over the model s evolution, significant capabilities have been added, including the incorporation of dust and water cycles, an active regolith and radiatively active clouds. Surface Winds: An in-depth discussion of the
Author
*Atmospheric General Circulation Models; Carbon Dioxide; Climate; Cycles; Fluid Dynamics; Mars Atmosphere*

**20040062256** NASA Ames Research Center, Moffett Field, CA, USA
**History and Progress of GCM Simulations on Recent Mars Climate Change**
Haberle, R. M.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 1 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Global Surveyor and Odyssey spacecraft reveal evidence that Mars may have experienced significant climate change in the recent past (10(exp 5) - 10(exp 6) Myr ago). Examples include gullies, cold-based tropical glaciers, paleolakes, and youthful near-surface ice. Except for the gullies, the evidence for recent climate change requires ice and/or liquid water at low latitudes. An obvious question, therefore, is how is it possible for ice and/or liquid water to exist at low latitudes which is not possible in the present climate system? There are several mechanisms to consider. An episode of intense volcanic activity could alter the mean composition of the atmosphere and, therefore, the climate system. Impacts, depending on the size, composition, and velocity of the impactor are another way to dramatically alter the climate system. Polar wander and solar variability are also possibilities. However, the most promising way to change the climate is through changes in orbital properties. Mars, because of its proximity to Jupiter and lack of a large stabilizing moon, experiences much greater changes in its orbit properties than the Earth.
Derived from text
*Mars Environment; Climate Change; Ice; Water; Stabilization*

## 48
## OCEANOGRAPHY

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

**20040058056** University Corp. for Atmospheric Research, Boulder, CO, USA
**World Ocean Circulation Experiment (WOCE) Young Investigator Workshops**
Austin, Meg; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-8928; No Copyright; Avail: CASI; A01, Hardcopy

The World Ocean Circulation Experiment (WOCE) Young Investigator Workshops goals and objectives are: a) to familiarize Young Investigators with WOCE models, datasets and estimation procedures; b) to offer intensive hands-on exposure to these models ard methods; c) to build collaborations among junior scientists and more senior WOCE investigators; and finally, d) to generate ideas and projects leading to fundable WOCE synthesis projects. To achieve these goals and objectives, the Workshop will offer a mixture of tutorial lectures on numerical models and estimation procedures, advanced seminars on current WOCE synthesis activities and related projects, and the opportunity to conduct small projects which put into practice the techniques advanced in the lectures.
Derived from text
*Ocean Currents; Education; NASA Programs; Earth Atmosphere; Mathematical Models*

## 51
## LIFE SCIENCES (GENERAL)

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

**20040050748** Kentucky Univ., Lexington, KY
**Prostate Cancer Risk Through Exposure to Halogenated Hydrocarbons and Modulation by Dietary Supplementation**
Ludewig, Gabriele; Robertson, Larry W.; Apr. 2003; 24 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0241
Report No.(s): AD-A421055; No Copyright; Avail: CASI; A03, Hardcopy

A high androgen level, oxidative stress, and low levels of selenium were identified as possible risk factors in prostate cancer development. Halogenated compounds may produce all these effects. Our hypothesis is that halogenated compounds may increase prostate cancer risk through these mechanisms. To test this hypothesis and to develop protection for exposed men, we propose to a) measure enzyme activities and antioxidant levels in PCB-exposed rats, b) determine possible co-carcinogenic factors like low selenium or high fat diets, c) study the mechanisms involved with prostate cancer cells in culture, and d) develop chemopreventive strategies. During this first year of our studies we found that 1) in in vivo studies substituting bromine for chlorine makes biphenyls more health damaging, indicating that brominated pesticides may deserve attention, 2) complex changes in lipid homeostasis, vitamin levels and redox status occur that need to be carefully taken into consideration, 3) cell culture experiments with prostate cells should use more than one pair of androgen sensitive/androgen insensitive cells, to avoid misleading conclusions, 4) a-tocopheryl quinone may be the most promising biomarker of oxidative stress by halogenated hydrocarbons. Overall these results provide a firm scientific basis for the work that is proposed and will follow.
DTIC
*Cancer; Diets; Exposure; Hydrocarbons; Modulation; Prostate Gland; Risk*

**20040056096** NASA Glenn Research Center, Cleveland, OH, USA
**A Quantitative Study of Oxygen as a Metabolic Regulator**
Radhakrishnan, Krishnan; LaManna, Joseph C.; Cabrera, Marco E.; [1999]; 1 pp.; In English; International Society of Oxygen Transport to Tissue 27th Annual Meeting, 28 Aug. - 2 Sep. 1999, Hanover, NH, USA
Contract(s)/Grant(s): NCC3-782; No Copyright; Avail: Other Sources; Abstract Only

An acute reduction in oxygen (O2) delivery to a tissue is generally associated with a decrease in phosphocreatine, increases in ADP, NADH/NAD, and inorganic phosphate, increased rates of glycolysis and lactate production, and reduced rates of pyruvate and fatty acid oxidation. However, given the complexity of the human bioenergetic system and its components, it is difficult to determine quantitatively how cellular metabolic processes interact to maintain ATP homeostasis during stress (e.g., hypoxia, ischemia, and exercise). Of special interest is the determination of mechanisms relating tissue oxygenation to observed metabolic responses at the tissue, organ, and whole body levels and the quantification of how changes in tissue O2 availability affect the pathways of ATP synthesis and the metabolites that control these pathways. In this study, we extend a previously developed mathematical model of human bioenergetics to provide a physicochemical framework that permits quantitative understanding of O2 as a metabolic regulator. Specifically, the enhancement permits studying the effects of variations in tissue oxygenation and in parameters controlling the rate of cellular respiration on glycolysis, lactate production, and pyruvate oxidation. The whole body is described as a bioenergetic system consisting of metabolically distinct tissue/organ subsystems that exchange materials with the blood. In order to study the dynamic response of each subsystem to stimuli, we solve the ordinary differential equations describing the temporal evolution of metabolite levels, given the initial concentrations. The solver used in the present study is the packaged code LSODE, as implemented in the NASA Lewis kinetics and sensitivity analysis code, LSENS. A major advantage of LSENS is the efficient procedures supporting systematic sensitivity analysis, which provides the basic methods for studying parameter sensitivities (i.e., changes in model behavior due to parameter variation). Sensitivity analysis establishes relationships between model predictions and problem parameters (i.e., initial concentrations, rate coefficients, etc). It helps determine the effects of uncertainties or changes in these input parameters on the predictions, which ultimately are compared with experimental observations in order to validate the model. Sensitivity analysis can identify parameters that must be determined accurately because of their large effect on the model predictions and parameters that need not be known with great precision because they have little or no effect on the solution. This capability may prove to be important in optimizing the design of experiments, thereby reducing the use of animals. This approach can be applied to study the metabolic effects of reduced oxygen delivery to cardiac muscle due to local myocardial ischemia and the effects of acute hypoxia on brain metabolism. Other important applications of sensitivity analysis include identification of quantitatively relevant pathways and biochemical species within an overall mechanism, when examining the effects of a genetic anomaly or pathological state on energetic system components and whole system behavior.
Author
*Oxygen; Metabolism; Tissues (Biology); Quantitative Analysis; Mathematical Models; Biochemistry; Regulatory Mechanisms (Biology)*

**20040058945** Burnham Inst., La Jolla, CA
**New Anti-Metastatic and Anti-Angiogenic Compound for Ovarian Cancer**
Rouslahti, Erkki I.; Sep. 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0556
Report No.(s): AD-A420794; No Copyright; Avail: CASI; A03, Hardcopy

We are studying anastellin, a novel anti- angiogenic protein. We have made significant progress toward understanding the mechanism of action of anastellin, and of polymeric fibronectin, the formation of which is induced by anastellin. We have shown that anastellin is ineffective in mice lacking plasma fibronectin, whereas the activity of the anti-angiogenic form of antithrombin does not depend on plasma fibronectin. As antithrombin is known to bind to another plasma adhesion protein, vitronectin, we also tested anastellin and antithrombin in vitronectin null mice. Antithrombin is inactive in these mice, whereas anastellin is active. Strikingly, a third anti-angiogenic protein, endostatin, was poorly active both in the plasma fibronectin-deficient and vitronectin null mice (Yi et al., PNAS, in press). These results provide strong evidence for our original hypothesis, which predicted that the various anti-angiogenic compounds depend on adhesion proteins, such as fibronectin and vitronectin, for their activity. Drawing from this new understanding of the mechanism of action, we are currently designing anastellin variants with enhanced activities and studying the effects of anastellin on endothelial cells in vitro. These advances in mechanistic understanding will help in designing experimental anti-angiogenic treatments for ovarian cancer.
DTIC
*Cancer; Metastasis; Ovaries*

**20040058949** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Psychomotor Functioning: Comparison of Patients Recovering From General Anesthesia With Remifentanil and a Volatile Anesthetic Versus Fentanyl and a Volatile Anesthetic**
Moseley, G. R.; Oct. 1998; 80 pp.; In English
Report No.(s): AD-A421410; No Copyright; Avail: CASI; A05, Hardcopy

A new opioid, remifentanil, recently gained approval for clinical use by the Food and Drug Administration. This has given anesthesia providers another agent with which to conduct anesthesia for both inpatient and outpatient surgery. Remifentanil has markedly different pharmacokinetics from other commonly used opioids. Specifically, remifentanil provides a predictable and rapid termination of action -- a potential advantage over other opioids. The purpose of this study was to compare how remifentanil and another more commonly used opioid, fentanyl, affect one aspect of anesthesia recovery -- psychomotor functioning. Twenty three subjects were sampled. Subjects received a balanced anesthetic using either remifentanil and a volatile agent, or fentanyl and a volatile agent. The Trieger Dot test was the assessment tool used to assess for baseline and recovery of psychomotor functioning. A test-retest reliability coefficient of 0.76 was obtained. Analysis of data did not reveal significant differences in psychomotor recovery between the two groups. Possible reasons behind this may have been related to the study s design. Due to the short duration of action associated with remifentanil, all subjects who received remifentanil also received other intraoperative opioids. These may have influenced postoperative psychomotor functioning postoperatively. Additionally, variety in case procedure, length, and the amount of anesthesia required may have significantly influenced postoperative psychomotor functioning.
DTIC
*Anesthesia; Anesthetics; Patients; Psychomotor Performance*

**20040058950** Academy of Health Sciences (Army), Fort Sam Houston, TX
**Case Study of the Capital Asset Realignment for Enhanced Services as Applied to the Wyoming VA Healthcare Market**
Mayer, Kurtis N.; Nov. 14, 2003; 81 pp.; In English
Report No.(s): AD-A421425; HCA-38-03; No Copyright; Avail: CASI; A05, Hardcopy

The Department of Veterans Affairs has embarked on a sweeping initiative to align capital assets with patient demand in order to improve access, quality, and cost effectiveness of care to veterans now and in the future. This study documents the first four steps of the nine-step Capital Asset Realignment for Enhanced Service (CARES) process as it applies to the Sheridan market area. This process involved establishing a communication plan and leading teams that analyzed and validated data and developed a strategic plan for the Sheridan market. The outcome of the study suggests that improving access to levels prescribed by CARES standards is possible but very expensive in a highly rural market. However, improving access through conscientious strategic planning is possible and practical. The CARES process is an accelerated program that relies heavily upon data and projections. Data validity, expedience, and political pressure may affect the outcomes. Nonetheless, CARES is a sound and dynamic process for improving the cost, quality, and access of the care delivered to our nation s veterans.
DTIC
*Management Planning; Management Systems; Medical Services*

**20040058951** Department of Defense, Arlington, VA
**Health Care: Franchise Business Activity Contracts for Medical Services**
Jun. 30, 2003; 26 pp.; In English
Report No.(s): AD-A421429; IG/DOD-D-2003-113; No Copyright; Avail: CASI; A03, Hardcopy

Contract personnel responsible for procuring medical services and military and civilian health care professionals within the military health system should read this report. Those responsible for acquiring and providing medical services should be interested in the issue of acquiring medical services through the Department of the Treasury, Franchise Business Activity contracts.
DTIC
*Commerce; Health; Medical Services; Procurement*

**20040058952** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Reported Knowledge and Management of Acute Low Back Pain by USA Army Nurse Practitioners as Compared to Clinical Practice Guidelines Published by the Agency for Health Care Policy and Research**
Davis, Jack M.; May 1999; 72 pp.; In English
Report No.(s): AD-A421430; No Copyright; Avail: CASI; A04, Hardcopy

Acute low back pain (ALBP) is a major malady of a large percentage of patients seen in the primary care setting. Office visits for acute low back pain number second only to upper respiratory infections (Jones, 97). Proper management of this condition would be facilitated by a consensus among providers as to treatment modalities. This goal can be obtained through the use of published clinical expert guidelines. Guidelines such as those published by the Agency for Health Care Policy and Research (AHCPR), U.S. Department of Health and Human Services are in existence, however the adherence of primary care providers to these is in question. Many studies have focused on this question as it relates to general medical officers, but few are oriented to Nurses Practitioners (NPs) and none to military NPs. This pilot study attempted to assess the knowledge and experience of Army NPs through the use of Benner s novice to expert model. Data collection was conducted through the use of a mailed survey to Nurse Practitioners on active duty in the USA Army in an Army Medical Center (N=10). The survey addressed issues in assessment, examination, diagnostic studies, treatment, learning opportunities, and experience with ALBP. A response rate of 66% was obtained. Nurse Practitioners surveyed scored 59% or better in adherence with the AHCPR guidelines. The data suggests a general need for further training among NPs in ALBP to include appropriate treatment and diagnostic modalities.
DTIC
*Health; Pain; Policies; Spine; United States*

**20040058957** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Suicide in the U.S. Federal Prison System**
Frickey, Robert C.; May 1999; 60 pp.; In English
Report No.(s): AD-A421443; No Copyright; Avail: CASI; A04, Hardcopy

This study examined the relationship between demographic traits of inmates in U.S. Federal prisons, and the commission of suicide from the time period 1993-97. A comparison was made to previous studies of two earlier 5-year periods. A stress adaptation model of nursing care was adopted for the purpose of providing a conceptual framework for the study, and the primary method of data collection employed was a chart review. Data surrounding the event of suicide was extracted from 61 inmate records, representing 100% of all suicides occurring during the five-year period of the study. Data was examined through the use of a tool used in previous research called the psychological autopsy. The results of the study were found to be similar to those of previous studies, and were demonstrated in an updated inmate profile which delineates common risk factors for suicide in this correctional setting. Results of this study confirm the effectiveness of suicide prevention programs in place within the Federal Bureau of Prisons. Recommendations for the future included the increased utilization of mid-level practitioners to identify inmates at high risk for suicide, a critical look at the physical environment in which the suicides take place, and the continuation of an on-going, systematic approach to the problem of inmate suicide in the correctional setting.
DTIC
*Autopsies; Death*

**20040058958** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**A Survey to Determine the Operational Readiness Training of the Army Certified Registered Nurse Anesthetist**
Kiebler, Patricia A.; Oct. 1999; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421447; No Copyright; Avail: CASI; A04, Hardcopy

The Army certified registered nurse anesthetist (CRNA) is an integral part of the health care team and offers a valuable service to the medical care of soldiers and their families. Delivering anesthesia on the battlefield will be vastly different from that of the technologically advanced military treatment facilities. The purpose of this study was to survey the type and amount

of trauma education and experience received by Army CRNAs. Results of this analysis revealed a mean of 6.48 4.6 years of military anesthesia experience. Annual anesthetics administered per Army medical facility ranged from 0-50,000. Trauma anesthesia is not included in 40% of current practice. Of particular interest, 71% percent of the respondents indicate that they did not have a trauma rotation in their clinical program. Fifty-three percent of respondents have been deployed. According to the questionnaire results, most respondents felt that vital training could be achieved through civilian trauma experience, attending the advanced trauma life support course, and participating in more deployment exercises.
DTIC
*Anesthesia; Education; Maintainability; Medical Personnel; Surveys*

**20040058959** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**The Lived Experience of Women With Abnormal Papanicolaou Smears Receiving Care in a Military Health Care Setting**
Kuehner, Cynthia A.; May 2001; 104 pp.; In English
Report No.(s): AD-A421451; No Copyright; Avail: CASI; A06, Hardcopy

The Papanicolaou (Pap) smear is one of modern medicine s greatest success stories. Since its introduction in 1942, this cost-effective procedure has greatly reduced morbidity and mortality from cervical cancer. Despite the effectiveness of this screening tool, patient compliance with treatment recommendations for abnormal Pap smears remains low. This qualitative research study explored the lived experience of women with abnormal Pap smears receiving care in a military health care setting. The purpose was to describe this phenomenon and contribute to existing knowledge, with the intent of understanding the experiences of women with abnormal Pap smear results. A purposive sample of six women who had received abnormal Pap smear results was engaged for data generation. Open-ended interviews were conducted, and transcripts of the interviews were reviewed and analyzed for themes, interpretation, and meaning of the lived experience. Participant s words and descriptions were integrated and provided the foundation of the study. From twenty-seven interpretive data clusters, seven essential themes emerged. The themes included: pre-experience knowledge, facing an abnormal Pap smear result, contextualizing, doing something, negotiating being more than a cervix , adapting and coping, and sharing. These themes illuminated the essence of the experience as it was lived and facilitated the description of the phenomenon under investigation.
DTIC
*Abnormalities; Cancer; Females; Health; Uterus*

**20040058960** Department of Defense, Arlington, VA
**Homeland Security: DoD Fire and Emergency Services Program**
Aug. 12, 2003; 51 pp.; In English
Report No.(s): AD-A421461; IG/DOD-D-2003-121; No Copyright; Avail: CASI; A04, Hardcopy

Civilian and military program managers for fire and emergency services at DoD installations should read this report. The report discusses how shortfalls for staffing and apparatus could adversely impact firefighter safety and installation missions.
DTIC
*Emergencies; Fire Fighting; Fires; Medical Services*

**20040058963** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Toward an Understanding of Health Care Delay Among Ethnic Minorities: Examining Health Care Behaviors Among Military Young-Adult Males**
Vaughn, Nicole A.; Jan. 2001; 118 pp.; In English
Report No.(s): AD-A421465; No Copyright; Avail: CASI; A06, Hardcopy

The importance of eliminating health disparities in the USA has become a top priority in public health efforts. Ethnic minorities have historically different experiences and access to health care services that may influence their current attitudes and health behaviors. The military provides a unique opportunity to address these important questions. Military personnel are a racially diverse sample that has universal access to quality health care thereby removing access as one of the major barriers to utilization and controlling for SES. The purpose of this study was to compare delay in treatment seeking behaviors as related to knowledge of disease among African American, Hispanic American, and Caucasian active duty enlisted personnel. Two hundred ninetyfive enlisted males personnel (X=22.86 years; SD= 4.14) from a command within the continental U.S. completed the Illness Attitudes Scale (IAS; Kellner, 1986) to measure the participant's overall health-related worries and concerns, the Knowledge of Cancer Warning Signs inventory (KCWSI; Berman & Wandersman, 1991), and a number of questions developed to evaluate diabetes knowledge. Health care rules and behaviors were also examined by a series of health

care vignettes that described a pattern of symptoms for acute as well as chronic problems and the respondent indicated their typical response. Results indicated that there were no differences in knowledge of cancer (F (2, 258)=.29, p = .29) and diabetes (F (2, 272) = .19, p = .83) symptoms among the racial groups. Also, there were no differences in treatment experience in the medical setting among the racial groups (F (3, 283) = .22, p = .88). However, differences in concern about bodily symptoms were found between minorities and Caucasians, with ethnic minorities showing higher concern about bodily symptoms, worry about illnesses, and concern about dise
DTIC
*Ethnic Factors; Health; Human Behavior; Males; Personnel; Physical Examinations; Psychology*

**20040058965** Harvard Univ., Cambridge, MA
**Was Smallpox Airborne? Implications for Biodefense**
Jun. 10, 2003; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421477; No Copyright; Avail: CASI; A03, Hardcopy
Presentation on the means of transmission in the case of an airborne version of the smallpox virus.
DTIC
*Infectious Diseases; Smallpox; Viruses*

**20040058967** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Weight Management Behaviors Used by Active Duty Nurses to Maintain Compliance With Military Weight Control Standards**
Candelario, Joseph M.; May 2003; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421490; No Copyright; Avail: CASI; A03, Hardcopy
It has been suggested that the stress of being in compliance with standards for weight control in the military may cause some individuals to pursue unhealthy weight management behaviors. These behaviors could have an adverse effect on fighting strength and can undermine the mission of the military. The objective of this study was to describe the weight control/loss behaviors of active duty service members to maintain compliance with military weight control standards. A questionnaire was used to determine the weight management strategies of active duty service members. Data were summarized using descriptive statistics. Study results showed that a significant number of respondents were engaging in unhealthy weight management behaviors in order to be in compliance with military weight standards.
DTIC
*Body Weight; Management Systems; Medical Personnel; Medical Services*

**20040058970** Army Research Inst. of Environmental Medicine, Natick, MA
**Influence of Moderate Altitude Residence on Arterial Oxygen Saturation at Higher Altitudes**
Muza, Stephen R.; Rock, Paul B.; Zupan, Michael; Miller, James; Thomas, William R.; May 2003; 28 pp.; In English
Report No.(s): AD-A421496; USARIEM/TMMD-T03-1; No Copyright; Avail: CASI; A03, Hardcopy
Mountainous terrain provides sanctuary for hostile forces as seen in Central and West Asia, the Balkans, and South America. This harsh environment lessens U.S. military technological superiority by limiting use of air support and crew-served combat vehicles. This places the burden of combat on dismounted warfighters. Objective Force Warrior (OFW) emphasizes the rapid deployment and mobility of troops to conduct operations for sustained periods without relief. However, rapid deployment of unacclimatized troops to high mountainous environments causes debilitating effects on fighting capabilities and Force health. Environmental illnesses are a significant portion of the non-battle injuries sustained by U.S. military forces. For example, during a major combat operation in Afghanistan, 12% of medevacs and hospital admissions were due to severe Acute Mountain Sickness. Available guidance for minimizing adverse effects of high altitude is based on worst-case scenarios that assume the personnel have no degree of altitude acclimatization. Many military bases are located at altitudes at which personnel will develop some magnitude of altitude acclimatization (>1, 500 m). However, the magnitude of altitude acclimatization developed in lowlanders residing at moderate altitudes has not been well documented. This study compared the distribution of arterial oxygen saturation and subjective symptoms to hypoxia in moderate altitude residents and low altitude residents following rapid ascent to 4,056 m (pressure altitude). This work will add to a database that will contribute to the development of models that should provide operational commanders with medical planning capability for high mountainous operations, resulting in decreased altitude illness, and reduced manpower and logistical and medical support requirements.
DTIC
*Altitude; Altitude Acclimatization; Altitude Sickness; Arteries; Hypoxia; Oxygen*

**20040058971** Department of Defense, Arlington, VA

**Financial Management: Controls Over DoD Medicare Eligible Retiree Health Care Fund Investments**

Jul. 31, 2003; 26 pp.; In English

Report No.(s): AD-A421497; IG/DOD-D-2003-119; No Copyright; Avail: CASI; A03, Hardcopy

Defense personnel who are responsible for managing funds provided to reduce the Military Retirement Health Benefits (MRHB) liability should read this report. The report discusses how the Defense Finance and Accounting Service invests funds from the Medicare Eligible Retiree Health Care Fund (MERHCF).

DTIC

*Health; Medical Services; Personnel; Retirement*

**20040058976** Uniformed Services Univ. of the Health Sciences, Bethesda, MD

**Instructional Methods for Neuroscience in Nurse Anesthesia Graduate Programs: A Survey of Educational Programs**

Sanchez, Michael R.; Oct. 1999; 91 pp.; In English; Original contains color illustrations

Report No.(s): AD-A421524; No Copyright; Avail: CASI; A05, Hardcopy

Advanced neuroscience instruction is a requirement for certification as a nurse anesthetist. The importance of learning neuroscience for the nurse anesthetist is reflected through the required hours determined by the Council of Accreditation of Nurse Anesthesia Educational Programs. Thirty percent of the certification examination relates to neuroscience. There are currently no studies in the literature describing instructional methods in neuroscience for nurse anesthesia programs. This study provides a descriptive analysis on how neuroscience is taught in accredited nurse anesthesia programs. A survey consisting of 29 questions regarding neuroscience course curriculum was mailed to the nurse anesthesia programs (n=83) accredited by the Council on Accreditation. Supporting evidence for content validity and reliability was obtained prior to the mailing. A total of 54 programs (64%) responded to the survey. The majority of the programs (51%) teach a specific course in neuroscience. The mean number of semester hours was (3.6 hours). The mean hours spent in lecture was 5 hours per week. The mean hours spent in the laboratory was 1 hour. Variability existed in the methods used for instruction. Textbooks were used on the average 33 % of the time teaching neuroscience. Lectures were used on the average 47 % of the time to teach neuroscience. Computer-aided instruction was used approximately 1% of the time to teach neuroscience. Clinical experience accounted for 10% of the instruction time to teach neuroscience. Laboratory time accounted for 1% and other for 2% of the time.

DTIC

*Anesthesia; Clinical Medicine; Education; Medical Personnel; Neurology; Surveys*

**20040058979** Uniformed Services Univ. of the Health Sciences, Bethesda, MD

**The Effects of Nicotine on Antinociception in Male and Female Sprague-Dawley and Long-Evans Rats With and Without Stress**

Apatov, Nathaniel M.; May 1998; 97 pp.; In English

Report No.(s): AD-A421533; No Copyright; Avail: CASI; A05, Hardcopy

Nicotine, the active pharmacologic agent in tobacco, has antinociceptive effects, but the importance of individual differences and the influence of stress on nicotine- induced antinociception has not been studied previously. The present experiment examined the effects of nicotine administration on two measures of nociception in 120 Sprague- Dawley and 120 Long-Evans male and female adult rats. Two strains and both sexes were included to investigate potential genotypic and sex differences in nicotine's antinociceptive actions. Subjects received 0 (saline), 6 or 12 mg/kg/day nicotine via Alzet osmotic mini-pumps. Nociception was measured following 2, 7, and 12 days of nicotine or saline administration using hot-plate and tail-flick paradigms. Tail- flick reflects a spinally-mediated pain behavior, whereas hot- plate is believed to reflect supraspinal processes. Effects depended on the methods used to evaluate nociception, strain, sex, and time of measurement. Nicotine administration significantly increased supraspinal hot-plate latencies on day 2 such that male and female rats receiving 12 mg/kg/day had longer latencies than did saline-treated rats. Nicotine administration significantly increased spinally-mediated tail- flick latencies on day 12 such that only male Sprague-Dawley rats receiving nicotine had longer latencies than did saline controls. There were no significant effects for stress. These findings suggest that nicotine-induced supraspinal analgesia is more widely-experienced, occurs rapidly, and dissipates quickly. In contrast, spinally-mediated antinociception from nicotine takes longer to be experienced and is dependent upon genotype and sex. These findings may reflect different sensitivities to, or different effects of, nicotine on antinociception at two different levels of neural processing.

DTIC

*Females; Males; Nicotine; Physiological Effects; Rats; Stress (Physiology)*

**20040058983** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Prevalence of Visible and Occult Blood on Airway Management Equipment Used Outside the Operating Room**
Nikkola, Rachael J.; Oct. 1999; 71 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421539; No Copyright; Avail: CASI; A04, Hardcopy

Unintentional transmission of blood-borne pathogens to patients, self, and co-workers is an inherent, but preventable hazard to those who provide anesthesia services. Anesthesia providers, their equipment, and monitors located within the operating room have often been shown to be contaminated with visible or occult blood in addition to potential pathogens. The potential to spread certain blood- borne pathogens such as human immunodeficiency virus (HIV), and hepatitis B & C virus' (HBV, HCV) is a major concern. The purpose of this study was to determine how effective current procedures for cleaning, disinfection, and handling of airway management equipment (AME) stored in emergency crash carts, airway management carts, and airway management bags, located outside the operating room, are for removing blood. An additional purpose was to compare these data with previous studies on such equipment used within the operating room. A descriptive survey was conducted on AME located outside the operating room on seven separate units within a large military medical facility. AME was inspected for visible blood and then tested for occult blood utilizing a modified phenolphthalein test. This study found a 3% incidence of visible blood and an overall prevalence of occult blood to be 17%. These findings are consistent with similar studies that looked at the AME used within the operating room. These data identify lack of compliance of established OSHA and EPA standards regarding high-level disinfection. Improperly cleaned AME continues to be used when performing lifesaving procedures, potentially exposing health care providers and their patients to life threatening infectious diseases.
DTIC
*Blood; Management Systems; Medical Services*

**20040058984** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**The Prevalence of Visible and/or Occult Blood on Anesthesia and Monitoring Equipment**
Perry, Susan M.; Oct. 1998; 54 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421541; No Copyright; Avail: CASI; A04, Hardcopy

This study examined the prevalence of visible and or occult blood on 6 types of equipment. This equipment included blood pressure cuffs, electrocardiograph cables, pulse oximeter probes, ventilator control switches, vaporizer control knobs and flow meter knobs. This equipment was inspected for visible blood and then tested for occult blood utilizing a three stage phenolphthalein test. A total of 28 operating suites from 2 separate medical facilities were used for data collection. The total sample size was 342 observations of the 6 types of equipment. Of the 342 observations, 32% were positive for occult blood. Only 6 samples were positive for visible blood. The presence of blood on this equipment may be in direct violation of the Occupational Safety and Health Administrations Blood-borne Pathogen Standard and the infection control guidelines of the American Association of Nurse Anesthetists and the American Society of Anesthesiologist. The presence of blood on this equipment may increase the risk for nosocomial and occupational exposure to viral and bacterial pathogens. Recommendations were made to decrease the risks from this contamination by redesigning equipment, increasing the use of disposable equipment and ensuring compliance with effective infection control procedures.
DTIC
*Anesthesia; Blood; Management Systems; Medical Equipment; Medical Services*

**20040058985** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**810 NM Light Treatment of Acute Spinal Cord Injury Alters the Immune Response and Improves Axonal Regeneration and Functional Recovery**
Byrnes, Kimberly R.; Jan. 2003; 154 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421543; No Copyright; Avail: CASI; A08, Hardcopy

Spinal cord injury (SCI) results in substantial and often permanent impairment of function due to the lack of regeneration of damaged axons. Despite vigorous research, no cure for SCI has been found. Light therapy (LT), through the absorption of light by target tissue, improves healing in a number of injury models. However, no study to date has assessed the ability of LT to facilitate the regeneration of specific spinal cord tracts. Our hypothesis was that transcutaneous application of 810 nm light promotes axonal regeneration and functional reinnervation following transection of the corticospinal tract (CST) by changing the extracellular milieu of the spinal cord. Three studies were implemented to investigate this hypothesis. First, anterograde and retrograde tract tracing techniques were used to investigate axonal regrowth after SCI and LT. LT (810 nm) was applied at the site of acute injury to the CST of adult rats. Anterograde tract tracing demonstrated that LT improved axonal regrowth after injury, with significant increases in axon number (199 +/- 12) and distance of regrowth (8.7 +/- 0.8 mm) as compared to controls ($p<0.01$). Double label retrograde tract tracing revealed that transected axons regrew and reinnervated

motor neurons in the lumbar spinal cord in the light treated group only ($p<0.05$). Functional analyses revealed that this regeneration was coupled with significant improvement in 2 tests of CST performance, angle of rotation and ladder beam cross time ($p<0.05$). Second, to explore the effect of LT on the spinal cord cellular environment, we investigated the inflammatory response after SCI, using quantitative immunohistochemistry techniques.
DTIC
*Axons; Immunity; Injuries; Nerves; Physiological Responses; Spinal Cord*

**20040058987** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Nuclear Organization and Myt1 Interaction in Transcriptional Control of Neural Cell Differentiation**
Nielsen, Joseph A.; Jan. 2002; 139 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421549; No Copyright; Avail: CASI; A07, Hardcopy

Neural cell differentiation is a complex set of events beginning with cells responding to both soluble and cell contact-dependent external signals. These signals activate pathways that lead to changes in gene expression patterns, which ultimately give rise to the differentiated cell phenotype. In these studies, potential mechanisms regulating different aspects of oligodendrocyte differentiation were explored. Specifically, these studies examined the contribution of gene and protein localization to the establishment and/or maintenance of terminally differentiated oligodendrocyte gene expression patterns and the role of myelin transcription factor 1 (Myt1) in the regulation of oligodendrocyte proliferation and differentiation. Myt1 is a zinc-finger DNA-binding protein that is expressed in neural progenitors and is localized to discrete domains within the nucleus of oligodendrocyte progenitors. Primary oligodendrocyte lineage cells were examined during cell differentiation in order to study the localization of the highly expressed tissue-specific proteolipid protein gene relative to nuclear proteins such as Myt1 and splicing factors within interphase nuclei. These data support a nuclear organization model in which nuclear proteins and genes exhibit specific patterns of distribution within nuclei, and activation of tissue-specific genes is associated with changes in protein distribution rather than changes in gene localization. Myt1 contains six zinc-finger DNA-binding domains with sets of two N-terminal and of four C-terminal zinc-fingers. A retroviral expression system was used to overexpress the four zinc-finger DNA-binding domain of Myt1 (4FMyt1) which lacks the putative domains for protein-protein interaction and transcriptional activation. In a dominant negative study, expression of 4FMyt1 inhibited both proliferation and differentiation of oligodendrocyte
DTIC
*Cells (Biology); Deoxyribonucleic Acid; Genes; Nervous System; Nuclear Interactions; Nuclear Models*

**20040058988** West Virginia Univ., Morgantown, WV
**Randomized, Double Blind, Placebo Controlled Trial of Neuroprotective Effects of Epoetin Alfa in Patients Receiving Adjuvant Chemotherapy for Breast Cancer**
Abraham, James; Oct. 2003; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0621
Report No.(s): AD-A421551; No Copyright; Avail: CASI; A02, Hardcopy

Adjuvant treatment with doxombicin and cyclophosphamide (AC) clearly prolongs the overall survival in women with breast cancer. In U.S.A only, over 100, 000 women will receive adjuvant chemotherapy for breast cancer every year. Cognitive deficits (e.g. problems with memory and concentration) are common during and after adjuvant breast cancer chemotherapy, but the pathophysiology of these phenomena is unknown. More importantly, treatment of the cognitive dysfunction, which can limit the quality of life of survivors, has not been investigated. We hypothesize that %O water PET scan along with neuropsychological tests can evaluate the effectiveness of EPO as a treatment for cognitive dysfunction and identify the pathophysiology of cognitive dysfunction in patients receiving. The specific aims of the study are to: examine the efficacy of EPO as a treatment of cognitive impairment associated with adjuvant chemotherapy for breast cancer and to examine the neural changes associated with cognitive dysfunction in patients receiving adjuvant chemotherapy for breast cancer using 150 water PET scans
DTIC
*Cancer; Chemotherapy; Mammary Glands; Patients*

**20040058989** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Role of Cytokines and Neurotrophins in the Central Nervous System in Venezuelan Equine Encephalitis Virus Pathogenesis**
Catlin, Kristen M.; Jan. 2001; 99 pp.; In English
Report No.(s): AD-A421552; No Copyright; Avail: CASI; A05, Hardcopy

Venezuelan equine encephalitis virus (VEE) is a mosquito-borne alphavirus capable of causing acute febrile illness and encephalitis in man. Currently, there is no licensed vaccine to combat this human health threat and no treatment other than supportive therapy. The inflammatory immune response in the central nervous system (CNS) has been implicated as a contributing factor in a number of neurodegenerative disorders and encephalitic virus infections. The studies detailed here have attempted to elucidate the role of the cytokine and neurotrophin response in the CNS in response to VEE infection by characterizing the gene and protein expression of a number of proinflammatory and anti- inflammatory cytokines in primary astrocyte cultures as well as in the CNS of mice following infection with VEE strains of differing degrees of neurovirulence. Reverse transcription- polymerase chain reaction, RNase protection assays, and enzyme- linkedimmunosorbent assays were used to achieve this. Data revealed proinflammatory cytokines were significantly upregulated following infection with the virulent VEE, while neurotrophins were significantly upregulated following infection with the attenuated VEE. These findings may contribute to the goal of manipulating these immune responses for therapeutic benefit.
DTIC
*Central Nervous System; Encephalitis; Infectious Diseases; Pathogenesis; Viruses*

**20040058990** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**The Regulation of Expression of the Stx2d Toxins in Shiga Toxin-producing Escherichia coli O91:H21 Strain B2F1**
Teel, Louise D.; Jan. 2002; 153 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421553; No Copyright; Avail: CASI; A08, Hardcopy

Shiga toxin (Stx) types 1 and 2 are encoded within intact or defective temperate bacteriophages in Stx-producing Escherichia coli (STEC), and expression of these toxins is linked to bacteriophage induction. Among Stx2 variants, only stx2e from one human STEC isolate has been reported to be encoded within a toxin-converting phage. In this study, I examined O91:H21 STEC isolate B2F1 that carries two functional alleles (stx2d1 and stx2d2) for the potent activatable Stx2 variant toxin, Stx2d, for the presence of Stx2d converting bacteriophages and other potential regulators of toxin expression. Mutants of B2F1 that produced one or the other Stx2d toxin were made. The Stx2d1-producing mutant (stx2d2:: cat) was less cytotoxic for Vero cells than the Stx2d2- producing mutant (stx2d1::cat). Consistent with those results, the Stx2d1-producing mutant was attenuated in a streptomycin- treated mouse model of STEC infection, while the Stx2d2- producing mutant was nearly as virulent as wild-type B2F1. When the mutants were treated with mitomycin C to promote bacteriophage induction, Vero cell cytotoxicity was elevated only in extracts of the Stx2d1-producing mutant. Additionally, when mice were treated with ciprofloxacin, an antibiotic that induces the O157:H7 Stx2-converting phage, the animals were more susceptible to the Stx2d1-producing mutant. An stx2d1- containing lysogen was isolated from plaques on strain DH5α that had been exposed to lysates of the mutant that produced Stx2d1 only. However, that RecA- lysogen could not be induced for phage nor were culture lysates from it cytotoxic for Vero cells. By contrast, when the lysogen was transformed with a plasmid encoding RecA and induced with mitomycin C, culture extracts were cytotoxic for Vero cells. Furthermore, electron microscopic examination of extracts from the φ B2F1-lysogen showed hexagonal particles that r
DTIC
*Bacteriophages; Escherichia; Infectious Diseases; Physical Examinations; Toxins and Antitoxins*

**20040058992** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Assessing the Compatibility of Packed Red Blood Cells With Lactated Ringer's Solution**
Helpling, Edward J.; Oct. 1998; 41 pp.; In English
Report No.(s): AD-A421564; No Copyright; Avail: CASI; A03, Hardcopy

Crystalloid solutions are frequently used to reconstitute packed red cells during rapid infusions during trauma situations and in the perioperative setting. Lactated Ringer Ys solution is a commonly used crystalloid for intravenous infusion. Calcium contained in lactated Ringer s solution has been reported to possibly cause blood clots because of replacing calcium ions previously chelated in the citrate anticoagulant. Authors of previous studies have cautioned against using lactated Ringer Ys solution to reconstitute packed red cells because of this calcium. Other studies have shown that there are no adverse effects when lactated Ringer Ys is used in situations when packed red cells are transfused rapidly. In this study, samples of CPD-preserved red cells were diluted with either lactated Ringer Ys solution or normal saline.
DTIC
*Compatibility; Erythrocytes; Lactates*

**20040058993** Uniformed Services Univ. of the Health Sciences, Bethesda, MD
**Military Nurses Perceptions of Autonomy**
Lyons, Denise M.; May 2002; 84 pp.; In English
Report No.(s): AD-A421565; No Copyright; Avail: CASI; A05, Hardcopy

Military nurses sustain the health of deployed soldiers in a variety of contingencies. Autonomy is considered by nurses to affect both job satisfaction and the delivery of effective patient care. Previous studies showed that military nurses perceptions of autonomy, as well as most indicators of job satisfaction, were lower than their civilian counterparts. Yet, when deployed, military nurses must function with greater autonomy than most of their civilian counterparts. To develop autonomy and authority in the military nurse, their current perceptions of autonomy must be known. Based on the Power Theory, Kanter s Model of Power and Opportunity and Organizational Empowerment Model, a comparative descriptive design was used to determine the perceived autonomy of military nurses both with and without deployment experience. Perceptions of autonomy and authority were only slightly above midpoint for the questionnaire scale, regardless of grouping by deployment experience, position held (rank) or work environment. Nurses with deployment experience had slightly higher perceptions of autonomy and authority. Type of work experience (unit) influenced perceptions of authority and autonomy.
DTIC
*Autonomy; Management Systems; Medical Personnel; Medical Services; Perception; Psychology*

**20040058996** Hawaii Univ., Honolulu, HI
**A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in women with Breast Cancer**
Shumay, Dianne M.; Sep. 2003; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0260
Report No.(s): AD-A421589; No Copyright; Avail: CASI; A03, Hardcopy

The study purpose is to examine the extent to which levels of depression and anxiety and coping at three- five months post-diagnosis are related to complementary and alternative medicine (CAM) use at initial assessment and follow-up at 9 and 15 months. This study will also identify the types of CAM sought after by women with higher levels of anxiety and depression. Additional aims of the study are to provide pilot data for further research in developing interventions (such as mood regulation skills, coping skills training or treatment information) to meet the emotional needs and healthcare expectations of breast cancer patients. In conclusion, during this middle phase of the project, the primary function for the research team was to recruit participants and collect data. Fifty-one participants have completed the first questionnaire of the study and 22 have completed the second questionnaire, yielding preliminary descriptive results about the sample. The award has supported and quality training experience for the trainee and has supported her to continue to make satisfactory progress on her dissertation.
DTIC
*Cancer; Diagnosis; Emotional Factors; Females; Mammary Glands; Stress (Psychology)*

**20040058997** Chicago Univ., Chicago, IL
**Computer-Aided Diagnosis of Digital Mammograms**
Jiang, Yulei; Jun. 2003; 54 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0197
Report No.(s): AD-A421590; No Copyright; Avail: CASI; A04, Hardcopy

The long-term goal of our research is to develop computer-aided diagnosis (CAD) techniques to improve the detection and diagnosis of breast cancer. We have developed a computer technique that can classify breast calcifications in mammograms accurately, and this technique as a diagnostic aid has been shown to be able to improve radiologists' diagnostic accuracy. We have determined that Breast Imaging Report and Data System (BI-RADS) lesion descriptions provided by radiologists can be used as supplemental data to computer- extracted image features to improve the performance of computer classification of malignant and benign breast lesions. We have also found that our classification technique developed on screen-film mammograms, can achieve equality high performance on full-filed digital mammograms. This high performance is little affected by variability in the way in which radiologists indicate the general location of calcification to the computer, which is designed as a means for the radiologist to query the computer aid. These results suggest that the computer technique has the potential to become a clinically useful and viable tool for diagnostic mammography.
DTIC
*Cancer; Computer Techniques; Diagnosis; Mammary Glands*

**20040059010** Michigan Univ., Ann Arbor, MI
**Structure-Based Approach for Discovery of Small Molecule Inhibitors Targeted at Bcl-2**
Wang, Shaomeng; Sep. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0256
Report No.(s): AD-A421629; No Copyright; Avail: CASI; A03, Hardcopy

Overexpression of Bcl-2 has been observed in 70% of breast carcinomas and the expression levels of Bcl-2 proteins correlate with resistance to a wide spectrum of chemotherapeutic drugs and radiation therapy. In this IDEA grant, we propose an effective structure-based approach to discover small molecule inhibitors of Bcl-2 through structure- based 3D-database search over large chemical databases containing >500,000 structurally diverse, non-peptide, drug- like synthetic compounds or natural products. Using this powerful approach, we have discovered 6 classes of structurally diverse, non-peptidic, drug-like, small-molecule inhibitors of Bcl-2. Our studies also showed that the most promising small-molecule inhibitors of Bcl-2 we have discovered potently bind to Bcl-2 protein, inhibit cell growth and induce apoptosis in breast cancer cells with high levels of Bcl-2 proteins and display good selectivity in cancer cells with low levels of Bcl-2 proteins.
DTIC
*Cancer; Inhibitors; Mammary Glands*

**20040059011** Boston Univ., Boston, MA
**Metastic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21**
Thiagalingam, Sam; Sep. 2003; 66 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0160
Report No.(s): AD-A421632; No Copyright; Avail: CASI; A04, Hardcopy

Mutations in the Smad2 and Smad4 genes, localized to chromosome 18q, a region frequently deleted in advanced cancers is rare in breast cancer unlike pancreatic, colon, lung, and ovarian cancers. However, the fact that 18q loss has been predominantly associated with the advanced stage of cancers suggests that the genes inactivated by this specific alteration or other genes in the same pathway targeted for the inactivation could be associated with the conversion of benign tumors to malignancy and metastatic progression of breast cancer. Our analysis showed that 30% of the breast cancers exhibit loss of Smad8 expression, making it on of the highly valued markers similar to Her/neu.
DTIC
*Cancer; Chromosomes; Losses; Mammary Glands*

**20040059017** JAYCOR, San Diego, CA
**Overuse Injury Assessment Model**
Sih, Bryant L.; Shen, Weixin; Stuhmiller, James H.; Jun. 2003; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-C-0073
Report No.(s): AD-A421662; JAYCOR-TR-J3181-03-192; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the first year's progress towards the development of a bone stress fracture model. A literature review was conducted to determine the current state of research and develop regression equations to estimate necessary gait parameters. U.S. Marine Corps Basic Training recruit and regime data was acquired and organized for input into a model. The initial stress fracture algorithm was based on a theoretical model published in the literature that accounts for micro- and macro-crack growth.
DTIC
*Bones; Fractures (Materials); Injuries*

**20040059021** Vanderbilt Univ., Nashville, TN
**Role of p120ctn in Cadherin Mediated Suppression of Breast Cancer**
Davis, Michael A.; Reynolds, Albert B.; Jul. 2003; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0485
Report No.(s): AD-A421687; No Copyright; Avail: CASI; A03, Hardcopy

In the previous reporting periods, we showed that cadherin binding is necessary to recruit p12O to cell junctions and that p12O is important to the generation of strong cell-cell adhesion. We have extended these observations to show that p12O acts at the cell surface to control cadherin turnover, thereby directly regulating cadherin levels. p12O knockdown by siRNA expression results in dose-dependant elimination of E-, P-, N-, and VE-cadherins, and complete loss of cell-cell adhesion. p120 family members ARVOF and 8-catenin are functionally redundant. The data reveal the core function of p12O in cadherin complexes, and strongly predict a dose- dependant loss of E-cadherin in tumors that partially or completely downregulate p12O. These data suggest a crucial and largely unrecognized tumor suppressor role for p12O, which will guide further studies aimed at determining whether p12O loss contributes to tumor progression in the breast.
DTIC
*Adhesion; Cancer; Cells (Biology); Mammary Glands*

**20040059025** Utah Univ., Salt Lake City, UT
**Short- and Long-Term Effects in Prostate Cancer Survival: Analysis of Treatment Efficacy and Risk Prediction**
Tsodikov, Alexander; Mar. 2004; 66 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0034
Report No.(s): AD-A421695; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the work performed at the University of Utah during the first 8 months of the project. Algorithms have been developed for model for model building, estimation, hypothesis testing, and simulation for nonlinear transformation models of prostate cancer survival. These algorithms form the basis of a comprehensive toolbox for statistical inference with such models.
DTIC
*Cancer; Personnel; Prostate Gland; Risk; Survival*

**20040059041** California Univ., Los Angeles, CA
**Functional Analysis of Oncogene Akt: Its Role in Tumorigenesis in Vivo and Cell Cycle Progression in Vitvo**
Stiles, Bangyan L.; Wu, Hong; Jul. 2003; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0182
Report No.(s): AD-A421732; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancer is the most common malignancy in women. The recently identified tumor suppressor gene PTEN has turned out to be a promising candidate for mammary tumorigenesis. Mice heterozygous for PTEN develops mammary tumors starting from 6 weeks. The goal of this project is to determine the role of AKT, a major downstream target of PI3K pathway, in PTEN mediated mammary tumor development. To study the function of AKT in breast cancer development, we have deleted AKT gene and are studying its role both in vivo and in vitro. In cell culture, we demonstrated that AKT is not only responsible for the survival phenotype but also important for the cell proliferation phenotype of PTEN null ES cells. In vivo analysis demonstrated that deletion of AKT on top of PTEN resulted in both decreased tumor occurrence and shorter tumor onset.
DTIC
*Functional Analysis; Genes; In Vivo Methods and Tests; Neoplasms; Oncogenes*

**20040059046** Winston-Salem State Univ., Winston-Salem, NC
**Tropomyosin-1, A Putative Tumor-Suppressor and a Biomarker of Human Breast Cancer**
Prasad, Gaddamanugu L.; Oct. 2003; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAM17-98-1-8162
Report No.(s): AD-A421752; No Copyright; Avail: CASI; A03, Hardcopy

Previous research from this laboratory indicated that 1) The expression of Tropomyosin-l (TMl), a microfilament-associated protein, is abolished form many human breast carcinoma cells, and; 2) That TMl is suppressor of the malignant transformation. These data led to the hypothesis that TMl plays an important role in mammary carcinogenesis. Therefore, we investigated whether TMl could serve as a biomarker of breast cancer, and TMl could function as a suppressor of the malignant growth of breast cancer cells. Our results show that TMl is downregulated in breast tumors (Objective 1). We demonstrated that TMl is a suppressor of the malignant growth phenotype of MDA MB 231 cells, indicating that TMl is a general suppressor of the transformed growth (Objectives 2). To assess the structure- function relationship of tumor suppression by TMl, we constructed chimeric and variant TMl proteins. By employing a variant TMl that contains an aminoterminal extension, we show that the aminoterminal integrity is important for TMl-mediated tumor suppression (Objective 4)
DTIC
*Biomarkers; Cancer; Mammary Glands; Suppressors; Tumors*

**20040059051** Texas Univ. Health Science Center, San Antonio, TX
**Targeted Antibody Inhibition of Bone Metastases by Prostate Cancer**
Sun, XiuHua; Feb. 2002; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9524
Report No.(s): AD-A421761; No Copyright; Avail: CASI; A03, Hardcopy

Metastasis to bone is a major cause of morbidity from prostate cancer. -Parathyroid hormone-related protein (PTHrP) is expressed by prostate cancer cells and stimulates osteoclasts. My project was to test whether an antibody against PTHrP will block prostate cancer metastasis to bone. I cloned the light and heavy chain cDNAs from a hybridoma, which secretes a PTHrP-neutralizing antibody which blocks breast cancer metastasis to bone but is untested against prostate cancer. The cDNAs

in a bicistronic expression vector produced mouse lgG when transfected into human 293 cells. Secreted mouse antibody inhibited osteoclast formation and bone resorption in two tissue culture assays stimulated with PTHrP. The DNA was transfected into the human prostate cancer cell line PC3, which secretes PTHrP and causes osteolytic metastases. No stable clones could be obtained. Instead, PC3 clones with decreased PTHrP consequent to a dominant negative TGFbeta receptor were tested for their ability to metastasize to bone in animals. Paradoxically, bone metastases were made worse by the dominant negative receptor. This may be due to effects on lGFBP3 expression by PC3 cells. In my fellowship I learned many molecular and immunological techniques in the first year. In the second year I learned animal techniques related to bone metastases, including quantitative x-ray image analysis and skeletal histomorphometry.
DTIC
*Antibodies; Bones; Cancer; Cells (Biology); Metastasis; Prostate Gland*

**20040059052** Minnesota Univ., Minneapolis, MN
**Prediction of Chemotherapy Response by Magnetic Resonance Spectroscopy**
Garwood, Michael; Oct. 2003; 73 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0331
Report No.(s): AD-A421762; No Copyright; Avail: CASI; A04, Hardcopy

This research seeks to validate the use of a non- invasive tool, in vivo magnetic resonance spectroscopy (MRS), to assess therapeutic response in patients with locally- advanced breast cancer who receive primary systemic therapy (PST), also know as neoadjuvant chemotherapy. Contrast- enhanced MRI was used to measure tumor size and MRS was used to monitor tumor concentrations of choline-containing compounds TCho) known to be elevated in cancers and in cell proliferation. To date, 13 women have been followed with MRS and MRI through the complete course of PST (ACx4). Clinical response assessment by MRI was based on the response evaluation criteria in solid tumors (RECIST). Changes in TCho between the baseline scan (<1 wk before starting AC) and 24 hours after the 1st cycle of AC showed a significant positive correlation with change in tumor size measured after 4 cycles of AC (R=O.89, p<O.OOOl). Opposite trends in TCho between objective responders and nonresponders (p=O.OlOl) were observed already at 24 hours after starting PST. These results show that MRS can distinguish responders versus nonresponders early in the course of PST. These findings provide evidence that MRS can be used clinically to individualize treatments for maximizing benefit and to rapidly assess efficacy of new drugs.
DTIC
*Chemotherapy; Magnetic Resonance; Spectroscopy*

**20040059053** Rochester Univ., NY
**Adequacy of Chemotherapy Dose Intensity Among African-American Women with HER-2/neu-Positive Breast Cancer**
Griggs, Jennifer J.; Sep. 2003; 22 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0422
Report No.(s): AD-A421764; No Copyright; Avail: CASI; A03, Hardcopy

Although the risk of breast cancer in African- American women is lower than in Caucasian women, African- American women have higher breast cancer fatality and case- fatality rates(1). The disparity in breast cancer outcome is not accounted for solely by differences in stage at diagnosis or in the biologic behavior of the disease(2). Differences in the quality of chemotherapy received by African-American women may provide an additional explanation for the poorer outcome among African-American women. Retrospective analyses suggest the beneficial impact of adjuvant chemotherapy on disease-free and overall survival in women with breast cancer is diminished when full doses of therapy are not received (3;4). The current recommendation is that patients undergoing adjuvant chemotherapy for breast cancer receive at least 80 to 85 percent of the planned doses (5). This multicenter study focuses on the clinical impact of suboptimal dose/dose intensity in women with HER-2/neu-positive tumors, a subgroup in whom optimal chemotherapy may be particularly critical. We are investigating the potential of relative chemotherapy dose (the ratio of actual to predicted doses) and dose intensity (which incorporates time to completion of adjuvant chemotherapy) as measures of quality of care. This study involves review of treatment records of subjects who have received chemotherapy for breast cancer and identification of the HER-2/neu oncogene on archival tumor specimens. The primary measures of chemotherapy quality (relative dose and dose intensity) will be related to the subjects' clinical outcome. The ultimate goal of the project is to design interventions targeting those factors that lead to lower dose intense chemotherapy in an effort to eliminate disparities in the quality of care of women with breast cancer.
DTIC
*Africa; Cancer; Chemotherapy; Dosage; Females; Mammary Glands*

**20040059054** California Univ., Berkeley, CA
**Training in Mammary Gland Biology and Breast Cancer**
Bissell, Mina J.; Sep. 2003; 49 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0224
Report No.(s): AD-A421765; No Copyright; Avail: CASI; A03, Hardcopy

The goal of the present proposal is to provide post-doctoral training opportunities in breast cancer research that focus on the role of microenvironment in mammary gland biology. Trainees will benefit from working in a dynamic interactive program under the guidance of the LBNL mentors to investigate the intersection of hormone action, growth factor activity and extracellular matrix remodeling during mammary gland development and carcinogenesis. In addition, trainees will be exposed to a variety of other topics related to breast cancer, as well as research ranging form molecular medicine to genomics, by their participation in working groups, lectures and scientific meetings with other Berkeley Lab and Bay Area researchers.
DTIC
*Cancer; Education; Mammary Glands; Medical Science*

**20040059055** Rochester Univ., NY
**Role of PTPase LAR in EGF Receptor in the Mammary Gland**
Mooney, Robert A.; Jun. 2003; 62 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-10423
Report No.(s): AD-A421766; No Copyright; Avail: CASI; A04, Hardcopy

The epidermal growth factor receptor (EGFR) and the related protein erbB2 have been implicated as important mediators of breast cancer tumorigenesis and metastasis. while much is known about EGFR signal transduction related to its tyrosine kinase activity, less is known about the protein tyrosine phosphatases (PTPs) that must be present to modulate the cellular effects of the EGFR by dephosphorylating the receptor and its substrates. Evidence derived from several approaches suggests that the transmembrane PTP LAR may be involved in EGFR signaling in mammary gland development and tumorigenesis. Two sets of data are particularly important. First, the LAR knockout mouse has been shown to have a defect in terminal mammary gland development. Second, we have shown that suppression of cellular LAR by 60% using an antisense expression vector results in a 3-4 fold elevation of EGF- dependent receptor signaling. Based upon these and other observations, the hypothesis to be tested in this proposal is that LAR plays an important role in EGFR-dependent mammary gland development and tumorigenesis through negative modulation of EGFR signal transduction.
DTIC
*Cancer; Cells (Biology); Epidermis; Mammary Glands; Metastasis; Receptors (Physiology); Tyrosine*

**20040059056** Michigan Univ., Ann Arbor, MI
**Automated Spot Mammography for Improved Imaging of Dense Breasts**
Goodsitt, Mitchell M.; Oct. 2003; 44 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9294
Report No.(s): AD-A421767; No Copyright; Avail: CASI; A03, Hardcopy

We are developing an automated stereo spot mammography technique to improve imaging of lesions within dense breast tissue. During the fourth year of this project, our work was devoted primarily to: I) completing our observer study comparing the suspicious spot regions selected by radiologists to those detected by a computer (CAD), 2) performing a study comparing the radiologist selected regions and CAD selected regions to true regions determined by a radiologist from mammograms, biopsy images and pathology results, 3) defining the geometric requirements for the automated collimator to insure the suspicious region in a full- field digital mammogram is adequately covered with stereo spot image acquisition, and 4) obtaining our first images of a modular breast phantom that was manufactured for our spot mammography experiments. The images of the phantom showed it did not satisfy our design requirements with respect to dense regions overlapping the simulated masses, and with respect to the phantom producing an image texture similar to that of an actual mammogram. We therefore were not able to complete our planned phantom experiments. The manufacturer has promised to build us a correct phantom that we will employ in experiments during an extended year of the project.
DTIC
*Cancer; Digital Systems; Imaging Techniques; Mammary Glands; Pathology*

**20040059057** Columbia Univ., New York, NY
**Murine Models of Breast Cancer: Assessment of the Role of c-Scr in Mammary Tumorigenesis**
Alexandropoulos, Konstantina; Oct. 2003; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9151
Report No.(s): AD-A421769; No Copyright; Avail: CASI; A05, Hardcopy

Strong evidence exists that the c-Src non-receptor tyrosine kinase plays a role in the pathology of human breast tumors. The purpose of this study is to examine the role of c- Src in mammary tumorigenesis and elucidate the mechanisms that lead to tumor formation in an animal model for breast cancer. In our previous experiments, we used Src substrates that we cloned to activate c-Src and study its signaling mechanisms. Using one of these substrates, Sin, we characterized a signaling cascade that is activated as a result of Sin binding to Src and Src-mediated Sin phosphorylation, and involves activation of the small GTP-binding protein Rap1. More recently we found that Sin, when phosphorylated by Src kinases, forms a signaling complex consisting of signaling intermediates including the Src related tyrosine kinase Fyn and phospholypase C-gamma (PLC-7). We also found that Sin regulates cell signaling by controlling the activation of PLC- gamma, which is important for proliferation in many different cell types. In future experiments, we will use inhibitory RNA oligonucleotides to address the effect of lack of Sin on cellular growth and transformation and we will isolate the Sin protein complex from breast cancer cell lines. These experiments will provide insight into the mechanisms of Src kinase/Sin-mediated tumorigenesis and may lead to the identification of proteins that will be used as targets for drug development.
DTIC
*Cancer; Cells (Biology); Mammary Glands; Nucleotides; Oligomers; Rodents*

**20040059058** Texas Univ., Houston, TX
**Differential Processing of Cyclin E Variants in Normal vs Tumor cells and their Role in Breast Cancer Oncogenesis**
McGahren, Mollianne J.; Keyomarsi, Khandan; Sep. 2003; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9214
Report No.(s): AD-A421770; No Copyright; Avail: CASI; A03, Hardcopy

Cyclin E is a posftive regulator, which controls the transition of the Ol to S phase of the cell cycle. When associated with CDK2, it is responsible for cells passing through the restriction point, which is the barrier between Gi and S. This commits the cell to complete one round of cell division. Previous findings by this laboratory have found that overexpression of cyclin E and the presence of lower molecular weight isoforms (LMW) are found more often in breast tumors and cancer cell lines when compared to normal tissues and cells. Also, tumor cells, but not normal cells have the mechanisms to proteolytically cleave the fall length cyclin E into these LMW forms. An altered cyclin E may contribute to the deregulation of the Gi to S checkpoint and lead to tumorigenesis. Our laboratory has also identified through mutational and biochemical analysis, the region of cyclin E that is proteolyticaly cleaved to generate the LMW forms. Critical phosphorylation sites of cyclin B are responsible for the appearance of the LMW forms of cyclin B. To invesrigate the possible role of phosphorylation in the processing of cyclin B into these lower forms, two approaches have been employed, First, incubation of breast cancer cell line extracts expressing the LMW forms with phosphatases was examined via western blot analysis. (isualization of cyclin B showed downward shifts in both the fall length and lower forms in the presence of active dephosphorylation. Second, fall length and truncated cyclin E cDNAs were mutated at critical phosphorylation residues via site-directed mutagenesis. Transfection of these mutants into tumor cells capable of LMW form processing followed by western analysis indicates that at least one of the mutations results in the loss of2 lower forms of cyclin B. However, assays for kinase activity in the transfected tumor cells demonstrate no change activity of the mutants deficient in these phosphorylation sites.
DTIC
*Cancer; Cell Division; Cells (Biology); Mammary Glands; Tumors*

**20040059059** Minnesota Univ., Minneapolis, MN
**Prevention of Breast Cancer in IGFBP**
Yee, Douglas; Jun. 2003; 4 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0349
Report No.(s): AD-A421773; No Copyright; Avail: CASI; A01, Hardcopy

In this proposal, we hypothesize that inhibition of IGF action by IGFBP-1 will prevent breast cancer in a SV40 Tag transgenic model of breast cancer. We will test this hypothesis with two specific aims: 1) to inhibit IGF action at the mammary epithelial cell by creating transgenic mice that express IGFBP-1 under the control of the whey acidic protein (WAP) promoter and 2) to test the ability of IGFBP-1 to suppress tumorigenesis by mating these animals with C3/Tag transgenic mice. To date, we have generated two founder lines containing the IGFBP-1 transgene and several F1 and F2 animals were analyzed.

Unfortunately, while the transgene was clearly integrated into these animals, we were unable to detect expression of IGFBP-1 protein. To correct this problem we have generated more founders with a modified construct involving insulator sequences. Oocytes have been injected and we are awaiting the offspring.
DTIC
*Cancer; Insulin; Mammary Glands; Prevention*

**20040059061** Alabama Univ., Birmingham, AL
**Genistein Programming Against Breast Cancer**
Lamartiniers, Coral A.; Sep. 2003; 27 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0118
Report No.(s): AD-A421775; No Copyright; Avail: CASI; A03, Hardcopy

Most soy-breast cancer epidemiological studies conclude that Asian women consuming a traditional diet high in soy products have a low incidence of breast cancer. We have previously demonstrated that prepubertal exposure to genistein, the primary isoflavone of soy, protects against chemically- induced mammary cancer. The purpose of this work was to determine if adult exposure to genistein will protect against chemically-induced mammary cancer and to investigate DNA methylation of estrogen receptor genes as the molecular mechanism of genistein chemoprevention. We have determined that adult only exposure to genistein does not protect against dimethylbenz(a)anthracene (DMBA)-induced mammary cancer. However, prepubertal plus adult exposure to 250 mg genistein/kg AIN-76A diet protected against DMBA-induced mammary cancer. Prepubertal genistein exposure appears to 'imprint' for additional adult genistein chemoprevention. Genistein down-regulates ER- alpha, but not ER-beta and androgen receptor, mRNA and protein expression in the rat mammary gland. The down-regulation of ER-alpha is not via DNA methylation gene silencing mechanism as measured via methylation sensitive and insensitive enzymes and Southern blots. On the other hand, genistein in the diet does up regulate overall maintenance, but not de novo, DNA methyltransferase activity, whose specificity needs to be resolved.
DTIC
*Cancer; Deoxyribonucleic Acid; Diets; Estrogens; Genes; Mammary Glands; Proteins*

**20040059062** South Carolina Univ., Columbia, SC
**The Effect of a Home-Based Walking Intervention on Quality of Life Body Composition and Estrogen Metabolism in Postmenopausal Breast Cancer Survivors**
Wilcox, Sara; Sep. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0628
Report No.(s): AD-A421781; No Copyright; Avail: CASI; A02, Hardcopy

Increased incidence of and survival from breast cancer have resulted in growth of the number of women who have survived this disease and are faced with the subsequent consequences of their diagnosis and treatment. Physical activity is a modifiable health behavior that has the potential to address both the emotional and physical needs of women with early stage breast cancer. However, for physical activity to be seen as a viable treatment option, and for a change in routine care to occur, its effectiveness must be determined. Accordingly, the objectives of this pilot study are to; 1) quantify the effect of a 12-week home-based walking intervention on quality of life, body composition, and estrogen metabolism in survivors of breast cancer, and 2) develop and test the feasibility of physical activity intervention materials for future studies in this population. We hypothesize that women randomized to the walking intervention will report higher levels of quality of life, experience less weight gain, and have more favorable estrogen metabolite profiles. The recruitment of participants into this study has not yet been initiated due to challenges in institutional agreements regarding coverage of potential medical expenses incurred by women as a consequence of their participation in this research. We submitted a change in PI form approximately one year ago, and received approval of this change in the last month. To date (and after many e-mails), we still have not received approval to begin recruiting participants into the study.
DTIC
*Cancer; Estrogens; Exercise Physiology; Mammary Glands; Metabolism; Walking*

**20040059063** Scripps Research Inst., La Jolla, CA
**Identification of Potential Biomarkers for the Early Diagnosis of Breast Cancer**
Sun, Peiquing; Sep. 2003; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0390
Report No.(s): AD-A421783; No Copyright; Avail: CASI; A02, Hardcopy

The successful treatment of breast cancer requires detection of the disease at early stages. In this application, we propose to systematically isolate secreted and cell surface proteins (trafficked proteins) with increased expression in early stage breast tumors. These proteins are candidates for blood-borne markers and cell surface markers that can be used in the routine screening of early stage breast cancer. We proposed to first isolate all secreted and cell surface proteins from breast tumors of multiple patients, using a functional approach we have designed and validated. Next, the expression levels of these proteins in normal and early stage breast tumor tissues will be compared, and those with increased expression in tumors will be identified and analyzed. To date, a cDNA library has been constructed using human breast tumor samples. This library has been subjected to genetic screens to enrich cDNA fragments that encode signal peptides for trafficked protein. The library enriched for trafficked protein has been validated in preliminary analysis. DNA sequencing analysis is underway to further confirm the quality of the enriched library. Micro-array analysis will be carried out to identify the trafficked proteins with increased expression in human breast tumor tissues.
DTIC
*Biomarkers; Cancer; Diagnosis; Mammary Glands*

**20040059064** McMaster Univ., Hamilton, Ontario
**In Vivo Structure-Function Studies on the Precise Role of ErbB-2 Signaling in Mammary Gland Development**
Chan, Richard; Muller, William J.; Oct. 2003; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0333
Report No.(s): AD-A421785; No Copyright; Avail: CASI; A04, Hardcopy

The ErbB2 receptor tyronsine kinase plays important roles in development and disease. To investigate the developmental roles of ErbB2 mediated signaling in vivo, we have generated a series of erbB2 cDNA knock-in animals expressing different ErbB2 mutants under the transcriptional control of the endogenous promoter. Firstly, we showed that the kinase activity of ErbB2 is essential for embryonic development since this mutant is a phenocopy of the erbB2 null mutants, which die at midgestation with cardiac and peripheral nervous system defects. In our studies, we also established a minimal threshold level of ErbB2 that was required for embryonic development and survival. The tyrosone autophosphorylation site YlO28 mediated a negative regulatory signal that affected the level of ErbB2 proteins expressed. This tyronsine appears to play a role in normal signaling and development. The mechanism of action is known at this point, however, the downregulatory effect is independent of Cbl binding and ubiquitylation of the receptor. In fact, we have also identified the phosphorylation sites in ErbB2 that is required for it's interaction with Cbl, although ErbB2 appears to be refractory to the downregulatory effect of Cbl. The results of my studies will provide important insight into the regulatory mechanisms controlling ErbB2 signaling and may lead to improved therapeutics.
DTIC
*Embryos; In Vivo Methods and Tests; Mammary Glands; Personnel; Survival; Transcription (Genetics)*

**20040059065** Georgetown Univ., Washington, DC
**Discovery of Novel Metastasis Genes in Breast Cancer**
Wellstein, Anton; Jul. 2003; 22 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0398
Report No.(s): AD-A421786; No Copyright; Avail: CASI; A03, Hardcopy

Under this proposal we plan to identify genes that drive the homing of invasive primary breast cancer to its metastatic sites. For the discovery of such genes, in vivo phage display of breast cancer cDNA libraries will be used. Validation will be achieved by expression monitoring in histological sections as well as by functional assays. In a first series of experiments we established the methodology for in situ hybridization of tissue microarrays containing paraffin-embedded breast cancers for homing genes that were discovered using the liver as a target organ. No distinct expression was found for breast cancer vs. non-cancerous breast tissues. It is planned to next select homing genes with the breast cancer cell library derived from MDA-MB 231 cells. Then, homing genes derived from that library will be screened against the breast cancer tissue microarray.
DTIC
*Bacteriophages; Cancer; Cells (Biology); Genes; Mammary Glands; Metastasis*

**20040059066** Baylor Coll. of Medicine, Houston, TX
**Prostate Specific Expression of Maspin in a Transgenic Mouse Model: Implications in Prostate Carcinogenesis**
Liu, Zesheng; Zhang, Ming; May 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0224
Report No.(s): AD-A421787; No Copyright; Avail: CASI; A02, Hardcopy

The object of this proposal is to understand the tumor suppressor function of maspin in prostate, and to explore maspin's role in normal prostate development. Maspin transgenic mouse model will be employed to study the effects of maspin overexpression on mouse prostate tumorigenesis and metastasis. Prostatic tumorigenesis and normal prostate development will be studied using a variety of established techniques, including organ culture, histopathology, and molecular biology.
DTIC
*Cancer; Carcinogens; Enzyme Activity; Inhibitors; Mice; Prostate Gland*

**20040059067** Baylor Coll. of Medicine, Houston, TX
**Hedgehog Signal Transduction Inhibitors in Breast Cancer Treatment and Prevention**
Lewis, Michael T.; Aug. 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0477
Report No.(s): AD-A421788; No Copyright; Avail: CASI; A03, Hardcopy

Mutations in at least two hedgehog signal transduction network genes leads to defects in mammary gland development. These mutations can cause enhanced hedgehog signaling in some organs. If this mechanism is functioning in the mammary gland, defects should be inhibited or reverted by treatment with specific inhibitors of hedgehog signaling. One such inhibitor is called cyclopamine which causes birth defects in sheep when ingested during pregnancy. We are using slow release pellets containing cyclopamine to test whether Smo, Ptcl or Gli2-induced developmental defects are inhibited or reverted by treatment. As controls we are also testing the in vivo effect of cyclopamine treatment of preneoplastic growths presumably caused by genetic alterations independent of hedgehog signaling. The effect of cyclopamine on normal mammary development and function is also being examined. Finally, we are testing the effect of cyclopamine on a series of human mammary epithelial cell lines for changes in their growth behavior. If cyclopamine can slow or prevent neoplastic growth, this class of inhibitors may be useful in breast cancer treatment or prevention.
DTIC
*Cancer; Genetics; Inhibitors; Mammary Glands; Prevention; Transferring*

**20040059069** Nebraska Univ., Omaha, NE
**Epstein-Barr Virus and Breast Cancer**
Chan, Wing C.; Sep. 2003; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0340
Report No.(s): AD-A421791; No Copyright; Avail: CASI; A03, Hardcopy

Epstein Barr virus (EBV) has been implicated as a cofactor in several human malignancies. The possibility that EBV may play a role in the development of breast cancer has been raised in recent years. However, published reports have shown conflicting results. This could be related to the different as says employed and also possible geographical variations in the incidence of this infection. We collected 282 cases of invasive breast carcinomas, as well as 30 normal tissues adjacent to the tumors from 5 different geographical regions (USA, India, Kuwait, China and Saudi Arabia) . Conventional polymerase chain reaction (PCR), real-time PCR and EBV-encoded small nonpolyadenylated RNA (EBER-1) in situ hybridization (ISH) were used to study these cases. The data indicate that EBV is present in a small subset of breast carcinomas, however, the high PCR positivity is likely due to the presence of latently infected infiltrating lymphocytes. The incidence and/or the viral load of EBV association with breast cancers were not significantly different among the geographical regions studied.
DTIC
*Cancer; Mammary Glands; Viruses*

**20040059070** Dana Farber Cancer Inst., Boston, MA
**Avoiding Late Cardiac Effects of Radiation of Treatment of Breast Cancer by Simple Respiratory Maneuvers**
Lu, Hsiao-Ming; Apr. 2003; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9084
Report No.(s): AD-A421792; No Copyright; Avail: CASI; A03, Hardcopy

The present proposal is aimed at developing a special treatment technique for radiotherapy treatment of left- sided breast cancer patients. This technique is based on the findings that holding one's breast after a deep inspiration can significantly reduce the volume of cardiac tissue in the treatment fields and thus reduce long-term cardiac risks for these patients. Specifically, the grant is for developing 1) a patient posture and position monitoring system based on infrared tracking technology to ensure treatment accuracy and therefore to maximize the benefit of the technique and 2) a special breast simulation tool to promptly and accurately evaluate the benefit of this technique for a particular patient. Both developments

have been completed. Tests on phantom and radiation therapy patient volunteers have shown that the patient posture and position system is accurate, efficient, and practical as a routine clinical tool. However, it was found that patients occasionally deviate significantly from their normal breath-holding patterns that could affect the treatment accuracy. New patient visual feedback component is added to the system and remains to be tested on patients.
DTIC
*Cancer; Heart; Mammary Glands; Radiation Effects; Respiratory System*

**20040059071** Winston-Salem State Univ., Winston-Salem, NC
**Tropomyosin-1 A Novel Class II Tumor-Suppressor and a Biomarker of Human Breast Cancer**
Prasad, Gaddamanugu L.; Oct. 2003; 48 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9395
Report No.(s): AD-A421793; No Copyright; Avail: CASI; A03, Hardcopy

Previous research from this laboratory indicated that 1. the expression of Tropomyosin-1 (TMI), a microfilament-associated protein, is abolished from many human breast carcinoma cells, and; 2. that TMI is suppressor of the malignant transformation. These data led to the hypothesis that TMI plays an important role in mammary carcinogenesis. Therefore, we investigated whether TMI could serve as a biomarker of breast cancer, and TMI could function as a suppressor of the malignant growth of breast cancer cells. Our results show that TMI is downregulated in breast tumors (Objective 1). We demonstrated that TMI is a suppressor of the malignant growth phenotype of MDA MB 231 cells, indicating that TMI is a general suppressor of the transformed growth (Objective 2). To assess the structure-function relationship of tumor suppression by TMI, we constructed chimeric and variant TMI proteins. By employing a variant TMI that contains an aminoterminal extension, we show that the aminoterminal integrity is important for TMI-mediated tumor suppression (Objective 4).
DTIC
*Biomarkers; Cancer; Mammary Glands; Neoplasms; Suppressors; Tumors*

**20040059072** Johns Hopkins Univ., Baltimore, MD
**The Roles of Histone Deacetylase and DNA Methylation in Estrogen Receptor alpha Expression in Breast Cancer**
Huang, Yi; Jun. 2003; 42 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0301
Report No.(s): AD-A421800; No Copyright; Avail: CASI; A03, Hardcopy

The proposal tests the hypothesis that histone deacetylase activity contributes to the transcriptional repression of the methylated estrogen receptor alpha (ER) gene. It further postulates that inhibition of histone deacetylase (HDAC) and DNA methylation may act together to reactivate the ER gene. Studies to date show that the HDAC inhibitor trichostatin A, can reactivate ER expression in ER-negative breast cancer cell line. Combined treatment with HDAC inhibitors and demethylating agents can synergistically reactivate expression of ER-negative breast cancer cell lines.
DTIC
*Cancer; Deoxyribonucleic Acid; Estrogens; Mammary Glands; Methylation; Receptors (Physiology)*

**20040059073** Catholic Univ. of America, Washington, DC
**Computerized Tomography of Projection Ultrasound**
Liu, Chu-Chuan; Wang, Yue; Sep. 2003; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0197
Report No.(s): AD-A421802; No Copyright; Avail: CASI; A02, Hardcopy

The second year of this training/research project focused on ultrasound tomography System simulation, integrating, and the tomography image reconstruction. A micro- Stepping motor has been purchased and integrated in the transmission ultrasound laboratory system (Imperium Acoustocam) and form a Transmission Ultrasound Computerized Tomography (TUCT) prototype system. The stepping motor is capable of rotating at a 1.8-degree per step with 200 steps per revolution up to a 1600 steps per revolution with 0.225 degrees resolution. Based on the prototype system, the first experiment of UTCT images has been performed using a silicone phantom. The image profiles were acquired by the Imperium Acoustocam. These image intensity profiles were then converted into ultrasound attenuation and used to reconstruct the ultrasound attenuation tomography images through filtered backprojection reconstruction algorithm. Since the CMOS acquisition is not perfectly linear with 1100 chip, the newly developed 1300 chip will be used to perform the study in the future study. In addition, a

scattering component will be added in the filtering algorithm to compensate for the attenuation signal.
DTIC
*Cancer; Computer Aided Tomography; Mammary Glands; Ultrasonics*

**20040059075** Mount Sinai School of Medicine, New York, NY
**Folate Intake Genetic Susceptibility and Risk of Breast Cancer**
Chen, Jia; Oct. 2003; 20 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0354
Report No.(s): AD-A421816; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancer is thought to be largely preventable through dietary and lifestyle modifications. Diets high in vegetables and fruits have been associated with reduced risk of breast cancer in many epidemiologic studies. Minor components of diet such as micronutrients including vitamins may be involved in mediating these associations, but it is not know which micronutrients are involved or how they act. Such knowledge is critical to rationally design and to implement a preventive strategy against breast cancer. Folate, a B vitamin mostly found in vegetables and fruits, may be a protective micronutrient in diet. It is a crucial component in DNA methylation as well as DNA synthesis, both of which are important processes in etiology of breast cancer. Certain genes involved in these processes differ from one person to another. Therefore, a portion of the general population with inherited sub-optimal folate metabolism along with low folate intake may be at increased risk of developing breast cancer. We plan to use a multi-disciplinary approach to study both nutritional and genetic aspects of the disease. We will investigate: (1) whether dietary folate is a micronutrient that is protective against breast cancer; (2) whether a proportion of the population with inherited sub-optimal folate metabolism is at increased risk of breast cancer; (3) whether such inherited variability modifies the association of folate intake and risk of breast cancer; and (4) whether folate may interact with alcohol that interrupts folate metabolism in contributing to risk of breast cancer.
DTIC
*Cancer; Diets; Folic Acid; Genetics; Mammary Glands; Risk*

**20040059078** Texas A&M Univ., College Station, TX
**Enzymatic Detoxification of Chemical Warfare Agents**
Raushel, Frank M.; Dec. 31, 2003; 5 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0235
Report No.(s): AD-A421843; No Copyright; Avail: CASI; A01, Hardcopy

We succeeded in completing our objectives for this research project. These accomplishments include the following: (a) synthesis and development of a flexible organophosphate substrate analog library for each of the stereoisomers of GB, GD, and VX. These compound have been utilized in the high throughput screening of mutant protein libraries; (b) site- directed mutagenesis of each amino acid within the active site of the bacterial phosphotriesterase; (c) development of mutagenic protocols for the efficient construction of protein libraries with altered catalytic properties; (d) development of high throughput spectrophotometric screens for characterization of individual mutant proteins derived from the enzyme libraries.
DTIC
*Chemical Warfare; Enzyme Activity*

**20040059079** General Hospital Corp., Boston, MA
**Preclinical Evaluation of Gene Therapy for NF2 Lesions in Mouse Models Using Amplicon Vectors and Prodrug Activation**
Breakefield, Xandra O.; Nov. 2003; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0537
Report No.(s): AD-A421844; No Copyright; Avail: CASI; A03, Hardcopy

These studies were designed to characterize tumors in mouse models of NF2 and to evaluate vector mediated therapy. Magnetic resonance, bioluminescence and near-infrared imaging were used in monitoring changes in tumor volume and in tracking gene delivery to there lesions over time in living animals. Several mouse models for NF2 were tested including: transgenic mice which express a dominant mutant form of the NF2 protein and develop spontaneous schwannomas; induction of schwannomas and brain tumors by injection of HSV amplicon vectors expressing Cre recombinase into mice homozygous for a floxed NF2 gene; and implantation of humanschwannoma or meningioma tissue into nude mice. Both schwannomas and meningiomas were shown to be highly infectable with therapeutic vectors derived from herpes simplex virus type-l. Injection of an oncolytic HSV vector G47A into schwannomas of transgenic mice led to a reproducible reduction in tumor volume. An

HSV amplicon vector expressing the apostolic protein, caspase-11 was also developed. These vectors can potentially be used to reduce volume of surgically inaccessible tumors in NF2 patients.
DTIC
*Clinical Medicine; Diseases; Drugs; Gene Therapy; Lesions; Magnetic Resonance; Mice*

**20040059080** Burnham Inst., La Jolla, CA
**Hypoxia as a Driving Force for Generic Instability During Breast Tumorigenesis**
Abraham, Robert T.; Oct. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0730
Report No.(s): AD-A421845; No Copyright; Avail: CASI; A02, Hardcopy

The overall hypothesis that drives this project is that the involvement of particular tumor suppressor genes, such as BRCA1 and BRCA2, in familial breast cancer (BCa) provides important clues regarding the etiology of the far more common, sporadic form of this disease. These two breast cancer susceptibility genes play central roles in genome surveillance during the process of DNA replication in proliferating cells. We hypothesize that BCa progression is fueled by the accumulation of cancer-promoting mutations due to errors in genome duplication during S phase. According to our model, hypoxia in developing tumors leads to cell growth arrest during S-phase, and selects for cells that have bypassed the this S-phase checkpoint due to mutations in the ATR-hChk1 pathway. The specific aims of this project are: 91) to define the role of the ART checkpoint pathway in hypoxia- induced cytostasis, and (2) to determine whether defects in this checkpoint pathway promotes BCa progression, and confers sensitivity to killing by certain anticancer agents.
DTIC
*Cancer; Hypoxia; Mammary Glands*

**20040059081** Massachusetts Univ., Amherst, MA
**Intervention Study of Flaxseed in Postmenopausal Women: Effects on Hormonal Biomarkers of Breast Cancer Risk**
Sturgeon, Susan R.; Jul. 2003; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0470
Report No.(s): AD-A421846; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this study is to determine if flaxseed supplementation to usual diet in postmenopausal women has a beneficial effect on important hormonal biomarkers of breast cancer risk. To date, a total of 47 eligible study participants have been successfully enrolled in the study from University of Massachusetts area; we anticipate that we will achieve the required sample size of 50 study subjects by 31 August 2003. Participants receive 6 weeks of usual diet plus 12 grams of raw flaxseed, followed by six weeks of usual diet plus 24 grams of raw flaxseed. Serum and urine are collected at baseline, 7 weeks and 13 weeks. At the completion of the study, serum and urinary levels of hormonal biomarkers of breast cancer risk will be measured (i.e., serum hormone levels: estradiol, testosterone, sex hormone binding globulin; urinary estrogen levels: 2/4-OHEl and 2/l6alpha-OHEl, genotoxic estrogen metabolites:total estrogens).
DTIC
*Biomarkers; Cancer; Estrogens; Hormones; Mammary Glands; Risk*

**20040059094** North Carolina Univ., Chapel Hill, NC
**Aberrant Gene Expression in NF1-Mediated Oncogenisis**
Shields, Janiel M.; Sep. 2003; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0552
Report No.(s): AD-A421873; No Copyright; Avail: CASI; A03, Hardcopy

Recent genetic understanding has identified the gene NF1 to be disrupted or mutated in patients affected with NF1 resulting in reduced expression of the protein neurofibromin. One function of NF1 has shown that it acts to negatively regulate, or turn off, positive signals in the cell that direct the cell to proliferate. Specifically, NF1 turn the positive signals relayed by a protein called Ras. However, other studies have shown that NF1 may negatively regulate cell proliferation by mechanisms other than through inactivation of Ras. These other mechanisms however, are currently unknown. The purpose of the proposed study was to determine what changes in gene expression occur in cells from a patient with neurofibromatosis when we force these cells to express neurofibromin. The study was designed to identify and determine genes deregulated by NF1 in a Ras-dependent and Ras- independent manner. Taken together, these studies were designed to contribute to our understanding of the function and downstream effects NF1 has on the cell. In addition, determining the downstream nuclear events that occur

in response to NF1 may provide novel targets for the treatment of NF1 associated cancers.
DTIC
*Aberration; Abnormalities; Diseases; Gene Expression; Genetics*

**20040059097** Air Force Inst. of Tech., Wright-Patterson AFB, OH
**Gender Effect on Recovery Time Following Isoflurane Administration While Using a Bispectral Index Monitor**
Fevurly, Thomas G.; Olanda, James G.; Pulmano, Gary A.; Dec. 2003; 66 pp.; In English
Report No.(s): AD-A421878; AFIT-CI-02-1337; No Copyright; Avail: CASI; A04, Hardcopy

Gender has been implicated as affecting outcomes of anesthesia (Gan et al., 1999; Myles, McLeod, Hunt, & Fletcher, 2001). The literature is replete with studies indicating significant gender differences in analgesic requirements. In contrast, literature comparing gender differences in recovery times following general anesthesia is sparse. Review of the literature found little published research considering recovery variations among genders using volatile inhaled agents; in addition, most of the studies referring to this potential were retrospective in nature. Recovery time differences have been reported between genders during propofol, alfentanil, and nitrous oxide anesthesia (Gan et al., 1999), with women recovering faster than men. Additionally, a prospective cohort study found that women emerged faster than men from general anesthesia but had a slower rate of return to preoperative health status (Myles et al., 2001). The purpose of this study was to further investigate gender differences in recovery times from general anesthesia using isoflurane and the Bispectral Index monitor (BIS). A convenience sample of 30 men and 22 women (ASA classification: I or II) was enrolled. Subjects received a standardized anesthetic of isoflurane and fentanyl. Depth of anesthesia was assessed using clinical parameters and the bispectral index monitor (BIS) monitor. Wake-up time was measured by the number of minutes it took for subjects to meet both of two endpoints (opening of eyes and hand grasp-and- release to command). An average time of 5.6 minutes for women versus 6.87 minutes for men was found. An analysis of covariance (ANCOVA) was performed to determine if there was any effect of gender on wake-up time.
DTIC
*Anesthesia*

**20040059102** Ohio State Univ., Columbus, OH
**Development of Dual Acting Inhibitors for Breast Cancer**
Li, Pui K.; Aug. 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0238
Report No.(s): AD-A421903; No Copyright; Avail: CASI; A03, Hardcopy

To design dual acting inhibitors that can block the enzyme estrone sulfatase and act as antiestiogens. Scope: The design and synthesis of 30 dual inhibit&s are proposed. The inhibitors contain 4 different structural core. The synthesized inhibitors will be tested on their ability to inhibit the enzyme estrone sulfatase and also their abilities to inhibit the growth of breast cancer cells stimulated by estrone sulfate. In addition, selected inhibitors will be tested in vivo using NMU-induced mammary tumors in rats. Major findings: More than 83 % (25 out of 30) of the proposed inhibitors have been synthesized. The inhibitors have been tested for their ability to inhibit estrone sulfatase activity of rat liver microsomes at 20 %M concentrations and in the presence of 20 %M of substrate estrone sulfate. All the inhibitors tested so far are more potent than our lead compound Tamoxifen sulfamate. Raloxifene sulfamate (inhibitor 30) is still the most potent compound among the 25 inhibitors we have synthesized. It inhibits more than 95% of the sulfatase activity at 20 %M concentration. It is by far the most potent dual inhibitor we have ever obtained. We have selected inhibitor 30 as one of the compounds for in vivo study using NMU-induced mammary tumors in rats. We have synthesized 4 grams of the compound needed for the study.
DTIC
*Cancer; Inhibitors; Mammary Glands*

**20040059104** New South Wales Univ., Sydney
**Augmentation of a Novel Enzyme/Pro-Drug Gene Therapy 'Distant Bystander Effect' to Target Prostate Cancer Metastasis**
Martiniello-Wilks, Rosetta; Russell, Pamela; Oct. 2003; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0083
Report No.(s): AD-A421912; No Copyright; Avail: CASI; A03, Hardcopy

Prostate cancer is now the second highest cause of cancer death in men in Western society. Early disease is treatable by surgery and radiation, but once late stage disease becomes refractory to hormone removal, patient care is limited to pain

management. New treatments are needed. We are using gene therapy, alone and in combination with hormones called cytokines that stimulate the immune system. The concept is that delivering a cell-killing agent to an accessible tumor, coupled with help from the immune system can promote tumor reduction both at the treatment site and at remote locations. In this therapy, a gene (a fusion of cytosine dreaminase and uracil phosphoribosyltransferase (DC/ UPRT)) is delivered to a cancer cell so that harmless bacterial proteins are made. When a pro-drug, 5 fluorocytosine (5-FC), is then given, cancer cells that make CD/UPRT convert 5-FC to a toxin that kills the original cell and other nearby. This system works in slow growing tumors like prostate cancer. Killing the tumor cells attracts immune cells. We will identify these and use cytokinase to attract more of them into tumors. We will deliver the cytokine gene alone or with the suicide gene because in other studies, combination therapy works better.
DTIC
*Augmentation; Cancer; Chemotherapy; Enzymes; Gene Therapy; Metastasis; Prostate Gland; Targets*

**20040059105** Albuquerque Univ., Albuquerque, NM
**99HRT Effects of Chronic Alcohol Exposure on Kainate Receptor-Mediated Neurotransmission in the Hippocampus**
Valenzuela, C. F.; Sep. 2003; 22 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0579
Report No.(s): AD-A421914; No Copyright; Avail: CASI; A03, Hardcopy

We have studied whether chronic alcohol exposure alters expression and/or function of hippocampal kainite receptors (KA-Rs). Under the support of this award, we demonstrated that interneuronal KA-Rs are among the most ethanol sensitive receptors in the central nervous system (see attached reprints #1 and 2). Based on these results and those of a previous study with CA3 pyramidal neurons, we expected KA- Rs to be upregulated in response to long-term ethanol exposure. During the last year, we have used the ethanol inhalation route to test this possibility. Unexpectedly, we found that 24 h withdrawal from long term exposure to ethanol vapor produced only small non-significant changes in KA-R subunit levels. Radioligand binding studies also yielded unexpected results. Specifically, 3H- vinylidene KA binding was unaffected in the CA3 region, dentate gyrus and cerebellum but significantly decreased in the colliculi, entorrhinal cortex and pre-frontal cortex. Taken together, these results indicate that hippocampal KA-R are minimally affected by long-term ethanol exposure and suggest that these receptors could be involved in the maintenance of sensitivity to ethanol. During the last year of support (non-cost extension), we will concentrate on characterizing the effect of ethanol on the function of presynaptic KA-Rs in the cA3 region.
DTIC
*Alcohols; Drugs; Electrophysiology; Ethyl Alcohol; Exposure; Hippocampus; Neurotransmitters*

**20040059106** Connecticut Univ., Storrs, CT
**Breast Cancer Diagnosis Using Ultrasound and Diffusive Light**
Zhu, Quing; Sep. 2003; 100 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0217
Report No.(s): AD-A421915; No Copyright; Avail: CASI; A05, Hardcopy

We have developed a novel near-infrared optical technique with ultrasound localization. During the last year, we have made significant progress on using our technique to improve breast cancer diagnosis. Initial results with a group of biopsied patients have shown that early stage invasive cancers present two-fold greater total hemoglobin concentration than fibroadenomas and benign lesions. Initial results of advanced cancers have shown good correlation between cancer angiogenesis distributions imaged by the hybrid imaging technique and histological microvessel density counts. We believe our unique has a great potential to improve current practice on breast cancer diagnosis and monitor treatment responses of advanced cancers.
DTIC
*Cancer; Diagnosis; Diffusivity; Infrared Instruments; Mammary Glands; Near Infrared Radiation; Ultrasonics*

**20040059107** State Univ. of New York, Stony Brook, NY
**The Role of Sphingolipid- and Cholesterol-Rich Membrane Domains in Pathophsiology of Cultured Human Breast Cancer**
Brown, Deborah A.; Jun. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0446
Report No.(s): AD-A421916; No Copyright; Avail: CASI; A03, Hardcopy

uPAR (urokinase-type plasminogen activator receptor) is a key player in metastasis of breast cancer cells. We suggest that

uPAR, because it is a GPI-anchored protein, must be present in discrete 'rafts' in the cell surface to function. Our proposal has two parts. First, we will set up systems in our lab for studying signaling trough uPAR in cultured human breast cancer cells. Second, we will disrupt rafts, and determine whether signal transduction is affected. Our most important advance this year has been in developing new tools for raft disruption. These include sterol analogs such as androstanol and coprostanol. Replacing cholesterol with these analogs allows us to disrupt rafts without depleting total cellular sterol, allowing raft disruption without the other pleiotropic effects that accompany bulk sterol removal. This will be an important tool in later experiments to examine the effect of raft disruption on uPAR- Mediated signaling and cell motility. We anticipate in the next year, we will develop improved methods for detecting uPAR in rafts in cells. We will then determine how the localization of uPAR in rafts governs its deadly activity in metastasis.
DTIC
*Cancer; Cells (Biology); Cholesterol; Domains; Mammary Glands; Membranes*

**20040059108** National Inst. of Health, Bethesda, MD
**Placebo Controlled Study of Repetitive Transcranial Magnetic Stimulation for the Treatment of Parkinson's Disease**
Hallett, Mark; Jul. 2003; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MIPR-2GCDGG2091
Report No.(s): AD-A421927; No Copyright; Avail: CASI; A02, Hardcopy

During the period of the study we researched the effects of 25 Hz rTMS in 12 patients with PD. Eight rTMS sessions were performed over a four-week period. Four cortical targets were stimulated in each of the sessions (left and right motor and dorsolateral prefrontal cortex) with 300 pulses each. We haven't done any type of the interim statistical analysis of the results at this point and will not do so until enough data has been collected. Preliminary results indicate the cumulative reduction of bradykinesia in the course of rTMS sessions. This manifested itself by a decrease of the time needed to execute motor tests. rTMS used under the parameters of the regimen is safe in patients with PD.
DTIC
*Diseases; Stimulation*

**20040059118** Mayo Foundation, Rochester, MN
**Characterization of Genetic Alterations in Ovarian Cancer**
Smith, David I.; Oct. 2003; 170 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9504
Report No.(s): AD-A421954; No Copyright; Avail: CASI; A08, Hardcopy

The goal of this Program Project was to utilize genetic technologies to begin to understand the important changes that underlie ovarian cancer development. Utilizing transcriptional profiling to ascertain consistently up-and down-regulated genes, we began to characterize ovarian epithelial cancer. We had three interactive projects in this Program Project. The first project, headed by Dr. Viji Shridhar, had its major aim the identification of genes that were consistently down-regulated during ovarian cancer development. Dr. Shridhar also led the efforts to transcriptionally profile the ovarian tumors and she has now identified a number of interesting and promising candidates. Dr. Fergus Couch focused on characterizing gene amplification in familial and sporadic ovarian tumors, also utilizing the database of gene expression that we obtained for the ovarian tumors. Dr. David I. Smith focused on the characterization of the highly active common fragile site, FRA6E. They also analyzed genes consistently down-regulated in ovarian tumors that were derived from chromosomal regions containing common fragile sites. They were able to identify a number of previously uncloned common fragile sites and identify important genes in those regions. We have begun to unravel the complex genetic changes that underlie the development of this aggressive cancer.
DTIC
*Cancer; Genes; Genetics; Ovaries; Transcription (Genetics)*

**20040059119** Arkansas Univ. for Medical Sciences, Little Rock, AR
**Sulfotransferase 1A1 (SULT1A1) Genotype and Phenotype in Relation to Efficacy of Tamoxifen Treatment**
Nowell, Susan A.; Nov. 2003; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0274
Report No.(s): AD-A421960; No Copyright; Avail: CASI; A02, Hardcopy

Genetic polymorphisms in SULT1A1 have been associate overall survival in breast cancer patients receiving tamoxifen. Studies have suggested that exposure of a breast cancer cell line to 4-hydroxytamoxifen (4-OH TAM) results in the, upregulation of SULT1A1 of transcript may be related to the observed difference in overall survival by SULT1A1 genotype

in tamoxifen-treated patients. SULT1A1 is expressed in platelets, and its expression has been shown to be coordinately regulated across tissues. Therefore, we proposed to recruit 150 patients with primary, incident breast cancer and collect a blood sample for platelet isolation and SULT1A1 activity as says both before and after tamoxifen treatment. Forty-nine patients have been recruited to date, and platelets, along with other blood components have been stored for additionally, the effect of 4-OH TAM treatment on the breast cancer cell lines MCF-7 and ZR74-1 have been evaluated by RT- PCR. Analysis by this method did not support the idea that SULT1A1 was regulated by tamoxifen. When enzymatic activity assays were performed using cytosol from cells treated with 4- OH TAM, there was no evidence of increased enzymatic activity with this treatment. These investigations will continue with other breast cancer cell lines.
DTIC
*Cancer; Mammary Glands*

**20040059120** New York Univ. Medical Center, New York, NY
**Genetic Susceptibility to Prostate Cancer Among Ashkenazi Jews**
Ostrer, Harry; Sep. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8535
Report No.(s): AD-A421961; No Copyright; Avail: CASI; A03, Hardcopy

This project will test the basic hypothesis that a given microsatellite marker allele occurs with greater frequency among the individuals affected with prostate cancer than among the controls. These studies will take advantage of the fact that two populations of Ashkenazi Jewish men are readily available for a case-control study. The first is a group of men at high heritable risk based on their having early-onset prostate cancer. The second is a group of men at low heritable risk who have no personal or family history of prostate cancer. Thus, we expect to observe predisposition alleles in the men at high risk that are not present in the men at low risk. The predisposition genes are likely to be within chromosomal regions in which loss of heterozygosity has occurred. Because these regions have remained identical by descent since the high-risk mutations occurred, they can be recognized by the presence of specific alleles of microsatellite markers in the high-risk group that are not present in the low-risk group.
DTIC
*Cancer; Genetics; Prostate Gland*

**20040059121** Pennsylvania Univ., Philadelphia, PA
**Maximizing Immune Response to Carbohydrate Antigens on Breast Tumors**
Kieber-Emmons, Thomas; Aug. 2003; 45 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0366
Report No.(s): AD-A421963; No Copyright; Avail: CASI; A03, Hardcopy

Tumor antigens are autologous antigens and thus are weakly immunogenic. Unresponsiveness appears to be related to suppression of antigen specific helper T cell function which can be overcome by providing heterologous help. Carbohydrates are richly expressed on the surface of many cancers, at frequencies higher than oncogene products. Consequently, tumor associated carbohydrate antigens, are in principle, excellent targets for immunotherapy. However, carbohydrates are generally poor at eliciting effective antibody responses and rarely provide target epitopes for CTL because of their T cell-independent nature. The major objective of this application is to examine ways to maximize the tumor-protective immunity directed to carbohydrate antigens expressed on breast tumors. Towards this end we are developing peptide mimotopes of tumor associated carbohydrate antigens as they are T cell dependent antigens. In our progress to date we have shown the 1) immunization with peptide mimotope activates a specific cellular response to a model murine tumor cell line; 2) vaccination of mice with peptide eradicates established tumor; 3) Immunization with DNA format of the peptide suppresses tumor growth in further challenge; and 4) Induced immunity has a cellular nature as it is transferred to nude mice by transferring splenocytes from cured mice.
DTIC
*Antigens; Cancer; Carbohydrates; Immunity; Mammary Glands; Physiological Responses; Tumors*

**20040059122** Alabama Univ., Birmingham, AL
**Role of Smooth Muscle Actin in Stromal-Epithelial Interactions**
Frost, Andra R.; Dec. 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0514
Report No.(s): AD-A421964; No Copyright; Avail: CASI; A02, Hardcopy

The structure and homestasis of normal breast parenchyma is maintained by dynamic interactions between breast

epithelial cells and their associated stroma. During breast carcinogenesis, these stromal-epithelial interactions are increasingly deregulated. Stromal fibroblasts in invasive breast carcinomas (i. e., carcinomas associated fibroblasts, CAF) differ from fibroblasts associated with normal breast. These differences include the production of increased amounts of type-specific collagens, the over expression of various growth factors, proteases and protease inhibitors, and acouisition of the myofibroblast phenotype, characterized by alpha-smooth muscle actin (SMA) expression. SMA functions to stop the migraton of breast fibroblasts and contributes to the contraction of myofibroblasts. These activities involve alterations in adhesion moleculares and cytoskeletal organization, which also affect expression of other molecules, such as extracellular matrix (ECM) proteins and proteases, by fibroblasts. In this project we test the hypothesis that expression of SMA is responsible for much of the CAF phenotype. RNA interference was utilized to inhibit expression of SMA in CAF. SMA-inhibited and SMA-expressing CAF were compared for the expression of a variety of cell adhesion mole%ules, ECM proteins, and ECM modulating proteases. We demonstrate that SMA in CAF affects the expression of several cell adhesion molecules, ECM proteins and ECM.
DTIC
*Cancer; Epithelium; Mammary Glands; Muscles*

**20040059125** Loyola Univ. Chicago, Maywood, IL
**Effects of Androgen Ablation on Anti-Tumor Immunity**
Kast, W. M.; Sep. 2003; 61 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0244
Report No.(s): AD-A421972; No Copyright; Avail: CASI; A04, Hardcopy

Androgen ablation (AA) constitutes the most common therapy for the treatment of advanced prostate cancer. While initially effective at reducing tumor burden, most patients recur with androgen insensitive disease. There exists a clear need to augment the clinical efficacy of hormone-based therapies, and immunotherapy of prostate cancer represents a promising approach for achieving such augmentation. Moreover, our data indicate that AA affects the immune system both systemically as well as at the prostate. Castration of mice stimulates B and T lymphopoiesis, thymic and bone marrow hyperplasia. The induction of apoptotic cell death following androgen ablation is accompanied by an inflammatory infiltrate comprised predominantly of activated T cells. This AA induced autoimmune-like response exerts limited anti-tumor activity in a mouse prostate cancel model, but the anti-tumor effect is potentially synergistic with CTLA-4 blockade, which promotes the development of autoreactive T cells. We have used the first year of this proposal to obtain and produce all necessary reagents (genes, tumor cell lines, hybridomas, purified antibodies) to position ourselves for studying the effects of AA on prostate cancer immunity as these effects might significantly influence the ability of a tumor-bearing host to mount an effective immune response.
DTIC
*Ablation; Cancer; Hormones; Males; Prostate Gland; Tumors*

**20040059128** Columbia Univ., New York, NY
**Dynamic Functional Mammoscopy: A Non-Ionizing Imaging Technique Enhancing Early Detection of Breast Cancer**
Smith, Suzanne J.; Apr. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8054
Report No.(s): AD-A421983; No Copyright; Avail: CASI; A03, Hardcopy

During the third and final year of this study, we focused on improving the imaging technology of Dynamic Functional Optical Mammoscopy (DFOM) and focused on technique on refining existing weaknesses in specificy identified during the second year of study. In addition, we summarize the case studies and analysis of data obtained during the first two years. This data included optical imaging of patients scheduled for biopsy of breast lesions. These patients were recommended for core or excisional breast biopsy on the basis of equivocal mammographic and ancillary clinical findings within ACR BI-RADS(TM) categories 3 or 4. Analysis of test results of 117 patients showed that DFOM modality detected cancer in 13 of the 15 patients in whom biopsies confirmed malignant lesions, giving a sensitivity of 87%. DFOM also correctly identified 79 of 102 benign lesions giving a specificity of 77%. In clinical practice, the adjunctive use of DFOM would have decreased the percentage of biopsies that turn out to be benign from 102/117 (87%) to 23/117 (20%). The negative predictive value, the chance that a negative DFOM result truly indicates a benign lesion, was 79/81(98%) for the cases included thus far. While encouraging, these results suggest the need for further patient studies on_specificity.
DTIC
*Cancer; Clinical Medicine; Detection; Images; Imaging Techniques; Mammary Glands*

**20040059129** New Mexico Univ., Albuquerque, NM
**Role of the 5HT3 Receptor in Alcohol Drinking and Aggression Using a Transgenic Mouse Model**
Allan, Andrea M.; Sep. 2003; 98 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0680
Report No.(s): AD-A421986; No Copyright; Avail: CASI; A05, Hardcopy

Alcohol use has been identified as an important factor in aggressive, or violent, behavior in humans. Alcohol not only increases the incidence but also the severity of violent attacks. Several clinical studies have reported the observation that highly aggressive individuals display a serotonin-deficient trait. A number of studies indicate that the 5HT(sub 3) receptor system mediates alcohol consumption and the subjective effects of alcohol. The 5HT(sub 3) receptor is unique in the serotonin receptor family in that it is a cation channel and modulates the release of a number of other neurotransmitters, including GABA and dopamine. Thus, the 5- HT(sub 3) receptor is likely to play a critical role influencing alcohol consumption, which appears to involve dopamine and influencing both natural and alcohol-heightened aggression through the GABAA receptor system. We have developed a 5-HT(sub 3) receptor over-expressing mouse to study the role of this receptor in alcohol drinking and aggression. We hypothesize that 5HT(sub 3) receptor over- expression decreases alcohol preference and aggressive activity through a 5HT(sub 3) receptor sensitive mechanism increasing the release of GABA. We will evaluate the transgene on 3 different inbred strains (C57, DBA, 129) who differ in alcohol preference in a two-bottle choice design and aggression using intruder- aggression test. We will test the ability of 5HT(sub 3) receptor antagonists to block and GABA receptor agonist to mimic the phenotypic effects of over- expression. These mice should prove useful in testing hypothesis regarding the role 5-HT(sub 3) receptors play in alcohol abuse and alcohol-heightened aggression.
DTIC
*Alcohols; Clinical Medicine; Drinking; Genetics; Mice; Neurotransmitters*

**20040059130** Brigham and Women's Hospital, Boston, MA
**Ca(2+) Receptor, Prostate Cancer, and Bone Metastases**
Brown, Edward M.; Mar. 2004; 42 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0015
Report No.(s): AD-A421987; No Copyright; Avail: CASI; A03, Hardcopy

While bony metastases of prostate cancer are often osteoblastic, excessive bone resorption also occurs, which contributes to skeletal complications (e.g., pain, fractures). This research evaluates whether prostate cancer cells express the extracellular calcium Ca2+0-sensing receptor (CaSR) and whether the CaSR in bony metastases of prostate cancer participates in a vicious cycle involving CaSR-mediated secretion of the bone-resorbing cytokine, parathyroid hormone- related protein (PTHrP). The secreted PTHrP would promote further bone resorption, thereby increasing Ca2+0 locally and stimulating further PTHrP release. The project entails four tasks--namely showing that: (1) prostate cancer cells express the CaSR, (2) the CaSR mediates high Ca2+0-induced stimulation of PTHrP secretion, (3) the CaSR transactivates the EGF receptor, and (4) CaSR-stimulated PTHrP secretion, from prostate cancer cells increases the severity of metastatic bone disease in vivo in mice. We have accomplished tasks 1 and 2, shown that the CaSR transactivates the CaSR in task 3 and are in the process of developing the stably transfected cell lines needed for the studies in task 4. These results support a role for the CaSR in a vicious cycle that increases the severity of bone resorption in vivo in humans.
DTIC
*Bones; Calcium; Cancer; Metastasis; Prostate Gland*

**20040059132** Health Research, Inc., Rensselaer, NY
**PCBs Alter Dopamine Mediated Function in Aging Workers**
Seegal, Richard F.; Jan. 2004; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0173
Report No.(s): AD-A421990; No Copyright; Avail: CASI; A03, Hardcopy

The major hypothesis is that prior occupational exposure to polychiorinated biphenyls (PCBs) results in decrements in neuropsychological and neurological performance and reductions in the number of dopamine (DA) terminals in the basal ganglia. In Albany, NY, 248 subjects (62 per year) will undergo neuropsychological and neurological examinations, complete a comprehensive questionnaire, have blood drawn to measure serum PCB concentration and undergo a non-invasive test to determine bone lead concentrations. This latter measure will allow us to control for exposure to lead-a potential confounder. In New Haven, CT, 96 subjects (24 subjects per year, chosen randomly) will be asked to undergo brain imaging at the Institute for Neurodegenerative Disorders to determine if PCBs reduce the number of basal ganglia DA terminals. To date, despite one of the worst winter in recent history, 62 subjects have undergone testing in Albany and 21 subjects have been image in New

Haven, CT. Serum PCB concentrations are being analyzed at Mt. Sinai School of Medicine. Secure electronic databases have been created for all data. We anticipate no problem in continuing to recruit and test the number of subjects needed for studies in both Albany and New Haven to reach our annual goals.
DTIC
*Aging (Biology); Diseases; Dopamine; Personnel; Physical Examinations; Physiology*

**20040059133** Georgetown Univ. Hospital, Washington, DC
**A New APC-Like Gene Involved in regulation of B- catenin/LEF**
Nishanian, Tagvor G.; Waldman, Todd; Jul. 2003; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9197
Report No.(s): AD-A421991; No Copyright; Avail: CASI; A02, Hardcopy

Here we describe two different approaches to better understanding the functions of Wnt and TGF-B signaling in cancer pathogenesis. First, we have identified a second adenomatous polyposis coli (APC)-like gene, APC2/APCL. Interphase fluorescence in situ hybridization analysis revealed an APC2 allelic imbalance in 19 of 20 ovarian cancers screened and indicates that APC2 could be a potential tumor suppressor gene in ovarian cancer. Antibodies against the NH2 terminus of human APC2 show that endogenous APC2 is diffusely distributed in the cytoplasm and colocalizes with both the Golgi apparatus and actin filaments. Second, we have identified a protein that interacts with the intracellular domain of the TGF-B receptor BMPRlA. This protein, known as SAP49, is a developmentally- regulated splicing factor. The interaction was identified in a yeast two-hybrid analysis and confirmed via immunoprecipitation/Western Blot analysis in transfected human cells. The interaction has been localized to the GS-domain of BMPRlA and the proline rich- domain of SAP49 via mutational analysis. Further studies will address the biological relevance of the interaction in human cancer pathogenesis.
DTIC
*Antibodies; Cancer; Genes; Ovaries*

**20040059134** Georgetown Univ., Washington, DC
**X-Box Binding Protein-1 in Breast Cancer**
Clarke, Robert R.; Aug. 2003; 47 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0388
Report No.(s): AD-A421992; No Copyright; Avail: CASI; A03, Hardcopy

Antiestrogens are effective in premenopausal and postmenopausal patients, and in the chemopreventive, adjuvant and metastatic settings (5), probably through the induction of growth arrest/apoptosis (5). The triphenylethylene TAM, a partial agonist, is the most widely used anti estrogen. Long term TAM use reduces the incidence of contralateral breast cancer (antagonist) and primary breast cancer in high risk women (antagonist), maintains bone density (agonist) and increases the risk of endometrial carcinomas (agonist) (10). Newer antiestrogens include the 'pure antagonist' ICI 182,780 (no agonist activity). In patients that had previously shown a response to TAM but recurred, ICI 182, 780 produces a response rate significantly higher than the response rate for crossover to another triphenylethylene (Toremifene) following TAM failure (29).
DTIC
*Cancer; Estrogens; Mammary Glands; Proteins*

**20040059135** National Academy of Sciences - National Research Council, Washington, DC
**Long-Term Follow-Up of Veterans Experimentally Exposed to Sarin and Other Anticholinesterase Chemical Warfare Agents**
Page, William; Sep. 2001; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9485
Report No.(s): AD-A421994; No Copyright; Avail: CASI; A03, Hardcopy

Between 1955 and 1975, the US Army enrolled volunteers in an experimental exposure program of chemical warfare and other agents at the Edgewood Arsenal, Maryland. In 1980 the National Research Council issued a report on the health status of test subjects which included 1,581 men exposed to anticholinesterase agents. The current study is a continued follow-up of the same subjects, including two control groups whose subjects were not exposed to anticholinesterase agents. The current study collected morbidity data via telephone survey on the following primary outcomes: somatization disorder, memory and attention problems, peripheral nerve disease, vestibular function, depression, generalized anxiety, sleep disturbance, and birth defects. In general, there were few statistically significant differences in these outcomes among the study groups. In contrast, self- reported non-experimental exposure was associated with higher levels of almost all outcomes, although this association

could be due to reporting bias. This suggests that if there were any true long-term health effects associated with anticholinesterase exposure, they are probably smaller than those associated with self-reported non-experimental exposure to hazardous chemicals. These results were published in Military Medicine, Vol. 168, March 2003, pp. 239-45.
DTIC
*Chemical Warfare; Cholinesterase; Inhibitors; Medical Services; Military Operations; Personnel*

**20040059136** Minnesota Univ., Minneapolis, MN
**Role of Angiogenesis in the Etiology and Prevention of Ovarian Cancer. 4. Prevention of Ovarian Carcinoma Dissemination by Inhibiting Cell Adhesion**
Ramakrishnan, Sundaram; Oct. 2003; 125 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9564
Report No.(s): AD-A421995; No Copyright; Avail: CASI; A06, Hardcopy

The purpose of this project is to evaluate the mechanism by which ovarian cancer cell spread with in the peritoneal cavity. Ovarian cancer cells adhere to mesothelial cells and their extracellular matrix lining the peritoneum. Characterizing the cell surface molecules involved in this interaction will facilitate development of methods to inhibit ovarian cancer spread and perhaps limit their growth as well.
DTIC
*Adhesion; Cancer; Etiology; Ovaries; Prevention*

**20040059137** Minnesota Univ., Minneapolis, MN
**Role of Angiogenesis in the Etiology and Prevention of Ovarian Cancer. 3. Rational Antiangiogenic Peptide Design-Effect on Ovarian Cancer Growth**
Ramakrishnan, Sundaram; Oct. 2003; 49 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9564
Report No.(s): AD-A421996; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this project is to evaluate de novo synthesis of a short polypeptides, which is capable of inhibiting tumor angiogenesis. As tumor growth in general and ovarian cancer in particular is associated with angiogenesis1 the synthetic peptide can be used to inhibit growth and peritoneal seeding of ovarian cancer.
DTIC
*Cancer; Etiology; Neoplasms; Ovaries; Peptides; Prevention*

**20040059138** Minnesota Univ., Minneapolis, MN
**Role of Angiogenesis in the Etiology and Prevention of Ovarian Cancer. 2. Angiogenesis Factors in the Malignant Transformation of Ovarian Surface Epithelium**
Ramakrishnan, Sundaram; Oct. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9564
Report No.(s): AD-A421997; No Copyright; Avail: CASI; A02, Hardcopy

Etiology of ovarian cancer is not completely understood Previous studies have shown that both genetic and epigenetic factors could contribute to ovarian tumorigenesis. Epidemiological studies suggest that number of ovulation and ovulation related gonadotropic hormones could play a role in the malignant transformation of surface epithelium. In this project, we will investigate how the normal ovarian epithelium acquires tumorigenic phenotype. Specifically, the effect of angiogenic growth factors in the etiology of ovarian cancer is studied using a model system.
DTIC
*Cancer; Epithelium; Etiology; Ovaries; Prevention*

**20040059139** Minnesota Univ., Minneapolis, MN
**Role of Angiogenesis in the Etiology and Prevention of Ovarian Cancer. 1. Effect of Angiogenesis Inhibitors in Preventing Ovarian Cancer Growth**
Ramakrishnan, Sundaram; Oct. 2003; 107 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9564
Report No.(s): AD-A421998; No Copyright; Avail: CASI; A06, Hardcopy

Primary growth of ovarian cancer and its spreading in the peritoneal cavity as micrometastases are dependent on angiogenesis. Therefore, angiogenesis inhibitors can be used in the prevention and treatment of ovarian cancers. One of the

objectives of Project 1 is the development of a genetically reengineered angiostatic protein, endostatin. A mutant endostatin containing a single amino acid substitution at position 125 (P125A-endostatin) was found to be more active than the native protein. P125A endostatin was further modified to incorporate vascular targeting sequence, RGD, so that the bioavailability can be increased at the tumor vasculature. Modified endostatins were evaluated for antiangiogenic and antitumor activities in model systems. Genetic modifications significantly improved the biological activity of endostatin. Synthetic peptides corresponding to the mutation site were made to characterize the mechanism of enhanced antiangiogenic activity.
DTIC
*Cancer; Etiology; Inhibitors; Ovaries; Prevention*

**20040059140** Calgary Univ., Alberta
**Preparation of a Burkholderia Mallei Vaccine**
Woods, Donald E.; Jan. 2004; 183 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-C-8003
Report No.(s): AD-A422000; No Copyright; Avail: CASI; A09, Hardcopy

Since Burkholderia mallie is of significance as an agent of bioterrorism (Category B, Centers for Disease Control, U.S.) and biological warfare, the development of effective vaccines and treatments is of particular concern. Our understanding of the disease caused by this organism is rapidly emerging, and we must move forward with our studies on the pathogenesis of this disease in order to develop new and effective vaccines and/or therapies against this organism. There is considerable dual use potential, since the development of vaccines and treatments can provide important items to assist the World Health Organization, to assist in providing a state of preparedness in case of bioterrorism attacks and to assist signatories of the Biological and Toxin Weapons Convention under Article X of the Convention. The long- term objective of our research is to define at a molecular level the pathogenesis of disease due to Burkholderia ssp. My laboratory is recognized internationally as a world leader in the understanding of the pathogenesis of disease caused by Burkholderia ssp., and considerable advances in understanding of the diseases caused by these organisms have already been made by my laboratory.
DTIC
*Vaccines; Warfare*

**20040059141** Texas Univ. Health Science Center, San Antonio, TX
**Identification of a Gene on Chromosome 18q21 Involved in Suppressing Metastatic Prostate Cancer**
Johnson-Pais, Teresa R.; Dec. 2003; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0044
Report No.(s): AD-A422001; No Copyright; Avail: CASI; A02, Hardcopy

Numerous chromosomal regions have been implicated as potential locations for tumor suppressor genes involved in prostate caner including 8p, 10q, 11p, 16q, 17p, 18q, 21 and Y. In addition, in metastatic prostate cancer there is increased frequency of loss of genetic material from chromosome 18q. We have previously identified two distinct regions on chromosome 18q as the site of a tumor suppressor gene involved in metastasis suppression. In order to identify the genes on 18q involved in metastasis suppression, we have created custom bacterial artificial chromosome (BAC) microarrays containing genomic DNA form the two regions of 18q that are lost at a high frequency in metastatic prostate cancer. We are in the process of analyzing the data obtained form the hybridization of prostate cancer DNA to the microarray slide. We have also analyzed the expression of known genes/expressed sequence tagged sites (ESTs) form these town regions on 18q in normal prostate epithelium and in metastatic prostate cancer cell lines. Interestingly, two of the ESTs in the distal region exhibit altered expression when comparing less aggressive prostate cancer to highly-metastatic prostate cancer. The data generated form this proposal will pinpoint the location of the proposed metastasis suppressor gene.
DTIC
*Cancer; Chromosomes; Genes; Metastasis; Prostate Gland*

**20040059142** Winston-Salem State Univ., Winston-Salem, NC
**Blood-Brain Barrier Transport of Uranium**
Aschner, Michael; Sep. 2003; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0685
Report No.(s): AD-A422003; No Copyright; Avail: CASI; A02, Hardcopy

Studies in Year 2 continued according to the original plan. Studies were carried out in RBE4 cells and in primary astrocyte cultures. In both cell types, there was a significant increase in 54manganese uptake due to the addition of uranium to the media.

Incubation with uranium did not significantly alter DMT-1 may not be the putative transporter for uranium across the blood-brain barrier. In addition studies, which were delayed by the lack of availability of DU pellets, we implanted rats in the gastrocnemius muscle with 10 pellets in each leg for a total of 20 pellets. The following doses were administered: sham=20 tantalum (Ta) pellets; low=16 Ta and 4 du; medium=10 Ta and 10 du; high=4 Ta and 16 du. The three-month cohort will be analyzed shortly for uranium brain levels, as well as DMT-1 expression in various brain regions. Rats have been monitored (e.g.; body weights, coat quality), and there are no noted differences in body weights in either the three-month or six-month cohorts (Figure 4) or physical appearance have occurred in rats receiving surgery (both Ta and du pellets) compared to non-surgical controls.
DTIC
*Blood-Brain Barrier; Brain; Cells (Biology); Endothelium; Transport Properties; Uranium*

**20040059143** Indiana Univ., Indianapolis, IN
**Cancer Specific Proliferating Cell Nuclear Antigen as a Novel Diagnostic Marker for the Detection of Breast Cancer**
Hoelz, Derek J.; Oct. 2003; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0467
Report No.(s): AD-A422005; No Copyright; Avail: CASI; A03, Hardcopy

Our laboratory has demonstrated the presence of different isoforms of proliferating cell nuclear antigen (PCNA) that display both acidic and basic isoelectric points (pI) . Analysis of PCNA by two- dimensional polyacrlamide gel electrophoresis (2D PAGE) from both malignant and non- malignant breast cells and tissues established the exclusive presence of the acidic form of PCNA in malignant cells (which is now referred to as the cancer-specific form of PCNA or csPCNA). Additionally, a basic form of PCNA was also observed in the malignant cells, but this isoform was the only isoform found in non-malignant cells and tissues. Testing of numerous other malignant and non-malignant breast cells suggested that the csPCNA would be an excellent prognostic indictor of breast cancer. Further investigation confirmed that a 29 amino acid fragment derived from the PCNA binding domain of the XPG protein interacted with csPCNA and not the basic PCNA isoform. This led us to believe that the xPG peptide would be a specific and sensitive probe that would enable us to identify csPCNA in different tissue and serum samples. It is therefore our goal in this research to develop an enzyme linked immunosorbent assay (ELISA) that utilizes the 29 amino acid fragment of XPG to detect the presence of csPCNA in cells, tissues, and sera. Additionally, we plan on using the XPG peptide for immunocytochemical (IHC) staining allowing us to look for csPCNA in tissues of patients with breast cancer and uncertain malignant diagnosis. Following development of these assays, we will then screen our breast tissue and serum repositories, which we have been generating, and correlate our finding with other prognostic factors such as BECAl and 2, p53, p2(exp kip), and estrogen receptor status and thus validate the usefulness of csPCNA as an earl diagnostic marker in breast cancer. 14 SUBJECT TERMS 15. NUMBER of PAGES
DTIC
*Antigens; Cancer; Cells (Biology); Mammary Glands; Markers*

**20040059144** Texas Univ., Houston, TX
**TARGET (Translational Approaches for the Reversal, Genetic Evaluation) of Lung Cancer**
Hong, Waun K.; Sep. 2003; 98 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0706
Report No.(s): AD-A422006; No Copyright; Avail: CASI; A05, Hardcopy

TARGET is focused on a series of projects designed to obtain data in the preclinical and clinical settings to help us further understand the epidemiology of lung cancer, the molecular biology, genetics and epigenetics of lung cancer in the context of tobacco-damaged aerodigestive tract tissue, and the anti-cancer activity of several promising new agents, and various treatment and drug delivery approaches in models of lung cancer and other aerodigestive tract tumors.
DTIC
*Cancer; Genetics; Lungs; Targets*

**20040059146** Naval Health Research Center, San Diego, CA
**Cellular and Molecular Changes of the Respiratory System in Rats Exposed to ACM Combustion**
Reinhart, Paul G.; Aug. 2003; 32 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0669
Report No.(s): AD-A422009; No Copyright; Avail: CASI; A03, Hardcopy

Rats exposed to advanced composite materials (ACM) combustion atmospheres develop a time dependent pulmonary

inflammation characterized by the influx of polymorphonuclear neutrophils (PMNs) into the lumen of the lung, epithelial permeability changes and inflammatory cytokine release. Mice with defective tumor necrosis factor alpha (TNF-alpha) gene produced significantly less interleukin-l beta (IL-1beta) and IL-6 while mice with defective IL-1beta gene produced significantly more TNF-alpha with on effect on IL-6. Both strains had significantly fewer BALF cells and PMNs but no effect on epithelial permeability. The use of antibodies towards TNF-alpha and IL-1beta had no effect on epithelial permeability, BALF IL-1beta or TNF-alpha. IL-1beta antibodies did not affect BALF cell numbers but did significantly increase PMNs. No effect was noted on IL-6 levels with anti-IL- 1beta. TNF-alpha antibodies significantly increased the BAbF cell numbers and IL-6 but significantly decreased the percentage of PMNs in the BALF. In conclusion, gene silencing was effective in reducing the inflammation (TNF-alpha > IL- 1beta) from ACM combustion atmospheres while pretreatment with TNF-alpha or IL-1beta antibodies under the current protocol is ineffective.
DTIC
*Combustion; Lungs; Rats; Respiratory System*

**20040059148**
**Flight Surgeon Support to USA Air Force Fliers in Combat**
Jones, David R.; Marsh, Raydon W.; May 2003; 212 pp.; In English
Contract(s)/Grant(s): F41622-03-M-1008
Report No.(s): AD-A422017; SAM/CSD-TR-2003-0001; No Copyright; Avail: CASI; A10, Hardcopy

The everyday practice and operational applications of U.S. Air Force flight medicine by its flight surgeons at the end of the 20th century comprise a system of medical care and support that is unique in human history. This system of preventive, occupational, clinical and participatory medicine seems so natural that modern aviators and flight surgeons may take it for granted, having little understanding of the manner in which it developed and matured. Yet, one may fairly argue that military aviation as we know it today would not be possible without its flight surgeons. Herein lies an in-depth review and analysis of the role of the flight surgeon in combat operations from an academic and historical point of view. This report provides a rich source of information both for novice flight surgeons and for their experienced colleagues, as well as a historical record, a detailed bibliography and a summary of the lessons hard-learned in past conflicts. Examples of the consequences of not providing aeromedical services provide a clear justification for the existence of the flight surgeon system and may prove useful in times of cutbacks in personnel and funding. The record clearly demonstrates that physicians trained in the principles of aviation medicine and assigned to flying units to care for the fliers contribute in specific ways to unit safety and effectiveness. Acknowledging the significant and notable contributions to flight medicine made by our aeromedical colleagues in the Navy and in the post-1949 Army, this report focuses on Army flight medicine prior to 1949 and Air Force flight medicine subsequent to 1949.
DTIC
*Aerospace Medicine; Combat; Flight Surgeons; United States*

**20040059175** New Mexico Univ., Albuquerque, NM
**Motivational Interviewing in the Prevention of Alcohol Abuse**
Moyers, Theresa; Aug. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0681
Report No.(s): AD-A422059; No Copyright; Avail: CASI; A03, Hardcopy

Motivational interviewing (MI) is a brief counseling method that has been shown to reduce alcohol abuse and alcohol-related problems. This project focuses on the training of AF behavioral health providers in the motivational interviewing method, with behavioral coding to assess the success and cost-effectiveness of the training. In addition, this project will assess the impact of such enhanced training on the overall level of alcohol- related events. Sixty behavioral health providers have now been enrolled in this project. Fourteen providers have been trained in the MI method and two additional workshop training have been scheduled. The behavioral coding system that forms the outcome measure for this study has been pilot-tested and reliability estimates have been generated from a double-coded sample. Barriers to recruiting subjects due to military deployments have been addressed.
DTIC
*Alcohols; Motivation; Prevention*

**20040059215** State Univ. of New York, Albany, NY

**DNA Code Validation Using Experimental Fluorescence Measurements and Thermodynamic Calculations**

Pogozeiski, Wendy; Mecule, Anthony; Mar. 2004; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-03-2-0086; Proj-DNAI

Report No.(s): AD-A422140; AFRL-IF-RS-TR-2004-73; No Copyright; Avail: CASI; A03, Hardcopy

Initial stages were completed in the development of an enabling technology for DNA computing. The technology focuses on construction of a biomolecular architecture to employ new algorithmic paradigms based on DNA hybridization. The intent is to develop a computing basis so that many discrete math problems can be solved in linear real time. Methods were developed to generate and screen collections of single-stranded DNA sequences called a DNA (n,d) code. Strands of 16 nucleotides were designed such that a code strand would hybridize only with its reverse- complement and would not cross-hybridize with any other strand in the set. Strands were tested for their potential to mispair by measuring fluorescence for every possible pair of strands over varying temperatures in the presence of SYBR Green I, a dye whose fluorescence increases exponentially when bound to double- stranded DNA. Strands with potential to bind to themselves or to another sequence in the set were identified and removed from the DNA (n,d) code. Sets of up to six pooled sequences were also tested to show that this method works with sets of multiple strands. In addition, the thermodynamic parameters of binding were examined using the program PairFold. Free energies of binding are reported.

DTIC

*Architecture (Computers); Deoxyribonucleic Acid; Fluorescence; Molecular Biology; Thermodynamics*

**20040059249** Drexel Univ., Philadelphia, PA

**A Model Bioterrorism Civilian Medical Response: Regional Initiatives Readiness and Response Training and Communications Infrastructure**

Onaral, Banu; Apr. 2004; 206 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-2-0010

Report No.(s): AD-A422202; No Copyright; Avail: CASI; A10, Hardcopy

Since its inception in 2000, the National Bioterrorism Civilian Medical Response Center (ClMERC) at Drexel University and Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA) have been united in the development of rural and urban demonstration test-beds for innovative technologies related to civilian preparedness and crisis response. In this effort, ClMERC has partnered with many regional, national, government, and non-government organizations. Such strategic partnering has permitted ClMERC to extend the scope of the projects beyond just biological issues and to address the larger genre of mass- casualty incidents (MCls). The projects presented in this report have benefited from this established and comprehensive network, as well as from the proven success of the institutions in integrating diverse interests and expertise into a large-scale initiative such as that which is inherent in biodefense. To present a coordinated front, ClMERC's efforts are driven via four concentration areas: Command and Control Operational Capabilities; Biodefense Assessment, Implementation and Evaluation; Readiness and Response Training; and Prevention and Remediation. Each of the projects presented in this report enhances the growing portfolio of projects within three of the identified concentration areas.

DTIC

*Education; Maintainability; Medical Services; Telecommunication*

**20040059253** Hutchinson (Fred) Cancer Research Center, Seattle, WA

**Center for the Evaluation of Biomarkers for the Early Detection of Breast Cancer**

Urban, Nicole D.; Oct. 2003; 118 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0691

Report No.(s): AD-A422209; No Copyright; Avail: CASI; A06, Hardcopy

Breast cancer remains a leading cause of death for women in the U.S. despite the popularity of mammography as a preventive tool. At diagnosis, many breast cancers are at an advanced stage of disease, even for women undergoing yearly screening, resulting in costly and painful follow-up procedures. Based on the ongoing studies in many research institutions, it has been shown that molecular markers can increase our ability to diagnose early stages tumors. This has been demonstrated by current clinical practices using the CA- 125 marker and PSA for the detection of ovarian and prostate cancer, respectively. The purpose of this study is to search for breast cancer biomarkers and evaluate their effectiveness in detecting early stage carcinoma. By combining molecular diagnosis with current imaging analysis of breast tissue, we may further reduce the number of deaths as well as the number of women undergoing surgery and chemotherapy due to breast cancer. To date, we have created the infrastructure necessary for our interdisciplinary team of investigators to obtain study samples, characterize

respective biomarkers, and efficiently communicate research findings. We have also increased the number of potential biomarkers and looked into more efficient and sensitive biotechnology that may better assist our study investigators.
DTIC
*Biomarkers; Cancer; Detection; Mammary Glands*

**20040059259** California Univ., Los Angeles, CA
**Genetic Definition and Phenotypic Determinants of Human Ovarian Carcinomas**
Karlan, Beth Y.; Oct. 2003; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9503
Report No.(s): AD-A422218; No Copyright; Avail: CASI; A03, Hardcopy

Ovarian cancer is the fourth leading cause of cancer-related death in U.S. women. This program project approaches the ovarian cancer problem by 1) establishing a human ovarian tissue and clinical data base core facility to support the proposed projects and future investigations, 2) identifying genes which are differentially expressed in ovarian cancers and thereby discovering biomarkers for early detection, 3) studying ovarian tumorigenesis in ovarian tissues obtained from germ line BRCA1 mutation carrier to better understand the interaction between mutational inactivation of BRCA1, the cellular caretaker gene and p53, the cellular gatekeeper gene, and 4) developing a genetically defined mouse model of epithelial ovarian cancer.
DTIC
*Cancer; Genetics; Ovaries*

**20040059261** Michigan Univ., Ann Arbor, MI
**Role of the Human Polyomavirus BKV in Prostate Cancer**
Imperials, Michael J.; Aug. 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0076
Report No.(s): AD-A422220; No Copyright; Avail: CASI; A03, Hardcopy

BKV is a human polyomavirus that establishes a lifelong, persistent infection of the urinary tract. The virus encodes oncoproteins that induce tumors in animal models, and BKV DNA has been detected in human urinary tract tumors, including prostate. Prostate tumors have a relatively low frequency of mutations in the p53 and Rbl genes, indicating that an agent such as a virus may be inactivating their functions. The aims of this proposal are to determine if BKV is present in prostate tumors and, if so, whether viral oncogenes are expressed. To accomplish this, normal and tumor tissue form individual patients will be analyzed. PCR, in situ PCR, and in situ hybridization will be performed to determine the presence of viral sequences, and RT-PCR and immunohistochemistry will be used to examine gene expression. Viral sequences from patients will be cloned and their function compared to wild type virus. This past year, we optimized most of these assays and began to analyze samples. We detect the presence and expression of the virus in a subset of normal and cancer cells. At this time, firm conclusions cannot be drawn as more samples need to be analyzed. If BKV is associated with some prostate cancers, our knowledge of the virus will be useful in designing drugs and vaccines for treatment.
DTIC
*Cancer; Carcinogens; Prostate Gland; Tumors; Viruses*

**20040059303** Minnesota Univ., Minneapolis, MN
**Molecular Determinants of Cellular Sensitivity to Flavopiridol an Anti-Cell Signaling Anticancer Agent**
Campbell, Colin R.; Oct. 2003; 41 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9299
Report No.(s): AD-A422275; No Copyright; Avail: CASI; A03, Hardcopy

Flavopiridol is an investigational drug undergoing Phase II clinical trials for the treatment of various solid tumors. This drug has been shown to inhibit of the cyclin- dependent protein kinases, which are essential mediators of the cell division cycle. While this activity is likely to be responsible for its anticancer activity, it is nevertheless unclear how this drug achieves selective toxicity. To address this question, we created a clavopiridol-resistant cell line. The experiments described in this proposal are designed to identify the mechanism(s) responsible for rendering this cell line drug-resistant. Levels of cyclin-dependent protein kinase activity in this resistant cell line will be determined, and compared to those seen in the parental, drug-sensitive cell. In addition, levels of relevant drug-detoxifying enzymes, such as UDP-glucoronosyl transferase and glutathione S-transferase will be measured in these two cell lines, as will levels of drug transporters. Additional strategies will examine whether other gene products are over or under expressed in drug- resistant cells, as well. It is anticipated that the results of these studies will shed light on the mechanism of flavopiridol resistance. This information could be of value in

designing second generation drugs that may prove more effective in the treatment of cancer.
DTIC
*Sensitivity*

**20040059304** Nebraska Univ., Omaha, NE
**Antigen-Independent Methods to Improve Radioimmunotherapy of Prostate Cancer**
Baranowska-Kortylewicz, Janina; Dec. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0105
Report No.(s): AD-A422276; No Copyright; Avail: CASI; A03, Hardcopy

Radioimmunolocalization of prostate cancer with radiolabeled antibodies is widely used in a clinic but radioimmunotherapy (RIT) fails to produce objective responses. Physiological barriers to the delivery of macromolecules to solid tumors are usually blamed for these failures. These studies are designed to improve the outcome of RIT in prostate adenocarcinoma by the inclusion of the antigen-independent peptides in the RIT protocol. To date two peptides able to modify vascular permeability were tested. Cytotoxicity studies indicate dose-dependent changes in cell metabolic activities after treatment with the C5aAP peptide; whereas peptide able to interact with a formyl peptide receptor-like 1 (FPRL1) does not seem to have any effect on the growth of these cells in vitro. In vivo results indicate that both peptides significantly augment RIT with 131ICC49. Three xenografts were tested to date: LNCaP, PC3 and DU145. These xenografts do not show differences in the growth pattern between the untreated tumors and peptide only-treated tumors, but there is a considerable delay in the tumor growth when peptides are combined with 131ICC49. The mechanism of this effect is more complicated than observed for LS174T tumors evaluated in the pilot studies and appears to vary depending on the tumor model and the peptide. The pattern of dependence on to key two factors emerged from these studies: (1) the improved vascular permeability and (2) the generation of reactive oxygen species.
DTIC
*Antigens; Cancer; Prostate Gland*

**20040059305** Tulane Univ., New Orleans, LA
**Enhancing the Immune Response to Recombinant Plague Antigens**
Clements, John D.; Mar. 2004; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-2-0058
Report No.(s): AD-A422277; No Copyright; Avail: CASI; A03, Hardcopy

The etiologic agent of plague is the Gram negative bacterium Yersinia pestis. Y. pestis is a concern as one of the microorganisms with potential for use against civilian or military populations as a biological warfare/biological terrorism agent. In that case, the pneumonic form of plague would be the most likely outcome. This form of plague is particularly devastating because of the rapidity of onset, the high mortality, and the rapid spread of the disease. Immunization against aerosolized,plague presents a particular challenge for vaccine developers. The studies reported herein explore the ability of a novel adjuvant, designated LT (R192G), to promote the rapid development of long-lasting, high titer antibodies against a recombinant plague antigen (Fl-v) in a murine model. Subsequent studies will be performed in non- human primates. Different routes of administration are examined to test the hypothesis that heterologous boosting will be more effective than homologous boosting at increasing the magnitude and/or duration of the antibody response.
DTIC
*Antigens; Immunity; Physiological Responses*

**20040059307** Naval Submarine Medical Research Lab., Groton, CT
**Transient-Evoked Otoacoustic Emissions, Preliminary Results for Validity of TEOAEs Implemented on Mimosa Acoustics T2K Measurement System v3.1.3**
Lapsley, Judi A.; Boege, Paul; Marshall, Lynne; Jeng, Patricia S.; Feb. 26, 2004; 46 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422279; NSMRL-TR-1232; No Copyright; Avail: CASI; A03, Hardcopy

The validity of transient-evoked otoacoustic emissions needed to be determined for click and chirp stimuli implemented on the Mimosa Acoustics T2K Measurement System. The validity of transient-evoked otoacoustic emissions was evaluated for the Mimosa Acoustics T2K Measurement System v3.1. 3 in eight hearing-impaired ears. These ears should not produce TEOAEs, so any responses are likely to be due to measurement artifact. Click and chirp stimuli showed acceptable validity for stimulus levels from 38 to 50 dB SPL when the stimuli were presented in the nonlinear mode. Validity was not acceptable

in linear mode. Transient-evoked otoacoustic emissions are sounds made by healthy inner ears to transient stimulation. They are thought to hold the potential for diagnosis and monitoring of noise-induced hearing loss in military hearing-conservation programs. Choosing TEOAE stimuli for use in hearing-conservation programs must include considering the validity of the measurement. This is to ensure that the measured TEOAEs are due to responses made by the inner ear and are not artifacts.
DTIC
*Acoustic Measurement; Acoustics; Auditory Defects; Ear*

**20040059308** Thomas Jefferson Univ., Philadelphia, PA
**Value-Based Decision-Making in Prostate Cancer Early Detection**
Myers, Ronald E.; Nov. 2003; 156 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8641
Report No.(s): AD-A422280; No Copyright; Avail: CASI; A08, Hardcopy

This report describes a randomized trial of an intervention designed to facilitate informed decision-making about prostate cancer screening. The study population included 199 adult men in the patient population of a university-based internal medicine practice. Participants completed a baseline survey and were randomly assigned to either a Standard Intervention (SI) Group (n=99) or an Enhanced Intervention (EI) Group (n=100). Men in both groups were mailed a prostate cancer informational booklet. The EI Group was offered a decision counseling session to clarify personal preferences about screening. Six months later, a medical chart audit was performed. Screening utilization was defined in two ways. The primary outcome defined utilization as having both a digital rectal exam (DRE) and a prostate specific antigen (PSA) test. The secondary outcome was defined less strictly to reflect common practice among physicians. It regarded a PSA test, with or without a DRE, as screening. For the primary outcome, the El Group had lower screening rates than the SI Group (8% vs. 12%). For the secondary outcome, the rates were similar (18.0% vs. 18.2% respectively) . Neither of these effects was statistically significant. Results of multivariable analyses showed that race was a significant predictor of the secondary outcome (p=0.012).
DTIC
*Antigens; Cancer; Decision Making; Detection; Physical Examinations; Prostate Gland*

**20040059309** Michigan Univ., Ann Arbor, MI
**Detection of Metastatic Potential in Breast Cancer by RhoC-GTPase and WISP3 Proteins**
Kleer, Celina G.; May 2003; 43 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0490
Report No.(s): AD-A422281; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancer is the most common type of life- threatening cancer, and the second most common cause of cancer related deaths of women in the USA. Even though the larger the primary tumor, the greater the likelihood of metastases, this is not always the case. There are many small breast cancers with a highly aggressive and metastatic behavior and discouraging outcome that remain under treated because there is no marker capable of identifying them. In this proposal we will study the utility of detecting RhoC GTPase and WISP3 proteins by Immunohistochemistry as biological prognostic markers capable of identifying breast cancers with high propensity to metastasize, independently of tumor size. The impact of this study is that we will develop a clinically useful test to detect which invasive cancers will metastasize, and that will allow clinicians to institute early treatment before the development of metastases. This will impact on patient outcome. We will also study the predictive power of RhoC GTPase and WISP3 expression in the response of breast cancer to farnesyl transferase inhibitors, a new gene- targeted treatment modality for advanced cancers.
DTIC
*Cancer; Mammary Glands; Metastasis; Proteins*

**20040059688** Albert Einstein Medical Center, Philadelphia, PA, USA
**Analysis of Activity Patterns and Performance in Polio Survivors**
Klein, Mary; Talaty, Mukul; Oct. 2003; 51 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0822
Report No.(s): AD-A421763; No Copyright; Avail: CASI; A04, Hardcopy

The goals of this project are: 1) to study the temporal relationship between activity level and health status in polio survivors and to compare the results with those obtained from an age matched control population and 2) to look at the effect of localized muscle weakness and the associated compensation response on performance of a walking task. simulation modeling techniques will be used to identify factors critical to task performance, which will provide valuable information for

optimizing rehabilitation interventions for polio survivors and other populations with lower extremity muscle weakness. To date, a total of 43 polio survivors and 63 controls have been enrolled and tested for Study #1. Preliminary data analysis has begun. An improved baseline has been developed for the simulation model in Study #2. Sensitivity analysis of the model has been completed. Initial IDA assessment of model performance has been performed, and perturbation analysis and interpretation are underway.
DTIC
*Poliomyelitis; Stress (Physiology); Tolerances (Physiology)*

**20040059698** National Jewish Medical and Research Center, Denver, CO, USA
**Cloning and Characterization of Genes that Inhibit TRAIL-Induced Apoptosis of Breast Cancer Cells**
Shu, Hong-Bing; Apr. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0358
Report No.(s): AD-A421784; No Copyright; Avail: CASI; A02, Hardcopy

TRAIL is a tumor necrosis factor family member that can specifically induce apoptosis of cancer cells but not of normal cells (1-5). However, some cancer cells are resistant to TRAIL-induced apoptosis (3, 4, 6-13). The purpose of this proposed study is to clone and characterize such inhibitory genes of TRAIL-induced apoptosis. To this end, following specific aims are proposed: #1. To clone genes that inhibit TRAIL- induced apoptosis of MCF7 cells by a subtractive hybridization screening approach and an expression/functional cloning approach using retroviral cDNA libraries; #2. To functionally characterize genes identified from specific aim #1.
DTIC
*Apoptosis; Cancer; Cloning (Biology); Genes; Mammary Glands*

**20040059703** Children's Hospital Medical Center, Cincinnati, OH, USA
**Ron in Breast Development and Cancer**
Waltz, Susan B.; Oct. 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-92-1-0342
Report No.(s): AD-A421839; No Copyright; Avail: CASI; A03, Hardcopy

The long-term objective of this project is to define the in viva role of the receptor tyronsine kinase Ron in mammary gland biology. Virtually nothing is known regarding the function of Ron in the breast. However, two recent studies have shown the Ron is over- expressed and highly phosphorylated in a significant fraction of human and feline breast cancers. To define the in vivo significance of Ron, mice were generated with a targeted ablation of the tyrosine kinase domain of this receptor (TK-/-mice). To analyze the function of Ron in mammary development, mammary glands from wild type and TK-/- mice were collected at weekly intervals form 3 to 15 weeks of age. Based on whole mount and histological analyses, the TK-/- mammary glands display a markedly increased amount of epithelial branching that was most prominent at 6 weeks of age. To determine the in vivo impact of Ron in mammary gland tumors, wild type and TK-/-mice containing mammary expression of polyoma middle T antigen (pMT) were generated. Preliminary analyses indicate that Ron signaling augments pMT-induced mammary tumor formation and growth.
DTIC
*Cancer; Mammary Glands*

**20040059717** Cornell Univ., New York, NY, USA
**Retinoids and Histone Deacetylase Inhibitors in the Treatment of Prostate Cancer**
Gudas, Lorraine J.; Dec. 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0158
Report No.(s): AD-A421967; No Copyright; Avail: CASI; A02, Hardcopy

Retinoids, derivatives of vitamin A (retinol), are required for the appropriate differentiation of normal human prostate epithelial cells. Human prostate cancer cells contain much lower levels of vitamin A and its metabolites that normal cells. We hypothesize that aberrant metabolism of vitamin A and dysregulation of gene expression in prostate tumor cells are related to the abnormal growth properties of the tumor cells. A rationale for using retinoids in prostate cancer chemotherapy is further supported by the effectiveness of ATRA (all-trans Retinoic Acid), a vitamin A metabolite, in the treatment of acute promyelocytic leukemia (APL). We hypothesize that the efficacy of retinoic acid can be enhanced if it is administered in combination with low doses of selective, potent histone deacetylase inhibitors such as trichostatin A (TSA or valproic acid). The goals of this idea grant are to use mouse xenograft models to ascertain the effectiveness of various retinoids plus his tone

deacetylase inhibitors in inhibiting the growth and inducing the differentiation of the human prostate cancer lines LNCaP and PC-3. A second goal of the project is to understand at the molecular level the mechanisms by which the combination of retinoids acid and his tone deacetylase inhibitors result in human prostate tumor cell growth inhibition. In the past year, we have begun the xenograft experiments, employing 13-cis RA and valproic acid. We have also continued to perform a variety of biochemical and molecular biological assays on human prostate cancer cells treated with various combinations of the aforementioned drugs in order to gain more insight into the molecular mechanisms involved in cell growth inhibition. The studies that we have performed, and the studies proposed in the next period of this Idea Development grant should provide a much clearer rationale for new clinical treatments for prostate cancer in humans.
DTIC
*Cancer; Inhibitors; Prostate Gland*

**20040059726** Roswell Park Memorial Inst., Buffalo, NY, USA
**Activation of Polyamine Catabolism as a Novel Strategy for Treating and/or Preventing Human Prostrate Cancer**
Porter, Carl W.; Mar. 2004; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0024
Report No.(s): AD-A421984; No Copyright; Avail: CASI; A03, Hardcopy

The relationship of polyamines to the prostate is unique among all tissues since, in addition to synthesizing these molecules for cell growth, the gland produces massive quantities for export into semen. It might, therefore, be expected that pro static tumors could exhibit atypical polyamine-related regulatory responses. We propose that activation of polyamine catabolism may have unique therapeutic potential against prostate carcinoma. Thus far, we have validated this hypothesis by demonstrating that (a) conditional overexpression of the polyamine catabolic enzyme spermidine/spermine N(exp 1)-acetyltransferase (SSAT) causes growth inhibition in LNCaP prostate carcinoma cells and (b) cross-breeding of SSAT transgenic mice with prostate cancer prone TRAMP mice markedly suppresses genitourinary tumor development via an apparent depletion of the SSAT cofactor acetyl-CoA. Depletion of the critical metabolite, acetyl-CoA, appears to be responsible for a selective effect on the prostate and prostate proliferative disease. The ultimate goal of these studies is to genetically validate the concept that small molecule induction of SSAT represents a promising anticancer strategy against prostate cancer and that it is worthy of small molecule discovery and development.
DTIC
*Cancer; Catabolism; Prostate Gland*

**20040059740** Texas Univ., Dallas, TX, USA
**Breast Tumor pH: Design Evaluation and Application of Novel Reporter Molecules**
Mason, Ralph P.; Oct. 2003; 87 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9381
Report No.(s): AD-A422234; No Copyright; Avail: CASI; A05, Hardcopy

Systematic drugs are one of the most potent means for controlling breast cancer. Their ability to kill cancer cells often depends, however, on the presence of appropriate physiological conditions. For instance, exciting recent results suggest that uptake and retention of 5-fluorouracil (5- FU) in tumors may be influenced by pH, in particular, the trans membrane pH gradient. We designed novel_19F NMR reporter molecules to investigate breast tumor pH. Several syntheses of novel molecules have been successful (e.g., trifluoromethyl pyridoxol) and he molecules have been characterized in vitro and evaluated in vivo. Certain strategic molecular goals proved to be intractable, but have provided valuable lessons in synthetic chemistry. The new indicators have provided non- invasive measurements of extra cellular pH in breast tumors, which is an important step towards understanding factors modulating chemotherapy. This research also laid a foundation for a novel concept in gene therapy, 19F NMR reporter molecules based on the fluoronitrophenol galactoside structure.
DTIC
*Cancer; Chemotherapy; Mammary Glands; Molecules; Receptors (Physiology); Synthesis (Chemistry); Tumors*

**20040059745** Cornell Univ., NY, USA
**Humanized Monoclonal Antibody Specific to the Extracellular Domain of PSMA: Dose Escalation Trial in Patients with Prostate Cancer**
Vallabhajosula, Shankar; Dec. 2003; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8594
Report No.(s): AD-A422002; No Copyright; Avail: CASI; A03, Hardcopy

Prostate specific membrane antigen (PSMA) is the single most well-established, highly restricted prostate epithelial cell membrane antigen expressed by virtually all prostate cancers. PSMA is an ideal target for developing radio labeled monoclonal antibodies (mAbs) for radioimmunotherapy (RIT) of prostate cancer. J591 mAb binds with very high affinity to the extra-cellular domain of PSMA and binds to viable tumor cells. We have previously submitted the final report of the Phase I of the Idea development Award in November 2000.
DTIC
*Antibodies; Cancer; Dosage; Patients; Prostate Gland*

**20040059747** Army Medical Command, VA, USA
**Evaluation of DeWitt Army Community Hospital's Home-Grown Coder Initiative**
Rogers, Reva; May 2003; 48 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421626; HCA-10-03; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this study was to evaluate the impact of the home-grown coder initiative on coding accuracy in DeWitt Army Community Hospital's Internal Medicine Clinic. The homegrown coder initiative is a training program designed to teach medical clerks how to code records. The study evaluated the accuracy of the home-grown coders after completion of the first phase of training, which consisted of six weeks of on-the-job training. Previous studies have appraised the difference in coding accuracy between providers and medical clerks, but no studies have been published evaluating the accuracy of medical clerks coding after completion of an on-the-job training program. Sixty patient encounters were included in the provider data set, and fifty- six patient encounters were included in the home-grown coder data set. The data sets were analyzed for variance from a standard established by a certified coder. Between data set variance was also tested for significance. The analysis used the following statistical tools: Wilcoxon Signed-Rank Test, Mann-Whitney Test, Chi Square, and Fishers Exact Probability Test. Results showed the home-grown coders to be more accurate in coding Evaluation and Management codes, diagnoses, and procedures. These results indicate that implementation of a home-grown coder initiative will result in improved medical record coding.
DTIC
*Coders; Coding; Hospitals; Management Systems; Medical Services; Statistical Analysis*

**20040059755**
**Mechanisms of Tissue Remodeling in Sepsis-Induced Acute Lung Injury**
Roman, Jesse; Guidot, David M.; Apr. 2003; 56 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0179
Report No.(s): AD-A421699; No Copyright; Avail: CASI; A04, Hardcopy

Acute lung injury (ALl) activates tissue remodeling that is responsible for the excessive deposition and turnover of extracellular matrices. This project will explore the factors that control tissue remodeling in this setting by focusing on chronic ethanol ingestion, a factor that renders the lung susceptible to ALl. We hypothesize that chronic ethanol ingestion renders the lung susceptible to ALl by acting on a7 nicotinic acetylcholine receptors (a7 NACliRs) and stimulating the expression of tissue remodeling genes such as fibronectin (FN). Aberrant deposition of FN affects the structure of the lung and promotes a 'proinfiammatory state' that drives the development of ALl after infection. The specific aims are to: 1) Determine the role of a7 nAChRs in ethanol induction of FN. 2) Delineate the intracellular pathways responsible for the induction of FN in fibroblasts in response to ethanol. 3) Elucidate the effects of ethanol- induced FN expression on lung cell function. 4) Study ethanol- induced FN expression in a rat model of sepsis-induced ALl. Service men and women are exposed to conditions considered risk factors for ALl (e.g., trauma, toxic gas, infection). Tissue remodeling is considered key to the development of the irreversible consequences of ALl.
DTIC
*Injuries; Lungs*

**20040059764** Providence Portland Medical Center, Portland, OR, USA
**Enhancing Anti-Prostate Cancer Immunity Through OX40 Engagement**
Weinberg, Andrew D.; Feb. 2004; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0093
Report No.(s): AD-A422213; No Copyright; Avail: CASI; A03, Hardcopy

The goal of the proposal studies is to extend our OX-40-specific anti-tumor responses to prostate tumor models by using a protein found on the surface of a T helper subset of leukocytes (OX40). Anti-OX40 delivered into animals with ongoing

immune responses are able to clear the tumors and pathogens quicker following the acute immune response and also are left with a greater amount of immunologic 'memory'. The greater number of memory T cells patients have the recognize these tumors, increases their chance to fight off subsequent metastatic disease. We have found that prostate cancer patients treated with androgen ablation have a large influx of leukocytes into their prostate gland. These cells enter the prostate gland to recognize and destroy tumor cells. Leukocytes that invade the prostate gland after androgen ablation are OX40+. Therefore, we hypothesize that androgen ablation followed by anti-OX40 treatment will enhance anti- tumor immunity in these patients and we propose to exploit our discovery in a prostate cancer mouse model. Fine- tuning our approach to gain preclinical data will help us to understand the mot efficient way to augment anti-prostate cancer immunity in prostate cancer patients for future clinical trials.
DTIC
*Cancer; Prostate Gland*

**20040059825** Walter Reed Army Medical Center, Washington, DC, USA
**Annual Research Progress Report, Volumes 1 and 2**
Sjogren, Maria H.; Pasquina, Paul; Jan. 2003; 1029 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421362; WRAMC-RCS-MED-300(R); No Copyright; Avail: CASI; A99, Hardcopy

Tbe Annual Progress Report documents all research protocols, both new and continuing, reviewed during FY O3 by the Clinical Investigation Committtee (CIC) and the Human Use Committtee/Institutinal Review Board (HUCIIRB) of Walter Reed Army Medical Center (WRAMC). Continuing research review is administered by tbe Research Review Service (RRS), Department of Clinical Investigation (DCI), WRAMC. A detailed summary sheet of each protocol giving tbe objective, technical approach, and progress is presented. Personnel rosters, DCI accomplisbments, funding information, and known publications and presentations by tbe WRAMC professional staff are listed for FY 03.
DTIC
*Clinical Medicine; Medical Science*

**20040059826** Veterans Administration, New York, NY, USA
**Biochemical Studies and Optical Digitizer Development for Enhanced Orthopedic Footwear**
Houston, Vern L.; Sep. 2003; 62 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0577
Report No.(s): AD-A422055; No Copyright; Avail: CASI; A04, Hardcopy

Properly fining, functional footwear is paramount for preventing foot/ankle discomfort and injury, and maintaining mobility of military personnel and veterans. Custom designed and manufactured orthopedic footwear is an essential component in treatment and rehabilitative care of persons with neuromusculoskeletal foot ankle pathologies, biomechanical disorders and injuries, and systemic disorders, such as Diabetes Mellitus and peripheral vascular disease, complications from which affect the feet and ankles. Orthopedic footwear design is still based on pedorthists' subjective judgments, so the degree of fit and function attained and the quality of footwear produced are inconsistent, and highly dependent upon the level of training, experience, and skill of the pedorthist involved. The objective of this project was to develop quantitative methods for effective, expeditious, repeatable, and consistent design and manufacture of well-fining, comfortable, and functional orthopedic footwear.
DTIC
*Analog to Digital Converters; Biochemistry; Orthopedics*

**20040059827** Institute for Genomic Research, Rockville, MD, USA
**Malaria Genome Sequencing Project**
Gardner, Malcolm J.; Jan. 2004; 179 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-2-8005
Report No.(s): AD-A422079; No Copyright; Avail: CASI; A09, Hardcopy

The objectives of this Cooperative Agreement were: Specific Aim 1, sequence 3.5 Mb of P. falciparum genomic DNA; Specific Aim 2, annotate the sequence; Specific Aim 3, release the information to the scientific community. Two Specific Aims were added to the Cooperative Agreement: Specific Aim 4, sequencing of P. yoelii to 5X coverage; Specific Aim 5, sequencing of P. vivax to 5X coverage. In 2002 the complete genome sequence of P. falciparum was published in Nature in collaboration with the Sanger Institute and Stanford University. A comparative analysis of the genome of the rodent malaria parasite P. yoelii with that of P. Falciparum was also published. The P. vivax genome has been sequenced to lOX coverage and genome closure

is underway. Preliminary P. vivax sequence data has been released to the scientific community. Proteomic analyses of several stages of the P. falciparum life cycle by colleagues at the Scripps Research Institute were also supported by this Agreement. In addition, colleagues at the Malaria Program, Naval Medical Research Center have identified 700 genes expressed in P. falciparum sporozoites and 1,200 genes expressed in P. yoelii liver stages. Bioinformatic approaches were used to identify 300 genes encoding potential liver-stage antigens. The P. falciparum, P. yoelii, and P. vivax genome sequences generated by this effort have supported malaria research worldwide.
DTIC
*Antigens; Genome; Immune Systems; Medical Services; Parasitic Diseases; Sequencing*

**20040059840** Ganeden Biotech, Inc., San Diego, CA, USA
**Tropical Strategy for the Prevention and Treatment of Fungal Infections in U.S. Marine Corps Personnel**
Farmer, Sean; Ghannoum, Mahmoud A.; Aug. 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-02-2-0041
Report No.(s): AD-A422124; No Copyright; Avail: CASI; A03, Hardcopy

The options for the treatment of dermatophytosis being limited, an effective and safe antifungal therapy is highly desired. Fungi-Free(TM) has the potential for use in the treatment of dermatophytosis. Guinea pigs are susceptible to dermatophytosis similar to humans. Their large body surface provides sufficient area to perform experiments. Thus, a guinea pig model of dermatophytosis has been used in efficacy studies of antifungal agents.
DTIC
*Fungal Diseases; Fungi; Infectious Diseases; Personnel; Prevention; Tropical Regions*

**20040059977** British Columbia Cancer Agency, Vancouver, British Columbia, Canada
**The Genome Sequence of the SARS-Associated Coronavirus**
Marra, Marco A.; Jones, Steven J. M.; Astell, Caroline R.; Holt, Robert A.; Brooks-Wilson, Angela; Butterfield, Yaron S. N.; Khattra, Jaswinder; Asano, Jennifer K.; Barber, Sarah A.; Chan, Susanna Y., et al.; Sciencexpress; May 1, 2003, pp. 1-13; In English; Copyright; Avail: Other Sources

We sequenced the 29,751-base genome of the severe acute respiratory syndrome (SARS) associated coronavirus known as the Tor2 isolate. The genome sequence reveals that this coronavirus is only moderately related to other known coronaviruses, including two human coronaviruses, HCoV-OC43 and HCoV-229E. Phylogenetic analysis of the predicted viral proteins indicates that the virus does not closely resemble any of the three previously known groups of coronaviruses. The genome sequence will aid in the diagnosis of SARS virus infection in humans and potential animal hosts (using PCR and immunological tests), in the development of antivirals (including neutralizing antibodies), and in the identification of putative epitopes for vaccine development.
Derived from text
*Respiratory Diseases; Antibodies; Diagnosis; Genome; Immune Systems; Infectious Diseases; Signs and Symptoms*

## 52
## AEROSPACE MEDICINE

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

**20040058100** Civil Aerospace Medical Inst., Oklahoma City, OK, USA
**Demographics and Vision Restrictions in Civilian Pilots: Clinical Implications**
Nakagawara, Van B.; Montgomery, Ronald W.; Wood, Kathryn J.; April 2004; 13 pp.; In English
Report No.(s): DOT/FAA/AM-04/6; No Copyright; Avail: CASI; A03, Hardcopy

Demographic statistics and medical restriction data were collected for all civilian airmen who were active on December 31 of each study year for the period 1976 to 2001. These data were extracted from the Aeromedical Certification Statistical Handbook, published annually by CAMI's Aerospace Medical Certification Division and from data collected by CAMI's Bioinformatics Team. Frequency and medical restriction data were examined for anomalies, which were corrected or deleted. The data were then delineated into 5-year increments and analyzed to identify population trends for the 25-year study period. Frequency counts, average age, and percentage of restrictions were calculated for various stratifications, which included class of medical certification, gender, and age category (under 40 and equal to or over 40 years of age). Although the precise

definition of some vision restrictions changed slightly during the study period, for this investigation the following definitions were applied: 1) Must have available glasses for near vision; 2) Must wear corrective lenses; 3) Must wear corrective lenses for near and distant vision; 4) Must wear lenses for distant and possess glasses for near vision; 5) Must wear corrective lenses and possess glasses for near and intermediate vision; 6) Holder shall possess glasses for near and intermediate vision; 7) Must wear prismatic correction; 8) Must wear corrective lenses: extra pair must be available; 9) Not valid for night flying or by color signal control (color vision); 10) Not valid for night flying (glaucoma).
Derived from text
*Age Factor; Vision; Visual Acuity; Aircraft Pilots; Civil Aviation*

**20040059145** Nevada Univ., Reno, NV
**Non-Invasive Techniques for Monitoring Human Fatigue**
Ji, Qiang; Dec. 2003; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-1-0243
Report No.(s): AD-A422007; AFRL-SR-AR-TR-04-0015; No Copyright; Avail: CASI; A03, Hardcopy

In this report, we summarize our efforts in developing real time non-intrusive technology-for monitoring human fatigue. Through this research, we have developed state of the art technologies and a prototype fatigue monitor for real time non-intrusive human fatigue monitoring. Our contributions include: 1) the development of various computer vision techniques for real-time and non-intrusive extraction of multiple fatigue parameters related to eyelid movements, gaze, head movement, and facial expressions, 2) the development of a probabilistic framework based on the Bayesian networks to model and integrate contextual and visual cues information for robust and accurate fatigue detection, and 3) systematic and scientific validation of the fatigue monitor. Experimental validation of our techniques using human subjects demonstrates the good measurement accuracy of our techniques. In addition, the validation also verifies the validity of the proposed fatigue parameters as well as that of the composite fatigue index computed by our fatigue monitor.
DTIC
*Human Performance*

**20040059295** Air Force Research Lab., Wright-Patterson AFB, OH
**Adaptive Aiding Implemented by Psychophysiologically Determined Operator Functional State**
Wilson, Glenn F.; Oct. 2003; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422255; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available
*Human Performance; Operators (Personnel); Psychophysiology*

## 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*.

**20040059150** Navy Experimental Diving Unit, Panama City, FL
**Northill Air Lung Fourth Field Test (Navy Experimental Diving Unit Report ER-8-57)**
Leyden, C. J.; Aug. 19, 1956; 22 pp.; In English
Contract(s)/Grant(s): Proj-NS185-005
Report No.(s): AD-A422020; NEDU-ER-8-57; No Copyright; Avail: CASI; A03, Hardcopy

This report covers the evaluation of the Northill Air-Lung Regulator to determine the suitability of the apparatus for use in the Naval Service to depths of 200 feet at work rates equivalent to 0.85 knot swimming. For the description of the demand regulator in detail, see Evaluation Report 3-57. The regulator was tested objectively by breathing machine runs and subjectively by depth swimming runs, with instrumentation for respiratory pressure, respiratory minute volume, and breathing rate. Subjective swimming pool tests covered in Evaluation Report 3-57 were not repeated here. Breathing machine runs are summarized as recording tape excerpts of peak respiratory pressure versus depth and cylinder pressure. The subjective depth swimming runs are summarized as graphs of peak respiratory pressure, respiratory minute volume, and respiratory rate against

time, cylinder pressure, and depth. The results are discussed constructively and lead to specific conclusions about the apparatus and its suitability for use in the Naval Service.
DTIC
*Airports; Diving (Underwater); Field Tests; Lungs; Navy; Underwater Breathing Apparatus*

**20040059179** Space and Naval Warfare Systems Command, San Diego, CA
**Autonomy and Intelligence - A Question of Definitions**
Blackburn, Michael R.; May 2002; 4 pp.; In English
Report No.(s): AD-A422063; No Copyright; Avail: CASI; A01, Hardcopy

It is tempting to call a mechanism that works by itself autonomous. The common dictionary definition of autonomy supports this temptation. According to Webster's Ninth New College Dictionary, autonomy is 'the quality or state of being self-governing'. But governance implies more than simple perpetual motion. Does the earth's rotation around the sun constitute an autonomous trajectory? Probably we would not commonly think so. What if an asteroid suddenly appeared in the earth's path? What would the earth do about it? Would the earth modify its trajectory and avoid the impending collision? Not likely. A collision would confirm for us that the earth was not autonomous. Now take a laboratory robot equipped with a SONAR array. The output of the SONAR array could be used to steer the robot away from looming obstacles, thus avoiding many potential collisions, Would we then say that the robot was autonomous? Many robotics developers, based on the titles and texts of their documents, do indeed say that obstacle avoidance is an autonomous behavior. Those very same robots, however, usually have an on-off switch. When that switch is in the off position, the robot cannot avoid a looming object and a serious and destructive collision is likely to occur. The on state of the robot could also be compromised by depletion of the robot's energy reserve, again making it vulnerable to environmental calamities. Something similar could happen to us when we are asleep or are otherwise not paying particular attention. Should we say then that autonomy is a state-dependent attribute?
DTIC
*Autonomy; Intelligence*

**20040059200** Office of Naval Research, Arlington, VA
**Operator Centered Design of Ship Systems**
Chipman, Susan F.; Kieras, David E.; Mar. 2004; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422107; No Copyright; Avail: CASI; A03, Hardcopy

Cognitive science research, much of it supported by the Office of Naval Research, is bringing about a scientific revolution in our understanding of the human operator. It is yielding computational theories of human cognition and perceptual/motor activity that provide precise quantitative predictions of important variables such as the times required to complete tasks or to learn them in training. Although the scope of coverage of these theories is limited and basic research aimed at expanding them is on-going, they already have much to offer in aiding the design of ship systems that will optimize the combined effectiveness of human operators and the systems they will he using. This presentation discusses 1) what can be done now, 2) tools under development that will facilitate the use of these theories, reducing the labor involved, and 3) a long-term vision for what might be achieved in this area.
DTIC
*Dynamic Structural Analysis; Human Factors Engineering; Marine Technology; Operators (Personnel); Ships*

**20040059209** Air Force Research Lab., Wright-Patterson AFB, OH
**The Application of a Qualitative Model of Human- Interaction with Automation: Effects of Unreliable Automation on Performance**
Galster, Scott M.; Bolia, Robert S.; Parasuraman, Raja; Oct. 2003; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422127; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
*Man Machine Systems*

**20040059624** Army Soldier and Biological Chemical Command, Aberdeen Proving Ground, MD, USA
**Guidelines for Use of Personal Protective Equipment by Law Enforcement Personnel During a Terrorist Chemical Agent Incident**
Jun. 2001; 95 pp.; In English
Report No.(s): AD-A422282; No Copyright; Avail: CASI; A05, Hardcopy

No abstract available
*Law (Jurisprudence); Personnel; Protectors; Terrorism*

**20040059652** Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany
**Human Centered Decision Support for Anti-Air Warfare on Naval Platforms**
Mooshage, Oliver; Distelmaier, Helmut; Grandt, Morten; Oct. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422264; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available

*Air Defense; Decision Support Systems; Operators (Personnel); Warfare*

**20040059686** Northrop Grumman Information Technology, Inc., Fairborn, OH, USA
**A Net Centric Collaborative Support System Concept: A Preliminary Investigation**
Eggleston, Robert; Whitaker, Randall; Jan. 2004; 55 pp.; In English
Contract(s)/Grant(s): Proj-2313
Report No.(s): AD-A422268; AFRL-HE-WP-TR-2003-0102; No Copyright; Avail: CASI; A04, Hardcopy

This study is an initial attempt to investigate the emerging net-centric warfare concept from the perspective of- the user interface and team performance. The report lays out a conceptual framework as the basis for establishing a scientific foundation for user interface design in the enterprise system context This framework includes a joint functional layer added to the information technology (IT) infrastructure. Design requirements for this layer of the collaborative interface are derived from principles of Cognitive Systems Engineering and characteristics of human expertise. In conjunction with the theoretical development an experimental testbed is that it includes a heterogeneous array of computer platforms and commercial off-the-shelf (COTS) products. In this study, the testbed was used to host a BMC4I scenario that required joint collaborative work across Air Force and Army units. This military scenario provided an additional means to uncover other issues important to user interface design in an enterprise IT environment. The report the user interface design framework, describes the research testbed, and discusses lessons learned from the informal experimentation of distributed teamwork using the BMC4I scenario.
DTIC

*Human Factors Engineering; Human Performance; Human-Computer Interface; Personnel; Support Systems*

## 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*.

**20040062210** Centre National de la Recherche Scientifique, Orleans, France
**The Search for Life on Mars Using Macroscopically Visible Microbial Mats (Stromatolites) in 3.5 - 3.3 Ga Cherts from the Pilbara in Australia and Barberton in South Africa as Analogues**
Westall, Frances; Hofmann, Beda; Brack, Andre; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Microbial mats from early terrestrial environments, formed in an epoch when life could still have existed on Mars (if it appeared), can be macroscopically visible and represent excellent analogues in the search for life on Mars. Tests using the Beagle 2 camera show that they can be observed by in situ instrumentation.
Author

*Microorganisms; Mars (Planet); Extraterrestrial Life*

**20040062214** Michigan State Univ., East Lansing, MI, USA
**Episodic Fossilization of Microorganisms on an Annual Timescale in an Anthropogenically Modified Natural Environment: Geochemical Controls and Implications for Astrobiology**
Velbel, M. A.; McGuire, J. T.; Madden, A. S.; Brandt, D. S.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Morphological features suggestive of microbial origin have been observed by scanning electron microscopy (SEM) in several categories of meteorites. These including meteorites thought to have originated on Mars (including ALH84001 and Nakhla) and some carbonaceous chondrites. In ALH84001, the putative fossil microbes occur in carbonate globules distributed along fractures. Contentious issues include (1) the origin of the morphological features (microbial or inorganic); (2) whether

the carbonate with which they are associated formed at temperatures conducive to life; (3) whether the putative microbes were indigenous to the rock or were introduced postmortem.
Derived from text
*Microorganisms; Carbonaceous Chondrites; Exobiology; Fossils; Geochemistry; Morphology*

**20040062215** Bergen Univ., Norway
**Microbial Alteration of Volcanic Glass in Modern and Ancient Oceanic Crust as a Proxy for Studies of Extraterrestrial Material**
Banerjee, N. R.; Furnes, H.; Muehlenbachs, K.; Staudigel, H.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Over the past decade, studies of volcanic glass preserved in pillow basalts and volcaniclastic tuffs from the oceanic crust have demonstrated the importance of endolithic microbes in the alteration process. Microbial alteration features are ubiquitous within the oceanic crust, having been discovered in basalts of all ages, wherever fresh glass is preserved. More recent work in ophiolites (fragments of ancient oceanic crust now exposed on land) has extended the evidence for microbial alteration of oceanic basalts back through the Phanerozoic, beyond the record preserved in the modern oceans. Here we review the evidence for microbial alteration of basaltic glass from modern oceanic crust and Phanerozoic ophiolites and present new data for two Precambrian ophiolites that extend the evidence for microbial alteration of oceanic basalts as far back as the Archean. We describe the use of petrological, geochemical, and microbiological methods for the detection of microbial activity and show how this novel combination of methods can be used to convincingly demonstrate its presence. We further suggest that these techniques could be used to prospect for evidence of past life on Mars.
Author
*Basalt; Extraterrestrial Matter; Fragments; Geochemistry; Petrology*

**20040062217** Universities Space Research Association, Houston, TX, USA
**Proterozoic Microfossils and Their Implications for Recognizing Life on Mars**
Oehler, D. Z.; Walter, M. R.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

An important element in the search for life on Mars involves efforts to detect evidence of past life life that may have arisen during the early history of the planet (more than 2.5 billion years ago) when surface conditions are thought to have been more amenable to supporting living systems and not too dissimilar from conditions on the early Earth. To guide such efforts, it is prudent to review our knowledge of early life on Earth. Hundreds of deposits with Proterozoic to Archean microfossils are now known; they tell us of an early Earth exclusively inhabited by microscopic organisms, mainly algae and bacteria. While uncertainty may exist regarding biogenicity of some of the oldest Archean structures, many assemblages of Proterozoic age are well preserved and indisputably biogenic. It is these that we will use to illustrate biosignatures typifying ancient microbiotas.
Derived from text
*Algae; Bacteria; Extraterrestrial Life; Fossils; Microorganisms; Mars (Planet)*

**20040062220** NASA Johnson Space Center, Houston, TX, USA
**Habitability of the Shallow Subsurface on Mars: Clues from the Meteorites**
McKay, David S.; Wentworth, Susan J.; Thomas-Keprta, Kathie L.; Clemett, Simon; Gibson, Everett K.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The properties that define habitability are commonly understood to include the following: Presence of water. Temperature range allowing some or all of the water to be liquid. A suitable physical volume or space permitting metabolism and growth. Presence of organic compounds or the building blocks to make them. Presence of an energy source suitable for utilization by living organisms. Interpretations of Mars Viking, Surveyor, and Odyssey orbital images have built a strong case that Mars had surface water during its past geological history. Neutron spectrometer data from Mars Odyssey show that poleward of about 60 degrees North and 60 degrees south, significant hydrogen, likely as ice or permafrost, is present in at least the upper meter or so of the martian regolith and crust and that similar high hydrogen areas exist, even near the equator. Here we present a

summary of independent data from the Mars meteorites showing that liquid water was present for at least some of the time in the upper few meters or tens of meters as early as 3.9 billion years (Ga), and was present at intervals and at various locations throughout most of Mars history.
Author
*Surface Water; Regolith; Planetary Geology; Organic Compounds; Mars Surface; Ice; Hydrogen; Habitability*

**20040062314** Arkansas-Oklahoma Center for Space and Planetary Sciences, Stillwater, OK, USA
**New Analyses of Diverse Hadean Zircon Inclusions from Jack Hills, Western Australia**
Trail, D.; Catlos, E. J.; Harrison, T. M.; Mojzsis, S. J.; Lunar and Planetary Science XXXV: Terrestrial Planets; 2004; 2 pp.; In English; See also 20040062312
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

The geological record is the only direct source of information regarding physical/chemical processes that may have ultimately been responsible for the origin of life. Known terrestrial rocks have ages that span from present day to approx. 4.0 Ga. This leaves a time gap of more than 500 Myr between lunar formation, and preservation of the oldest terrestrial crust. What were planetary conditions like wherein the prebiotic chemistry leading to life took place? The recent discovery of up to 4.37 Ga detrital zircons from Western Australia represents the only tangible record of the time period termed the Hadean Eon (4.5-4.0 Ga). Knowledge of the paragenesis of the oldest zircons potentially contributes information regarding the origin of the atmosphere, hydrosphere, continental lithosphere and the potential for life on the Hadean Earth.
Author
*Rocks; Life Sciences; Geology; Earth Hydrosphere; Biological Evolution*

## 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*.

**20040056099** Lockheed Martin Corp., Schenectady, NY, USA
**Nickel(II) Oxide Solubility and Phase Stability in High Temperature Aqueous Solutions**
Ziemniak, S. E.; Goyette, M. A.; Mar. 17, 2003; 42 pp.; In English
Report No.(s): DE2004-821370; LM-03KO28; No Copyright; Avail: Department of Energy Information Bridge

A platinum-lined, flowing autoclave facility was used to investigate the solubility behavior of nickel(II) oxide (NiO) in deoxygenated ammonium and sodium hydroxide solutions between 21 and 315 C. Solubilities were found to vary between 0.4 and 400 nanomolal (nm). The measured nickel ion solubilities were interpreted via a Ni(II) ion hydroxo- and amino-complexing model and thermodynamic functions for these equilibria were obtained from a least-squares analysis of the data. Two solid phase transformations were observed: at temperatures below 149 C, the activity of Ni(II) ions in aqueous solution was controlled by a hydrous Ni(II) oxide (theophrastite) solid phase rather than anhydrous NiO (bunsenite); above 247 C, Ni(II) activities were controlled by cubic rather than rhombohedral bunsenite.
NTIS
*Nickel Oxides; High Temperature; Least Squares Method*

**20040056149** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Lawrence Livermore National Lab., Livermore, CA
**Mesh Refinement for Particle-In-Cell Plasma Simulations: Applications to and Benefits for Heavy-Ion-Fusion**
Vay, J. L.; Colella, P.; McCorquodale, P.; Van Straalen, B.; Friedman, A.; 2003; 10 pp.; In English
Report No.(s): DE2004-820652; LBNL-51457; No Copyright; Avail: Department of Energy Information Bridge

The numerical simulation of the driving beams in a heavy ion fusion power plant is a challenging task, and simulation of the power plant as a whole, or even of the driver, is not yet possible. Despite the rapid progress in computer power, past and anticipated, one must consider the use of the most advanced numerical techniques, if we are to reach our goal expeditiously. One of the difficulties of these simulations resides in the disparity of scales, in time and in space, which must be resolved. When these disparities are in distinctive zones of the simulation region, a method which has proven to be effective in other areas (e.g., fluid dynamics simulations) is the mesh refinement technique. They discuss the challenges posed by the implementation of this technique into plasma simulations (due to the presence of particles and electromagnetic waves). They

will present the prospects for and projected benefits of its application to heavy ion fusion. In particular to the simulation of the ion source and the final beam propagation in the chamber. A collaboration project is under way at LBNL between the Applied Numerical Algorithms Group (ANAG) and the HIF group to couple the Adaptive Mesh Refinement (AMR) library (CHOMBO) developed by the ANAG group to the Particle-In-Cell accelerator code WARP developed by the HIF-VNL. They describe their progress and present their initial findings.
NTIS
*Plasmas (Physics); Grid Generation (Mathematics); Grid Refinement (Mathematics); Electromagnetic Radiation*

**20040057963** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
**AMRNodeElliptic Software Package Node-Centered AMR for Elliptic Problems**
McCorquodale, P.; Apr. 21, 2003; 74 pp.; In English
Report No.(s): DE2004-820264; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
*Applications Programs (Computers); Discretization (Mathematics); Mathematical Models; Multigrid Methods*

**20040057965** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
**AMRNodeElliptic User Guide: On Rectangular Problem Domains**
McCorquodale, P.; Apr. 15, 2003; 54 pp.; In English
Report No.(s): DE2004-820265; No Copyright; Avail: Department of Energy Information Bridge
This document describes an extension to the Chombo package (CGL+00) for solving elliptic equations using adaptive mesh refinement on multiple levels with node-centered data. Chapter 2 describes the class NodeFArrayBox and functions that use this class to manipulate node-centered data. Interfaces for elliptic equation solvers are described in chapter 3. Some internal classes of the solvers are described in chapter 4. User interfaces for physical boundary conditions are described in chapter 5.
NTIS
*Elliptic Differential Equations; Grid Refinement (Mathematics)*

**20040057966** Lawrence Livermore National Lab., Livermore, CA
**Workshop on FireMod 1**
Carpenter, K. H.; Lee, R. S.; Nov. 16, 2000; 54 pp.; In English
Report No.(s): DE2004-15006128; UCRL-JC-141436; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
*Computerized Simulation; Systems Simulation*

**20040057974** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
**AMRNodeElliptic User Guide: On Irregular Problem Domains**
McCorquodale, P.; Apr. 15, 2003; 58 pp.; In English
Report No.(s): DE2004-820266; No Copyright; Avail: Department of Energy Information Bridge
This document describes an extension to the Chombo package (CGL+00) for solving elliptic equations using adaptive mesh refinement on multiple levels with node-centered data on non-rectangular domains. Chapter 2 describes the subroutines that the user must supply to describe the geometry and the operator. Chapter 3 describes the class NodeFArrayBox and functions that use this class to manipulate node-centered data. Interfaces for elliptic equation solvers are described in chapter 4. Some internal classes of the solvers are described in chapter 5. User interfaces for physical boundary conditions are described in chapter 6.
NTIS
*Elliptic Functions; Boundary Conditions; Elliptic Differential Equations; Grid Refinement (Mathematics)*

**20040057976** Fermi National Accelerator Lab., Batavia, IL, USA
**Evaluation of Longitudinal Emittance Growth Caused by Negative Mass Instability in Proton Synchrotrons**
MacLachlan, J. A.; 2003; 14 pp.; In English
Report No.(s): DE2004-820324; FERMILAB-CONF-03/369; No Copyright; Avail: Department of Energy Information Bridge
The theory of negative mass instability (NMI) in proton synchrotrons has been regarded as established for about thirty years, but both accurate calculations and solid beam observations for real cases have been difficult and practically non-existent.

The wider availability of so-called computing farms has made credible macroparticle simulations practical for routine use. The comparison of a macroparticle model with the existing theory indicates interesting discrepancies, although the theoretical threshold is confirmed. That comparison and code validation for the model are discussed in the context of useful specific cases. The importance of perturbations other than statistical fluctuation as the seed of instability is considered.
NTIS
*Protons; Emittance; Synchrotrons*

**20040059960** Institute of Museum and Library Services, Washington, DC, USA
**Toward Equality of Access. The Role of Public Libraries in Addressing the Digital Divide**
2003; 40 pp.; In English
Report No.(s): PB2004-105155; No Copyright; Avail: CASI; A03, Hardcopy

Ninety-five percent of public libraries in the USA offer free access to computers and the Internet, often providing the only Internet access for residents of the nations poorest areas. This report evaluates the importance of these library-based computers in addressing the digital divide. Drawing from government statistics and independent research, the report finds widespread acceptance of library-based computer and Internet access from patrons and librarians. But more importantly, the report finds that public access computing is benefiting those socioeconomic groups with the greatest need.
NTIS
*Information Systems; Libraries; Research*

**20040059963** National Inst. of Standards and Technology, Gaithersburg, MD
**Feature-Based Inspection and Control System**
Kramer, T. R.; Horst, J.; Huang, H.; Messina, E.; Proctor, F. M.; Mar. 2004; 226 pp.; In English
Report No.(s): PB2004-105156; NISTIR-7098; No Copyright; Avail: CASI; A11, Hardcopy

This report describes an architecture and software system for automatically performing process planning and control code generation for cutting and inspecting prismatic piece parts. This Feature-Based Inspection and Control System (FBICS) consists of seven processes joined by interprocess communication. FBICS starts with a feature-based description of a part. Planners are provided at three hierarchical control levels that consider, in turn: (1) an entire part, (2) work done in a single part fixturing, and (3) work done on a single part feature. FBICS implements the RCS architecture. For data handling, FBICS uses ISO 10303 (STEP) methodology, standards, and tools. FBICS includes a solid modeler and 3D interactive graphics. Control code is written in RS274 for machining and DMIS for inspection.
NTIS
*Architecture (Computers); Software Development Tools*

**20040059986** Lawrence Livermore National Lab., Livermore, CA
**Variational P(1)-DP(0) Diffusion Theory for Planar Geometry**
Brantley, P. S.; Apr. 06, 2002; 22 pp.; In English
Report No.(s): DE2004-15006002; UCRL-JC-150125; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
*Harmonic Analysis; Numerical Analysis; Diffusion Theory*

**20040059997** Lawrence Livermore National Lab., Livermore, CA
**Performance of PFs, the Compaq Sierra Product's Parallel File System**
Uselton, A. C.; Jun. 20, 2001; 22 pp.; In English
Report No.(s): DE2004-15006183; UCRL-ID-144018; No Copyright; Avail: Department of Energy Information Bridge

In FY 2000 Livermore Computing took delivery of serial number one of the Compaq Sierra high performance cluster product. The Sierra product employs a derivative of the Tru64 UNIX operating system called Tru-Cluster, which provides a cluster-wide parallel file system called PFS. This report documents the observed performance of PFS along with the performance of some of the underlying file system components. Testing reveals that the underlying AdvFS file system does a good job of read-ahead and write-behind I/O performance enhancement at the expense of a high CPU utilization. On the other hand, PFS performs at only a fraction of the speed that the underlying I/O and communication hardware allow.
NTIS
*Clusters; Data Transfer (Computers)*

## 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*.

**20040059003** Carnegie-Mellon Univ., Pittsburgh, PA
**Architecture Reconstruction Guidelines Third Edition**
Kazman, Rick; O'Brien, Liam; Verhoef, Chris; Nov. 2003; 42 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A421612; CMU/SEI-2002-TR-034; ESC-TR-2002-034; No Copyright; Avail: CASI; A03, Hardcopy

Architecture reconstruction is the process of obtaining the 'as-built' architecture of an implemented system from the existing legacy system. For this process, tools are used to extract information about the system that will assist in building successive levels of abstraction. Although generating a useful representation is not always possible, a successful reconstruction results in an architectural representation that aids in reasoning about the system. This recovered representation is most often used as a basis for redocumenting the architecture of an existing system if the documentation is out of date or nonexistent, and can be used to check the 'as-built' architecture against the 'as-designed' architecture. The architectural representation can also be used as a starting point for reengineering the system to a new desired architecture. Finally, the representation can be used to help identify components for reuse or to help establish a software product line. This report describes the process of architecture reconstruction using the Architecture Reconstruction and Mining (ARMIN) tool developed by the Carnegie Mellon(registered) Software Engineering Institute and the Robert Bosch Corporation. Guidelines are presented for reconstructing the architectural representations of existing systems. Most of these guidelines are not specific to ARMIN, can be used with other tools, and are useful even if the architecture reconstruction is carried out manually.
DTIC
*Architecture (Computers); Systems Engineering*

**20040059005** Carnegie-Mellon Univ., Pittsburgh, PA
**Integrating the Architecture Tradeoff Analysis Method (ATAM) with the Cost Benefit Analysis Method (CBAM)**
Nord, Robert L.; Barbacci, Mario R.; Clements, Paul; Kazman, Rick; Klein, Mark; Dec. 2003; 35 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A421615; CMU/SEI-2003-TN-038; No Copyright; Avail: CASI; A03, Hardcopy

The Architecture Tradeoff Analysis Initiative at the Carnegie Mellon Software Engineering Institute (SEl) has developed a number of architecture-centric methods currently in use including the SEISM Architecture Tradeoff Analysis Method (ATAM), the SEl Quality Attribute Workshop (QAW), the SEl Cost Benefit Analysis Method (CBAM), SEl Active Reviews for Intermediate Designs (ARID), and the SE Attribute-Driven Design (ADD) method. Building on our success in developing and piloting a collection of software architecture methods, we're now focusing on integrating them, and building the bridges between them and the processes and architecture efforts outside the SEl, all the while continuing to refine existing methods and models. This technical note reports on a proposal to integrate the SE ATAM and SEl CBAM. The ATAM provides software architects with a framework for understanding the technical tradeoffs and risks they face as they make design decisions, but it does not provide any guidance for understanding economic tradeoffs. The CBAM helps software architects consider the return on investment of any architectural decision and provides guidance on the economic tradeoffs involved. The CBAM takes the architectural decision analysis done during the ATAM arid helps make it part of a strategic roadmap for software design and evolution by associating priorities, costs, and benefits with architectural decisions.
DTIC
*Architecture (Computers); Cost Analysis; Cost Effectiveness; Tradeoffs*

**20040059087** Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA
**Digital Skills Training for Net-Centric Operations**
Schaab, Brooke B.; Dressel, J. D.; Moses, Franklin L.; Jan. 2004; 35 pp.; In English
Contract(s)/Grant(s): Proj-A790
Report No.(s): AD-A421861; ARI-SR-58; No Copyright; Avail: CASI; A03, Hardcopy

Multiple research activities identified training methods that enhance Army net-centric operations where Soldiers use sophisticated digital systems that interact over an electronic network. Researchers collected information from Soldiers over five years, from 1999 to 2003, to understand how 'going digital' changes responsibilities and training needs. Soldiers documented training preferences and shared frustrations and successes as their understanding and expertise evolved over time.

This special report presents principles and recommendations, including supporting evidence from extensive experimentation and field surveys, for training Soldiers to maximize their use of digital systems. Results should help Soldiers to increase the speed and the ease of transformation to net-centric operations.
DTIC
*Digital Systems; Education; Personnel Development*

## 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.

**20040043745** Naval Postgraduate School, Monterey, CA
**Web Portal Design, Execution and Sustainability for Naval Websites and Web Services**
Amsden, Saundra L.; Dec. 2003; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A420360; No Copyright; Avail: CASI; A06, Hardcopy

With the rapid evolution of Web-based technologies, keeping up with the latest trends is a complicated process. The newest Web Service is the development of Web Portals. Portals allow the design of Web Services in such a way as to allow users to define their own needs and create a home of their own within a site. As users become more proficient, knowledgeable, and demanding, this technology will expand due to the demand of its users. As with all new technology, it includes significant benefits and pitfalls. Determining where to best use Web Services and Portals is important. The plethora of tools being promoted for the development of portals is significant, and choosing the right tool to accomplish the task while ensuring compatibility is critical. Already, considerable work has been accomplished by Task Force Web (TF Web) and the Fleet Numerical Meteorology and Oceanography Center (FNMOC). An important factor in the decision process is in meeting the demands of an ever- increasing technology literate environment. Reaching the goal of a fully connected Navy will require significant expenditure of money and manpower, but will reap large benefits from the long-term value of improved training and access to knowledge. This research focuses on the design and evaluation of Web Services and Web Portals. Following an introductory chapter, Chapter II provides information on Web site design, SIGGRAPH Online, SCORM, Mailing Lists, Hypermail Archives, Web Logging, DHTML, and several key standards. Chapter III defines and describes Web Services and Web Portals, how they differ, and the advantages of each. Chapter IV reviews open source Web Portal design software, specifically Apache Jetspeed, Plone, and uPortal. Chapter V looks at three organizations that are exploring the use of Web Portals. Chapter VI evaluates three Portals (Undersea Warfare (USW), FNMOC, and NPS's Dudley Knox Library), and Chapter VII provides recommendations for future work. (2 tables, 62 figures, 73 ref7
DTIC
*Design Analysis; Information Systems; Internets; Websites*

**20040058103** NASA Langley Research Center, Hampton, VA, USA, Rockwell Collins, Inc., Cedar Rapids, IA, USA
**Software Safety Analysis of a Flight Guidance System**
Butler, Ricky W., Technical Monitor; Tribble, Alan C.; Miller, Steven P.; Lempia, David L.; March 2004; 80 pp.; In English
Contract(s)/Grant(s): NCC1-01001; WU 728-30-10-03
Report No.(s): NASA/CR-2004-213004; No Copyright; Avail: CASI; A05, Hardcopy

This document summarizes the safety analysis performed on a Flight Guidance System (FGS) requirements model. In particular, the safety properties desired of the FGS model are identified and the presence of the safety properties in the model is formally verified. Chapter 1 provides an introduction to the entire project, while Chapter 2 gives a brief overview of the problem domain, the nature of accidents, model based development, and the four-variable model. Chapter 3 outlines the approach. Chapter 4 presents the results of the traditional safety analysis techniques and illustrates how the hazardous conditions associated with the system trace into specific safety properties. Chapter 5 presents the results of the formal methods analysis technique model checking that was used to verify the presence of the safety properties in the requirements model. Finally, Chapter 6 summarizes the main conclusions of the study, first and foremost that model checking is a very effective verification technique to use on discrete models with reasonable state spaces. Additional supporting details are provided in the appendices.
Author
*Fault Trees; Software Engineering; Avionics; Aircraft Guidance; Mathematical Models; Control Systems Design; Computer Program Integrity*

**20040058104** NASA Langley Research Center, Hampton, VA, USA

**Portable Wireless LAN Device and Two-Way Radio Threat Assessment for Aircraft VHF Communication Radio Band**

Nguyen, Truong X.; Koppen, Sandra V.; Ely, Jay J.; Williams, Reuben A.; Smith, Laura J.; Salud, Maria Theresa P.; March 2004; 93 pp.; In English

Contract(s)/Grant(s): DFTA03-96-X-90001; WU 23-728-30-10

Report No.(s): NASA/TM-2004-213010; L-18362; No Copyright; Avail: CASI; A05, Hardcopy

This document summarizes the safety analysis performed on a Flight Guidance System (FGS) requirements model. In particular, the safety properties desired of the FGS model are identified and the presence of the safety properties in the model is formally verified. Chapter 1 provides an introduction to the entire project, while Chapter 2 gives a brief overview of the problem domain, the nature of accidents, model based development, and the four-variable model. Chapter 3 outlines the approach. Chapter 4 presents the results of the traditional safety analysis techniques and illustrates how the hazardous conditions associated with the system trace into specific safety properties. Chapter 5 presents the results of the formal methods analysis technique model checking that was used to verify the presence of the safety properties in the requirements model. Finally, Chapter 6 summarizes the main conclusions of the study, first and foremost that model checking is a very effective verification technique to use on discrete models with reasonable state spaces. Additional supporting details are provided in the appendices.

Author

*Local Area Networks; Very High Frequencies; Wireless Communication; Portable Equipment; Radio Communication; Avionics; Aircraft Communication; Threat Evaluation*

**20040058953** Illinois Univ. at Urbana-Champaign, Urbana, IL

**M3T: Morphable Multithreaded Memory Tiles**

Torrellas, Josep; Abbott, Ben; Bapty, Ted; Bassett, Bob; Franke, Hubertus; Jan. 2004; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-C-0078; DARPA ORDER L175; Proj-L175

Report No.(s): AD-A421431; AFRL-IF-RS-TR-2004-18; No Copyright; Avail: CASI; A03, Hardcopy

The Morphable Multithreaded Memory Tiles (M3T) system proves that a polymorphous computing system polymorphous hardware and a complete polymorphous software environment is orders of magnitude more cost effective than conventional computing systems. The cornerstone of M3T is two main contributions: (1) architectural support that enables the processor cores and memories in an M3T chip to reconfigure at run time, allowing the processing architecture to morph or reconfigure itself into different 'architectural templates' such as VLIW (Very Long Instruction Word), MIMD (Multiple Instruction Stream and Multiple Data Stream), or Streaming engine or even some combination of them as a program executes; and (2) a complete polymorphous software includes synthesis tools for high-level design, a polymorphous low level compiler and code generator, and morphware fragments. TaskScalar is an architectural template where the processing components work in a tightly-executing very fine-grain tasks speculatively. Some of M3T's polymorphous features have been tech-transferred to the IBM Blue Gene/C (Cyclops) chip. To ensure commercial viability and defense interest, the primary den application domain for the M3T system is speech processing.

DTIC

*Architecture (Computers); Configuration Management; Tiles*

**20040058956** Drexel Univ., Philadelphia, PA

**COSAK: Code Security Analysis Kit**

Mancoridis, Spiros; Jan. 2004; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-2-0534; DARPA ORDER M140; Proj-CHAT

Report No.(s): AD-A421440; AFRL-IF-RS-TR-2004-19; No Copyright; Avail: CASI; A03, Hardcopy

There are two significant parts to the Code Security Analysis Kit (CoSAK) project. The first part of the project is called Front Line Functions (FLF) and involves the development of static analysis tools for C code to assist in the characterization of software functions that are most vulnerable to a security attack. The effectiveness of the FLF work was demonstrated empirically using a repository of open source software with known security vulnerabilities. The second part of the project is called Gemini and involves the development of tools to transform C programs into equivalent ones that are less susceptible to a buffer overflow security attack. The effectiveness of the Gemini project was demonstrated using a case study that involved transforming several software packages from the Linux operating system distribution.

DTIC

*Computer Programming; Kits; Security*

**20040058977** Carnegie-Mellon Univ., Pittsburgh, PA
**MAPLE: Multi-Agent Planning, Learning, and Execution**
Thrun, Sebastian; Feb. 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-98-2-0137; DARPA ORDER J388; Proj-AGEN
Report No.(s): AD-A421529; AFRL-IF-RS-TR-2004-25; No Copyright; Avail: CASI; A03, Hardcopy

The fundamental problems addressed in this report pertained to the coordination of multi-agent software systems acting in dynamic, physical environments. The Multi-Agent Planning MAPLE project focused on the development and evaluation of new algorithms for integrating information and for coordinating the actions of large multi-agent teams. Three different aspects of multi-agent systems are in this report. First, this project developed a prototype of a secure decentralized database, which made it possible to disperse information among multiple agents in a secure and scalable way. Second, the project developed a multi-agent system for acquiring and integrating information in large dynamic environments. Third was a planning and multi-agent coordination technique for enabling large teams of autonomous agents to perform missions in highly dynamic and partially observable environments. The resulting algorithms were implemented and evaluated predominately using a simulator called 'MapleSim', which simulated the country of Honduras after the devastation caused by Hurricane Mitch in 1998.
DTIC
*Computer Programs*

**20040058978** Georgia State Univ., Atlanta, GA
**MESO-Adaptation Based on Model Oriented Reengineering Process for Human-Computer Interface (MESOMORPH)**
Moore, Melody; Yu, David; Shi, Cen; Hoang, Gnan; Feb. 2004; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0516; DARPA ORDER K516; Proj-DASA
Report No.(s): AD-A421532; AFRL-IF-RS-TR-2004-28; No Copyright; Avail: CASI; A03, Hardcopy

As computing technology increasingly pervades everyday life, demand for more flexible and adaptable user interfaces increases. With advent of assistive technology for people with disabilities, user interfaces for mainstream applications become more unique and specialized. This requires user interfaces to be adapted to fit their context, consisting of the physical environment, user capabilities and activity factors. The MesoMORPH project examined methods to add automation to context-dependent user interfaces. MesoMORPH is a toolset containing gauges that allow design-time metrics related to feature importance and impact of changes according to a specialized context. MesoMORPH provides support for the following capabilities: create optimized applications for a specified set of tasks, adapt for particular user, adapt for a situation and/or adapt for a new device, such as from a desktop to a Palmtop display.
DTIC
*Human-Computer Interface*

**20040059004** Carnegie-Mellon Univ., Pittsburgh, PA
**Current Perspectives on Interoperability**
Brownsword, Lisa L.; Carney, David J.; Fisher, David; Lewis, Grace; Meyers, Craig; Mar. 2004; 50 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A421613; CMU/SEI-2004-TR-009; ESC-TR-2004-009; No Copyright; Avail: CASI; A03, Hardcopy

This report describes current research within the software engineering community on the topic of interoperability between software systems. That research includes analyses of the different types of interoperability problems and issues and efforts to define models of interoperability that will aid in creating solutions to those problems. The report also describes work that is currently underway at the Software Engineering Institute (SEI) in this area. That work originated in an independent research effort and now has grown into a separate technical initiative in the area of interoperability. The SEI initiative is currently focused on analyzing several aspects of interoperability: how it is manifest in different kinds of activities (i.e., programmatic vs. constructive vs. operational activities), the essential characteristics of interoperability, and the key principles on which solutions will depend.
DTIC
*Computer Programming; Interoperability; Software Engineering*

**20040059006** Carnegie-Mellon Univ., Pittsburgh, PA
**Product Line Analysis for Practitioners**
Chastek, Gary; Donohoe, Patrick; Sep. 2003; 42 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A421616; CMU/SEI-2003-TR-008; ESC-TR-2003-008; No Copyright; Avail: CASI; A03, Hardcopy

Planning for the development of products early in the lifetime of a software product line is critical to the success of that product line. Requirements for that development both affect and are affected by the product requirements. This technical report describes the addition of development requirements to product line analysis. It further describes the refinement of product and development responsibilities, and the relationships among them, by use of examples specifically targeted at the practitioner of product line analysis.
DTIC
*Computer Programming; Production Engineering; Software Engineering*

**20040059007** Carnegie-Mellon Univ., Pittsburgh, PA
**Preliminary Design of ArchE: A Software Architecture Design Assistant**
Bachmann, Felix; Bass, Len; Klein, Mark; Sep. 2003; 66 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A421618; CMU/SEI-2003-TR-021; ESC-TR-2003-021; No Copyright; Avail: CASI; A04, Hardcopy
This report presents a procedure for moving from a set of quality attribute scenarios to an architecture design that satisfies those scenarios. This procedure is embodied in a preliminary design for an architecture design assistant named ArchE (Architecture Expert), which will be implemented on a rule-based platform. This report includes the theory and rationale precipitating the design of ArchE and then describes this design in detail.
DTIC
*Architecture (Computers); Software Engineering*

**20040059008** Carnegie-Mellon Univ., Pittsburgh, PA
**Architecture Reconstruction of J2EE Applications: Generating Views from the Module Viewtype**
O'Brien, Liam; Tamarree, Vorachat; Nov. 2003; 29 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A421619; CMU/SEI-2003-TN-028; No Copyright; Avail: CASI; A03, Hardcopy
This report outlines the application of architecture reconstruction techniques to the Sun Microsystems' Duke's Bank system-a Java2 Platform, Enterprise Edition/Enterprise JavaBeans (J2EE/EJB) application implemented mainly in Java. The goal of the reconstruction was to apply architecture reconstruction techniques to a system implemented in Java to produce a set of views that depict that system's architecture. Decomposition style views of the module view type were used. They focus on the 'is part of' relation and show how the system is decomposed into modules and submodules. During the reconstruction, several decomposition style views of the architecture were generated using the Understand for Java tool. That tool extracted and then abstracted low- level source information from the system. Then that information was formatted using Perl scripts, so it could be loaded into the Architecture Reconstruction and Mining (ARMIN) tool developed by the Carnegie Mellon(registered) Software Engineering Institute and the Robert Bosch Corporation. The resulting views showed the architectural elements of the Duke's Bank system and the dependencies among them.
DTIC
*Jave (Programming Language); Architecture (Computers)*

**20040059016** Carnegie-Mellon Univ., Pittsburgh, PA
**SCAM: The Software Architecture Comparison Analysis Method**
Stoermer, Christopher; Bachmann, Felix; Verhoef, Chris; Dec. 2003; 48 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A421661; CMU/SEI-2003-TR-006; ESC-TR-2003-006; No Copyright; Avail: CASI; A03, Hardcopy
Comparing software architectures for any nontrivial system is a difficult task. Software architectures are designed with particular requirements and constraints, and are often poorly documented. However, organizations often need to select a software architecture for future development from several candidate architectures. The Software Architecture Comparison Analysis Method (SACAM) was created to provide the rationale for an architecture selection process by comparing the fitness of architecture candidates for required systems. The SACAM compares architectures based on a set of criteria derived from the business goals of an organization. The SACAM was developed in a technical reuse context where an organization investigated architectural commonalities and differences to explore architectural designs for a software product line architecture. This report outlines a first version of the method and its underlying concepts.
DTIC
*Architecture (Computers); Computer Programs*

**20040059037** Phillips Lab., Hanscom AFB, MA
**New World Vistas: New Models of Computation Lattice Based Quantum Computation**
Yepez, Jeffrey; Jul. 25, 1996; 5 pp.; In English
Report No.(s): AD-A421712; No Copyright; Avail: CASI; A01, Hardcopy

I propose to consider the feasibility of implementing a quantum lattice-gas dynamics based on quantum computing ideas and to explore the practicality of building a quantum computer, a question first posed by Richard Feynman over a decade ago.
DTIC
*Computation; Quantum Computation; Quantum Theory*

**20040059045** Georgia Inst. of Tech., Atlanta, GA
**DYNAMO: Dynamic Assembly From Models**
Rugaber, Spencer; Stirewalt, Kurt; Feb. 2004; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0618; DARPA ORDER-K504; Proj-DASA
Report No.(s): AD-A421751; AFRL-IF-RS-TR-2004-35; No Copyright; Avail: CASI; A03, Hardcopy

The DYNAMO project is concerned with assembling high-assurance systems from components, and, specifically, with guaranteeing correct interaction of sets of large, heterogeneous components. Several problems must be overcome to provide such guarantees: I) dealing with the sheer complexity of the individual components and their interoperation; 2) maintaining design integrity and information hiding in the individual components; 3) providing the desired guarantees; and 4) not compromising efficiency while accomplishing the other goals. DYNAMO addresses these problems with several techniques: I) a layered, implicit invocation architecture limits complexity by reducing the quantity and nature of allowed interactions; 2) a declarative specification mechanism abstracts away low-level details such as event dispatch and handling and variable updates; and 3) compile time component wrapper generation removes expensive, inter-layer procedure calls.
DTIC
*Computer Programs; Dynamic Models; Systems Engineering*

**20040059047** Washington Univ., Seattle, WA
**RENDEZVOUS: Self-Organizing Services in an Active Network**
Wetherall, David J.; Anderson, Thomas E.; Feb. 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-98-1-0205; DARPA ORDER-G412; Proj-G412
Report No.(s): AD-A421754; AFRL-IF-RS-TR-2004-41; No Copyright; Avail: CASI; A03, Hardcopy

We propose to explore a rendezvous model that has three characteristics: self-organization, heterogeneity, and administrator for friendliness. Not only do we believe that active network techniques have much to offer the overlay, proxy and interposition models that are prevalent in the Internet, but for the most part previous active networks research has not explored models with these characteristics. Our approach builds on our earlier experience with active networks, and specifically the ANTS active network toolkit. We model the network as an Internet-like arrangement of IP routers, some of which are co-located with active nodes that support additional computation in the form of a well-known runtime. We assume this to be ANTS, although our strategies will be applicable to other runtimes too.
DTIC
*Interprocessor Communication*

**20040059060** Army Tank-Automotive Research and Development Command, Warren, MI
**Dynamic Link Library of Interpolation/Table Lookup Functions for 20SIM**
Bylsma, Wesley; Sep. 2002; 22 pp.; In English
Report No.(s): AD-A421774; TARDEC-13825; No Copyright; Avail: CASI; A03, Hardcopy

A dynamic link library (DLL) is developed to perform interpolation/table lookup functions from within 20- SIM by Controllab Products B.V. (Netherlands). The use of these functions, implemented in the C programming language, provides a multi-platform modeling and simulation environment through 20 SIM's C code generation capability. Externally developed interpolation/table lookup functions are necessary since 20-SIM's internal table lookup functions are not allowed with its C code process.
DTIC
*Computer Aided Design; Computer Programming; Interpolation; Libraries; Software Engineering*

**20040059085** Naval Research Lab., Stennis Space Center, MS
**3-Dimensional Enhancements for Visualizing Lane Navigation Performance**
Myrick, Stephanie A.; Steed, Chad A.; Oct. 29, 2003; 6 pp.; In English
Report No.(s): AD-A421858; NRL/PP/7440-03-1027; No Copyright; Avail: CASI; A02, Hardcopy

Research results are typically reported using 2- dimensional (2D) methods that include tables, figures, and charts. With the availability of 3-dimensional (3D) visualization applications, based on the Virtual Reality Modeling Language (VRML) and Extensible 3D (X3D) graphics, the Naval Research Laboratory (NRL) has employed alternative methods of information presentation. These 3D applications are displayed with viewer software on conventional Internet web- browsers and may be effectively used in oral presentations and for separate viewing on the Internet. This paper describes 3D applications that were developed to visualize Marine Corps Amphibious Assault Vehicle (AAV) navigation performances during field demonstrations and augment the 2D performance data. They depict steering patterns used to avoid surface waves, how well the drivers negotiate lane turning points, and a vehicle's vulnerability to mines and other dangers (e.g., subsurface rocks) when steered outside the cleared navigation lanes.
DTIC
*Augmentation; Computer Graphics; Navigation*

**20040059089** Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA
**How Formal Training Affects Soldier Attitudes and Behaviors Towards Digitization**
Barnett, John S.; Feb. 2004; 58 pp.; In English
Contract(s)/Grant(s): Proj-2O262785A790
Report No.(s): AD-A421864; ARI-TR-1142; No Copyright; Avail: CASI; A04, Hardcopy

This research measured how formal training affects Soldier patterns of behavior and attitudes towards digitization. A set of questionnaires was administered to 24 enlisted Soldiers and 12 officers attending formal classroom training for the Force XXI Battle Command, Brigade and Below (FBCB2) digital system. One questionnaire was administered before training, and a second after training was complete. The questionnaires assessed Soldier opinions of FBCB2 usefulness and also their attitudes associated with using the system. Soldier responses before and after training were compared to assess how training affected their attitudes and behaviors towards digitization. Results showed Soldiers generally feel FBCB2 is useful and worth the additional effort required to learn the systems. It also indicated that formal training in digital systems has a significant positive effect on Soldiers' attitudes and behaviors towards digital systems. The results also seem to indicate that training may help Soldiers avoid maladaptive behavior patterns that have been identified in other areas. Behaviors such as disuse or over-reliance on automated systems, a significant problem in other areas, were relatively rare for Soldiers attending formal training.
DTIC
*Computer Networks; Digital Systems; Digital Techniques; Education; Human Behavior; Psychology*

**20040059090** Naval Research Lab., Stennis Space Center, MS
**Heading Sensor Integration With an Electronic Moving Map System**
Edwards, Stephanie S.; Gendron, Marlin L.; Lohrenz, Maura C.; Oct. 29, 2003; 6 pp.; In English
Report No.(s): AD-A421865; NRL/PP/7440-03-1029; No Copyright; Avail: CASI; A02, Hardcopy

An electronic mapping system, installed on a vehicle, can provide an accurate and visual depiction of the operating environment to the vehicle operator. This enhanced situational awareness (SA) is useful in critical decision- making and operational safety. The Naval Research Laboratory (NRL) has developed and tested a moving-map (MM) system based on commercial-off-the-shelf (COTS) hardware and government-off- the- shelf (GOTS) software for amphibious assault vehicles. The MM system consists of a computer, display -and software depicting the position of the vehicle, obtained via the Global Position System (GPS), as an icon overlaid on a geo-registered map. This configuration can be run in either north-up or track-up mode. In north-up mode, the map is always displayed with north at the top of the display, and the icon moves as the position of the vehicle changes. In track-up mode, the map moves as the direction of travel changes with the forward direction at the top of the display. In this mode, the icon remains stationary over the moving map.
DTIC
*Digital Data; Maps*

**20040059101** Geological Survey, Reston, VA

**Geographic Information System Tools for Conservation Planning: User's Manual**

Fox, Timothy J.; Rohweder, Jason J.; Kenow, Kevin P.; Korschgen, Carl E.; DeHaan, Henry C.; Mar. 2004; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A421900; USGS/BRD/ITR-2003-0005; No Copyright; Avail: CASI; A04, Hardcopy

Public and private land managers desire better ways to incorporate landscape, species, and habitat relations into their conservation planning processes. We present three tools, developed for the Environmental Systems Research Institute's ArcView 3.x platform, applicable to many types of wildlife conservation management and planning efforts. These tools provide managers and planners with the ability to rapidly assess landscape attributes and link these attributes with species-habitat information. To use the tools, the user provides a detailed land cover spatial database and develops a matrix to identify species-habitat relations for the landscape of interest. The tools are applicable to any taxa or suite of taxa for which the required data are available. The user also has the ability to interactively make polygon-specific changes to the landscape and re-examine species-habitat relations. The development of these tools has given resource managers the means to evaluate the merits of proposed landscape management scenarios and to choose the scenario that best fits the goals of the managed area.

DTIC

*Conservation; Geographic Information Systems; User Manuals (Computer Programs)*

**20040059152** Cornell Univ., Ithaca, NY

**Language-Based Security for Extensible Systems**

Schneider, Fred B.; Morrisett, J. G.; Mar. 18, 2004; 19 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0198

Report No.(s): AD-A422023; CU-36641; No Copyright; Avail: CASI; A03, Hardcopy

Successful attacks on computing infrastructures often involve failures of type safety. A major contribution of this grant has been the creation of type systems and type- checking algorithms for low-level languages in use today. In addition, 'certifying compilation' was developed to eliminate the need to trust correctness of highlevel language implementations. However, ensuring type safety is not sufficient for ruling-out misbehavior in code. A second contribution of this grant was to design and build program- rewriting tools employed for security policy enforcement and also to derive a theoretical characterization for what kinds of policies can be enforced by program rewriting. The theoretical work compares the expressive power of rewriting against traditional security enforcement mechanisms; rewriting is proved to be strictly more powerful. The in-lined reference monitor toolkits handle x86 machine code, the Java virtual machine, and Microsoft's .NET framework.

DTIC

*Computer Programs; Security; Warning Systems*

**20040059183** Naval Research Lab., Washington, DC

**NRL Atmospheric Correction Algorithms for Oceans: Tafkaa User's Guide**

Montes, Marcos J.; Gao, Bo-Cai; Davis, Curtiss O.; Mar. 22, 2004; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422068; NRL/MR/7230--04-8760; No Copyright; Avail: CASI; A03, Hardcopy

Tafkaa is an atmospheric correction algorithm for remote sensing of ocean color that has been developed at the Naval Research Laboratory (NRL). This document describes how to use Tafkaa, and presents some background on Tafkaa, including differences and similarities in both the current tabular and 6S versions. Descriptions of various options, restrictions, assumptions, keywords, input files, and output files associated with Tafkaa are also presented.

DTIC

*Algorithms; Atmospheric Correction; Detection; Remote Sensing*

**20040059193** Naval Postgraduate School, Monterey, CA

**Web-Based 3D Technology for Scenario Authoring and Visualization: The Savage Project**

Blais, Curtis; Brutzman, Don; Horner, Doug; Nicklaus, Shane; Jan. 2001; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422086; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this paper is to describe current work in specification and development of Web-based 3D standards and tools. The paper presents a Web3D application for military education and training currently in progress for the Defense Modeling and Simulation Office and the Marine Corps Combat Development Command. This paper presents current efforts

in Web- based 3D technology by one key organization, the Web3D Consortium (hfto:Hwww.web3d.ora). In a pioneering endeavor, the Web3D Consortium is working to open the Web- based 3D frontier to all by charting the territory, establishing shared goals, and building lines of communication. The paper also describes efforts of the Modeling, Virtual Environments, and Simulation (MOVES) Institute at the Naval Postgraduate School (NPS) to introduce emerging Web3D technology into the forefront of military professional education. Specific techniques, models, and scenarios are presented from the Scenario Authoring and Visualization for Advanced Graphical Environments (SAVAGE) project at NPS.
DTIC
*Virtual Reality*

**20040059214** Naval Postgraduate School, Monterey, CA
**Design and Development of a Web-Based DOD PKI Common Access Card (CAC) instruction Tool**
Athanasopoulos, Vasileios; Mar. 2004; 100 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422135; No Copyright; Avail: CASI; A05, Hardcopy

Public key cryptography and the infrastructure that has been designed to successfully implement it, the Public Key Infrastructure (PKI), is a very promising computer security technology. As a significant enhancement to this infrastructure, DoD is now issuing smart card tokens, in the form of the Common Access Card (CAC), to its service members. This card is a relatively complex cryptographic device that contains its user's private keys, digital certificates, and other personal administrative information. Service personnel are being issued these cards with little or no training regarding what they are or how they function, Such an omission detracts from the infrastructure's overall security. This thesis presents an introductory-level description of public key cryptography and its supporting infrastructure (PKI). The thesis then goes on to develop a web-based training tool that could provide all DoD CAC holders with the rudimentary knowledge of how their CAC fits into the broader infrastructure. The training tool will require no instructor, and will present a validation test to each user. DoD commands could utilize this tool to provide basic CAC training to their members.
DTIC
*Access Control; Cards; Education; Numerical Control*

**20040059218** Naval Postgraduate School, Monterey, CA
**Autonomous-Agent Based Simulation of Anti- Submarine Warfare Operations with the Goal of Protecting a High Value Unit**
Akbori, Fahrettin; Mar. 2004; 124 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422144; No Copyright; Avail: CASI; A06, Hardcopy

The Anti-Submarine Warfare screen design simulation is a program that provides a model for operations in anti-submarine warfare (ASW). The purpose of the program is to aid ASW commanders, allowing them to configure an ASW screen, including the sonar policy, convoy speed, and the number of ships, to gain insight into how these and other factors beyond their control, such as water conditions, impact ASW effectiveness. It is also designed to be used as a training tool for ASW officers. The program is implemented in Java programming language, using the Multi Agent System (MAS) technique. The simulation interface is a Horizontal Display Center (HDC) which is very similar to a MEKQ2OO class Frigate Combat Information Center's (CIC) HDC. The program uses Extensible Markup Language (XML) files for reading data for program scenarios; parameters are initialized before each run time begins. The simulation also provides all the output data at the end of run time for analysis purposes. The program user's goal, and the purpose of the program, is to decrease the number of successful attacks against surface vessels by changing the configuration parameters of the ASW screen, to reflect sonar policy, convoy speed or number of ships in the simulation. Ongoing use of the program can provide data needed to anticipate required operational needs in future ASW situations.
DTIC
*Antisubmarine Warfare; Autonomy; Computer Programs; Simulation; Warfare*

**20040059220** Naval Postgraduate School, Monterey, CA
**Two-Period, Stochastic Supply-Chain Models with Recourse for Naval Surface Warfare**
Avital, Ittai; Mar. 2004; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422148; No Copyright; Avail: CASI; A04, Hardcopy

We model the minimum-cost procurement and allocation of anti-ship cruise missiles to naval combat ships as a two-period stochastic integer program. Discrete scenarios in two periods define 'demands' for missiles (i.e., targets and number of missiles required to kill those targets), which must be met with sufficiently high probabilities. After the former combat period, ships

may replenish their inventories from a depot if desired and if the available depot inventory suffices. A force commander optimizes ship-to-target assignments to meet demands. The basic model solves slowly, so we add constraints to enforce reasonable operational directives, and add valid inequalities. These improvements reduce the solution time by 95% for the test case. Instances with up to six ships and five scenarios in each period then solve in less than one hour on a 2 GHz personal computer.
DTIC
*Antiship Missiles; Computer Programs; Cruise Missiles; Navy; Procurement; Stochastic Processes; Warfare*

**20040059225** Naval Postgraduate School, Monterey, CA
**The Use of Massive Multiplayer Online Games to Evaluate C4I Systems**
Juve, Kambra; Mar. 2004; 75 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422155; No Copyright; Avail: CASI; A04, Hardcopy

In the past few years, Massive Multiplayer Online Games (MMOG) have gained in popularity in the gaming industry, the public and the Department of Defense Improvements to computer technology and the increased data transfer rate over networks have caused the potential applications for networked environments to blossom MMOGs are a product of these improvements, as technological advancements have made it possible for the masses to gain access to virtual environments and participate. The ability to communicate and interact within the virtual environment has the potential to make MMOG technology an ideal tool for evaluating C4I systems The design and evaluation of C4I systems with MMOGs has the potential to allow for exploration in the areas of warfighter effectiveness, emergent behavior, collective decision making, human systems integration and effective information flow. This thesis strives to illustrate how a C4I system modeled in an MMOG can aid designers in gathering insights on the effectiveness of the system in various combat situations.
DTIC
*Command and Control; Game Theory; Games; Interprocessor Communication; On-Line Systems; Virtual Reality*

**20040059230** Army Engineer Research and Development Center, Vicksburg, MS
**SELECT Version 1.0 Beta: A One-Dimensional Reservoir Selective Withdrawal Model Spreadsheet**
Schneider, Michael L.; Wilhelms, Steven C.; Yates, Laurin I.; Feb. 2004; 21 pp.; In English
Report No.(s): AD-A422160; ERDC/EL-SR-04-1; No Copyright; Avail: CASI; A03, Hardcopy

SELECT is a numerical, one-dimensional model of selective withdrawal developed at the U.S. Army Engineer Research and Development Center. SELECT v1.0 Beta uses Microsoft Excel spreadsheet software to compute withdrawal characteristics and release water quality for various operational alternatives. The spreadsheet implementation of the SELECT model provides a highly interactive environment for the application of the model. This guide was developed to assist users of the SELECT v1.0 Beta spreadsheet model. The guide briefly discusses the concepts of selective withdrawal in reservoirs and describes how those concepts are implemented in the spreadsheet model. It then provides an overview of the execution of the spreadsheet model and includes guidance on preparing the required input data for the model. Examples of model input and model output are provided.
DTIC
*Mathematical Models; Reservoirs; Spreadsheets; Water Quality*

**20040059242** University of Southern California, Marina del Rey, CA
**Dynamic Sensor Networks**
Schott, Brian; Riley, Ronald; Srivastava, Mani; Elgorriaga, Igor; Mar. 2004; 243 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-1-0529; DARPA ORDER-H557; Proj-H577
Report No.(s): AD-A422178; AFRL-IF-RS-TR-2004-57; No Copyright; Avail: CASI; A11, Hardcopy

The DSN team investigated hardware and software technologies for unattended ground sensor applications. Task I: Distribution and Aggregation includes node localization techniques, low-power data link protocols, power aware routing protocols, and spatial addressing and routing. Task 2: Declarative Languages and Execution Environment includes topographical soldier interface and a sensor network simulation environment for algorithm development, deployment planning, and operational support. Finally, Task 3: Platforms include investigative hardware development to support laboratory communications, processing, or localization experiments as well as open-source COTS PDA integration and system software in support of the soldier interface.
DTIC
*Computer Networks; Computer Programs*

**20040059243** Boeing Phantom Works, Seattle, WA
**Naval Battleforce Networks Composite Routing**
Kim, Jae H.; Henderson, Thomas R.; Spagnolo, Phillip A.; Ahrenholz, Jeffrey M.; Nov. 21, 2003; 54 pp.; In English
Contract(s)/Grant(s): N00014-02-C-0029
Report No.(s): AD-A422179; No Copyright; Avail: CASI; A04, Hardcopy

This document is the final technical report for the Boeing Composite Routing program as part of the Naval Battleforce Network (NBN) program, a subset of the ONR Knowledge Superiority and Assurance (KSA) Future Naval Capability (FNC) program. This document supplements the three previous technical reports and the software deliverables submitted under this contract: Naval Battleforce Networking Requirements Report; Protocol Evaluation Report; Final Demonstration Plan; and Routing Protocol Source Code and Documentation. In particular, this document describes the software implementation of a modified OSPFv2 routing daemon for Linux, the laboratory testing results of the prototype implementation, and the results of the final program demonstration in San Diego on September 18, 2003.
DTIC
*Computer Programs*

**20040059257** Naval Postgraduate School, Monterey, CA
**Parametric Studies of DDG-81 Ship Shock Trial Simulations**
Didoszak, Jarema M.; Mar. 2004; 166 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422216; No Copyright; Avail: CASI; A08, Hardcopy

Motivated by the sizable ledger of ships sent to the ocean floor without ever sustaining a direct hit during World War II, a heightened interest in ship shock survivability spread throughout the Naval Engineering community. As a result, over the last fifty years, Live Fire Test & Evaluations, otherwise known as ship shock trials, have been conducted in order to determine the seaworthiness of each new class of ship commissioned in the U.S. Fleet. While beneficial in determining the overall survivability of a ship and its mission essential equipment in a severe shock environment, these Navy-mandated tests pose serious danger to the crew, ship and environment.
DTIC
*Computerized Simulation; Ships; Shock Tests; Simulation*

**20040059263** Massachusetts Univ., Amherst, MA
**Probabilistic, Dynamic Analysis of Plans**
Cohen, Paul R.; Mar. 2004; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-1-0529; DARPA ORDER-K442; Proj-ATEM
Report No.(s): AD-A422223; AFRL-IF-RS-TR-2004-70; No Copyright; Avail: CASI; A03, Hardcopy

The University of Massachusetts developed three technologies under the Active Templates program. The first was Capture the Flag, a wargaming environment that includes a simulator of battalion-and-higher level land warfare. Capture the Flag was initiated by the Active Templates program manager LTC Doug Dyer, but funded primarily by other programs, so it is not reported in any detail here. The second project involved training rats to carry audiovisual backpacks under computer and human control for surveillance and search and rescue missions. The third effort concerned an hypothesis of LTC Dyer's that the semantics of the kinds one sees in the Active Templates program could be developed bottom up' by the people who use them, rather than 'top down' by trained ontologists.
DTIC
*Combat; Project Management; Semantics; Simulation*

**20040059264** Naval Postgraduate School, Monterey, CA
**Network Processors and Utilizing their Features in a Multicast Design**
Diler, Timur; Mar. 2004; 74 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422228; No Copyright; Avail: CASI; A04, Hardcopy

The main goal of this thesis was to design a multicasting forwarder using Intel Internet exchange architecture and the IXPl2OO network processor. The combat system computers on warships are connected to each other with a network to respond any attack immediately. The sensors and the weapons of the ships communicate with each other by using this network. The communication between systems must be lightweight to increase the respond time. This thesis can be used in these

systems to eliminate network over-heads. The sensors can send the information packets to control consoles by using unicast based multicasting to eliminate network overhead.
DTIC
*Communication Networks; Computer Networks*

**20040059269** Naval Postgraduate School, Monterey, CA
**Transforming Fleet Network Operations with Collaborative Decision Support and Augmented Reality Technologies**
Fay, John J.; Mar. 2004; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422235; No Copyright; Avail: CASI; A06, Hardcopy

Current network administrators use network management software to monitor and control elements within a network, This is largely a manual process since managers must interrogate devices individually and evaluate performance statistics manually. The systems provide multiple views on network data but lack capabilities that allow operators to visualize network performance. Since personnel are required to identify problem, interpret potential solutions, and decide on appropriate corrective measures without automatic assistance, maintaining and solving problems for a network can be time- consuming and complex significantly reducing network efficiency.
DTIC
*Communication Networks; Decision Support Systems; Military Operations*

**20040059270** Naval Postgraduate School, Monterey, CA
**Developing an After Action Review System for a 3D Interactive Training Simulation Using XML**
Filiagos, Dimitrios E.; Mar. 2004; 73 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422236; No Copyright; Avail: CASI; A04, Hardcopy

An important capability that many modern 3D interactive training simulations lack is an After Action Review System (AARS) that helps both the trainer and trainee to conduct an After Action Review (AAR). Although AAR is not a new idea in the 3D simulation field, it is not widely used in training simulations. In real life training, AAR has been proven as one of the most important phases of the training procedure, sometimes taking the form of debriefing, or in other cases, by conducting a deeper analysis and discussion of the facts. In order to conduct an AAR, a well-designed system (AARS) must exist to keep track of the conditions and the actions during an exercise, so they can be available for review later. This thesis translates the idea of AAR for real training situations to the 3D interactive simulation domain and also develops an After Action Review System (AARS) using XML technology for capture, analysis, and interactive playback of an entire simulation training session. Users can change the point of view to any desired position and direction, something that is impossible in video streaming playbacks.
DTIC
*Computerized Simulation; Education; Training Devices*

**20040059275** Naval Postgraduate School, Monterey, CA
**Design and Analysis of a Model Reconfigurable Cyber-Exercise Laboratory (RCEL) for Information Assurance Education**
Guild, R. J.; Mar. 2004; 109 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422241; No Copyright; Avail: CASI; A06, Hardcopy

This thesis addresses the need to create a flexible laboratory environment for teaching network security. For educators to fully realize the benefit of such a facility, prototype exercise scenarios are also needed. The paper is based on a model laboratory created at the Naval Postgraduate School. The initial configuration of the NPS lab is described. The work then develops a list of learning objectives achievable in the kCEL. Six prototype cyber-exercise scenarios are presented to supplement the kCEL description. The activities within each potential scenario are described. The learning objectives met during each scenario are shown. This work demonstrates how a variety of potential kCEL exercises can supplement traditional information assurance education delivery techniques.
DTIC
*Computer Assisted Instruction; Computer Networks; Design Analysis; Education; Physical Exercise; Security*

**20040059311** Army Engineer Research and Development Center, Vicksburg, MS
**Mission Level Mobility Analysis of the U.S. Marine Corps HIMARS Vehicles**
Jones, Randolph A.; Price, Stephanie J.; Ahlvin, Richard B.; Feb. 2004; 128 pp.; In English
Report No.(s): AD-A422287; ERDC/GSL-TR-04-3; No Copyright; Avail: CASI; A07, Hardcopy

The U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS, conducted a vehicle mobility analysis for the U.S. Marine Corps (USMC) High Mobility Artillery Rocket System (HIMARS) to identify the different mission profiles the prime transporters (the USMC Medium Tactical Vehicle Replacement (MTVR) and the MK48-14 Logistics Vehicle System (LVS)) may encounter during worldwide deployment. The proposed mission profile evaluation program focused on using computer-based digital terrain and vehicle mobility models to determine the different terrain types the vehicle may encounter while deployed on missions in three representative climatic regions. The predicted mission profiles for the MTVR and LVS, with and without a M1095 trailer, were quantified to determine their relationship to standard mission profile descriptions. The TeleEngineering Toolkit was used to graphically plan and locate the potential HIMARS mission scenarios in the three regions. The NATO Reference Mobility Model (NRMM) was used to predict the mobility performance of the MTVR and LVS over these regions. The Route Analysis Routine was used to determine the fastest routes to the different storage areas based on the selected corridors of operation and on the NRMM vehicle mobility performance predictions. The Mission Severity Rating algorithms were used to quantify the different mission segments for comparison to standard mission levels and to determine the appropriate mission level for the study vehicles for each climatic region. These climatic re ion conclusions were combined to develop a worldwide mission profile for each vehicle configured with and without a trailer.
DTIC
*Artillery; Mobility; Rocket Launchers*

**20040059320** Naval Postgraduate School, Monterey, CA
**Distributed Team Collaboration in a Computer Mediated Task**
Halin, Amy L.; Mar. 2004; 187 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422314; No Copyright; Avail: CASI; A09, Hardcopy

Due to the rapid development of technology, many simple tasks can now be automated, leaving more difficult and cognitive tasks such as planning, decision making and design to teams. Technology also allows these teams to be distributed through time and space. While this is becoming more and more prevalent in the business world, distributed teams also exist in the military where the stresses are much different. One of the key factors associated with collaboration in military teams is situational awareness. This research used a commercial command and control type video game to investigate the issues of collaboration and situational awareness. The amount of information subjects had access to was varied to see if there was a significant impact upon their level of situational awareness which was measured by the accuracy of maps that the subjects drew. Results from this research may provide insight into how which information is needed by distributed teams and when they need it. Ideas for future research in this area have also been proposed.
DTIC
*Cognition; Command and Control; Decision Making; Personnel*

**20040059328** Naval Postgraduate School, Monterey, CA
**Cost Analysis for the Development and Operation of a Mobile Wireless Research Facility**
Lock, Jeffrey S.; Weber, John B.; Mar. 2004; 118 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422337; No Copyright; Avail: CASI; A06, Hardcopy

Tbe Nemesis program's primary objective is to provide a mobile wireless research facility for Federal agencies and otber authorized agencies. Tbe report provides estimates of the Nemesis program's original cost, replication cost scheduled costing for operational reqtiirements and btidgeting guidelines. Tbe report provides future funding request justification for both labor and equipment lifecycle costs. Tbe report also provides the program funding agencies a more precise cost benefit analysis, to project future operating costs and to provide standardized budget guidelines. Tbe estimate of the original cost includes equipment acquisitions, software and reference material acquisition, inventory validation, billed labor, estimated non-billed labor, estimated non-billed infrastructure support, billed training and certification, estimated project management, and estimated administrative support. Tbe estimate of tbe original cost does not include legal support and Governmental administrative requirements. Tbe replicating cost is determined from the original cost with discovery costs removed. The discovery cost includes initial research/evaluation of afternate methods of system implementation, reduced expertise in labor due to documented replicating procedures, and an improved training process for operators. Tbe costing schedule is based on tbe projected program-operating tempo. Tbe budgeting guidelines provide tbe budget format, target parameters for inventory, and capital reinvestment to offset depreciation expenses..
DTIC
*Cost Analysis; Research Facilities*

**20040059336** Naval Postgraduate School, Monterey, CA
**Design and Implementation of a DSP-Based Control Interface Unit (CIU)**
Kavousanos-Kavousanakis, Andreas; Mar. 2004; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422367; No Copyright; Avail: CASI; A05, Hardcopy

This research involves the development of a human- body motion tracking system constructed with the use of commercial off-the-shelf (COTS) components. The main component of the system investigated in this thesis is the Control Interface Unit (CIU). The CIU is a component designed to receive data from magnetic, angular rate, and gravity (MARG) sensors and prepare them to be transmitted through a wireless configuration. A simple and effective algorithm is used to filter the sensor data without singularities, providing the measured attitude in the quaternion form for each human limb. Initial calibration of the MARG sensors also is performed with the use of linear calibrating algorithms. The testing and evaluation of the whole system is performed by MATLAB(registered) and SIMULINK(registered) simulations, and by real-time visualization using a human avatar designed with the X3D graphics specifications. Through this research, it was discovered that the MARG sensors had to be redesigned to overcome an erratum on the Honeywell magnetometer HMC1051Z data sheet. With the redesigned MARG sensors, the testing results showed that the CIU was performing extremely well. The overall motion tracking system is capable of tracking human body limb motions in real time. (2 tables, 25 figures, 22 refs. )
DTIC
*Accelerometers; Bionics; Control Equipment; Human Body; Magnetometers; Targets; Wireless Communication*

**20040059631** Sensoria Corp., Culver City, CA, USA
**Wireless Integrated Network Sensors Next Generation**
Merrill, William; Kaiser, William; Mar. 2004; 65 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-C-0171; Proj-H578
Report No.(s): AD-A422310; AFRL-IF-RS-TR-2004-58; No Copyright; Avail: CASI; A04, Hardcopy

During the WINS NG program, three generations of networked embedded sensor development systems were created, with over 180 of these systems provided to both the SensIT and NRL SRSS development communities. In addition to the supply of development systems, throughout this contract, support was provided to multiple teams of developers investigating various problems in collaborative signal processing, autonomous networking, and distributed operations for wireless networked sensor systems. Multiple types of sensor systems were developed and provided including capabilities for acoustic, seismic, passive infrared detection, and visual imaging. These systems were demonstrated as multiple tests and experiments by multiple groups Sensoria was supporting for each of the three years of this program.
DTIC
*Integrated Circuits; Radiotelephones*

**20040059725** Oregon Univ. Health Sciences Center, Portland, OR, USA
**Robust Agent-Based Systems Incorporating Teams of Communicating Agents**
Cohen, Philip R.; Feb. 2004; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-98-2-0098; DARPA ORDER-J383; Proj-AGEN
Report No.(s): AD-A421753; AFRL-IF-RS-TR-2004-39; No Copyright; Avail: CASI; A03, Hardcopy

This report describes OGI's contribution to agent based systems design and prototyping. The project had two major thrusts: I) the development of the Adaptive Agent Architecture (A3), and 2) the development of a second generation agent communication language (AgentTalk). The A3 architecture supports human participation as agents, dynamic formation of agent teams, reorganization of teams based on network loads, and offers libraries for legacy code to be able to participate in agent based systems. AgentTalk offers a small set of primitive communication actions, operators with which to build more complex communication activities, provably correct dialogue protocols, and is a candidate for international standardization.
DTIC
*Communicating; Interprocessor Communication*

**20040059737** Veridian Systems Div., VA, USA
**Urban Sunrise**
Vane, Russ; Spring, Woody; Waltz, Ed; Tulenko, Tom; Schenaker, Mike; Feb. 2004; 182 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-03-C-0092; DARPA ORDER Q106; Proj-DAML
Report No.(s): AD-A421528; AFRL-IF-RS-TR-2004-22; No Copyright; Avail: CASI; A09, Hardcopy

This report describes the research performed to explore the potential to enhance military urban operations, planning and execution, by providing new civil intelligence preparation-analysis and Effects Based Operations (EBO) planning capabilities to the urban warfighters and occupying civil administrations. The objective is to provide a comprehensive capability for construction of urban civil intelligence for dynamic effects-based operations analysts to coordinate administrative, information, and military security operations for greatest effects. A three-domain' urban model was developed to model human organizational behavior (cognitive domain), information paths and structures (information domain), and the physical infrastructure of the urban area of interest (physical domain). This effort was a 'seedling' effort to conduct the basic research and develop the theory. A follow-on effort by the Army will develop the static description and dynamic simulation of the three urban domains, providing visualization and explanation facilities to allow analysts and planners to explore the consequences of effects based administrative, security and information operations.
DTIC
*Knowledge Based Systems; Military Operations; Planning; Sunrise*

**20040059742** Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven, Germany
**Modelling Situation Awareness Information for Naval Decision Support Design**
Doering, Bernhard; Doerfel, Gert; Distelmaier, Helmut; Oct. 2003; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422251; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
*Decision Support Systems; Education; Graphical User Interface; Knowledge Based Systems; Operators (Personnel); Situational Awareness*

**20040059830** Army Missile Command, Redstone Arsenal, AL
**Distributed Virtual Newtonian Physics as a Modeling and Simulation Grand Challenge**
Tackett, Gregory B.; Apr. 2004; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422094; TR-RD-SS-03-22; No Copyright; Avail: CASI; A03, Hardcopy
The subject of Modeling and Simulation (M&S) Grand Challenges has been a debate topic at various M&S conferences and symposia in recent years, leading to various thoughts and processes on how best to define Grand Challenges and how best to identify those worth accepting. This report gives as background a brief discussion of some ways to think about M&S Grand Challenges in terms of vectors, and then delves into one of those vectors for more detailed consideration. It is inevitable that any discussion of M&S Grand Challenges will eventually include the serious and zealous promotion of a 'holodeck' capability; the gist of which is an immersed virtual environment made-to-order upon command, and indistinguishable from reality. This report is not that promotion. It is valuable, however, to take the ubiquitous concept of the holodeck and use it as a departure point for describing an immersive environment that does not require the suspense of any laws of physics to design and utilize, and yet is so distant from our current way of interacting that it constitutes a Grand Challenge. This is the scope of this discussion, and the concept behind distributing virtual physical interactions.
DTIC
*Computerized Simulation; Simulation*

**20040059832** National Defense Univ., Washington, DC, USA
**What Makes Industries Strategic**
Libicki, Martin C.; Jan. 1990; 94 pp.; In English
Report No.(s): AD-A422099; No Copyright; Avail: CASI; A05, Hardcopy
Partial contents: Technology Development as strategy, Technological dependence, Networks of Development, The Strategic content of Key Industries, Perspectives on Defense Policy, Perspectives on Commercial policy, National Stakes in the Globalization of Industry.
DTIC
*Industries*

**20040059836** Fraunhofer Center for Research in Computer Graphics, Inc., Providence, RI, USA
**Mobile Code Security**
Luo, Chenghui; Mar. 2004; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-2-0505; Proj-OIPG
Report No.(s): AD-A422102; AFRL-IF-RS-TR-2004-65; No Copyright; Avail: CASI; A03, Hardcopy

Mobile code is computer code that is produced on one node of a computer network but is transferred and executed on another network node. A mobile agent is a mobile software module composed of autonomous mobile code. Mobile agent software is a promising new computing paradigm for distributed computing in a large computer network environment, because of the autonomy and efficiency of mobile code. In the course of the Mobile Code Security (MCS) project supported by the U.S. Air Force Research Laboratory, a MCS Framework has been developed by Fraunhofer CRCG. The MCS Framework provides a multi-layered approach to safeguarding mobile agents, and includes technologies to support: complete obfuscation, and encrypted execution and code watermarking technologies.
DTIC
*Computer Programming; Distributed Processing; Security; Software Reliability*

**20040061981** Geological Survey, Flagstaff, AZ, USA
**Modernization of the Integrated Software for Imagers and Spectrometers**
Anderson, J. A.; Sides, S. C.; Soltesz, D. L.; Sucharski, T. L.; Becker, K. J.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The cartographic and scientific processing of planetary image data has a long history within the USGS Astrogeology Program. The software used has evolved numerous times to keep up with the steady advances made in computing technology. The following outlines the progression of the software over nearly thirty years:
Derived from text
*Image Processing; Software Engineering; Computer Programs; Geology; Mapping*

**20040061983** Geological Survey, Flagstaff, AZ, USA
**Expansion in Geographic Information Services for PIGWAD**
Hare, T. M.; Tanaka, K. L.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; 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

GIS usually refers to Geographic Information Systems, although other common applications include Geographic Information Sciences and Geographic Information Services. This year the Planetary Interactive GIS on-the-Web Analyzable Database (PIGWAD) website focused on the latter. The PIGWAD task, funded by NASA s Planetary Cartography and Geologic Mapping Working Group, has been busy supporting the planetary community in working with GIS applications and dealing with the vast amount of planetary data now available.
Derived from text
*Planetary Mapping; Data Bases; Geographic Information Systems; Information Systems*

**20040061984** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Science-based Region-of-Interest Image Compression**
Wagstaff, K. L.; Castano, R.; Dolinar, S.; Klimesh, M.; Mukai, R.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; 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 the number of currently active space missions increases, so does competition for Deep Space Network (DSN) resources. Even given unbounded DSN time, power and weight constraints onboard the spacecraft limit the maximum possible data transmission rate. These factors highlight a critical need for very effective data compression schemes. Images tend to be the most bandwidth-intensive data, so image compression methods are particularly valuable. In this paper, we describe a method for prioritizing regions in an image based on their scientific value. Using a wavelet compression method that can incorporate priority information, we ensure that the highest priority regions are transmitted with the highest fidelity.
Derived from text
*Data Compression; Image Processing; Transmission Rate (Communications); Extraterrestrial Resources*

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## COMPUTER SYSTEMS

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

**20040058946** Army Research Lab., Aberdeen Proving Ground, MD
**Flight Demonstration Results of a Two-Way Robust Acquisition of Data (2-RAD) System**
Childers, Marshal A.; Jan. 2004; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-1L162618H80
Report No.(s): AD-A421368; ARL-TR-3103; No Copyright; Avail: CASI; A03, Hardcopy

This report describes a joint effort between the U. S. Army Research Laboratory (ARL), the John Hopkins Applied Physics Laboratory (APL), and Yuma Proving Ground (YPG), which was funded by the Central Test and Evaluation Investment Program to extend the wireless local area network approach to munition testing. The objective of this two-way robust acquisition of data (2-RAD) system program was to design, produce, and demonstrate in flight an instrumented 2.75-inch diameter rocket warhead system that integrates commercial off- the-shelf network hardware to demonstrate the feasibility of wireless two-way communication on board a munition. Five instrumented warheads were produced, and two of these were flight demonstrated at Rocket Alley, YPG. The results of this experiment mark the first successful wireless two-way network communication on a munition.
DTIC
*Data Acquisition; Data Systems; Flight Tests; Local Area Networks; Wireless Communication*

**20040058982** Kansas Univ. Center for Research, Inc., Lawrence, KS
**Architecture and Prototype of an Ambient Computational Environment**
Minden, Gary J.; Evans, Joseph B.; Agah, Arvin; James, Jeremiah W.; Searl, Leon; Feb. 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0581; DARPA ORDER J960; Proj-J960
Report No.(s): AD-A421537; AFRL-IF-RS-TR-2004-29; No Copyright; Avail: CASI; A03, Hardcopy

This Final Report describes the performer's effort of the design, development and initial prototype implementation of an Ambient Computational Environment (ACE). The concept began with the idea that computation resources, in the broadest sense, are readily available in our offices, conference rooms, auditoriums, and hallways. Users co-opt, with authorization, the computational resources within their proximate area. Users access computational services that are long-lived and extremely robust.
DTIC
*Computer Networks; Interprocessor Communication; Prototypes*

**20040059019** Phillips Lab., Hanscom AFB, MA
**AFOSR Initiative Element: Lattice-Gas Automata and Lattice Boltzmann Methods as a Novel Parallel Computing Strategy**
Yepez, Jeffrey; Mar. 22, 1993; 24 pp.; In English
Report No.(s): AD-A421677; No Copyright; Avail: CASI; A03, Hardcopy

We present a simple way to add an arbitrary equation of state to a automaton gas modelled in the lattice Boltzmann limit. As a way of interpreting the lattice Boltzmann equation we present a new derivation based on an automaton Hamiltonian and the Liouville equation. A convective- gradient term added to the LBE is shown to be a sufficient route for modeling hydrodynamic flow with a general equation of state. The method generalizes to multi-speed gases in three- dimensions.
DTIC
*Automata Theory; Computational Fluid Dynamics; Parallel Processing (Computers); Quantum Theory*

**20040059038** Air Force Research Lab., Hanscom AFB, MA
**A Quantum Lattice-Gas Model for Computational Fluid Dynamics**
Yepez, Jeffrey; Aug. 11, 1999; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421713; No Copyright; Avail: CASI; A03, Hardcopy

Quantum-computing ideas are applied to the practical and ubiquitous problem of fluid dynamics simulation. Hence, this paper addresses two separate areas of physics: quantum mechanics and fluid dynamics (or specically, the computational

simulation of fluid dynamics). The quantum algorithm is called a quantum lattice gas. An analytical treatment of lattice-gas system is carried out to predict its behavior at the mesoscopic scale. At the mesoscopic scale, a lattice Boltz-mann equation with a nonlocal collision term that depends on the entire system wave function, governs the dynamical system. Numerical results obtained from an exact simulation of a one-dimensional quantum lattice-gas model are included to illustrate the formalism. A symbolic mathematical method is used to implement the quantum mechanical model on a conventional workstation. The numerical simulation indicates that classical viscous damping is not present in the one- dimensional quantum lattice-gas system.
DTIC
*Computational Fluid Dynamics; Quantum Theory*

**20040059048** Carnegie-Mellon Univ., Pittsburgh, PA
**Scalable Advanced Network Services Based on Coordinated Active Components**
Steenkiste, Peter; Seshan, Srini; Zhang, Hui; Feb. 2004; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-1-0518; DARPA ORDER-H489; Proj-H489
Report No.(s): AD-A421755; AFRL-IF-RS-TR-2004-42; No Copyright; Avail: CASI; A03, Hardcopy

The lnternet has evolved from a simple best-effort communication platform to an infrastructure that delivers a wide range of services to end users. However, deploying services that are both scalable and provide rich functionality remains a major challenge. The CMU Libra project developed a set of technologies that allows new services to be defined through composition of service components. Service components either take the form of highly scalable communication layers that are self-organizing or of higher level building blocks that offer computation or storage functionality. Active networking technology is used both to customize generic service components so they better support specific user requirement, and to deployment services instances where they are needed. A shared service infrastructure implements basic operations such as network measurements and universal connectivity. These technologies were demonstrated using a set of example services that include multicast, distributed games, video conferencing, and broadcasting.
DTIC
*Interprocessor Communication*

**20040059151** Space and Naval Warfare Systems Command, San Diego, CA
**Maintaining Communications Link for a Robot Operating in a Hazardous Environment**
Nguyen, Hoa G.; Pezeshkian, Narek; Gupta, Anoop; Farrington, Nathan; Mar. 2004; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422021; No Copyright; Avail: CASI; A02, Hardcopy

We address the problem of maintaining a robust high-bandwidth RF communication link between a mobile robot and its remote control/monitoring station. The solution we are exploring uses a number of autonomous mobile relay nodes. These slave robots convoy behind the teleoperated or autonomous lead robot and automatically stop where needed to maintain an ad hoc network that guarantees a link between the lead robot and its control station. their mobility allows for more versatility in the network. Nodes that are no longer needed in the network have the ability to navigate back to the lead robot, in order to redeploy at a later time. This further extends the lead robot's range. This paper describes the system, strategy, hardware development, software algorithms, and experiments conducted.
DTIC
*Communication Networks; Data Links; Hazardous Materials; Radio Relay Systems; Robots*

**20040059178** Space and Naval Warfare Systems Center, San Diego, CA
**Using Video Sensor Networks to Command and Control Unmanned Ground Vehicles**
Kogut, Greg; Blackburn, Mike; Everett, H. R.; Dec. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422062; No Copyright; Avail: CASI; A03, Hardcopy

Most unmanned ground vehicles (UGVs) used in defense and physical security applications have a limited onboard sensor range, and are only 'aware' of their immediate surroundings. This limited range hinders the ability of UGVs to detect or respond to remote events, and limits their cost- effectiveness in securing large areas. The Distributed Interactive Video Array (DIVA) system is a network of wireless, man-portable vision sensors under development at Spawar Systems Center (SSC) San Diego. DIVA provides two pflmary capabilities: 1) the detection, tracking, and classification of moving targets in a variety of

tactical environments, and 2) the autonomous coordination of a UGV response to detected events.
DTIC
*Command and Control; Navigation; Remotely Piloted Vehicles; Unmanned Ground Vehicles*

**20040059202** Bolt, Beranek, and Newman, Inc., Cambridge, MA
**Transitioning Secure Border Gateway Protocol (S- BGP) Into the Internet**
Kent, Stephen T.; Lynn, Charles W.; Seo, Karen S.; Mar. 2004; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0212; DARPA ORDER-K496; Proj-K496
Report No.(s): AD-A422110; AFRL-IF-RS-TR-2004-63; No Copyright; Avail: CASI; A03, Hardcopy

Internet routing is based on a distributed system composed of many routers grouped into management domains called Autonomous Systems (ASes). Routing information is exchanged between ASes in Border Gateway Protocol (BGP) UPDATE messages. BGP is a critical component of the Internet's routing infrastructure. However, it is highly vulnerable to a variety of attacks due to the lack of a scalable means of verifying the authenticity and authorization of BGP control traffic. Secure BGP (S-BGP) addresses these vulnerabilities. The S-BGP architecture employs three security mechanisms. First, a Public Key Infrastructure (PKl) is used to support the authentication of ownership of P address blocks, ownership of Autonomous System (AS) numbers, and a BGP router's identity and its authorization to represent as AS. Second, a new, optional, GBP transitive path attribute is employed to carry digital signatures ('route attestations') covering the routing information in a BGP UPDATE. Third, IPsec is used to provide data and partial sequence integrity, and to enable BGP routers to authenticate each other for exchanges of BGP control traffic.
DTIC
*Internets; Protocol (Computers)*

**20040059203** Space and Naval Warfare Systems Center, San Diego, CA
**Composeable FORCEnet: Composeable Command and Control for Superior Decision Making**
Reilley, Mike; Grossman, Jeff; Clarkson, Jeff; Galdorisi, George; Priebe, Christopher; Mar. 2004; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422117; No Copyright; Avail: CASI; A03, Hardcopy

This paper examines one of the most critical aspects of networking the elements of Sea Power 21: how do warfighters operating in a FORCEnet-enabled environment compose the C4ISR elements at their disposal to ensure superior decision-making and enable the Joint Force Commander to achieve the Joint Vision 2020 goal of Full Spectrum Dominance? The key word in this construct is composeable, and the authors' thesis is that commanders must have the ability to compose a command and control architecture that meets their warfighting requirements from a broad array of multi-tiered networked platforms and sensors, dynamic bandwidth capabilities, and tailorable visualizations. In the naval context, this requires that FORCEnet is engineered from the keel up, not as a set-piece bundle of fixed systems, but as a fungible toolbox of capabilities that the commander selects based on the operational mission he/she must accomplish. Composeable FORCEnet provides the framework to achieve a faster speed to capability and it enables warfighters to make the superior decisions necessary to win in battle. (10 figures, 12 refs.)
DTIC
*Command and Control; Decision Making; Decision Support Systems; Multisensor Fusion; Navy; Warfare; Wide Area Networks*

**20040059224** Naval Postgraduate School, Monterey, CA
**Full-Duplex Underwater Networking Using CDMA**
Bektas, Kurtulus; Mar. 2004; 173 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422154; No Copyright; Avail: CASI; A08, Hardcopy

Establishing a full-duplex underwater network, researching and applying a CDMA protocol to the network, providing a recommendation for a full-duplex underwater network and providing recommendations for using CDMA to increase the efficiency of this network are the general scope of this thesis.. A connection that allows traffic in both directions simultaneously underwater is the example of full- duplex communication. Compared to a half duplex configuration, the full duplex network underwater may provide a better networking environment. Currently, most Underwater Acoustic Networks (L)ANs) still utilize half duplex network communication. CDMA is the third kind of channel partitioning protocol. Most of the wireless communication devices utilize different kinds of CDMA protocol as a reliable and faster communication. The research conduct

in establishing a full- duplex LAN using CDMA may provide reliable and faster communication compared to half duplex.
DTIC
*Code Division Multiple Access; Communication Networks; Duplexers; Underwater Acoustics*

**20040059245** California Univ., Berkeley, CA
**Sensor Webs of SmartDust: Distributed Signal Processing/Data Fusion/ Inferencing in Large Microsensor Arrays**
Ramchandran, Kannan; Pister, Kristofer; Mar. 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0538; DARPA ORDER-K253; Proj-K253
Report No.(s): AD-A422190; AFRL-IF-RS-TR-2004-64; No Copyright; Avail: CASI; A03, Hardcopy

The research has, to a large measure, addressed many of the theoretical foundations and algorithmic advances necessary to exploit the capabilities of Sensor Webs. Leveraging the SmartDust infrastructure, this project has been instrumental in developing a framework for real-time distributed/decentralized information processing.
DTIC
*Distributed Processing; Microinstrumentation; Multisensor Fusion; Sensors; Signal Processing; Webs*

**20040059254** Naval Postgraduate School, Monterey, CA
**Monitoring the Progress of the Navy Marine Corps Intranet (NMCI): implementation, Performance and Impact**
Dalaklis, Dimitrios; Mar. 2004; 208 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422210; No Copyright; Avail: CASI; A10, Hardcopy

Information Superiority Information Superiority is the driver for the creation of the Global Information Grid (GIG) as the mean to provide connectivity between all parts of shore establishments, and with all deployed forces at sea and ashore, The Navy Marine Corps Intranet (NMCI) is an information technology (IT) services contract to provide to provide secure universal access to integi-ated voice, video and data communications; eliminate interoperability problems and remove network impediments to improve productivity and speed of command to the shore-based components of the Navy and Marine Corps. The NMCI contract is the procurement of IT services based on a commercial model of Service Level Agreements (SLAs). Under this model, the emphasis is placed on the verification, validation, and monitoring of the end-user services and not on the underlying infrastructure of systems. The research explores the current implementing effort of NMCI and analyzes the way this common network capability is tested and monitored. This thesis will provide a single source of information for managers seeking to quickly understand the impact of NMCI as an enterprise level asset. Security policies related to the project are examined and recommendations to improve this new IT initiative are made.
DTIC
*Computer Networks; Navy*

**20040059268** Naval Postgraduate School, Monterey, CA
**The Feasibility Study of Implementing a Fiber Optic Local Area Network in Software Metrics Laboratory in Ingersoll 158**
Be, Chai C.; Mar. 2004; 67 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422232; No Copyright; Avail: CASI; A04, Hardcopy

Optical fiber bas been the preferred cabling technology for certain building and campus network LAN backbones. Until recently however the use of fiber as a cabling medium to the desktop has been confined to special environments that require the unique properties of optical fiber such as noise immunity security distance high bandwidth demands (CAD/CAM video conferencing) and immunity to electrical interference. However choosing to use optical fiber in a network over other cabling options may present significant advantages in its inherent ability to handle data at higher speeds Decrease costs of optical fiber components compared to the increase electronic costs of carrying Gigabit Ethernet over Cat 5 or Cat SE UTP copper cabling has also accelerated the migration to optical fiber LAN. The thesis conducts a feasibility study of implementing a Fiber Optic Local Area Network in Software Metrics Laboratory in Ingersoll 158.
DTIC
*Computer Systems Programs; Feasibility; Fiber Optics; Local Area Networks; Software Engineering; Transmission Lines*

**20040059272** Naval Postgraduate School, Monterey, CA
**High Speed Network Access to the Last-Mile Using Fixed Broadband Wireless**
Fougias, Nikolaos; Mar. 2004; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422238; No Copyright; Avail: CASI; A06, Hardcopy

Despite the increase in the demand for high speed Internet services, the last-mile solutions currently available neither are inexpensive enough to attract the majority of the population, nor are they available in low density populated areas, This thesis examines Fixed Broadband Wireless (FBW) as an alternative technology to the current last-mile solutions, The analysis shows that LMDS and MMDS are the most promising emerging FBW technologies and that they are able, by utilizing microwave radio as their fundamental transport medium and using high modulation schemes, to provide digital two-way voice, data, video and Internet services.
DTIC
*Broadband; Communication Networks; Computer Networks; High Speed; Internets; Wireless Communication*

**20040059274** Naval Postgraduate School, Monterey, CA
**Prototype System for Detecting and Processing of IEEE 802.11a Signals**
Goh, Che S.; Mar. 2004; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422240; No Copyright; Avail: CASI; A05, Hardcopy

As the need to send larger amounts of information increases, the military is looking into viable solutions to push this information throughout the battle space. IEEE 802. 1la wireless LAN network presents an attractive high-speed solution by providing data rates up to 54 Mbps. At the same time, wireless LAN introduces increased security risk due to its vulnerability to exploitation of the wireless LAN physical layer. This research will develop a prototype system using low cost hardware and software solution to detect and process wireless IEEE 802.1la signals. Using the prototype, performance data will be collected to determine whether IEEE 802.1 la is a feasible option as a high-speed information network for military use. Additionally, the performance data collected will provide a good basis for predicting the expected performance in an operational scenario and provide valuable information for proper deployment planning.
DTIC
*Computer Networks; Detection; Local Area Networks; Prototypes; Signal Processing; Wireless Communication*

**20040059319** Naval Postgraduate School, Monterey, CA
**Adaptive Management of Emerging Battlefield Network**
Fountoukidis, Dimitrios P.; Mar. 2004; 114 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422313; No Copyright; Avail: CASI; A06, Hardcopy

The management of the battlefield network takes place in a Network Operations Center (NOC). The manager based on the importance of the managed network, is sometimes required to be present all the time within the physical installations of the NOC. The decisions regard a wide spectrum of network configurations, fault detection and repair, and network performance improvement. Especially in the case of the battlefield network operations these decisions are sometimes so important that can be characterized as critical to the success of the whole military operation. Most of the times, the response time is so restricted that exceeds the mean physical human response limits. An automated response that also carries the characteristics of human intelligence is needed to overcome the restrictions the human nature of an administrator imposes. The research will establish the proper computer network management architecture for an adaptive network. This architecture will enhance the capabilities of network management and in terms of cost and efficiency.
DTIC
*Computer Networks; Military Operations*

**20040059334** Naval Postgraduate School, Monterey, CA
**Session Hijacking Attacks in Wireless Local Area Networks**
Onder, Hulusi; Mar. 2004; 151 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422361; No Copyright; Avail: CASI; A08, Hardcopy

Wireless Local Area Network (WLAN) technologies are becoming widely used since they provide more flexibility and availability, Unfortunately, it is possible for WLANs to be implemented with security flaws which are not addressed in the original 802.11 specification, IEEE formed a working group (TGi) to provide a complete solution (code named 802.11i standard) to all the security problems of the WLANs, The group proposed using 802.1X as an interim solution to the deficiencies in WLAN authentication and key management, The full 802. 11i standard is expected to be finalized by the end of 2004, Although 802.1X provides a better authentication scheme than the original 802.11 security solution, it is still vulnerable to denial-of-service, session hijacking, and man-in- the-middle attacks, Using an open-source 802.lx test-bed, this thesis evaluates various session hijacking mechanisms through experimentation, The main conclusion is that the risk of session hijacking attack is significantly reduced with the new security standard (802.11i); however, the new standard will not resolve

all of the problems, An attempt to launch a session hijacking attack against the new security standard will not succeed, although it will result in a denial-of- service attack against the user,
DTIC
*Air Piracy; Local Area Networks; Wireless Communication*

**20040059728**
**Visualizing Risks: Icons for Information Attack Scenarios**
Hosmer, Hilary H.; Oct. 2000; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421372; No Copyright; Avail: CASI; A03, Hardcopy

This paper proposes icons and visual conventions for rapid comprehension and presentation of information security (INFOSEC) attack scenario information: Malicious Intruder, Buffer Overflow, Data Scavenging, QuickTime and a Photo -JPEG decompressor are needed to see this picture. Theft Poorly Installed Software Attack scenarios describe diverse ways to compromise the security of computer systems and networks. Visual attack scenarios help defenders see system ambiguities, imprecision, vulnerabilities and omissions, thus speeding up risk analysis, requirements gathering, safeguard selection, cryptographic protocol analysis, and INFOSEC training. The Naval Research Laboratory sponsored this work, a subset of a larger working paper Visual Conventions for Information Attack Scenarios, 1 to develop conventions for visualizing INFOSEC scenarios.
DTIC
*Security; Visual Aids*

**20040059736** Army Research Lab., Aberdeen Proving Ground, MD, USA
**Gateway Portal**
Pierce, Marlon; Wilkerson, Stephen; Mar. 2004; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-JONO3UH7CC
Report No.(s): AD-A421516; ARL-TR-3154; No Copyright; Avail: CASI; A03, Hardcopy

One problem facing researchers needing high-speed computations for their research is easy access to High Performance Computing (HPC) resources. At one time, a majority of the users in the research community had two machines: one Unix workstation for research and another personal computer (PC) type machine for word processing, e-mail, and creating publications and presentations. As the speed and popularity of PCs have grown, their roll has also changed to include pre and post-processing of complex jobs as well as their other functions. Moreover, these machines have started replacing the more expensive Unix-based workstations for graphics and other multimedia functions. While PC machines can be made to emulate a Unix X-Windows environment this requires users to understand both operating systems and have X-software loaded on PC client. In some cases, unfortunately, users are becoming more PC literate and less Unix knowledgeable. Not knowing the correct commands has led to difficulties in transferring files writing job scripts and the like for HPC access. One solution is to make the access to HPC assets available through a web interface. A web server can establish a connection between the user's PC and HPC assets, allowing file transfers and job submission. This interface eliminates the need for the user to understand how to write GRD scripts and the problems associated with setting up HPC computer runs, while allowing the scientist to concentrate on the application of the computation for his or her research. However, there are security concerns associated with Web access to HPC. This report addresses the implementation of a Web solution using Java, Java Beans, and Java Server Pages (JSP) on an Apache web server running Tomcat. Examples from the Gateway interface are used as evidence of this technology as a solution to a growing problem.
DTIC
*Protocol (Computers); Wide Area Networks*

**20040059760** Alphatech, Inc., USA
**Real-Time Evaluation of Cyber-Course of Action (COA) Impact on Performance & Effectiveness**
Shaw, John J.; Mar. 2004; 49 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-C-0169; DARPA ORDER-J353; Proj-CPAN
Report No.(s): AD-A422197; AFRL-IF-RS-TR-2004-75; No Copyright; Avail: CASI; A03, Hardcopy

A fundamental challenge for modern Battle Management/Command, Control, and Communications (BMC3) systems is to withstand attacks against their constituent computer and communication subsystems. However, measures to safeguard or respond to a cyber attack against a BMC3 system, invariably disrupt the processing flow within that system. Thus disruptions may ultimately affect mission effectiveness, and a prudent strategy is to predict those impacts before committing to a specific

response or safeguard. The objective of this work is to develop reliable methods for generating cyber Courses of Action (cyber-COAs) in near-real time.
DTIC
*Computer Networks; Real Time Operation*

**20040059831** CACI Technologies, Inc., Chantilly, VA, USA
**Portable Data Wall Transition To Production**
Nolander, John D.; McCoy, Annette L.; Choate, Timothy J.; Mar. 2004; 69 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-D-0221; Proj-459S
Report No.(s): AD-A422096; AFRL-IF-RS-TR-2004-50; No Copyright; Avail: CASI; A04, Hardcopy

This report details the contractor's ability to develop an interactive data wall (IDW) product line that would effectively transition IDW technology, developed in-house at Air Force Research Laboratories (AFRL) - Rome Research Site (RRS), from its current prototype status to a full-up production capability, making it commercially available to potential customers, both military and commercial. The scope of this effort was to demonstrate the contractor's capabilities to reproduce the portable, interactive data wall (PIDW) and its associated technologies. The completion of this objective would result in the delivery of a fully constructed and tested PIDW to AFRL/RRS as well as much needed PIDW documentation including: 1) a set of Assembly and Production Plans detailing the PIDW components, frame production, unit assembly, features, shipping specifications, schedule, and representative vendors and sources; and 2) a User's Manual which would provide instructions for frame assembly and equipment installation, raising and lowering the PIDW screen, projector maintenance and adjustment, and disassembly of the PIDW.
DTIC
*Display Devices; Man Machine Systems; Walls*

## 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*.

**20040058101** Northeastern Univ., Boston, MA, USA
**Team Oriented Robotic Exploration Task on Scorpion and K9 Platforms**
Kirchner, Frank; December 2003; 13 pp.; In English
Contract(s)/Grant(s): NCC2-1336; No Copyright; Avail: CASI; A03, Hardcopy

This final report describes the achievements that have been made in the project over the complete period of performance. The technical progress highlights the different areas of work in terms of Progress in Mechatronics, Sensor integration, Software Development. User Interfaces, Behavior Development and Experimental Results and System Testing. The different areas are: Mechatronics, Sensor integration, Software development, Experimental results and Basic System Testing, Behaviors Development and Advanced System Testing, User Interface and Wireless Communication.
Author
*Robotics; Walking Machines; Robot Sensors; Robot Control*

**20040058107** Institute for Scientific Research, Fairmont, WV, USA
**The Intelligent Flight Control Program (IFCS)**
April 2004; 2 pp.; In English
Contract(s)/Grant(s): NCC4-00130; No Copyright; Avail: CASI; A01, Hardcopy

This is the closeout report for the Research Cooperative Agreement NCC4-00130 of accomplishments for the Intelligent Flight Control System (IFCS) Project. It has been a pleasure working with NASA and NASA partners as we strive to meet the goals of this research initiative. ISR was engaged in this Research Cooperative Agreement beginning 01 January 2003 and ending 31 January 2004. During this time ISR conducted efforts towards development of the ARTS II Computer Software Configuration Item (CSCI) version 4.0 by performing or developing the following: 1) Requirements Definition; 2) Software Design and Development; 3) Hardware In the Loop Simulation; 4) Unit Level testing; 5) Documentation.
Author
*Artificial Intelligence; Flight Control; Computer Programs*

**20040059092** Naval Research Lab., Stennis Space Center, MS
**Multi-Robot Position Tracking**
Roe, Marvin; Bourgeois, Brian; McDowell, Patrick; Dec. 11, 2003; 6 pp.; In English
Report No.(s): AD-A421870; NRL/PP/7440-03-1032; No Copyright; Avail: CASI; A02, Hardcopy

Accurate navigation is just one of the many challenges for successfully coordinating multiple robot interaction. It is especially important when trying to quantify the success of new techniques being developed to achieve coordinated formation maneuvering. This paper presents the experimental procedures followed while determining robot navigation error along with an evaluation of the resultant measurements. An inexpensive, easily configurable, camera system is presented that shows the potential to provide accurate position information. Along with a description of the system configuration, test procedures and test data are presented and evaluated. Finally, a comparison of the robot navigation error to that of the proposed camera system is presented.
DTIC
*Robots*

**20040059153** Space and Naval Warfare Systems Center, San Diego, CA
**A Supervised Autonomous Security Response Robot**
Ciccimaro, Donny A.; Everett, H. R.; Bruch, Michael H.; Phillips, Clifton B.; Apr. 1999; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422024; No Copyright; Avail: CASI; A03, Hardcopy

Autonomous mobile robots typically require a preconceived and very detailed navigational model (map) of their intended operating environment, but most law enforcement and urban warfare response scenarios preclude the availability of such a priori information. ROBART III is an advanced demonstration platform for non-lethal robotic response measures, incorporating a supervised autonomous navigation system specifically configured to support minimally attended operation in previously unexplored interior structures. A 'human-centered mapping' strategy has been developed to ensure valid first-time interpretation of navigational landmarks as the robot builds its world model. The accuracy of the robot's real-time position estimation (and hence the model itself) is significantly enhanced by an innovative algorithm which exploits a heuristic that assumes the majority of man-made structures are characterized by parallel and orthogonal walls. Intruder detection and assessment capabilities are supported by intelligent fusion of data collected by a multitude of various sensors. Initial detection is by a 360-degree array of eight passive-infrared motion detectors responding to the thermal energy gradient created by a moving human target, with partial validation from a Doppler microwave motion detector. The robot's head-mounted sensors (and non-lethal weapon system) are then panned to the center of any perceived disturbance for further assessment. Automatic tracking of any confirmed movement is accomplished through conventional image processing using a black-and-white video surveillance camera equipped with a near-infrared illuminator for low-light conditions.
DTIC
*Autonomy; Robots; Security*

**20040059157** Space and Naval Warfare Systems Center, San Diego, CA
**Challenges for Deployment Man-Portable Robots into Hostile Environments**
Bruch, M. H.; Laird, R. T.; Everett, H. R.; Nov. 2000; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422028; No Copyright; Avail: CASI; A03, Hardcopy

The Man Portable Robotic System (MPRS) project objective was to build and deliver hardened robotic systems to the U.S. Army's 10th Mountain Division in Fort Drum, New York. The systems, specifically designed for tunnel and sewer reconnaissance, were equipped with visual and audio sensors that allowed the Army engineers to detect trip wires and booby traps before personnel entered a potentially hostile environment. The greatest challenges for the project stemmed from the users three main requirements: 1) man-portable (lightweight and small), 2) waterproof (not just water- resistant), and 3) soldier proof (high rugged and reliable). The MPRS systems were, of course plagued by the usual problems in robotics: limited battery power (run-time) and limited communications range. At the Army's request, the systems incorporated no autonomous functionality; however, MPRS did integrate several state-of-the-art components, including a fully digital video system. This paper discusses specific challenges encountered and lessons learned by the MPRS team during recent tunnel and sewer reconnaissance testing at three sites in 2000; Fort Drum (New York), Fort Leonard Wood (Missouri), and Fort Pol (louisiana).
DTIC
*Deployment; Robotics; Robots*

**20040059160** Space and Naval Warfare Systems Command, San Diego, CA
**Autonomous Communication Relays for Tactical Robots**
Nguyen, Hoa G.; Pezeshkian, N.; Raymond, M.; Gupta, A.; Spector, J. M.; Jul. 2003; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422031; No Copyright; Avail: CASI; A02, Hardcopy

One of the weaknesses of current mobile robots operating in real-world scenarios is the communication link to the operator's console. Hard cables reduce mobility and often become entangled and broken, rendering the robot inoperable. User surveys have identified radio-frequency (RF) communications as more desirable. However, most RF communication systems currently employed on teleoperated robots in the field are analog which often experience signal interference, multipath, and attenuation. Spread spectrum digital systems are more immune to these problems and provide a level of transmission security, but operate at shorter ranges and mostly on line-of-sight (LOS).
DTIC
*Autonomy; Communication Networks; Robots*

**20040059167** Space and Naval Warfare Systems Center, San Diego, CA
**Autonomous Mobile Communication Relays**
Nguyen, Hoa G.; Everett, H. R.; Manouk, Narek; Verma, Ambrish; Apr. 2002; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422044; No Copyright; Avail: CASI; A02, Hardcopy

Maintaining a solid radio communication link between a mobile robot entering a building and an external base station is a well-recognized problem. Modern digital radios, while affording high bandwidth and Internet-protocol- based automatic routing capabilities, tend to operate on line- of-sight links. The communication link degrades quickly as a robot penetrates deeper into the interior of a building. This project investigates the use of mobile autonomous communication relay nodes to extend the effective range of a mobile robot exploding a complex interior environment. Each relay node is a small mobile slave robot equipped with sonar, ladar, and 802.IIb radio repeater. For demonstration purposes, four Pioneer 2-Dx robots are used as autonomous mobile relays, with SSC-San Diego's ROBART III acting as the lead robot. The relay robots follow the lead robot into a building and are automatically deployed at various locations to maintain a networked communication link back to the remote operator. With their on-board external sensors, they also act as rearguards to secure areas already explored by the lead robot. As the lead robot advances and RF shortcuts are detected, relay nodes that become unnecessary will be reclaimed and reused, all transparent to the operator. This project takes advantage of recent research results from several DARPA-funded tasks at various institutions in the areas of robotic simulation, wireless ad hoc networking, route planning, and navigation. This paper describes the progress of the first six months of the project.
DTIC
*Autonomy; Radio Relay Systems; Robots; Telecommunication*

**20040059170** Space and Naval Warfare Systems Center, San Diego, CA
**Mobile Robots for Outdoor Security Applications**
Pastore, Tracy H.; Everett, H. R.; Bonner, Kevin; Apr. 1999; 17 pp.; In English
Report No.(s): AD-A422047; No Copyright; Avail: CASI; A03, Hardcopy

A comprehensive robotic security solution for outdoor storage facilities is provided by the Mobile Detection Assessment and Response System-Exterior (MDARS-E). The system consists of multiple supervised autonomous platforms equipped with intruder detection, barrier assessment, and inventory assessment subsystems commanded from an integrated control station. The exterior platforms is only one component of the overall MDARS system, which supports a variety of remote resources including interior platforms and fixed-place security sensor suites. All such resources are controlled by the Multiple Resource Host Architecture (MRHA), with minimal human (i.e., security personnel) supervision required.
DTIC
*Autonomous Navigation; Personnel; Robotics; Robots; Security*

**20040059182** Space and Naval Warfare Systems Center, San Diego, CA
**MPRS (URBOT) Commercialization**
Ciccimaro, Donny; Baker, William; Hamilton, Ian; Heikkila, Leif; Renick, Joel; Apr. 2003; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422066; No Copyright; Avail: CASI; A03, Hardcopy

The Man Portable Robotic System (MPRS) project objective was to build and deliver hardened robotic systems to the U.S. Army's 10 Mountain Division in Fort Drum, New York. The system, specifically designed for tunnel and sewer reconnaissance, was equipped with visual and audio sensors that allowed the Army engineers to detect trip wires and booby traps before personnel entered a potentially hostile environment. The MPRS system has shown to be useful in government and military supported field exercises, but the system bas yet to reach the hands of civilian users. Potential users in Law Enforcement and Border Patrol have shown a strong interest in the system, but robotic costs were thought to be prohibitive for law enforcement budgets. Through the Center for Commercialization of Advanced Technology (CCAT) program, an attempt will be made to commercialize the MPRS. This included a detailed market analysis performed to verify the market viability of the technologies. hence, the first step in this phase is to fully define the marketability of proposed technologies in terms of actual market size, pricing and cost factors, competitive risks and/or advantages, and other key factors used to develop marketing and business plans.
DTIC
*Cameras; Commercialization; Reconnaissance; Robotics*

**20040059184** Space and Naval Warfare Systems Command, San Diego, CA
**Issues in Vehicle Teleoperation for Tunnel and Sewer Reconnaissance**
Laird, R. T.; Bruch, M. H.; West, M. B.; Ciccimaro, D.A.; Everett, H. R.; Apr. 2000; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422071; No Copyright; Avail: CASI; A02, Hardcopy

With the introduction of the Man Portable Robotic System (MPRS), things are about the change for the next generation of military engineers (tunnel rates) tasked with tunnel and sewer reconnaissance. No longer will there be a need for soldiers to descent below the surface into a hostile environment, blindly crawling through rubble and mud while probing ahead for explosives with a bayonet. This paper represents a comprehensive overview of the MRPS and its associated Operator Control Unit teleoperation interface, with an emphases on lessons learns during preliminary and interim testing.
DTIC
*Reconnaissance; Robotics; Sewers; Teleoperators*

**20040059187** Space and Naval Warfare Systems Center, San Diego, CA
**Robotic Security Systems**
Everett, H. R.; Dec. 2003; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422075; No Copyright; Avail: CASI; A02, Hardcopy

Fixed and mobile sensors can be used in the early detection and assessment technology that is crucial for homeland security.
DTIC
*Robotics; Robots; Security; Warning Systems*

**20040059205** Naval Sea Systems Command, Washington, DC
**Operational Impacts of the Aegis Cruiser Smartship System**
Fullerton, Jeff; Scotchlas, Marc; Smith, Thad; Freedner, Adam S.; Mar. 2004; 12 pp.; In English
Report No.(s): AD-A422119; No Copyright; Avail: CASI; A03, Hardcopy

The Chief of Naval Operations guidance over the past few years has challenged the fleet with finding ways to increase efficiencies while maintaining overall readiness as a highly effective force. In addition, today's ships must be continuously ready and surge capable in accordance with the Fleet Response Plan. One way to meet these goals is to leverage technologies that will optimize ship manning and streamline shipboard training. The Smartship installation in the USS Antietam (CG 54), when used in synergy with a flexible manning concept (Core Flex), the conversion of steam systems to all-electric, and the development of web-based administrative tools enables the ship to meet and exceed these challenges. Antietam uses the enabling tools of virtual training devices and simulators in conjunction with IT-21 installation and Core Flex to reduce underway watchstanding requirements and increase ship readiness, personnel qualifications, and training depth throughout the ship. These combined efforts reduce required unit level training time, increase situational awareness, and dramatically decrease the administrative burden on personnel. Innovative ideas for leveraging technology to increase control and monitoring capability, and adapting training organizations around new functionality allows for increased readiness and war fighting power. Employment of this technology is key. Unit level training time and required manning are decreased through automation. Situational awareness is increased through web enablement and a better common operating picture. This leads to a higher level

of unit effectiveness and readiness while directly supporting Strike Group needs and Fleet Commander ideology, and clearly setting the foundation for future innovations.
DTIC
*Education; Manpower*

**20040059212** Space and Naval Warfare Systems Center, San Diego, CA
**Multiple Resource Host Architecture (MRHA) for the Mobile Detection Assessment Response System (MDARS) Revision A**
Everett, H. R.; Laird, R. T.; Carroll, D. M.; Gilbreath, G. A.; Heath-Pastore, T. A.; Sep. 2000; 110 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422131; SSC/SD-TD-3026; No Copyright; Avail: CASI; A06, Hardcopy

The Mobile Detection Assessment and Response System (MDARS) program employs multiple robotic security platforms operating under the high level control of a remote host, with the direct supervision of a human operator. This document describes the major components of a distributed host architecture geared towards a single guard controlling up to thirty-two robots, and explores some of the key issues that were considered in the development phase. The objective is to field a supervised robotic security system that basically runs itself until an exceptional condition is encountered, which requires human intervention.
DTIC
*Detection; Robotics*

**20040059226** Northwestern Univ., Evanston, IL
**Lightweight Cryptographic Techniques**
Yuen, Horace P.; Sarrafzadeh, Majjid; Chan, Agnes; Katsagelos, Aggelos; Mar. 2004; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0536; Proj-K251
Report No.(s): AD-A422156; AFRL-IF-RS-TR-2004-68; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this project was to develop new cryptographic techniques, and to modify the important existing ones, for applications to encryption and authentication in energy-constrained sensors with limited memory and computational capability. The goal was to minimize power consumption in order to maximize the lifetime of the sensor operation and the amount of useful processing that can be carried out within the lifetime. For handling low power stream cipher on small handheld devices, Software Based Stream Ciphers were implemented and compared with other software based encryption algorithms. A new spread signal cryptographic technique has been developed that promises significant additional security with no new bandwidth or power overhead. New design methodologies have been developed for power conscious systems with power/ security tradeoffs. The impact of imaging sensors on benchmark and operational scenarios related to target tracking in a wireless sensor network has been investigated in an added task. Leveraging on the state-of- the-art in image-based tracking, new algorithms and novel methods have been discovered that enhance the capability of existing imaging technologies.
DTIC
*Cryptography*

**20040059231** Space and Naval Warfare Systems Center, San Diego, CA
**Extending Mobile Security Robots to Force Protection Missions**
Carroll, Daniel; Everett, H. R.; Gilbreath, Gary; Mullens, Katherine; Jul. 2002; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422161; No Copyright; Avail: CASI; A03, Hardcopy

The Mobile Detection Assessment Response System (MDARS) is a joint Army-Navy development effort to field mobile robots at Department of Defense (DoD) sites for physical security and automated inventory missions MDARS was initiated in 1989 to improve the effectiveness of a shrinking guard force, but was quickly expanded to address the intensive manpower requirements associated with accounting for high- dollar and critical DoD assets, Two types of autonomous platforms patrol inside warehouses (Interior) and outside of storage facilities (Exterior), carrying payloads for intruder detection, inventory assessment, and barrier assessment. The MDARS console for command and control is based upon the Multiple Resource Host Architecture (MRHA), which allows a single human guard to oversee and monitor up to 255 platforms and/or unmanned sensors, Recent improvements to satisfy mission requirements for physical security have expanded the system capabilities to

enable force-protection missions in tactical situations, Rapid-prototyping approaches have facilitated investigations into aiming and firing less-than- lethal weapons on an unmanned platform, deployment of a marsupial capability to carry smaller robots, and seamless all- digital communication between unmanned sensors and unmanned ground and air vehicles, This paper provides an overview of the MDARS evolutionary development approach (using mobile robots and fixed sensors) for both physical security and force protection missions Special treatment is provided on feedback from developmental tests at Aberdeen Proving Grounds, MD, and operational tests at Defense Distribution Depot Susquehanna PA,
DTIC
*Protection; Robots; Security*

**20040059278** Universitaet der Bundeswehr Muenchen, Neubiberg
**Cognitive Cooperation for the Sake of the Human- Machine Team Effectiveness**
Onken, R.; Oct. 2003; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422247; No Copyright; Avail: CASI; A03, Hardcopy

Man-machine cognitive cooperation has become a reality. There are many prototype systems that have demonstrated the capabilities of cognitive cooperation. These systems have artificial cognitive capabilities, thereby allowing teaming with human operators as well as with other artificial cognitive systems. They can actively assist the operator in improving situational awareness and knowing effective actions with respect to the situational context. The most salient feature of these systems is that they have much knowledge in common with the human operator. This enables them to carry out the work tasks on their own, if necessary. Most important, they have explicit knowledge of the prime work system objectives and can cooperate to catch up with the intentions of the team mate, and to interact sensibly as a team mate. Since prototype systems have demonstrated that cognitive cooperation is technically feasible, the following chapters will not dwell on the technical details of artificial cognitive systems. The focus will be on the underlying fundamental ideas about artificial cognitive systems and intrinsic potentials for cognitive cooperation. Hence, this keynote will dwell on the main properties of artificial cognitive systems and how these properties can be used to improve work system capabilities and make work processes more productive and more efficient. It will point out that automation in the new setting of cognitive automation will bring about human-machine cognitive cooperation that is similar to human-human cognitive cooperation, and that it can be exploited for more effective coordination between team- mates, humans as well as machines. (10 figures, 24 refs.)
DTIC
*Artificial Intelligence; Cognition; Man Machine Systems; Operators (Personnel)*

**20040059280** QinetiQ Ltd., Farnborough
**Capability, Cognition and Autonomy**
Taylor, Robert M.; Oct. 2003; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422249; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
*Artificial Intelligence; Autonomy; Cognition; Decision Making; Human Factors Engineering; Man Machine Systems; Operators (Personnel)*

**20040059299** Defence Research and Development Suffield, Suffield, Alberta
**Humans Teaching Learning Machines: Apprentice Systems and Shared Control of Military Vehicles**
Digney, Bruce L.; Oct. 2003; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422263; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
*Artificial Intelligence; Education; Man Machine Systems; Remote Control*

**20040059310** Space and Naval Warfare Systems Center, San Diego, CA
**An Advanced Telereflexive Tactical Response Robot**
Everett, H. R.; Gilbreath, G. A.; Ciccimaro, D. A.; Jan. 2001; 10 pp.; In English
Report No.(s): AD-A422285; No Copyright; Avail: CASI; A02, Hardcopy

ROBART III is intended as an advanced demonstration platform for non-lethal tactical response, extending the concepts of reflexive teleoperation into the realm of coordinated weapons control (i.e., sensor-aided control of mobility, camera, and weapon functions) in law enforcement and urban warfare scenarios. A rich mix of ultrasonic and optical proximity and range sensors facilitates remote operation in unstructured and unexplored buildings with minimal operator oversight. Supervised

autonomous navigation and mapping of interior spaces is significantly enhanced by an innovative algorithm which exploits the fact that the majority of man-made structures are characterized by (but not limited to) parallel and orthogonal walls. This paper presents a brief overview of the advanced telereflexiveman-machine interlace and its associated human-centered mapping‘ strategy.
DTIC
*Remote Control; Robots*

**20040059318** Naval Undersea Warfare Center, Newport, RI
**Uncertainty and Automation**
Kirschenbaum, Susan S.; Oct. 2003; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422305; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
*Decision Support Systems; Man Machine Systems; Military Technology*

**20040059628** Defence Research and Development Canada, Valcartier, Quebec, Canada
**The Cognitive Costs and Benefits of Automation**
Breton, Richard; Bosse, Eloi; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422303; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
*Cognition; Command and Control; Costs; Decision Support Systems; Human Performance; Man Machine Systems*

**20040059743** Defence Research and Development Canada, Valcartier, Quebec, Canada
**A Pragmatic Cognitive System Engineering Approach to Model Dynamic Human Decision-Making Activities in Intelligent and Automated Systems**
Paradis, Stephane; Breton, Richard; Bosse, Eloi; Elm, William C.; Potter, Scott S.; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422253; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
*Automatic Control; Command and Control; Decision Making; Decision Support Systems; Man Machine Systems; Systems Engineering*

**20040059744** University of Southern California, Arlington, VA, USA
**HORMCOMM: Hormone-Inspired Cooperative Communication**
Shen, Wei-Min; Dec. 14, 2003; 31 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0441
Report No.(s): AD-A422130; AFRL-SR-AR-TR-04-0197; No Copyright; Avail: CASI; A03, Hardcopy
The control and communication of massive robot swarms in a distributed manner is a difficult problem because global behaviors must be emerged as a collection of many local actions. This project uses a biologically inspired control method called Digital Hormone Model (DHM) to control the communication, tasking, and execution of massive robot swarms based on local communication, signal propagation, and stochastic reactions. This model is probabilistic, dynamic, fault-tolerant, efficient in computation, and can be easily tasked to deal with topology changes in the communication network and modify the global behaviors. Different from most existing distributed control and learning mechanisms, the DHM considers the topological structure of the organization, and supports dynamic re-configuration and self-organization. In the last year, we have formalized the concept of DHM and conducted experiments of simulating swarm behaviors in large scale for target attacking, network formation, self-repair, and avoid pitfalls in mission execution.
DTIC
*Hormones; Robotics; Robots*

**20040059761** National Academy of Sciences - National Research Council, Washington, DC, USA
**Two-Level Behavior Control of Virtual Humans**
Tom, Igor E.; Navasiolava, Natallia A.; Oct. 2003; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422184; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
*Artificial Intelligence; Computer Programs; Digital Simulation; Engineering Drawings; Human Factors Engineering; Virtual Reality*

**20040062030** Dickinson Independent School District, Dickinson, TX, USA
**K. E. Little Elementary School and the Young Astronaut Robotics Program**
Bonett, David; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration; 2004; 1 pp.; In English; See also 20040062024; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Thirty boys and girls were involved in the Mars robotics program. Students were organized into cooperative groups with six students to each group. Each team was assigned a Lego robotics kit to inventory, organize, and familiarize themselves with. Each team made decisions by consensus, concerning the robots design and capabilities. Each group chose a particular Martian landing site and designed their robot according to the Martian terrain that would be explored. Models of Martian landing sites were constructed to test the robots ability to perform simple tasks on the Martian 'surface'. Students used the Dell Computer Lab on campus to program their robots. The robots will be used as a hands-on interactive activity for one-hundred sixty-five fifth grade students during K. E. Little Elementary School s fourth annual Space Day, May 3, 2004.
Derived from text
*Mars (Planet); Robotics; Schools; Education*

## 64
## NUMERICAL ANALYSIS

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

**20040058961** Air Force Research Lab., Wright-Patterson AFB, OH
**Linear Feedback Control and Numerical Approximation for a System Governed by the Two-Dimensional Burgers' Equation**
Camphouse, R. C.; Myatt, James H.; Aug. 2003; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421462; AFRL-VA-WP-TP-2003-326; No Copyright; Avail: CASI; A03, Hardcopy

This paper is concerned with developing distributed parameter control laws for the governing equations of fluid flow. This paper illustrates the efficiency of these control laws on a simpler problem.
DTIC
*Approximation; Burger Equation; Control Theory; Feedback; Feedback Control; Linear Systems*

**20040059031** Colorado State Univ., Fort Collins, CO
**Algebraic Equivalence of Conjugate Direction and Multistage Wiener Filters**
Scharf, Louis; McWhorter, Todd; Chong, Edwin; Goldstein, Scott; Zoltowski, Michael; Mar. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421706; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this program is to define a very general class of iterative subspace Wiener filters. Within this class, identify two interesting subclasses: conjugate direction Wiener filters and multistage Wiener filters, and to study their equivalencies.
DTIC
*Algebra; Conjugates; Equivalence; Functions (Mathematics); Wiener Filtering*

**20040059049** California Inst. of Tech., Pasadena, CA
**A Next Generation Scalable Finite Element Software to Describe Fracture and Fragmentation of Solids and Structures**
Knap, J.; Mota, A.; Ortiz, M.; Mar. 29, 2004; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0546
Report No.(s): AD-A421757; ARO-41630.1-EG; No Copyright; Avail: CASI; A03, Hardcopy

Summary of accomplishments: The overarching goal of the originally proposed work was the development of a new generation scalable Lagrangian finite element software framework capable of capturing local and non-local fracture processes in solids and structures. The principal objectives of the work, as stated in the proposal, were: 1. Development a scalable Lagrangian software framework to simulate fracture and fragmentation due to weapon-target interactions. 2. Implementation of complex phenomenological as well as physics- based advanced material strength and damage models. 3. Validation and verification of software through simulation of several benchmark DoD application problems. All the objectives have been

successtully achieved. Spme of the main developments are summarized in the text.
DTIC
*Finite Element Method; Fracturing; Fragmentation; Lagrangian Function; Solids*

**20040059050** Army Tank-Automotive and Armaments Command, Warren, MI
**Defining Paths for Driver Models with Hermite Parametric Curves**
Bylsma, Wesley; Jun. 2002; 18 pp.; In English
Report No.(s): AD-A421758; AMSTA-13815; No Copyright; Avail: CASI; A03, Hardcopy

In determining ground vehicle dynamic performance it is generally accepted that comparisons between simulated and test results will be compared for precision and accuracy. The test environment will define a particular course that will be used to define the excitation to the vehicle. In the simulation environment the same course must be replicated to excite the dynamics of the model. Each course used may have different characteristics that excite the dynamics in different ways to obtain a complete spectrum of inputs to the system. The broader the spectrum the better the characterization of the system. In the simulation environment, driver models are developed to ensure that the vehicle model is traversing the desired course in the same manner as in the test environment. A path must be defined for each course that represents the desired vehicle trajectory and will be used as a reference signal in the driver model for feedback control to maintain the vehicle parameters (speed, steering, etc.). Ideally, each position on the path should be uniquely identifiable. To satisfy these conditions, each position on the path is defined by a point. A parametric curve is then defined through these points that will allow one parameter to define a unique position on the path. This report provides a method (MATLAB function) to define continuous smooth and nonsmooth paths using Hermite parametric curves. The defined path can be used as a reference signal in a driver model for feedback control of vehicle position. Four input formats are allowed that encompass two- and three-dimensional paths. The formulation can account for path crossover and provides a method to deal with the nonlinear relationship relating path distance and path parameter values.
DTIC
*Curves (Geometry); Navigation; Position (Location); Trajectories*

**20040059095** Naval Research Lab., Stennis Space Center, MS
**POS Polyline Smoothing: Reduction of Polyline Vertices**
Layne, Geary; Gendron, Marlin; Lohrenz, Maura; Mar. 17, 2004; 8 pp.; In English
Report No.(s): AD-A421874; NRL/PP/7440-04-1011; No Copyright; Avail: CASI; A02, Hardcopy

The POS polyline smoothing algorithm was developed to reduce the needed storage and rendering complexity of polylines by the removal of vertices with two goals in mind. First was to define a single algorithm that would produce a 'good enough' result with varying characteristics, which are user defined. The concept of 'good enough' is built on the trade of time vs. precision, where the best result takes the longest time and the quickest maybe less than desirable form. The second goal was to incorporate surrounding data into the set of control factors. To accomplish this, the concept of Points of Significance (POS) was developed. POS can be a group of individual points, or the point that represents more complex shapes or regions. The complete Set of POS is divided into subsets by the polyline, and by maintaining these subsets the algorithm insures that the polyline maintains a proper relationship with the surrounding data. It is the use of POS that makes this algorithm so powerful. The smoothing is complete after a maximum number of successive passes are made through the polyline, or no additional removals can be made without violating the control factors. -
DTIC
*Algorithms; Apexes; Polygons; Smoothing*

**20040059177** Naval Research Lab., Washington, DC
**A Multiple Hypothesis Correlation Algorithm for Advanced Multisensor, Multiplatform Integration in CEC**
Khoury, Edward N.; Helmick, Ronald E.; Dec. 30, 2003; 74 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N001404WX2076; Proj-02235
Report No.(s): AD-A422061; NRL/FR/5740--03-10075; No Copyright; Avail: CASI; A04, Hardcopy

This report provides an overview of the technologies developed by the Naval Research Laboratory (NRL) in support of the Office of Naval Research (ONR) advanced Sensor Netting Technology (ASNT) project. NRL has developed both single and multiplatform algorithms designed specifically to integrate Electronic Support Measure (ESM) data into a network of sensors, including both radars and ESM sensors. In addition to providing capability for multiplatform/multisensor tracking, these algorithms also provide capability for linking emitter parameters to radar tracks, and thus potentially allowing

identification of such radar tracks. A number of factors often cause ambiguous kinematic associations in ESM-to- radar correlation, which then produce ambiguities in linking emitter parameters to radar tracks and subsequent errors in the ID process. The only method to handle these ambiguous associations in a unified and probabilistic manner is to maintain multiple association hypotheses, where each is evaluated as to its probability of being correct. This Multiple Hypothesis Correlator (MHC) approach quantifies the level of ambiguity and in many circumstances can resolve or reduce the ambiguities when later measurements are processed. The MHC concept forms the basis of the algorithms developed for ASNT and is the subject of this report.
DTIC
*Algorithms; Hypotheses; Statistical Correlation*

**20040059197** Illinois Univ. at Urbana-Champaign, Urbana, IL
**Dendritic Materials Systems**
Moore, Jeffrey S.; Sep. 22, 2003; 16 pp.; In English
Contract(s)/Grant(s): DAAG55-97-1-0126
Report No.(s): AD-A422098; ARO-37254.62-CH-MUR; No Copyright; Avail: CASI; A03, Hardcopy

The research activities of our MURI focused on the use of dendritic polymers in materials applications. The research concentrated in four main areas: hulk properties, devices, advances in computational methods for modeling and simulation of dendrimers, and chemical properties. The area of hulk properties addressed issues relating to fundamental and technological aspects of dendrimers for their intrinsic properties or ability to modify other materials in mass quantity. Examples of research in this area included the search for new high performance hyperbranched polymers, novel approaches to control macromolecular architecture, and the study of blends of dendritic materials with commodity polymers to facilitate processing and enhance the performance of traditional polymeric materials. The area of devices focused on using dendritic materials as active components in sensors. Augmenting all of the research was the development of new computational methods for simulating dendritic materials. The team combined strengths in synthesis, molecular modeling and computation, and characterization to capitalize on the materials opportunities offered by this unusual family of polymers. Finally, the area of chemical properties addressed dendrimers in applications that involved molecular recognition and catalysis.
DTIC
*Crystal Structure; Dendritic Crystals; Macromolecules; Numerical Analysis*

**20040059247** Louisiana State Univ., Baton Rouge, LA
**Critical Infrastructure Protection and Information Assurance (CIPIA) Fellow Program**
Chen, Peter P.; Sep. 2003; 21 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0264
Report No.(s): AD-A422199; AFRL-SR-AR-TR-04-0224; No Copyright; Avail: CASI; A03, Hardcopy

LSU was one of the universities chosen to participate in the project of training new researchers to work on the Critical Infrastructure Protection and Information Assurance (CIPIA) areas. Three Ph.D.'s (Steve Seiden, Guoli Ding, and Nigel Gwee) who were not in the Cyber Security area were selected to become the CIPIA Fellows at LSU. These fellows were trained intensively using multiple methods: auditing relevant courses, reading relevant books and articles, communicating with CIPIA experts inside and outside of LSU, and participating in CIPIA research projects. Although they have participated in several CIPIA projects, the main thrust has been developing mathematical models and efficient algorithms to identify malicious cyber transactions and terrorists. Each of the three Fellows has produced excellent research results. Steve Seiden has developed several online algorithms useful in cyber security. Guoli Ding and Steve Seiden have developed an anonymous communication scheme based on the concept of randomized busing to protect the security of communication no matter in cyber space or in other environments. Nigel Gwee has developed a technique to combine several heuristics algorithms together to locate the malicious cyber transactions quicker. In summary, this CIPIA Fellow project at LSU has been very successful as indicated by the following facts: (1) a huge number of research papers has been produced by these 3 fellows (Seiden has 16, Ding has 9, and Gwee has 3), and (2) teaming up with his mentor, Ding has obtained a large NSF grant on cyber security as a Co-PI.
DTIC
*Mathematical Models; Protection; Security*

**20040059687** Syracuse Univ., NY, USA
**Coherent Processing Across Multiple Staggered Pulse Repetition Interval (PRI) Dwells in Radar**
Sarkar, Tapan K.; Koh, Jinhwan; Feb. 2004; 90 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-C-0041; Proj-4506
Report No.(s): AD-A421756; AFRL-SN-RS-TR-2004-43; No Copyright; Avail: CASI; A05, Hardcopy

This report addresses the development of a methodology for dealing with staggered PRI coherent dwells in radar through the application of multirate signal analysis. The performance of multiple PRF systems is discussed along with the discussion of a number of techniques to obtain a spectrum from nonuniformly sampled data. The methods described include: Interpolating in spatial domain by polynomials; Chinese remainder theorem and the clustering algorithm; Least squares method; Multi-resolution analysis; Iterative method; Orthogonal Polynomial Expansions; and Estimation from the Analog Frequency. The report closes out with a comparison of various methods and a Conclusions section.
DTIC
*Dwell; Numerical Analysis*

**20040059729** Army Research Lab., Adelphi, MD, USA
**Spectral Solution of the Helmholtz and Paraxial Wave Equations and Classical Diffraction Formulae**
Pritchett, Timothy M.; Mar. 2004; 28 pp.; In English
Report No.(s): AD-A421453; ARL-TR-3179; No Copyright; Avail: CASI; A03, Hardcopy

This report examines the general nonlinear vector wave equation implied by the Maxwell equations in a nonmagnetic, isotropic medium and discusses the various approximations under which this general result reduces to the familiar scalar Helmholtz equation and the paraxial wave equation. We see why the Helmholtz equation may be regarded as a singular perturbation of the paraxial wave equation and bow some of the difficulties arising in the solution of the former partial differential equation are related to this fact. Standard integral transform methods are used to obtain general solutions of the Helmholtz equation in a linear medium and of the paraxial wave equation in a linear medium. We show that these solutions are equivalent, respectively, to the exact Rayleigh-Sommerfeld diffraction integral and the Rayleigh- Sommerfeld integral in the Fresnel approximation. We discuss the use of these linear solutions in numerical procedures for treating the corresponding nonlinear beam propagation problems. The general linear solutions are specialized to situations with axial symmetry, and the results are used to treat the example of a clipped Gaussian beam.
DTIC
*Diffraction; Spectral Theory; Wave Equations*

**20040060017** Academy of Sciences (Russia), Moscow, Russia
**Meteorites from Mars: Constraints from Numerical Modeling**
Artemieva, N.; Ivanov, B.; Lunar and Planetary Science XXXV: Meteorites to and from the Moon and Mars: My Planet or Yours?; 2004; 2 pp.; In English; See also 20040060016; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Oblique impacts are simulated with a three-dimensional version of the SOVA code [3], coupled to ANEOS-derived [4] equation of state tables. The later stage of ejecta motion in a disturbed Martian atmosphere is described by multi-phase hydrodynamics [5]. Each particle is characterized by its individual parameters (mass, density, shape, position, velocity) and exchanges momentum and energy with a surrounding vapor-air mixture.
Derived from text
*Mathematical Models; Meteorites; Mars Atmosphere; Atmospheric Turbulence; Hydrodynamics; Ionospheric Disturbances*

**20040062241** Centre National de la Recherche Scientifique, Paris, France
**A New Astronomical Solution for the Long Term Evolution of the Insolation Quantities of Mars**
Laskar, J.; Gastineau, M.; Joutel, F.; Levard, B.; Robutel, P.; Correia, A.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As the obliquity of Mars is strongly chaotic[2, 5], it is not possible to give a solution for its evolution over more than a few million of years. Using the most recent data for the rotational state of Mars, and a new numerical integration of the Solar System, we provide here a precise solution for the evolution of Mars spin over 10 to 20 Myr. Over 250 Myr, we present a statistical study of its possible evolution, when considering the uncertainties in the present rotational state. Over much longer time span, reaching 5 Gyr, the chaotic diffusion prevails, and we have performed an extensive statistical analysis of the orbital

and rotational evolution of Mars, relying on Laskar s secular solution of the Solar System, based on more than 600 orbital and 200 000 obliquity solutions over 5 Gyr. The density function of the eccentricity and obliquity are explicited with simple analytical formulas. We found an averaged eccentricity over 10 Myr. The large increase of the obliquity at about 5 Myr is thus robust and can be used as a constraint for martian paleoclimate studies.
Derived from text
*Mars (Planet); Insolation; Statistical Analysis; Numerical Integration; Astronomy; Diffusion*

## 65
## STATISTICS AND PROBABILITY

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

**20040043937** South Carolina Univ., Columbia, SC
**Resource Allocation in Dynamic Uncertain Domains**
Vargas, Juan E.; Dec. 2003; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-2-0513; DARPA ORDER-H359; Proj-PE62301E
Report No.(s): AD-A420868; AFRL-IF-RS-TR-2003-293; No Copyright; Avail: CASI; A03, Hardcopy

The problem of dynamically allocating services to a changing set of consumers arises in many applications. One such application is the tracking of multiple targets through a sensor field, where sensors decide which area to cover while preserving their resources. This report covers two related areas: (1) the development of TargetShare, and (2) the development of the SCTracker. TargetShare is a resource allocation architecture in which agents use utility to negotiate and allocate resources. The SCTracker is a multi- target tracking system that is compatible with the program's overall challenge problem infrastructure. (7 figures, 26 refs.)
DTIC
*Allocations; Domains; Multisensor Fusion; Radar Tracking; Resource Allocation; Targets*

**20040058973** Department of Defense, Arlington, VA
**Information Technology Management: Defense Civilian Personnel Data System Functionality and User Satisfaction (D-2003-110)**
Jun. 27, 2003; 78 pp.; In English
Report No.(s): AD-A421518; IG/DOD-D-2003-110; No Copyright; Avail: CASI; A05, Hardcopy

Civilian personnel policy makers, personnel managers, human resources personnel responsible for processing civilian personnel actions, and the users of their services will be interested in this report. The report provides information regarding the Defense Civilian Personnel Data System (DCPDS) used to process civilian personnel actions.
DTIC
*Data Management; Data Systems; Information Systems; Management Information Systems; Personnel; User Requirements*

**20040059029** Colorado State Univ., Fort Collins, CO
**Matched Subspace Detectors for Stochastic Signals**
McWhorter, Todd; Scharf, Louis; Mar. 13, 2003; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-C-0145; N00014-01-1-1019
Report No.(s): AD-A421704; No Copyright; Avail: CASI; A03, Hardcopy

Presentation on Matched Subspace Detectors for Stochastic Signals.
DTIC
*Signal Processing; Stochastic Processes*

**20040059034** Massachusetts Inst. of Tech., Lexington, MA
**Mean Squared Error Performance Prediction of Maximum-Likelihood Signal Parameter Estimation**
Richmond, Christ D.; Mar. 12, 2003; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A421709; No Copyright; Avail: CASI; A03, Hardcopy

Presentation of mean squared error performance prediction of maximum-likelihood signal parameter estimation.
DTIC
*Errors; Estimating; Maximum Likelihood Estimates; Mean Square Values; Performance Prediction; Signal Processing*

**20040059036** Naval Undersea Warfare Center, Newport, RI
**Saddlepoint Approximations for the Combined Probability and Joint Probability Density Function of Selected Order Statistics and the Sum of the Remainder**
Nuttall, Albert H.; Feb. 17, 2004; 72 pp.; In English
Report No.(s): AD-A421711; NUWC-NPT-TR-11509; No Copyright; Avail: CASI; A04, Hardcopy

A set of N independent random variables ?Xn! with arbitrary probability density functions (pn(X)! are ordered into a new set of dependent random variables, each with a different probability density function. From this new set, the M - I largest random variables are selected. Then, the sum of the remaining N + I - M random variables is computed, giving a total of M dependent random variables. Several statistics have been computed for these M random variables, including their joint probability density function and a quantity called the 'combined probability and joint probability density function' of particular selections. Most of the results can be expressed in terms of a single Bromwich contour integral in the moment-generating domain. A saddlepoint approximation and first-order correction term are derived for this contour integral and then applied to several typical examples. Actual numerical calculation of these saddlepoint approximations requires evaluation of several functions that have high-order removable singularities, thereby requiring power series expansions near these removable singularities. Expansions with 13 to 14 decimal-digit accuracy have been derived and programmed for this purpose.
DTIC
*Probability Density Functions; Probability Theory; Statistical Analysis*

**20040059043** Air Force Inst. of Tech., Wright-Patterson AFB, OH
**Extending the Reach of Statistical Software Testing**
Weber, Robert J.; Feb. 2004; 170 pp.; In English
Report No.(s): AD-A421743; AFIT-CI04-137; No Copyright; Avail: CASI; A08, Hardcopy

Statistical software testing is a promising technique for reducing the software testing burden by applying test cases to the software under test according to a model of the expected usage of the system in operation, called an operational profile. However, current statistical testing techniques have not been put into general practice, as they do not scale well as the complexity of the systems under test increases. In particular, as system complexity increases, the matrices required to generate test cases and perform model analysis can grow dramatically, even exponentially, overwhelming the test generation and analysis applications. In this work, a new technique for representing the operational profile is proposed to mitigate the complexity issue for statistical test case generation. The use of a state-based requirements specification model as the basis of the operational profile leverages parallelism to reduce the visible size of the model. The specification model can then be extended to include conditional probabilities of input data occurrence. * This work also proposes a statistical testing framework using this specification-based operational profile to generate and execute test cases. Such a framework allows us to evaluate the effectiveness and efficiency of this statistical testing technique.
DTIC
*Computer Programming; Program Verification (Computers); Software Engineering*

**20040059098** Arcon Corp., Waltham, MA
**Installation and Operation of Particle Transport Simulation Programs to Model the Detection and Measurement of Space Radiation by Space-Borne Sensors**
Woolf, Stanley; Sep. 25, 2003; 44 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-99-C-0077; Proj-2822
Report No.(s): AD-A421884; AFRL-VS-HA-TR-2004-1005; No Copyright; Avail: CASI; A03, Hardcopy

This document is a report of the work performed during the period 10 Aug 1999 - 31 Aug 2003 in the areas of: (1) research, evaluation and adaptation of particle transport simulation programs for modeling the detection and measurement of space radiation by space-borne sensors; (2) the transfer of this particle transport simulation capability to the Air Force Research Laboratory, Space Weather Center of Excellence (AFRL/VSBXR); (3) construction of realistic flight sensor computer models; (4) performance of particle transport calculations; (5) space-borne dosimeter simulation studies; and (6) studies of scattering of grazing incidence protons from surfaces of material constituents of space-borne X-ray telescopes. The computer programs ITS-ACCEPT and MCNPX were applied to the modeling of the CEASE and HEP sensors, and the CRRES

dosimeter. This document also summarizes our collaboration in research leading to the publication of two technical papers.
DTIC
*Computerized Simulation; Detection; Electron Transfer; Extraterrestrial Radiation; Installing; Particle Motion; Radiation Measurement*

**20040059240** Naval Surface Warfare Center, Bethesda, MD
**High-Volume Data Analysis Suite (HVDAS) Manual November-17-2003**
Hildstrom, Gregory A.; Nov. 2003; 95 pp.; In English
Contract(s)/Grant(s): NOOO2499MD11140
Report No.(s): AD-A422175; NSWCCD-65-TR-2003/02; No Copyright; Avail: CASI; A05, Hardcopy

This manual describes the design, implementation and use of the High-Volume Data Analysis Suite (HVDAS), which is a collection of parallelized statistical analysis software packages for Linux clusters. HVDAS is designed to reduce and perform statistical analysis on any raw time history data. This manual has been written for the HVDSAS version, November- 17-2003, which was developed by the Naval Surface Warfare Center, Carderock Division, Code 653 and The George Washington University. This software is designed and built en a seven- node i686-based Linux cluster.
DTIC
*Computer Programs; Statistical Analysis*

**20040059276** Wisconsin Univ., Madison, WI
**Planning Under Uncertainty: Methods and Applications**
Ferris, Michael C.; Robinson, Stephen M.; Apr. 13, 2004; 18 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0040
Report No.(s): AD-A422242; AFRL-SR-AR-TR-04-0243; No Copyright; Avail: CASI; A03, Hardcopy

The research program commenced 1 November 2000 and terminated 14 January 2004. Progress was achieved in a broad range of areas, including (1) radiosurgery treatment planning; (2) stochastic network approximations for improving air operations planning; (3) basis pursuit; limited-memory solution of complementarity problems; (4) solution of MPECs via nonlinear programming; (5) supporting research in optimization methods. This progress is described in more detail in Section 3. This work was described and documented in a total of 46 research papers and 2 doctoral theses. These papers, with their status as of the end of the reporting period, are listed in Section 5.
DTIC
*Stochastic Processes*

**20040059707** Defence Research and Development Suffield, Suffield, Alberta
**Mock Urban Setting Trial: Data Analysis and Interpretation**
Yee, Eugene; Dec. 2003; 84 pp.; In English
Report No.(s): AD-A421837; DRDC-SUFFIELD-TR-2003-097; No Copyright; Avail: CASI; A05, Hardcopy

This report describes a comprehensive study of the statistical characteristics of concentration fluctuations in a neutrally buoyant tracer plume dispersing through a large array of building-like obstacles, each of which measured 12.2 m x 2.42 m x 2.54 m. The plumes were released both upwind and within the obstacle array for a range of source heights between 0.15 and 5.2 m. Detailed flow field and instantaneous plume concentration data were obtained from a comprehensive series of tracer experiments which utilized a large number of high-resolution concentration detectors. accompanied by the simultaneous acquisition of meteorological and turbulence measurements with sonic anemometer/ thermometers. Extensive analyses are performed on the plume concentration data, and results are presented for a number of concentration statistics such as the mean plume lateral and vertical spreads, mean concentration, fluctuation intensity, peak concentration to concentration standard deviation ratio, concentration probability density function (PDF). concentration power spectra, and various concentration time and length scales of dominant motions in the array plume (e.g., integral scale, Taylor microscale).
DTIC
*Data Processing; Fluid Mechanics*

**20040059982** Lawrence Livermore National Lab., Livermore, CA
**Feature Subset Selection by Estimation of Distribution Algorithms**
Cantu-Paz, E.; Jan. 17, 2002; 14 pp.; In English
Report No.(s): DE2004-15005951; UCRL-JC-146851; No Copyright; Avail: Department of Energy Information Bridge

This paper describes the application of four evolutionary algorithms to the identification of feature subsets for classification problems. Besides a simple GA, the paper considers three estimation of distribution algorithms (EDAs): a compact GA, an extended compact GA, and the Bayesian Optimization Algorithm. The objective is to determine if the EDAs present advantages over the simple GA in terms of accuracy or speed in this problem. The experiments used a Naive Bayes classifier and public-domain and artificial data sets. In contrast with previous studies, we did not find evidence to support or reject the use of EDAs for this problem.
NTIS
*Algorithms; Bayes Theorem*

**20040059995** Lawrence Livermore National Lab., Livermore, CA
**Methods of Travel-Time Residual Declustering for the Knowledge Base Calibration and Integration Tool (KBCIT)**
Meyers, S. C.; Feb. 05, 2001; 18 pp.; In English
Report No.(s): DE2004-15006177; UCRL-ID-142521; No Copyright; Avail: Department of Energy Information Bridge

Calibration of seismic nuclear test monitoring stations relies on a diverse reference-event database. The reference-event covariance structure must be characterized and the covariance propagated to subsequent processes and calibration products. In seismic location one of the first steps in the calibration process is declustering, in which closely spaced epicenters are combined to reduce redundant data and random observational errors. We formulate a new declustering procedure that accounts for correlated and uncorrelated components of reference-event error, producing a declustered data set that tracks raw reference-event uncertainties. Declustering behavior is demonstrated using example data sets.
NTIS
*Calibrating; Covariance; Data Bases*

## 66
## SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

**20040058972** Massachusetts Inst. of Tech., Cambridge, MA
**New Tools in Nonlinear System Analysis**
Megretski, Alexandre; Mar. 31, 2003; 8 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0096
Report No.(s): AD-A421507; AFRL-SR-AR-TR-04-0175; No Copyright; Avail: CASI; A02, Hardcopy

This project was aimed at developing novel theories for the analysis and design of systems exhibiting essentially nonlinear behavior, such as systems utilizing quantized decision making, periodic orbits, switching, etc. The original primary directions of research were extending the framework of Integral Quadratic Constraints (IQC); studying the robustness of periodic trajectories subject to unmodeled dynamical perturbations; efficient analysis of switching piecewise linear systems; and model order reduction for linear and nonlinear subsystems. The primary result of the project, the IQC system analysis package 'iqcBeta,' is finished and is now available on the Web. New IQC for handling specific nonlinearities were discovered and used to make IQC analysis more accurate. A new methodology for robustness analysis of forced and self-induced oscillations in dynamically uncertain nonlinear systems was developed and tested. A new unconventional methodology of constructive global analysis of piecewise-linear systems (PLS) was developed, based on using surface Lyapunov functions instead of ordinary Lyapunov functions. The method was shown to work extremely well in the analysis of benchmark switching systems. Also, several new methods for linear system model order reduction (MOR) were discovered, providing error bounds that are superior to those of Hankel MOR and Balanced Truncation. A procedure for applying these methods in model reduction of nonlinear systems has been proposed. A new major research direction has emerged as a result of this work: the development of an alternative robust control framework in which finite state stochastic automata serve as nominal system models. (9 refs.)
DTIC
*Computer Programs; Nonlinear Systems; Systems Analysis*

**20040059300** George Mason Univ., Fairfax, VA
**Real Time Scheduling and Routing: Using Column Generation, Branch-and-Cut, and Modern Heuristics to Solve Difficult Combinatorial Optimizational Problems**
Hoffman, Karla; Sep. 30, 2002; 6 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0357
Report No.(s): AD-A422267; AFRL-SR-AR-TR-03-0390; No Copyright; Avail: CASI; A02, Hardcopy

The objective of the bandwidth-packing problem is to decide which demands, or calls, on a list of requests should be chose to route on a capacitated network. The objective is to maximize the revenue that is obtained by routing the chosen calls. If call splitting is allowed, then a multi-commodity flow formulation can be used. However, we are concerned with the situation where call splitting is not allowed, as with video data. Without call splitting, the problem requires that one know the paths upon which the calls are routed. There are many possible paths for each call. Oox et al 1991, Laguna and Clover 1993, Anderson, Jones, Parker and Ryan 1993, Parker and Ryan 1994, and Kang and Park 1996 have done research on this problem. A number of problems exist within the open literature as the common test bed. This problem is of interest to the US navy as part of a larger project known as the Network Centric Warfare (NSW). NSW is concerned with applying advanced communications technology to achieve improved military effectiveness while simultaneously avoiding the expense of building large numbers of new weapon systems and platforms. Within this framework, the Navy has devoted considerable attention to nodal targeting--an offensive form of NOW. Here, the aim is to identify a select set of nodes critical to an enemy network and attack these nodes in the hopes of crippling the entire system. In short, it is the study of conducting precision engagement to reduce effectiveness of the enemy.
DTIC
*Combinatorial Analysis; Cutting; Heuristic Methods; Operations Research; Real Time Operation; Scheduling*

**20040059838** CACI Technologies, Inc., Chantilly, VA, USA
**Advanced Command, Control, Communications, & Intelligence (C3I) Systems Analysis and Trade-Offs**
Mineo, Jack; Mar. 2004; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-D-0221; Proj-281A
Report No.(s): AD-A422115; AFRL-IF-RS-TR-2004-49; No Copyright; Avail: CASI; A03, Hardcopy
This report details the system analysis activities conducted within AFRL/IF to extend C31 capabilities of on- going research. The research areas were diverse and included a number of program areas (i.e., impacts of Effects Based Operations on Dynamic Planning and Execution, extension of Sensor-to-Decision Maker-to-Shooter concepts and Network Distributed Remote Sensor Concepts) that cut across AFRL directorates, were funded by multiple sources and had joint service and coalition involvement. The analysis focused on meeting current needs, outlining technical design difficulties and research and transition opportunities. The analysis became an integral part of the AFRL/IF programs and strategy.
DTIC
*Command and Control; Intelligence; Systems Analysis; Telecommunication; Tradeoffs*

**20040059945** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
**High-Performance Combinatorial Algorithms**
Pinar, A.; 2003; 10 pp.; In English
Report No.(s): DE2004-820273; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
*Algorithms; Combinatorial Analysis*

## 67
## THEORETICAL MATHEMATICS

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

**20040059708** Tufts Univ., Medford, MA, USA
**Entropic Lattice Boltzmann Methods**
Boghosian, Bruce M.; Yepez, Jeffrey; Coveney, Peter V.; Wagner, Alexander; Dec. 10, 2001; 56 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421829; No Copyright; Avail: CASI; A04, Hardcopy
We present a general methodology for constructing lattice Boltzmann models of hydrodynamics with certain desired features of statistical physics and kinetic theory. We show how a methodology of linear programming theory, known as Fourier-Motzkin elimination, provides an important tool for visualizing the state space of lattice Boltzmann algorithms that conserve a given set of moments of the distribution function. We show how such models can be endowed with a Lyapunov functional, analogous to Boltzmann's H, resulting in unconditional numerical stability. Using the Chapman-Enskog analysis and numerical simulation, we demonstrate that such entropically stabilized lattice Boltzmann algorithms, while fully explicit and perfectly conservative, may achieve remarkably low values for transport coefficients, such as viscosity. Indeed, the lowest

such attainable values are limited only by considerations of accuracy, rather than stability. The method thus holds promise for high-Reynolds number simulations of the Navier-Stokes equations.
DTIC
*Boltzmann Transport Equation; Computational Fluid Dynamics; Hydrodynamics*

**20040059756** Texas Univ., Austin, TX, USA
**Fully Automatic, hp-Adaptive Simulations for Maxwell's Equations**
Demkowicz, Leszek; Mar. 18, 2004; 9 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0043
Report No.(s): AD-A422164; AFRL-SR-AR-TR-04-0205; No Copyright; Avail: CASI; A02, Hardcopy

The report describes a computational and theoretical work toward developing a fully automatic hp- adaptive methodology for solving 3D time-harmonic Maxwell equations. The algorithm produces automatically a sequence of hp meshes that deliver exponential convergence. The optimal hp- refinements are identified by minimizing the projection based interpolation error of the solution obtained on a (fine) grid obtained by a global hp- refinement of a current (coarse) grid. The idea of the algorithm is very general and it applies to all discretizations forming the hp de Rham diagram - Hi- H(curl)-and H(div)-conforming.
DTIC
*Interpolation; Maxwell Equation; Simulation*

## 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*.

**20040056101** National Inst. of Standards and Technology, Gaithersburg, MD
**Materials Science and Engineering Laboratory FY 2003 Programs and Accomplishments**
Oct. 2003; In English
Report No.(s): PB2004-104125; NISTIR-7018; No Copyright; Avail: National Technical Information Service (NTIS)

This is the 15th report of the activities of the NIST Center for Neutron Research (NCNR).
NTIS
*Neutron Activation Analysis; Research Projects; Nuclear Reactors; Measuring Instruments; Condensed Matter Physics*

**20040056102** Swedish Defence Research Establishment, Linkoeping
**Review of Models for Scattering from Rough Surfaces**
Hermansson, P.; Forssell, G.; Fagerstroem, J.; Nov. 2003; 66 pp.; In English
Report No.(s): PB2004-104133; FOI-R-0988-SE; No Copyright; Avail: CASI; A04, Hardcopy

The objective of this report is to present results from a literature search of models for scattering of light from random rough surfaces in the IR, visible and UV wavelengths. The literature search was performed with signature management applications in mind. We have focused on methods for calculating the bidirectional reflectance distribution function (BRDEF), which is an important input parameter in IR signature simulation software. The influence of surface roughness on optical signatures can therefore be studied using the scattering models. We have studied four analytical methods in more detail. These methods have been found to be amongst the most common in the literature: The Kirchnoff Approximation Method, The Method of Small Perturbations, The Integral Equation Method (IEM) and The Small Slope Approximation (SSA). Of these models, the IEM and the SSA have the largest ranges of validity. However, they are more complex and therefore more difficult to implement. The literature search also shows that all models are less accurate for grazing incidence.
NTIS
*Surface Roughness; Electromagnetic Scattering; Mathematical Models*

**20040056124** Swedish Defence Research Establishment, Linkoeping
**Nordic Nanotechnology Workshop: Conference Report**
Savage, S. J.; Oct. 2003; 18 pp.; In English
Report No.(s): PB2004-104139; FOI-R-0982-SE; No Copyright; Avail: CASI; A03, Hardcopy

This report contains a brief summary of the recent Nordic Nanotechnology Workshop which the author attended. The

workshop provided a forum for scientists from the Nordic region to meet and discuss plants to present pre-proposals to Nordisk Industrifond. Two groups in which the author participated are described.
NTIS
*Nanotechnology; Conferences*

**20040056128** Swedish Defence Research Establishment, Linkoeping
**Preparations for the Swedish Defence Nanotechnology Programme**
Savage, S. J.; Dec. 2003; 142 pp.; In English
Report No.(s): PB2004-104142; FOI-R-1036-SE; No Copyright; Avail: CASI; A07, Hardcopy
This report documents the planning and preparations prior to the start of the Swedish Defense Nanotechnology Program in October 2003. It contains all the meeting minutes, lists of initial project ideas, project applications and a short description of the planning process in Swedish and English.
NTIS
*Nanotechnology; Defense Program*

**20040056131** Swedish Defence Research Establishment, Stockholm
**Nanotechnology in Defence Applications Programme Status Report nr 1, 4th Quarter 2003**
Savage, S. J.; Dec. 2003; 108 pp.; In English
Report No.(s): PB2004-104143; FOI-R-1102-SE; No Copyright; Avail: CASI; A06, Hardcopy
This report documents the status of the Swedish Nanotechnology in defense applications program as of December 2003. The report contains a brief presentation of the program's activities since the start on 1 October 2003, a description of the current status of each project, details of the program start conference and a preliminary activity plan for phase 1.
NTIS
*Nanotechnology; Defense Program*

**20040056163**
**Vector Boson Pair Production in Hadronic Collisions at Order alpha(s): Lepton Correlations and Anomalous Couplings**
Dixon, L.; Jul. 1999; 30 pp.; In English
Report No.(s): DE2003-10109; SLAC-PUB-8188; No Copyright; Avail: Department of Energy Information Bridge
We present cross sections for production of electroweak vector boson pairs, WW, WZ and ZZ, in p(bar p) and pp collisions, at next-to-leading order in(alpha)(sub s). We treat the leptonic decays of the bosons in the narrow-width approximation, but retain all spin information via decay angle correlations. We also include the effects of WWZ and WW(gamma) anomalous couplings.
NTIS
*Pair Production; Bosons; Particle Collisions; Electroweak Interactions (Field Theory)*

**20040056164** Lawrence Livermore National Lab., Livermore, CA
**2 omega Laser Propagation and Raman Backscatter in Underdense Gasbag Plasmas**
Meezan, N. B.; Divol, L.; Suter, L. J.; Miller, M. C.; Stevenson, R. M.; Sep. 05, 2003; 10 pp.; In English
Report No.(s): DE2003-15004668; UCRL-JC-155216; No Copyright; Avail: Department of Energy Information Bridge
Recent 2(omega) gasbag experiments on the Helen laser studied single-beam propagation and backscatter as a function of gas density. We present a comprehensive analysis of these experiments using simulations in HYDRA. Post-processed results agree well with experimental fast x-ray images (FXI) showing stable laser propagation across the bag. The measured total stimulated Raman backscatter (SRS) increases with initial gas density up to n(sub e)(approx) 0.08 n(sub c), then decreases. Near-backscatter images (NBI) show that the decrease in total SRS with increasing density is not due to scatter outside of the collection optics. SRS gain spectra calculated from the HYDRA results agree well with experimental streak spectra. The tilt and spread in wavelength of the spectra appear to be explained by gasbag hydrodynamics only, with no need to invoke filamentation. Axial density gradients and laser pump absorption may combine to detune and limit SRS gain at high density.
NTIS
*Gas Density; Backscattering; Laser Beams*

**20040057962** Lawrence Livermore National Lab., Livermore, CA
**Measurement of the Polarization of the K(beta)2 Line of Heliumlike V(sup21+)**
Smith, A. J.; Beiersdorfer, P.; Wong, K. L.; Reed, K. J.; Oct. 15, 2001; 14 pp.; In English
Report No.(s): DE2004-15006082; UCRL-JC-145899; No Copyright; Avail: Department of Energy Information Bridge
We have measured the polarization of the intercombination line 1s3p(sup 3)P(sub 1)-1s(sup 2)(sup 1)S(sub 0), the so called K(beta)2 line, in helium-like V(sup 21+) using two Bragg crystal spectrometers. The ions were excited in the Lawrence Livermore National Laboratory electron beam ion trap. We find values which are not significantly different from theoretical predictions based on some admixing of the initial state by the hyperfine interaction. In this short paper we present our results.
NTIS
*Polarization; Electron Beams*

**20040057964** Lawrence Livermore National Lab., Livermore, CA
**Charged Particle and Neutron Backgrounds in an e(sup-)e(sup-) Interaction Region at the NLC**
Gronberg, J.; Mar. 06, 2000; 14 pp.; In English
Report No.(s): DE2004-15005927; UCRL-JC-138010; No Copyright; Avail: Department of Energy Information Bridge
We compare the detector background situation in an e(sup -) e(sup -) interaction region at the NLC with previous studies done of the NLC e(sup+) e(sup -) interaction region. We note from previous studies that the dominant source of detector backgrounds are the beamstrahlung pairs. Since these scale with luminosity, the reduction in luminosity in e(sup -) e(sup -) collisions leads to a reduction in detector backgrounds compared to the e(sup+) e(sup -) situation.
NTIS
*Charged Particles; Neutrons*

**20040057975** Johns Hopkins Medical Institutions, Baltimore, MD, USA, Purdue Univ., West Lafayette, IN, Fermi National Accelerator Lab., Batavia, IL, USA, Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
**CDF Run IIb Silicon Vertex Detector DAQ Upgrade**
Behari, S.; Bacchetta, N.; Bolla, G.; Cardoso, G.; Ciobanu, C. I.; Dec. 2003; 10 pp.; In English
Report No.(s): DE2004-820307; FERMILAB-CONF-03/406-E; No Copyright; Avail: Department of Energy Information Bridge
The CDF particle detector operates in the beamline of the Tevatron proton-antiproton collider at Fermilab, Batavia, IL. The Tevatron is expected to undergo luminosity upgrades (Run IIb) in the future, resulting in a higher number of interactions per beam crossing. To operate in this dense radiation environment, an upgrade of CDF's silicon vertex detector (SVX) subsystem and a corresponding upgrade of its VME-based DAQ system has been explored. Prototypes of all the Run IIb SVX DAQ components have been constructed, assembled into a test stand and operated successfully using an adapted version of CDF's network-capable DAQ software. In addition, a PCI-based DAQ system has been developed as a fast and inexpensive tool for silicon detector and DAQ component testing in the production phase. In this paper they present an overview of the Run IIb silicon DAQ upgrade, emphasizing the new features and improvements incorporated into the constituent VME boards, and discuss a PCI-based DAQ system developed
NTIS
*Detectors; Particle Accelerators; Proton-Antiproton Interactions; Computer Systems Programs*

**20040058094** NASA Glenn Research Center, Cleveland, OH, USA
**The Extended Parabolic Equation Method and Implication of Results for Atmospheric Millimeter-Wave and Optical Propagation**
Manning, Robert M.; March 2004; 37 pp.; In English
Contract(s)/Grant(s): WBS 22-302-20-2F
Report No.(s): NASA/TM-2004-212944; E-14384; No Copyright; Avail: CASI; A03, Hardcopy
The extended wide-angle parabolic wave equation applied to electromagnetic wave propagation in random media is considered. A general operator equation is derived which gives the statistical moments of an electric field of a propagating wave. This expression is used to obtain the first and second order moments of the wave field and solutions are found that transcend those which incorporate the full paraxial approximation at the outset. Although these equations can be applied to any propagation scenario that satisfies the conditions of application of the extended parabolic wave equation, the example of propagation through atmospheric turbulence is used. It is shown that in the case of atmospheric wave propagation and under the Markov approximation (i.e., the -correlation of the fluctuations in the direction of propagation), the usual parabolic

equation in the paraxial approximation is accurate even at millimeter wavelengths. The methodology developed here can be applied to any qualifying situation involving random propagation through turbid or plasma environments that can be represented by a spectral density of permittivity fluctuations.
Author
*Electromagnetic Wave Transmission; Wave Propagation; Atmospheric Turbulence; Millimeter Waves; Optical Communication*

**20040059044** Arizona State Univ., Tempe, AZ
**Space Vector Methods for AC Drives to Achieve High Efficiency and Superior Waveform Quality**
Ayyanar, Raja; Zhao, D.; Krishnamurthy, H.; Narayanan, G.; Mar. 31, 2004; 73 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0751
Report No.(s): AD-A421744; DWA0074/TE; No Copyright; Avail: CASI; A04, Hardcopy

Space vector approach to pulse width modulation offers several advantages over the traditional triangle comparison methods, which are not fully exploited by conventional space vector PWM (SVPWM). New sequences, which divide the active vector duration, offer additional degrees of freedom that are not possible in triangle comparison approach. The objectives of this research are to identify% all such new sequences and develop new PWM techniques that reduce distortion and switching loss. Four new sequences involving active state division are introduced. The concept of stator flux ripple is used to design THD-optimized PWM techniques. By applying different sequences within a sector based on above techniques, THD can be reduced by 47% compared to conventional SVPWM. The effects of sequences on inverter switching loss are analyzed to design a new hybrid PWM that reduces switching loss by 30%. This involves using sequences that clamp the phase with the highest current, and double switch the phase with lowest current. Finally, a combined hybrid PWM technique that simultaneously reduces THD by over 30% and switching loss by 20%, under nominal conditions is developed. The new techniques have been implemented in a 2kW induction motor drive controlled by a DSP - TMS320F243. THD reduction of 38% in the THD-optimized PWM and switching loss reduction of 30% in the loss-optimized PWM are demonstrated. Future work in this area may focus on extending the concept to multi-level inverters.
DTIC
*Alternating Current; Pulse Duration Modulation; Waveforms*

**20040059165** Massachusetts Inst. of Tech., Cambridge, MA
**Type II Quantum Computing With Superconductors**
Orlando, Terry P.; Apr. 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0461
Report No.(s): AD-A422037; AFRL-SR-AR-TR-04-0187; No Copyright; Avail: CASI; A03, Hardcopy

The results of this research centered on the experimental studies of a single superconducting persistent current qubit, the implementation of type-II algorithms using these qubits, and the proposal for adiabatic quantum computing using these qubits. The major experimental results on single superconducting persistent current qubits have been the observation of the quantum energy level crossings in niobium qubits, and the microwave measurements of intra-well relaxation times. We have developed two implementation methods for solving the one-dimensional diffusion equation with a type- II algorithm. In the first method, the state of each qubit is set by the local magnetic field bias. Although this initialization method has the advantage of simplicity, the subsequent unitary collision operations demand precise timing. The second method uses nearly identical qubits that can be addressed locally at the node. Microwave pulses are then used for the initialization, and the unitary transformation is simplified to just timed free propagation. A scalable architecture for an adiabatic quantum computer has been proposed for superconducting persistent current qubits in which an adiabatically varying magnetic field is applied to all the qubits simultaneously.
DTIC
*Quantum Computation; Quantum Theory; Superconductors (Materials)*

**20040059262** Florida Agricultural and Mechanical Univ., Tallahassee, FL
**High Temperature Texturing of Engineered Materials in a Magnetic Field**
Gamestani, Hamid; Mar. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0311
Report No.(s): AD-A422222; ARO-40296.2-EG-SAH; No Copyright; Avail: CASI; A03, Hardcopy

The primary objective of this proposal is to investigate the effect of high field/temperature in the development of texture (preferred orientation) in magnetic materials. Highly textured permanent magnet materials of Ne2Fe14B have been produced

using the facility constructed within the first part of the ARO support. Other materials systems including: FePd, Terfenol-D, steel and Zink material have also been processed and a highly oriented microstructure has been obtained in these materials. The success in texturing Zn-1.1% Al diamagnetic material shows that the new processing technique can also be applied to nonmagnetic materials. A new initiative in orienting nano-tube in magnetic field resulted in a huge success. These studies were carried mostly in a newly constructed high temperature furnaces funded by ARO. This facility includes two high temperature furnaces (1250 deg C and 1600 deg C) in the bore of a 20 inch resistive magnet capable of producing a uniform high magnetic field of 20 Tesla. These studies will also be carried out in the core of a 9 Tesla superconducting magnet.
DTIC
*High Temperature; Magnetic Fields; Magnetic Properties*

**20040059324** Aerospace Corp., El Segundo, CA
**Dose/Surface Charging and Plasma Monitor (DOS/SCM) Flight Model 2 - HiLET Subsystem Critical Design Review**
Mazur, J. E.; Crain, W. R.; Camacho, C. N.; Lin, A. Y.; Mabry, D. J.; Mar. 10, 2004; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8802-04-C-0001
Report No.(s): AD-A422321; TR-2004(8570)-2; SMC-TR-04-10; No Copyright; Avail: CASI; A03, Hardcopy

This report documents the critical design review for the High Linear Energy Transfer (HiLET) instrument subsystem of the Dose/Surface Charging and Plasma Monitor Flight Model 2. The design review took place on 15 January 2004 at The Aerospace Corporation, El Segundo, CA.
DTIC
*Design Analysis; Dosage; Energy Transfer; Linearity; Plasmas (Physics)*

**20040059330** Army Research Lab., Aberdeen Proving Ground, MD
**Lateral Control Jet Aerodynamic Predictions for a 2.75-in Rocket Testbed Munition**
Weinacht, Paul; Apr. 2004; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-1L1612618AH80
Report No.(s): AD-A422342; ARL-TR-3165; No Copyright; Avail: CASI; A03, Hardcopy

The aerodynamic performance of lateral control jets for a 2.75-in rocket testbed munition has been investigated using a sophisticated numerical technique. The computational approach utilized a finite difference-based overset gridding approach to predict the interaction of the lateral control jet with the external flow around the munition and the resulting effect on the lateral control jet performance. The jet interaction effect was found to be an important contributor to the overall effectiveness of the lateral control jet. The circumferential location of the jet relative to the tail fins was also found to influence the jet s effectiveness. A variation of 30% in the net jet moment was computed for the two fin orientations considered in the study. The predictions also showed that spin did not significantly influence the lateral control jet performance for the expected spin rates of the testbed munition; however, if the spin was increased significantly, the resulting jet interaction produced a misalignment of the total jet thrust relative to the nozzle. Single and tandem jet configurations were examined. For the configurations examined here, the tandem jet doubled the effective jet thrust, although a similar effective jet thrust could be obtained by sequential independent firings of both jets. Time-dependent predictions of the performance of pulsed lateral control jets indicate that steady-state flow is attained during the duration of the firing cycle, and the overall performance of the pulsed jets can be represented reasonably well by the steady-state jet-on performance.
DTIC
*Aerodynamic Characteristics; Ammunition; Jet Control; Lateral Control*

**20040059333** Naval Surface Warfare Center, Indian Head, MD
**Sensitivity Testing of Contaminated Surfaces to Establish Nonreactivity Levels at Energetic Processing Facilities**
Caris, Anne; Wallman, Paul G.; Mar. 15, 2004; 261 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422353; NSWC-IHTR-2573; No Copyright; Avail: CASI; A12, Hardcopy

The downsizing and closing of military facilities have generated the need to eliminate potential explosive hazards from facilities previously used to process energetic materials. Testing for contamination levels of such hazards is an established practice; however, there are no established criteria for determining safe levels of the contamination. Small-scale sensitivity testing was performed to establish levels of contamination that would not exhibit reactions to normally executed construction practices, such as equipment installation and facility remodeling. Standard friction, impact, and electrostatic discharge (ESD) sensitivity tests were selected as appropriate to duplicate stimuli created by construction or remodeling operations. Wood,

concrete, a transite simulant, and metal anvils and plates were prepared for use in standardized small-scale sensitivity testing equipment. The materials were coated with a quantifiable amount of contaminant on the testing surface. The materials were then subjected to impact, friction, and ESD sensitivity testing and observed for reactions.
DTIC
*Contamination; Electric Discharges; Explosives; Sensitivity*

**20040059335** Science Applications International Corp., McLean, VA
**Broadband Adaptive Beamforming: Motion Mitigation in the Littoral Environment by Frequency Averaging**
Greene, Robert; Mar. 14, 2001; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A422363; No Copyright; Avail: CASI; A03, Hardcopy
These vieewgraphs discuss single wavenumber adaptive processing.
DTIC
*Beamforming; Broadband; Frequencies*

**20040059739** North Carolina State Univ., Raleigh, NC, USA
**Time-Reversal for Electromagnetic Waves in Complex Media**
Fouque, Jean-Pierre; Haider, Mansoor A.; Jul. 2003; 16 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0739
Report No.(s): AD-A421538; No Copyright; Avail: CASI; A03, Hardcopy
A time-reversal mirror is, roughly speaking, a device which is capable of receiving an acoustic signal in time, keeping it in memory and sending it back into the medium in the reversed direction of time. In this paper, we employ an accurate numerical method for simulating waves propagating in complex one-dimensional media. We use numerical simulations to reproduce the time-reversal self-averaging effect which takes place in randomly layered media. This is done in the regime where the inhomogeneities are smaller than the pulse, which propagates over long distances compared to its width. We show numerical evidence for possible use of an expanding window time-reversal technique for detecting anomalies buried in the medium.
DTIC
*Electromagnetic Radiation; Electromagnetic Wave Transmission*

**20040059934** Princeton Univ., NJ
**Lithium Pellet Injector Development for NSTX**
Gettelfinger, G.; Dong, J.; Gernhardt, R.; Kugel, H.; Sichta, P.; Nov. 2003; 12 pp.; In English
Report No.(s): DE2004-820198; PPPL-3902; No Copyright; Avail: Department of Energy Information Bridge
A pellet injector suitable for the injection of lithium and other low-Z pellets of varying mass into plasmas at precise velocities from 5 to 500 m/s is being developed for use on NSTX (National Spherical Torus Experiment). The ability to inject low-Z impurities will significantly expand NSTX experimental capability for a broad range of diagnostic and operational applications. The architecture employs a pellet-carrying cartridge propelled through a guide tube by deuterium gas. Abrupt deceleration of the cartridge at the end of the guide tube results in the pellet continuing along its intended path, thereby giving controlled reproducible velocities for a variety of pellets materials and a reduced gas load to the torus. The planned injector assembly has four hundred guide tubes contained in a rotating magazine with eight tubes provided for injection into plasmas. A PC-based control system is being developed as well and will be described elsewhere in these Proceedings. The development path and mechanical performance of the injector will be described.
NTIS
*Injection; Pellets; Plasmas (Physics)*

**20040059937** Brookhaven National Lab., Upton, NY, USA, Florida State Univ., Tallahassee, FL, USA, Rochester Univ., NY, USA, State Univ. of New York at Buffalo, Amherst, NY, USA
**NLO QCD Corrections to Hadronic Higgs Production with Heavy Quarks**
Dawson, S.; Jackson, C. B.; Orr, L. H.; Reina, L.; Wackeroth, D.; 2003; 10 pp.; In English
Report No.(s): DE2004-15006425; BNL-71759-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
The production of a Higgs boson in association with a pair of t(bar t) or b(bar b) quarks plays a very important role at both the Tevatron and the Large Hadron Collider. The theoretical prediction of the corresponding cross sections has been

improved by including the complete next-to-leading order QCD corrections. After a brief description of the most relevant technical aspects of the calculation, we review the results obtained for both the Tevatron and the Large Hadron Collider.
NTIS
*Higgs Bosons; Quarks; Hadrons*

**20040059942** Princeton Univ., NJ
**Destruction of Invariant Surfaces and Magnetic Coordinates for Perturbed Magnetic Fields**
Hudson, S. R.; Nov. 2003; 46 pp.; In English
Report No.(s): DE2004-820204; PPPL-3904; No Copyright; Avail: Department of Energy Information Bridge
Straight-field-line coordinates are constructed for nearly integrable magnetic fields. The coordinates are based on the robust, noble-irrational rotational-transform surfaces, whose existence is determined by an application of Greene's residue criterion. A simple method to locate these surfaces is described. Sequences of surfaces with rotational-transform converging to low order rationals maximize the region of straight-field-line coordinates.
NTIS
*Magnetic Fields; Coordinates; Sequencing*

**20040059973** Brookhaven National Lab., Upton, NY, Indiana Univ., Bloomington, IN, USA, Argonne National Lab., IL
**Preserving Polarization through an Intrinsic Depolarizing Resonance with a Partial Snake at the AGS**
Huang, H.; Ahrens, L.; Bai, M.; Sep. 2002; 10 pp.; In English
Report No.(s): DE2004-15006421; BNL-71708-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
An 11.4% partial Siberian snake was used to successfully accelerate polarized protons through a strong intrinsic depolarizing spin resonance in the AGS. No noticeable depolarization was observed. This opens up the possibility of using a 20% partial Siberian snake in the AGS to overcome all weak and strong spin resonances.
NTIS
*Depolarization; Electron Sources*

**20040059987** Lawrence Livermore National Lab., Livermore, CA
**3D HYDRA Simulations of NIF Targets**
Marinak, M. M.; Kerbel, G. D.; Gentile, N. A.; Jones, O.; Munro, D.; Oct. 30, 2000; 28 pp.; In English
Report No.(s): DE2004-15006077; UCRL-JC-141084-R1; No Copyright; Avail: Department of Energy Information Bridge
The performance of NIF target designs is simulated in three dimensions using the HYDRA multiphysics radiation hydrodynamics code. In simulations of a cylindrical NIF hohlraum that include an imploding capsule, all relevant hohlraum features and the detailed laser illumination pattern, the motion of the wall material inside the hohlraum shows a high degree of axisymmetry. Laser light is able to propagate through the entrance hole for the required duration of the pulse. Gross hohlraum energetics mirror the results from an axisymmetric simulation. A NIF capsule simulation resolved the full spectrum of the most dangerous modes that grow from surface roughness. Hydrodynamic instabilities evolve into the weakly nonlinear regime. There is no evidence of anomalous low mode growth driven by nonlinear mode coupling.
NTIS
*Hydrodynamics; Cylindrical Bodies; Laser Outputs*

**20040059988** Lawrence Livermore National Lab., Livermore, CA
**Simple Advection Scheme for Material Interface**
Jun, B.; Jan. 10, 2001; 18 pp.; In English
Report No.(s): DE2004-15006111; UCRL-JC-139912; No Copyright; Avail: Department of Energy Information Bridge
We introduce a new simple advection scheme for capturing multi-material interfaces. A material interface is tracked by solving a scalar transport equation of the volume of fluid. The method is developed by modifyjng the Hyper-C flux limiter and it does not require material interface reconstruction. A new single step unsplit advection scheme is developed by including corner flux monotonically. The algorithm is designed to minimize the necessary mixed zones as well as to preserve sharp and stable interfaces. Numerical tests show improvements compared to other existing methods such as Tipton's method.
NTIS
*Advection; Numerical Analysis*

**20040059993** Lawrence Livermore National Lab., Livermore, CA
**Temperature Dependent ENDF/B-VI, Release 7 Cross Section Library**
Cullen, D. E.; Nov. 22, 2000; 18 pp.; In English
Report No.(s): DE2004-15006157; UCRL-ID-127776-REV-1; No Copyright; Avail: Department of Energy Information Bridge

The ENDF/B data library has recently been updated and is now freely available through the National Nuclear Data Center (NNDC), Brookhaven National Laboratory. This most recent library is identified as ENDF/B-VI, Release 7. Release 7 completely supersedes all preceding releases. As distributed the ENDF/B-VI, Release 7 data includes cross sections represented in the form of a combination of resonance parameters and/or tabulated energy dependent cross sections, nominally at 0 Kelvin temperature. For use in applications this library has been processed into the form of temperature dependent cross sections at eight temperatures between 0 and 2100 Kelvin, in steps of 300 Kelvin. At each temperature the cross sections are tabulated and linearly interpolable in energy. All results are in the computer independent ENDF/B-VI character format, which allows the data to be easily transported between computers. In its processed form this library is approximately 1.6 gigabyte in size and is distributed on three CDs.
NTIS
*Temperature Dependence; Libraries; Computers*

**20040059999** Brookhaven National Lab., Upton, NY, Indiana Univ., Bloomington, IN, USA
**Analysis of Depolarization Factors in the last RHIC Run**
Ptitsyn, V.; Luccio, A. U.; Ranijbar, V. H.; Sep. 2002; 10 pp.; In English
Report No.(s): DE2004-15006418; BNL-71701-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

Polarized proton beams were accelerated successfully at RHIC up to 100 Gev with the use of Siberian Snakes. Although the snakes were designed to preserve polarization, the successful acceleration and storage of polarized beams was dependent also on beam characteristics, like closed orbit, betatron tunes and even betatron coupling. The high-order spin resonances were observed and evaluated. The paper summarizes depolarizing effects observed during the run.
NTIS
*Depolarization; Proton Beams*

**20040060001** Brookhaven National Lab., Upton, NY, Indiana Univ., Bloomington, IN, USA
**RHIC pC CNI Polarimeter: Experimental Setup and Physics Results**
Alekseev, I. G.; Bravar, A.; Bunce, G.; Sep. 2002; 10 pp.; In English
Report No.(s): DE2004-15006419; BNL-71704-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

Acceleration of polarized proton beams and experiments with them at RHIC require fast and reliable measurements of the polarization. The polarimeter presented here uses very high figure of merit of the elastic pC scattering at very low momenta transfer since the cross section is large. Small (a few percent) analyzing power of the reaction makes it necessary to collect about 10(sup 7) events per measurement. A dead-timeless DAQ system for the polarimeter is discussed in this paper. It is based on the waveform digitizer modules with 'on-board' event analysis, resulting in typical polarization measurement times of several tens of seconds. During winter 2001/2002 RHIC polarized run several dedicated data runs were taken by the polarimeter to extract the form of the analyzing power dependence as a function of the momentum transferred at beam energies 24 and 100 GeV. This dependence is extremely important for the theoretical understanding of the CNI process including the contribution of the spin-flip hadronic amplitude.
NTIS
*Proton Beams; Acceleration (Physics); Polarimeters*

## 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*.

**20040059023** Texas Univ., Austin, TX
**Estimation of Receiver Operating Characteristic Curves for Multiping Mine Detection Using Empirical Target Data**
Rusu, Petre I.; Pitt, S. P.; Mar. 14, 2002; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00039-96-D-0051; Proj-0329
Report No.(s): AD-A421690; ARL-TR-02-03; No Copyright; Avail: CASI; A03, Hardcopy

This report develops the formalism for computing receiver operating characteristic (ROC) curves for an active sonar detector, consisting of linear receiver processing followed by a linear envelope detector. The formalism is applicable to both single-ping and multiple-ping detection. The methodology for computing the ROC curves directly incorporates measurements of target strength as a function of aspect angle to estimate the requisite signal-plus-noise probability density function (PDF) under the assumption of Gaussian background statistics. This 'empirical' approach for computing the probability of detection allows ROC curve performance to be estimated for multiple ping integration and for any sensor-target scenario that is supported by the available target data.
DTIC
*Mine Detectors; Receivers; Sonar*

**20040059030** Georgia Inst. of Tech., Atlanta, GA
**Blind Adaptive Dereverberation of Speech Signals Using a Microphone Array**
Bakir, Tariq S.; Mersereau, Russell M.; Mar. 11, 2003; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421705; No Copyright; Avail: CASI; A02, Hardcopy
Presentation on blind adaptive dereverberation of speech signals using a microphone array.
DTIC
*Microphones; Reverberation; Speech Recognition*

**20040059103** Naval Research Lab., Stennis Space Center, MS
**Ocean Through the Sensor (TTS) Update**
Koehler, Kim A.; Harris, Michael M.; Bibee, Leonard D.; Steed, Chad A.; Bates, David; Dec. 3, 2003; 12 pp.; In English
Report No.(s): AD-A421907; NRL/PP/7440--03-1031; No Copyright; Avail: CASI; A03, Hardcopy
Traditional geoacoustic and ocean data collection efforts by skilled scientists will always be a cornerstone of the Naval Meteorology and Oceanography (MetOc) Program. In recent years however, other methods have been explored to further expand the scope of these data collection efforts. This effort has been driven, in part, by a declining MetOc Program Budget combined with other programmatic considerations both within and outside the Naval MetOc Program. PEO C41 and Space PMW 150, in conjunction with CNMOC, NAVOCEANO, NAVSEA, NAVAIR, and scientists from ONR, NRL, and various National Laboratories and industry, are focused on developing new methods to sense the environment, either through direct or inferred measurements, using tactical sensors. One of these efforts is focused on the development of Through-The-Sensor (TTS) technology. This effort seeks to use data from tactical sensors to characterize the battlespace environment. These data can then be used in Fleet Tactical Decision Aids (TDAs) to modify ASW and MIW tactics and enhance situational awareness at the single ship, Carner Strike Group (CSG), Expeditionary Strike Group (ESG) and Theater USW (TUSW) level. Near term efforts include the exploitation of various mine- hunting sensors such as the AOS-20 and side scan sonar and submarine sensors such as the Precision Undersea Mapper (PUMA) and tactical towed arrays. Exploitation of sensors further on the horizon include submarine sensors such as the submarine CTD and fathometer (BON-17), the surface ship Instrumented Tow Cable (lTC), and the air community's Tactical Acoustic Measurement (TAM) Buoy.
DTIC
*Data Acquisition; Oceanographic Parameters; Oceans*

**20040059181** Naval Research Lab., Bay Saint Louis, MS
**Indian Rocks Beach Experiment, January-March 2003**
Bower, Grant R.; Richardson, Michael D.; Briggs, Kevin B.; Vaughan, W. C.; Kennedy, Conrad S.; Mar. 22, 2004; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422065; NRL/MR/7430--04-8752; No Copyright; Avail: CASI; A06, Hardcopy
An experiment to characterize subsequent (scour) mine burial was conducted in the winter of 2003 in water depth of 13 meters near Tampa Bay, Florida. Four NRL Acoustic Instrument Mines (AIMs), Six Forschungsanstalt der Bundeswehr fur Wasserschall- und Geophysik (FWG) Instrumented Mines and two each Inert Manta Mines, Rockan Mines and 500 lb bombs were placed on the seafloor and left for a period of approximately 64 days. The instrumented mines will provide temporal burial status the burial status of the inert assemblies was observed and noted by divers. This preliminary report includes the diver observed data upon recovery for each mine, the recorded orientation change for each FWG mine and for each AIM the recorded burial, orientation, water temperature, tide wave period and significant weight height.
DTIC
*Rocks*

**20040059188** Naval Research Lab., Washington, DC

**Using the Foldy-Wouthuysen Transformation to Derive Acoustic Parabolic Equations that Properly Dress Discontinuities**

Wurmser, Daniel; Mar. 31, 2004; 363 pp.; In English

Report No.(s): AD-A422077; NRL/FR/7140--04-10018; No Copyright; Avail: CASI; A16, Hardcopy

This effort develops a firm theoretical foundation for the acoustic parabolic equation (PE) used in the presence of penetrable rough interfaces. As the interface roughness extends through the wavelength scale, it induces Bragg scattering (i.e., behaves like a diffraction grating). This is a nontrivial, phase-sensitive problem that involves theoretical and computational challenges that go beyond those found in problems to which the PE is most typically applied. A satisfactory formalism that addresses Bragg scattering should fully integrate the PE with field and rough surface scattering theories. In this report, the Foldy-Wouthuysen (FW) transformation is used to design a PE formalism that addresses this challenge. Along an interface where the density jumps, the full-wave problem predicts a jump in the downrange flux, but the PE generated by the FW transformation buffers this discontinuity by absorbing it into the higher-order boundary conditions. The new formalism is free of the ad hoc fixes that have characterized the PE methods currently used in the vicinity of a jump in the density, and it is ideally suited for the modeling of (forward) scattering from multiscale rough surfaces. The formalism can also be used to generate stochastic equations in circumstances where it has been impossible until now to do so.

DTIC

*Acoustics; Discontinuity; Parabolic Differential Equations*

**20040059222** Air Force Research Lab., Wright-Patterson AFB, OH

**Over-Water Noise Propagation Study: Preliminary Assessment**

Downing, Micah; Lee, Robert A.; Sep. 1998; 30 pp.; In English

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A422150; AFRL-HE-WP-TR-2003-0098; No Copyright; Avail: CASI; A03, Hardcopy

The current propagation algorithms in the Department of Defense NOISEMAP assume soft grassy ground cover for noise propagation. The new noise propagation algorithm to be implemented into NOISEMAP (Version 7.0) accounts for the effects of topography. The algorithm accounts for the reduced attenuation for noise propagation over a water surface by treating it an acoustically hard surface. This effectively increases the noise exposures that propagate across water surfaces to increase by 3dB. To investigate this modeled effect a noise monitoring study was conducted at Naval Air Station (NAS) Ja9ksonville and NAS North Island. The primary objective of the study was to evaluate this effect pn long4erm noise exposures and determine the validity of representing water as an acoustically hard surface in the NOISEMAP algorithms. A secondary objective was to observe the magnitude of variations associated with noise propagation over water. From these preliminary noise studies, some effect of over- water prnpagation was observed. The comparison supports the use of modeling water surfaces as acoustically hard as a good first approximation. This modeling approach should be incorporated into NOISEMAP. The noise data qualitatively displayed the trend that water surface can enhance noise exposure around an airfield by reducing the ground absorption; however, the data collected were not sufficient to support any quantitative assessment about the exact magnitude of the effect.

DTIC

*Aircraft Noise; Algorithms; Noise Propagation*

**20040059223** Ohio State Univ., Columbus, OH

**Mixing and Noise in High Speed Axisymmetric Jets**

Samimy, M.; Hileman, J.; Caraballo, E.; Apr. 2003; 64 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0023; Proj-2307

Report No.(s): AD-A422153; GDTL-1-2003; AFRL-SR-AR-TR-04-0229; No Copyright; Avail: CASI; A04, Hardcopy

This work investigated noise sources and the effects of passive mixing and noise control schemes using vortex generating tabs on noise sources. It is believed that such information is necessary for jet noise modeling and provides guidance for active control of jets for noise mitigation that will follow. The bulk of this work attempts to correlate instantaneous large-amplitude features of the far acoustic field to the dynamic evolution and interaction of large-scale structures within the mixing-layer of ideally expanded, high-speed, high Reynolds number jets. Such information is essential for a better understanding of jet noise sources, and jet aeroacoustic modeling and control.

DTIC

*High Speed; Jet Aircraft Noise*

**20040059239** Naval Postgraduate School, Monterey, CA

**Acoustic Properties of Toroidal Bubbles and Construction of a Large Apparatus**

Harris, Ashley M.; Mar. 2004; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422174; No Copyright; Avail: CASI; A05, Hardcopy

When a burst of air is produced in water, the result can be a toroidal bubble. This thesis is concerned with experimental investigations of three acoustical properties of toroidal bubbles: (i) propagation through high-intensity noise, (ii) emission, and (iii) scattering. In (i), an attempt to observe a recent prediction of the acoustic drag on a bubble is described, which is analogous to the Einstein-Hopf effect for an oscillating electric dipole in a fluctuating electromagnetic field. No effect was observed, which may be due to insufficient amplitude of the noise. In (ii), observations of acoustic emissions of volume oscillations of toroidal bubbles are reported. Surprisingly, the emission occurs primarily during the formation of a bubble, and is weak in the case of very smooth toroidal bubbles. In (iii), we describe an experiment to observe the effect of a toroidal bubble on an incident sound field. In addition to the acoustical investigations, we describe the construction of a large hallway apparatus for further investigations and for hands-on use by the public. The tank has cross section 2 feet by 2 feet and height 6 feet, and the parameters of reservoir pressure and time between air bursts are adjustable by the observer.

DTIC

*Acoustic Emission; Acoustic Properties; Bubbles; Construction*

**20040059255** Lamont-Doherty Geological Observatory, Palisades, NY

**Location, Characterization and Quantification of Hydroacoustic Signals in the Indian Ocean**

Tolstoy, M.; Bohnenstiehl, D.; Feb. 19, 2004; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DTRA01-01-C-0070; Proj-DTRA

Report No.(s): AD-A422211; AFRL-VS-HA-TR-2004-1017; No Copyright; Avail: CASI; A03, Hardcopy

Data from three Indian Ocean hydroacoustic stations (Diego Garcia North, Diego Garcia South, and Cape Leeuwin) have been characterized and quantified for the calendar year 2002. These results were delivered in the form of a 2002 catalogue, and are briefly summarized here, with additional consideration of their significance in the overall station characterization. Background noise spectra for each station have been characterized for the entire year and show distinct seasonal variations, as well as station-to-station differences. For the most part, Garcia North is the quietest station, with Garcia South being slightly noisier, and Cape Leeuwin being the noisiest station. These observations in background noise variations help explain variations in some of the signals observed at each station. Quantification of observed signals show that ship noise is the most commonly observed signal at all three sites with a whale call being a frequent source of background signal. Airgunning is also observed at the three sites.

DTIC

*Indian Ocean; Position (Location); Underwater Acoustics*

**20040059306** Boston Univ., Boston, MA

**The Perceptual Impact of Simulating Sources Within Reach of a Listener**

Shinn-Cunningham, Barbara; Apr. 20, 2004; 11 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0005; Proj-2313

Report No.(s): AD-A422278; AFRL-SR-AR-TR-04-0241; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes the results of the research performed at Boston University (and in collaboration with researchers at the Air Force Research Laboratory Hurnan Effectiveness Branch) on the acoustics and psychoacoustics of sound localization for sound sources near a listener's head, particularly in rooms where the effects of reverberation influence performance. The results of this work are unique in that little previous work has examined how the acoustics of the signals reaching a listener depend on the environment. Detailed analysis of the acoustic signals reaching a listener in a classroom demonstrate that the listener location relative to nearby walls has a dramatic impact on spatial acoustic cues. Source location relative to the listener also has a large impact; distortion of spatial cues generally grows with source distance and with source laterality. The ability to detect and understanding a sound source in the presence of a masker sound source improves when the competing sources are in different source locations. Results studying the effects of this 'spatial unmasking' for nearby sources shows that the large interaural level differences that arise for nearby sources have an important influence on spatial unmasking. Furthermore, the influence of spatial unmasking decreases with growing levels of reverberant energy if the masker is a steady-state signal. However, the unmasking is robust in cases where the masking source is speech. The results suggest that even noisy, distorted spatial cues are sufficient to mediate competition between competing sources that are spectro-temporally complex, conditions in which 'informational masking' dominates behavior.

DTIC

*Signal Transmission; Simulation; Sound Waves*

**20040059321** Washington Univ., Seattle, WA
**An Acoustic Hemostasis Device for Acute Arterial Bleeding**
Crum, Lawrence; Andrew, Marilee; Vaezy, Shahram; Kaczkowski, Peter; Kargl, Steven; Apr. 21, 2004; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-G-0460
Report No.(s): AD-A422316; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes research efforts conducted under the ONR grant entitled An Acoustic Hemostasis Device for Acute Arterial Bleeding, ' Lawrence Crum, Principal Investigator. The revised scope of effort concentrated on four tasks: Bleeding Detection, Therapy Delivery, Systems Design and Development, and Animal Testing of Systems. The revised performance period was 19 February 2002 -31 December 2003.
DTIC
*Arteries; Audio Equipment; Hemostatics; Medical Equipment*

**20040059623** Quantitative Morphology Consulting, San Diego, CA, USA
**Biomimetic Dolphin Sonar Source**
Cranford, Ted W.; Elsberry, Wesley R.; Jan. 20, 2004; 5 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0683
Report No.(s): AD-A422271; No Copyright; Avail: CASI; A01, Hardcopy

Dolphin click generators were studied via anatomy, tissue properties, physiology, and acoustic analyses. Our objective was to design, produce, and test computational models and physical devices that mimic dolphin sonar signal generation. Our multi-mass computational model of dolphin click production was based the Steinecke-Herzel model of the human larynx. We developed and implemented an acoustic model that translates the motions from our multi-mass model into acoustic signals. We also mastered CNC controlled milling machine and lathe operations to produce physical prototypes of biomimetic sound sources, complete with dolphin-like phonic lips and a pneumatic driver.
DTIC
*Biomimetics; Dolphins; Sonar*

**20040059754** Duke Univ., Durham, NC, USA
**Array Shape Tracking Using Active Sonar Reverberation**
Varadarajan, Vijay; Krolik, Jeffrey; Mar. 13, 2003; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421701; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this project is to estimate and track the shape of a towed distorted linear array using reverberation from active sonar pings as a distributed source of opportunity.
DTIC
*Reverberation; Shapes; Sonar*

## 72
## ATOMIC AND MOLECULAR PHYSICS

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

**20040058059** NASA Ames Research Center, Moffett Field, CA, USA
**The Role of Born-Oppenheimer Breakdown in the Prediction of Accurate Transition Frequencies in Ordinary Molecules**
Schwenke, David W.; [2003]; 23 pp.; In English; International Symposium on Molecular Spectroscopy, 20 Jun. 2003, Columbus, OH, USA; No Copyright; Avail: CASI; A03, Hardcopy

Conclusions from this work: Born-Oppenheimer breakdown is important at 1 cm(sup-1) level; BO corrections can be computed accurately ab initio; Basis extrapolations can be very accurate;and Deviations from FCI?
Derived from text
*Born-Oppenheimer Approximation; Predictions; Molecules*

**20040059750** Old Dominion Univ., Newport News, VA, USA
**Application of Ultracold Molecules to Inertial Sensing for Navigation**
Sukenik, Charles L.; Jan. 2004; 4 pp.; In English
Contract(s)/Grant(s): N000140310875; Proj-03PR12414-00
Report No.(s): AD-A421641; No Copyright; Avail: CASI; A01, Hardcopy

We are studying fundamental interactions between ultracold atoms and near-resonant laser light. In particular, we have been investigating ultracold collisions between one alkali atom (rubidium) and one metastable noble gas atom (argon). The research is geared to the ultimate goal of producing ultracold molecules for use in a new generation of matter wave interferometers with enhanced sensitivity. Such devices will improve the performance of gyroscopes used in naval navigational systems. The project addressed above is a long term (multi-year) endeavor. During the performance period of the ONR grant, we have observed a surprisingly weak interaction between ultracold rubidium and ultracold, metastable argon. We have measured a total trap loss rate coefficient for rubidium due to the presence of argon. Experiments to assign the exact mechanism of trap loss (radiative escape, Penning ionization, associative ionization.. .) are ongoing. We successfully implemented a quadrupole mass spectrometer system which is capable of differentiating between ionization products. As a result, a new measure of the ratio of Penning to associative ionization in metastable argon traps has been made.
DTIC
*Detection; Diatomic Molecules; Inertial Navigation; Molecules*

## 73
## NUCLEAR PHYSICS

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

**20040059208** California Univ., San Diego, La Jolla, CA
**Positron Plasmas in the Laboratory**
Surko, Clifford M.; Apr. 15, 2004; 9 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0123
Report No.(s): AD-A422126; No Copyright; Avail: CASI; A02, Hardcopy

The focus of this project was the development of efficient methods to accumulate low-energy positrons in the laboratory and to create positron plasmas and beams in new regions of parameter space. A new high-magnetic-field, cryogenic positron storage trap was put into operation. Rapid cooling is achieved by cyclotron emission in a 5 tesla magnetic field. Radial plasma compression is achieved using a rotating, radio-frequency electric field. New plasma operating regimes were explored that offer the potential to produce higher density positron plasmas, infinite confinement times, and a new-generation of cold, bright positron beams. Techniques were developed to efficiently compress plasmas without the need to carefully tune the frequency of the rotating electric field. A method of beam extraction was demonstrated that can produce a finely focused beam with a diameter of four Debye lengths. At the end of the project, research was in progress to explore and understand the limits of plasma density compression with the goals of massive positron storage and the creation of brighter positron beams.
DTIC
*Beams (Radiation); Plasmas (Physics); Positrons*

**20040059786** Waseda Univ., Tokyo, Japan
**Leakage of Gamma Rays and Neutrons from Thick Targets Bombarded by Energetic Protons**
Yamashita, N.; Hasebe, N.; Kobayashi, M.-N.; Miyachi, T.; Miyajima, M.; Okudaira, O.; Berezhnoy, A. A.; Shibamura, E.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Cosmic-ray-induced nuclides and naturally radioactive elements result in emission of gamma rays with energies characteristic of planetary surface materials. Measuring the gamma rays determines the elemental composition of the surface. Quantitative nuclear data are required for the analysis of mission data. Fluxes of line gamma rays from a planet are essential to the analysis of elemental abundances. A continuum level in the energy spectrum is important in designing a gamma-ray spectrometer for a space mission, but is not precisely known. A minimum detectable limit of elements is determined not only by emission fluxes of the elements but also sensitivity of a detection system, which is governed by observation time, detection

efficiency, energy resolution, and background counts in terms of signal-to-noise ratio. Therefore the increase in planetary missions which employ gamma-ray spectrometers, e.g. SELENE, demand more sophisticated nuclear data, which will be gained by ground experiments using an accelerator. When executing ground experiments, some basic parameters are required, for example, how large a target should be. When carrying out an efficient and low-cost experiment, the behavior of secondary neutrons produced by energetic protons in thick materials should be studied. Monte Carlo simulation library Geant4 release 5.2.p02 is employed to calculate production, transport, and reaction of neutrons and gamma rays. The irradiation environment of a planetary surface is simulated using proton beams regarded as cosmic rays and target materials as planetary surfaces, except the fact that the targets are not isotropically irradiated on the whole surface.
Derived from text
*Gamma Rays; Neutrons; Proton Beams; Energetic Particles*

## 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*.

**20040059172** Massachusetts Inst. of Tech., Cambridge, MA
**PBG Cavity in NV-Diamond for Large Scale Type II Quantum Computing**
Shahriar, Selim; Apr. 22, 2004; 32 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0520
Report No.(s): AD-A422052; AFRL-SR-AR-TR-04-0183; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this project was to investigating the feasibility of realizing a type II quantum computer (QC) on a large scale, using nitrogen-vacancy color centers in diamond (NV-Diamond). To see the basic mechanism behind this scheme, consider a small volume of this medium. A laser beam incident on this volume can interact with all the centers in this volume. However, each center has a transition frequency that is slightly different from that of the others, a feature known as inhomogeneous broadening. This implies that individual centers can be addressed distinctively by tuning the laser. . In order to perform two qubit operations, such as the controlled-NOT (CNOT), it is necessary to couple two centers that are spectrally adjacent. One mechanism for such a coupling is the dipole-dipole interaction. However, since the spectral neighbors are not necessarily close to each other spatially, it is necessary to enhance this interaction artificially. This can be achieved by embedding the centers in a high-Q optical cavity. A key challenge in realizing this scheme is the cavity. If one were to embed the NV-diamond crystal inside a bulk-mirror based cavity, the residual reflection from the crystal surfaces would degrade the Q to an unacceptable level. A photonic band gap (PBG) cavity holds the best promise to overcome this constraint. The small mode volume of the PBG cavities (on the order of lambda 3 ) implies that the coupling of cavity photons to atoms in the cavity will be enhanced by three or more orders of magnitude over conventional bulk-mirror based cavity couplings. Another key feature of this approach is that the whole substrate will contain many QC's that can be operated simultaneously. Such a structure is ideally suited for type II quantum computing on a large scale. Such a QC may enable efficient computation of complex fluid dynamics, for example.
DTIC
*Cavities; Diamonds; Photonics; Quantum Computation; Quantum Theory*

**20040059234** California Univ., Davis, CA
**Modeling Communication Losses and Interference in Fiber Optic Systems**
Rocke, David M.; Rodrigue, Garry; Woodruff, David L.; Kolner, Brian H.; Dec. 2003; 16 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0327
Report No.(s): AD-A422167; AFRL-SR-AR-TR-04-0185; No Copyright; Avail: CASI; A03, Hardcopy

Philosophy: The transmission characteristics of optical fibers are of utmost importance for future communication systems. Higher bandwidth and better signal quality are but a few of the reasons that fiber optics are replacing conventional means of communication. However, an optical signal experiences all kinds of losses as it propagates and demands the use of regenerators repeaters along the length of the fiber. External factors that can cause such losses include deformations of the fiber such as bends or environmental effects such as electrical fields. Consequently, a better understanding of these losses will lead to more efficient optical communication systems.
DTIC
*Fiber Optics; Optical Communication; Telecommunication; Transmission Lines*

**20040059277** Polytechnic Univ., Brooklyn, NY
**Electromagnetic Modeling of Quantum-Well Infrared Photodetectors**
Tamir, Theodor; Nov. 4, 2003; 11 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0126
Report No.(s): AD-A422244; ARO-39672.11-EL; No Copyright; Avail: CASI; A03, Hardcopy

Our work has focused on two principal aspects: (a) developing a rigorous modal transmission-line (MTL) approach for modeling quantum-well infrared photodetectors (QWIPs) and other optoelectronic devices, and (b)applying this approach to evaluate the performance of actual QWIPs, The geometry of the QWIPs may include any number of different dielectric and metallic layers. which may generally be periodic with arbitrary profiles. The theoretical part (a) was carried out for both two-dimensional lamellar and three- dimensional grid geometries. In the applied part (b), we have obtained numerical results for QWIPs under experimental study by scientists at the Army Research laboratory (ARL) and Princeton University. with whom we collaborated on a continuous basis. Our analytical results show very good agreement with the experimental data, thus establishing that our MTL modeling is both powerful and accurate. Using this approach, we have also derived design criteria for a wide variety of QWIPs, which were subsequently fabricated with specifications that conformed to our design guidelines. In addition, we have developed design procedures for new QWIPs for focal plane arrays, as well as novel QWIP geometries to be used as two- color detectors, or as spectrometers over a wide frequency range. These newer devices are presently in the fabrication stage at ARL.
DTIC
*Infrared Radiation; Photometers; Quantum Wells*

**20040059302** Massachusetts Inst. of Tech., Cambridge, MA
**Feasibility of Spectral Holeburning Memories and Processors for Space-Based Applications**
Shahriar, Selim; Ezekiel, Shaoul; Warde, Cardinal; Apr. 22, 2004; 38 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0224
Report No.(s): AD-A422273; AFRL-SR-AR-TR-04-0182; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this research was to explore the feasibility of using spectral hole-burning (SHB) memories for caching and processing large amounts of high-speed imagery data that are expected in future space-based surveillance systems. The research was to consist of three parts. First, the power of spectral holeburning for image-based storage and processing was to be illustrated by performing several demonstration experiments, using Raman excited spin coherence (RESC). Second, the properties of Raman excited spin coherences were to be used to increase the operating temperature of spectral holeburning materials. Third, long term storage of very high volume of optical data was to be demonstrated via frequency domain spectral holeburning in an organic dye embedded in a host of PMMA. In pursuing application of RESC, we have demonstrated that nitrogen- vacancy color centers in diamond is a viable medium for SHB memory. Furthermore, we have demonstrated, for the first time in a solid, the slowing and halting of light pulses in a crystal of Pr:YSO. This effect has spawned a wide range of activities in the research community, and has a range of application including optical data buffering and high- fidelity quantum memory. For high volume storage systems, it became clear early on that the objectives of this project could be better met by simple variations of the tasks originally envisioned.
DTIC
*Spectra*

**20040059775** Bern Univ., Bern, Switzerland
**A BRDF Measurement Apparatus for Lab-based Samples**
Gunderson, K.; Whitby, J.; Thomas, N.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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 intensity distribution of scattered light off of any material's surface, whether that surface is a planetary regolith layer or otherwise, is rarely isotropic. For example, illuminated portions of the Moon exhibit an apparent increase in brightness as phase angle decreases. Such opposition effects generally are attributed to the disappearance of large surface grain shadows behind illuminated portions of the grains. This non-Lambertian property demonstrates the dependence of the scattered light distribution, commonly called the bidirectional reflectance distribution function (BRDF), on basic microscopic (or subpixel) physical properties of the scattering surface. Additionally, this dependence suggests that BRDF measurements of planetary surfaces can make valuable contributions to the remote sensing of surface properties. Transmitter arm
Derived from text
*Brightness; Planetary Surfaces; Bidirectional Reflectance; Regolith; Remote Sensing; Surface Properties*

**20040059991** Lawrence Livermore National Lab., Livermore, CA
**X-ray Optics Research for the Linac Coherent Light Source: Interaction of Ultra-short X-ray Laser Pulses with Optical Materials**
Kuba, J.; Jul. 24, 2002; 10 pp.; In English
Report No.(s): DE2004-15006121; UCRL-JC-147682; No Copyright; Avail: Department of Energy Information Bridge

Free electron lasers operating in the 0.1 to 1.5 nm wavelength have been proposed for the Stanford Linear Accelerator Center and DESY (Germany). The unprecedented brightness and associated fluence predicted for pulses <300 fs pose new challenges for optical components. A criterion for optical component design is required, implying an understanding of x-ray-matter interactions at these extreme conditions. In our experimental effort, the extreme conditions are simulated by currently available sources ranging from optical lasers, through x-ray lasers (at 14.7 nm) down to K-alpha sources ((approx)0.15 nm). In this paper we present an overview of our research program, including (a) Results from the experimental campaign at a short pulse (100 fs-5 ps) power laser at 800 nm, (b) K-a experiments, and (c) Computer modeling and experimental project using a tabletop high brightness ps x-ray laser at the Lawrence Livermore National Laboratory.
NTIS
*Linear Accelerators; Xray Lasers*

## 75
## PLASMA PHYSICS

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

**20040056365** Stanford Linear Accelerator Center, Stanford, CA, USA
**Reference Guide for Cryogenic Properties of Materials**
Weisend, J. G.; Thompson, F. E.; Sep. 2003; 16 pp.; In English
Report No.(s): DE2003-815653; SLAC-TN-03-023; No Copyright; Avail: Department of Energy Information Bridge

A thorough knowledge of the behavior of materials at cryogenic temperatures is critical for the design of successful cryogenic systems. Over the past 50 years, a tremendous amount of material properties at cryogenic temperatures have been measured and published. This guide lists resources for finding these properties. It covers online databases, computer codes, conference proceedings, journals, handbooks, overviews and monographs. It includes references for finding reports issued by government laboratories and agencies. Most common solids and fluids used in cryogenics are covered.
NTIS
*Cryogenics; Computer Programs; Temperature*

**20040059026** Boston City Hospital, Boston, MA
**Plasma Instability Based Compact Coherent Terahertz Radiation Sources**
Bakshi, P.; Kempa, K.; Feb. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0108
Report No.(s): AD-A421700; ARO-40460.7-PH; No Copyright; Avail: CASI; A02, Hardcopy

We explore the feasibility of plasma instabilities in quantum well structures with the aim of developing compact, coherent THz radiation sources, by introducing and studying specific structures which could lead to experimental verification of current driven plasma instabilities, and ensuing Thz radiation. A fully self-consistent formalism was developed to determine the non-equilibrium steady state under bias. Determination of the non-equilibrium steady state provides the I-V curves and the plasma response. These are in good agreement with experiments carried out at TU Vienna. A sharp emission line was obtained in the most recent structure, suggesting that we are close to the onset of plasma instability. Effects of magnetic field on the electron- electron scattering rate was studied theoretically, and experimentally verified, providing a diagnostic tool for the relative strength of two-electron, vs. one-electron scattering processes. A new connection was established with an experimental group at UC santa Barbara, to obtain an independent proof of principle of the plasma instability phenomenon in a THz pumped quantum well structure.
DTIC
*Coherent Radiation; Magnetohydrodynamic Stability; Radiation Sources*

**20040059156** Old Dominion Univ., Norfolk, VA
**Development of MHD Algorithms on Type II Quantum Computers**
Vahala, Linda; Mar. 9, 2004; 6 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0462
Report No.(s): AD-A422027; 213971; AFRL-SR-AR-TR-04-0204; No Copyright; Avail: CASI; A02, Hardcopy

While a classical computer manipulates either a '0' or '1' bit, a quantum computer can manipulate states that are arbitrary superpositions of these base states-a qubit state. Quantum computers can entangle and operate on a collection of qubits in parallel and thereby provide exponential speed up over classical computers. Quantum lattice algorithms have been developed to solve problems that are very difficult to solve in classical computers- e.g. magnetohydrodynamic turbulence. In particular a special sequence of collide-steam operators, that can be implemented on a quantum computer, has been devised that will recover the one-dimensional magnetohydrodynamic equations. The results are compared to classical algorithms and the results are in excellent agreement. The power law spectrum is shown to be k(- 2). Quantum lattice algorithms have also been developed for nonlinear Schrodinger equations and Korteveg-deVries solitons. There is again excellent agreement between the quantum algorithm solutions and the exact analytic soliton solutions.
DTIC
*Algorithms; Magnetohydrodynamics; Quantum Computers; Quantum Theory*

**20040059217** HyPerComp, Inc., Westlake Village, CA
**Performance Enhancement of High Speed Inlets using MHD**
Aithal, Shashi; Munipalli, Ramakanth; Shankar, Vijaya; Mar. 30, 2004; 84 pp.; In English
Contract(s)/Grant(s): F49620-01-C-0022
Report No.(s): AD-A422143; AFOSR-01-2004; AFRL-SR-AR-TR-04-0233; No Copyright; Avail: CASI; A05, Hardcopy

HyPerComp is developing advanced computational tools to model high speed flows with MHD effects. Unstructured, multi-dimensional hypersonic MHD codes have been developed at HyPerComp to study supersonic viscous flows in a self-consistent, fully coupled manner. Effects of thermal, chemical and internal mode dis-equilibrium with and without the presence of electro-magnetic fields have been included in these codes. An existing parallel code environment using generalized mesh structure (prisms, tetrahedra, etc.) developed for Computational Electromagnetics, was adapted to model MHD with (a) Finite rate chemistry of ionizing air, (b) Thermal Non-equilibrium (Distribution of energy across various modes of storage), and (c) Electromagnetic effects. The effect of boundary conditions such as conducting/non-conducting walls, applied or extracted electric power and so forth, render this predictive capability invaluable in the study of MHD accelerators, power generators, turbulence control, and integrated analysis of fluid mechanics and time-varying electromagnetic fields. The subject of inlet flow control for hypersonic vehicles with MHD has attracted attention due to the possibility of flow modifications without the need for moving parts. There are numerous proposed designs to reduce drag, decrease total pressure loss and enhance air mass capture using MHD. Additionally, proposed MHD based concepts can even serve as a source of auxiliary onboard power, and as means to increase thrust produced by nozzles in hypersonic vehicles. The code development activity at HyPerComp has resulted in a high performance toolkit by which these ideas can be tested computationally.
DTIC
*Augmentation; High Speed; Magnetohydrodynamics*

**20040059992** Lawrence Livermore National Lab., Livermore, CA
**Photometric Calibration of an EUV Flat Field Spectrometer**
May, M.; Lepson, J.; Beiersdorfer, P.; Thorn, D.; Chen, H.; Jul. 03, 2002; 16 pp.; In English
Report No.(s): DE2004-15006156; UCRL-JC-148357; No Copyright; Avail: Department of Energy Information Bridge

The photometric calibration of ail extreme ultraviolet flat field spectrometer has been done at the Advanced Light Source at LBNL. This spectrometer is used to record spectrum for atomic physics research from highly charged ions in plasmas created in the Livermore electron beam ion traps EBIT-I and SUPEREBIT. Two calibrations were done each with a different gold-coated grating, a 1200 l/mm and a 2400 L/mm, that covered 75 - 300A and 15 - 160A, respectively. The detector for this calibration was a back thinned CCD. The relative calibration was determined for several different incident angles for both gratings. Within the scatter of the data, the calibration was roughly insensitive to the incidence angle for the range of angles investigated.
NTIS
*Photometry; Spectrometers; Calibrating; Extreme Ultraviolet Radiation*

## 76
## SOLID-STATE PHYSICS

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

**20040059042** Phillips Lab., Hanscom AFB, MA
**Lattice-Gas Crystallization**
Yepez, Jeffrey; Jun. 20, 1994; 40 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421735; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a new lattice-gas method for molecular dynamics modeling. A mean field treatment is given and is applied to a linear stability analysis. Exact numerical simulations of the solid-phase crystallization is presented, as is a finite-temperature multiphase liquid-gas system. The lattice-gas method, a discrete dynamical method, is therefore capable of representing a variety of collective phenomena in multiple regimes from the hydrodynamic scale down to a molecular dynamics scale.
DTIC
*Crystallization; Lattice Vibrations*

## 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*.

**20040057993** Raytheon Information Technology and Scientific Services, Moffett Field, CA, USA
**Student Interns Work on Mars**
Bowman, C. D.; Bebak, M.; Bollen, D. M.; Curtis, K.; Daniel, C.; Grigsby, B.; Herman, T.; Haynes, E.; Lineberger, D. H.; Pieruccini, S., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The exceptional imagery and data acquired by the Mars Exploration Rovers since their January 2004 landing have captured the attention of scientists, the public, and students and teachers worldwide. One aspect of particular interest lies with a group of high school teachers and students actively engaged in the Athena Student Interns Program. The Athena Student Interns Program (ASIP) is a joint effort between NASA s Mars Public Engagement Office and the Athena Science Investigation that began in early 1999 as a pilot student-scientist research partnership program associated with the FIDO prototype Mars rover field test . The program is designed to actively engage high school students and their teachers in Mars exploration and scientific inquiry. In ASIP, groups of students and teachers from around the country work with mentors from the mission s Athena Science Team to carry out an aspect of the mission.
Derived from text
*Education; Mars Exploration*

**20040062024** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062025 - 20040062032
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Engaging K-12 Educators, Students, and the General Public in Space Science Exploration' included the following reports:Training Informal Educators Provides Leverage for Space Science Education and Public Outreach; Teacher Leaders in Research Based Science Education: K-12 Teacher Retention, Renewal, and Involvement in Professional Science; Telling the Tale of Two Deserts: Teacher Training and Utilization of a New Standards-based, Bilingual E/PO Product; Lindstrom M. M. Tobola K. W. Stocco K. Henry M. Allen J. S. McReynolds J. Porter T. T. Veile J. Space Rocks Tell Their Secrets: Space Science Applications of Physics and Chemistry for High School and College Classes -- Update; Utilizing Mars Data in Education: Delivering Standards-based Content by Exposing Educators and Students to Authentic Scientific Opportunities and Curriculum; K. E. Little Elementary School and the Young Astronaut Robotics Program; Integrated Solar

System Exploration Education and Public Outreach: Theme, Products and Activities; and Online Access to the NEAR Image Collection: A Resource for Educators and Scientists.
Derived from text
*Education; Space Exploration*

## 81
## ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**20040059814** NASA, Washington, DC, USA
**ASK Magazine, No. 17**
Laufer, Alexander, Editor; Post, Todd, Editor; Brady, Jody Lannen, Editor; McKee, Sally, Editor; April 2004; 43 pp.; In English; See also 20040059815 - 20040059824
Report No.(s): NASA/NP-2004-02-337-HQ; No Copyright; Avail: CASI; A03, Hardcopy

The following articles were processed for inclusion in the NA&SD database:Right on Time, Radically; Radical is Temporary; Walking a Fine Line; Sounds Clear Enough; Bringing Up Baby; Transition Time: Zero; Passing the Baton - Lessons in Regret; The PMDP Roadmap; Managing History: A Practicum; and ASK Talks with Tom Gavin.
Derived from text
*Project Management; Decision Making*

**20040059815** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Radical is Temporary**
Barrett, Larry; ASK Magazine, No. 17; April 2004, pp. 10-13; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

I suspect that even if Ken had stayed on, we would have evolved to the state we're in right now. In terms of the nature of the work that we're doing, we've gone from development to maintenance, and so the project team needed to evolve to reflect that change. The analogy I use to describe Hubble is a data factory, and we provide the factory controller. The telescope takes in light and produces pictures, and we're the ones sending all of the control signals and monitoring the temperature, power, and voltages in the factory to make sure the production line is doing its job and that it's not reaching some sort of a stress point. That's basically it. We maintain the Hubble command and control system. I think we're still putting out a good quality product. We still meet our schedule and cost milestones. Every time we make a change to the ground system, we run a suite of tests to make sure that the system still runs as expected, and that it correctly controls the spacecraft. Other than that, provided the interfaces are controlled, everything is okay.
Derived from text
*NASA Programs; Project Management; Management Methods; Personnel Management*

**20040059816** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Walking a Fine Line**
Bothwell, Mary; ASK Magazine, No. 17; April 2004, pp. 14-17; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

My division was charged with building a suite of cameras for the Mars Exploration Rover (MER) project. We were building the science cameras on the mass assembly, the microscope camera, and the hazard and navigation cameras for the rovers. Not surprisingly, a lot of folks were paying attention to our work - because there's really no point in landing on Mars if you can't take pictures. In Spring 2002 things were not looking good. The electronics weren't coming in, and we had to go back to the vendors. The vendors would change the design, send the boards back, and they wouldn't work. On our side, we had an instrument manager in charge who I believe has the potential to become a great manager, but when things got behind schedule he didn't have the experience to know what was needed to catch up. As division manager, I was ultimately responsible for seeing that all my project and instrument managers delivered their work. I had to make the decision whether or not to replace him.
Derived from text
*NASA Programs; Project Management; Personnel Management*

**20040059817** Line6, USA
**Sounds Clear Enough**
Zak, Alan; ASK Magazine, No. 17; April 2004, pp. 18-21; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

I'm a vice president at Line6, where we produce electronics for musical instruments. My company recently developed a guitar that can be programmed to sound like twenty-five different classic guitars - everything from a 1928 National 'Tricone' to a 1970 Martin. It is quite an amazing piece of technology. The guitar started as a research project because we needed to know if the technology was going to be viable and if the guitar design was going to be practical. I've been in this business for about twenty years now, and I still enjoy starting up projects whenever the opportunity presents itself. During the research phase, I headed up the project myself. Once we completed our preliminary research and made the decision to move into development, that's when I handed the project off - and that's where this story really begins.
Author
*Project Management; Product Development*

**20040059818** NASA Ames Research Center, Moffett Field, CA, USA
**Bringing Up Baby**
Guastaferro, Angelo; ASK Magazine, No. 17; April 2004, pp. 22-25; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

In 1977, I had just finished eight years on the Viking program, which was just a marvelously rich, fascinating experience, using the most up-to-date, sophisticated management techniques, under an outstanding leader named Jim Martin. After that, you could say the opportunities available to me within NASA in some ways were limitless. I remember quite vividly when I got the phone call from Ed Cortright, who was the Langley Center Director at the time, with news about my next assignment. He asked me to come to the aid of a project that was in trouble, the Rotor Systems Research Aircraft (RSRA).
Derived from text
*NASA Programs; Project Management; Management Methods*

**20040059819** Proctor and Gamble Co., USA
**Transition Time: Zero**
Cameron, W. Scott; ASK Magazine, No. 17; April 2004, pp. 26-28; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

I had been in a technical/project management assignment about two years, when one day my boss asked me to come to his office to 'discuss an opportunity.' When I arrived in his office, he indicated that the project manager of one of our biggest ($10M+) and most important projects had requested to be removed from the job immediately, and the organization was going to grant the request. He felt I was the most experienced person he had and thought I would be a perfect fit for this job.
Author
*Project Management; Personnel Management*

**20040059820** Missile Defense Agency, Washington, DC, USA
**Passing the Baton: Lessons in Regret**
Little, Terry; ASK Magazine, No. 17; April 2004, pp. 28; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

I have led six major defense acquisition programs during my civil service career. For most of those, I was the first leader the program had and did not have to adjust to someone else's legacy. This was both good and bad. The obvious good was that I was able, for the most part, to fashion things as I wanted them. These included patterns of interaction inside and outside the project office. I chose who would be in leadership positions. I developed the managerial philosophy and leadership vision. I decided my role vis-a-vis others in the office. I created the expectations and goals. The bad part was that all the while I was doing this I never considered what I might be leaving my successor to deal with. My reasoning was simple: I never intended to leave. I should have known better.
Author
*Project Management; Management Methods*

**20040059821** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Right on Time, Radically**
Lehtonen, Ken; ASK Magazine, No. 17; April 2004, pp. 6-9; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

Back in the early 1990s, reengineering was all the rage. All of the corporations and their CEOs got excited about the prospect of having to streamline and reorganize, reengineering their organizations in an effort to improve the bottom line. NASA Goddard Space Flight Center was no exception to that rule. Some folks in upper management wanted to take advantage of this new paradigm and they turned their attention to the Hubble Space Telescope ground system. The objective was to reduce the operating cost of the system by at least 50 percent. This was a noble objective, as Hubble would likely be around for another ten to fifteen years at least.
Derived from text
*NASA Programs; Project Management; Management Methods*

**20040059822** NASA, USA
**The PMDP Roadmap**
ASK Magazine, No. 17; April 2004, pp. 29-31; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

NASA's complex and highly technical missions rely on effective project teams and managers. Since 1993, through its Project Management Development Process (PMDP), the Academy of Program and Project Leadership (APPL) has offered direction to the Agency's project practitioners as they advance in their careers. PMDP helps identify and sequence professional experiences, courses, and other project-based learning experiences that support individual career goals and center activities by outlining competencies at four levels of development. The result is that PMDP provides NASA project practitioners with a road map to the knowledge and competencies appropriate for their job and the jobs to which they aspire. Plus, new this year, APPL has rolled out its electronic Project Management Development Process (ePMDP) tool, a learning management system that includes a dynamic presentation of the PMDP levels, competency areas, competency organizational structures, Individual Development Plans (IDP), and online PMDP enrollment. APPL's website, www.appl.nasa.gov, provides access to ePMDP as well as other online resources for NASA practitioners enrolled in the Project Management Development Process.
Author
*NASA Programs; Project Management; Leadership; Management Methods*

**20040059823** NASA, Washington, DC, USA
**Managing History: A Practicum**
Garber, Stephen J.; ASK Magazine, No. 17; April 2004, pp. 32-34; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

In the summer of 2002, I was asked to serve as interim chief historian for NASA until a permanent replacement was hired.
Author
*NASA Programs; Histories; Management Methods; Project Management*

**20040059824** NASA, Washington, DC, USA
**ASK Talks with Tom Gavin**
ASK Magazine, No. 17; April 2004, pp. 35-39; In English; See also 20040059814; No Copyright; Avail: CASI; A01, Hardcopy

Thomas R. Gavin joined the Jet Propulsion Laboratory (JPL) in 1962. Currently the Associate Director of Flight Projects and Mission Success he has garnered a long list of engineering and management positions, including serving as mission assurance manager for both the Voyager and Galileo projects.
Author
*NASA Programs; Project Management; Management Methods*

## 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*.

**20040056135**
**Refining and Revising the Gulf of Mexico Outer Continental Shelf Region High-Probability Model for Historic Shipwrecks: Final Report. Volume 3: Appendices**
Pearson, C. E.; James, S. R.; Krivor, M. C.; El Darragi, S. D.; Cunningham, L. L.; Dec. 2003; 142 pp.; In English
Report No.(s): PB2004-104714; No Copyright; Avail: CASI; A07, Hardcopy

For 20 years, the Minerals Management Service (MMS) has required cultural resources assessments for oil and gas leases in the northern Gulf of Mexico. These assessments reflect the obligations of the MMS relative to the identification, protection and management of prehistoric and historic properties that may exist on Federal lands in this area. In 1989, the Texas A&M Research Foundation conducted a study for MMS (Garrison et al. 1989) to identify high-probability areas and establish remote-sensing survey guidelines and equipment requirements most appropriate for locating historic shipwrecks on the Outer Continental Shelf (OCS) in the Gulf of Mexico Region (GOMR). Over the years, deficiencies in the 1989 model of historic shipwreck distributions and occurrences have been noted, plus new remote-sensing technologies have been developed that have application to the MMS program of offshore surveys. The present study was undertaken to refine the model of shipwreck distributions presented in the 1989 study and reevaluate the survey strategies and instrumentation recommended. These report appendices provide technical information on: 1989 shipwreck database developed by Garrison; mangetometer technology; grid transects coordinates for the Josaphine and Rhoda; and stipcharts.
NTIS
*Remote Sensing; Continental Shelves; Gulf of Mexico; Data Bases*

**20040059009** Department of Defense, Arlington, VA
**Acquisition: Acquisition Management of the Army's All Source Analysis System (D-2004-006)**
Oct. 10, 2003; 40 pp.; In English
Report No.(s): AD-A421622; IG/DOD-(D-2004-006); No Copyright; Avail: CASI; A03, Hardcopy

Who Should Read this Report and Why? DoD acquisition executives, program managers, and independent testers and evaluators should read this report because similar management control issues may apply to other weapons and information technology acquisitions. The All Source Analysis System (ASAS) is an Army Acquisition Category II, mission- critical weapon system that has been in development since 1979. It is a family of systems being acquired and deployed by evolutionary blocks and spiral version enhancements. A key ASAS component is the Remote Workstation. The combination hardware and software system provides automated information support to intelligence staff elements and other designated intelligence organizations. The Program Executive Officer, Command, Control and Communications Tactical is the ASAS Milestone Decision Authority. The Project Manager, Intelligence and Effects, in coordination with the Army Training and Doctrine Command System Manager and the Army Test and Evaluation Command, acquires, tests, and deploys ASAS hardware and software components. Total Army acquisition development and deployment costs for ASAS could exceed $2.5 billion.
DTIC
*Analysis of Variance; Management Planning; Organizations; Procurement*

**20040059012** National Defense Univ., Norfolk, VA
**To Wield Excalibur: Seeking Unity of Effort in Joint Information Operations**
Jones, Synthia S.; Flowers, Bernard; Johnson, Karlton D.; Jun. 7, 2002; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A421636; No Copyright; Avail: CASI; A03, Hardcopy

Throughout history, many authors have used European folklore as a medium to express complex ideas and clarify issues. Most known is the legend of King Arthur, a memorable story replete with rich allusions and profound metaphors. The Arthurian legend depicts Britain as a divided country: factional and disjointed with feudal entities fighting for control of the land. All seemed lost until the Lady of the Lake gave King Arthur the sword, Excalibur. Wielding this sword with vision, Arthur unified the people to bring order to a troubled land. There is a similar need for order leading to unity of effort in the realm of Joint information Operations (JIO).
DTIC
*Information Management; Information Dissemination*

**20040059040** SRI International Corp., Menlo Park, CA
**Incremental Negotiation and Coalition Formation for Resource-Bounded Agents**
Ortiz, Charles L.; Vincent, Regis; Hsu, Eric; Dutertre, Bruno; Grosz, Barbara; Jan. 2004; 116 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-C-0169; Proj-H358
Report No.(s): AD-A421724; AFRL-IF-RS-TR-2004-14; No Copyright; Avail: CASI; A06, Hardcopy

This report describes SRI's contributions toward the solution of the problem of real-time distributed resource allocation.

For the most part, the distributed multi-sensor challenge problem utilized by the Defense Advanced Research Projects Agency's Autonomous Negotiating Teams (ANTs) program was used to motivate the research. However, the contributions are not restricted to the sensor domain. We model the resource allocation problem as a multiagent problem in which each resource is modeled as an agent which can communicate with other agents to exchange requirements or task information. Agent interactions generally take the form of message exchanges to support auction-style algorithms in which a mediator requests bids on a task or a collection of tasks and then receives bids from agents. Each bid encapsulates local information, important to the allocation decision, in the form of utility or cost estimates.
DTIC
*Resources Management*

**20040059115** Naval War Coll., Newport, RI
**Research in the Library**
Jan. 2003; 21 pp.; In English
Report No.(s): AD-A421949; No Copyright; Avail: CASI; A03, Hardcopy

In the following sections the collections and services of the Naval War College Library are briefly outlined in order to assist the researcher in forming an overall impression of those resources and services. Additional materials and aids which more fully describe the collections and the means of access to them are available in the Library. Most important of all the professional librarians who staff the Library should be freely approached for information and assistance of every kind. Reference librarians are expert in the organization of information in the Library and in assisting the researcher to locate needed materials whether in this Library or in other academic and research organizations both private and governmental. To benefit fully from that expertise the researcher should communicate as openly and fully as possible with the librarian in order that together they may define the research topic or question in a manner which will enable the librarian to provide the maximum assistance.
DTIC
*Libraries*

**20040059124** Pittsburgh Univ., Pittsburgh, PA
**Development of Integrated Information Technology System**
Gilstrap, Scott E.; Jan. 2004; 70 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-2-0017
Report No.(s): AD-A421971; No Copyright; Avail: CASI; A04, Hardcopy

The Integrated Medical Information Technology System (IMITS) Program is focused on implementation of advanced technology solutions that eliminate inefficiencies, increase utilization and improve quality of care for active duty forces. The work on this project has focused on the development and implementation of prototype telemedicine systems and advanced technology applications at USA Air Force bases. Significant effort has been devoted to the DITSCAP security process for the applications developed. Emphasis has been placed on the development of sound evaluation methodologies for each of the sub-projects with special attention to the areas of cost effectiveness and end- user satisfaction within the AFMS.
DTIC
*Information Systems; Systems Integration; Telemedicine*

**20040059131** Department of Defense, Arlington, VA
**Export Controls: Export-Controlled Technology at Contractor, University, and Federally Funded Research and Development Center Facilities (D-2004-061)**
Mar. 25, 2004; 40 pp.; In English
Report No.(s): AD-A421989; IG/DOD-D-2004-061; No Copyright; Avail: CASI; A03, Hardcopy

Who Should Read This Report and Why? Civil service and uniformed officers responsible for controlling the release of technology or technical data detrimental to our national security should read this report. The report discusses the steps DoD needs to take to identify unclassified export- controlled technology and to ensure that DoD contractors, universities, and Federally Funded Research and Development Centers are preventing unauthorized disclosure to foreign nationals. Background. Public Law 106-65, 'National Defense Authorization Act for FY 2000,' section 1402, 'Annual Report on Transfers of Militarily Sensitive Technology to Countries and Entities of Concern,' October 5, 1999, requires that the Inspectors General of the Departments of Commerce, Defense, Energy, and State, in consultation with the Director of Central Intelligence and the Director of the Federal Bureau of Investigation conduct annual reviews of the transfer of military

technologies to countries and entities of concern. The USA Government restricts the release of critical technologies, including technical data, to foreign nationals through the Export Administration Regulations and the International Traffic in Arms Regulations. U.S. entities are generally required to obtain an export license before providing foreign nationals access to software or technology that is subject to export licensing requirements. Within DoD, multiple offices oversee the development and implementation of export control policies and control foreign nationals access. The Under Secretary of Defense for Acquisition, Technology, and Logistics is responsible for the implementation of DoD technology transfer policies for all research, development, and acquisition matters.
DTIC
*Contractors; International Trade; Regulations; Technology Transfer*

**20040059176** Industrial Coll. of the Armed Forces, Washington, DC
**Information as An Instrument and a Source of National Power**
Bokel, John; Jan. 2003; 11 pp.; In English
Report No.(s): AD-A422060; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
*Data Management; Information Retrieval; Information Systems*

**20040059191** Industrial Coll. of the Armed Forces, Washington, DC
**Policy Options on Intellectual Property Rights, China Regional Study**
Falvey, Michael; Jan. 2003; 13 pp.; In English
Report No.(s): AD-A422083; No Copyright; Avail: CASI; A03, Hardcopy
The Chinese government's inability to enforce international laws on Intellectual Property Rights (IPR) is a growing concern for USA (US) policy makers. Our government's policy on IPR with respect to China must be modified to ensure our national strategy objective of growing free and fair intentional trade is achieved without undue harm to either the Chinese or US economies. After a brief overview of the relevant background, three policy options are presented and analyzed leading to a recommended policy called Hard industry Enlightenment. Intellectual property refers to the creations of the human mind. Intellectual Property Rights (IPR) are the rights given to individuals over those creations. Those rights are typically defined into two main areas: Industrial property, which includes inventions (patents), trademarks, industrial designs, and geographic indications of source; and Copyright, which includes literary and artistic works such as novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs and sculptures, and architectural designs. The concept of IPR is a strictly a modern product of European thought which began to coalesce during the 18th century. As the industrial revolution created the need to protect this new form of wealth generation, especially from one's economic rivals, the European nation states began to enter into an evolving series of IPR treaties starting in 1870. That evolution has culminated in the current World Trade Organization (WTO) Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement. TRIPS is the standard by which all WTO countries define, enforce, and resolve disputes on IPR.
DTIC
*China; Copyrights; Intellectual Property; International Law; Inventions; Policies*

**20040059201** Army Engineer Research and Development Center, Vicksburg, MS
**Results of a Pilot Customer Satisfaction Survey of Corps of Engineers Recreation Visitors**
Kasul, Richard L.; Chang, Wen-Huel; Franco, Sam F.; Sep. 2003; 12 pp.; In English
Report No.(s): AD-A422108; ERDC/NR-TN-REC-14; No Copyright; Avail: CASI; A03, Hardcopy
This paper presents results of a pilot national satisfaction survey of visitors to Corps-managed recreation areas. The survey was based on a sampling protocol capable of producing a national estimate of customer satisfaction and on standardized data collection methods ensuring consistency across recreation areas and projects. The survey data were used to 1) produce a national estimate of customer satisfaction, 2) provide preliminary data for benchmarking Corps-managed recreation areas, and 3) evaluate the suitability of the survey protocol for monitoring visitor satisfaction in the Corps' Recreation Business Area.
DTIC
*Data Acquisition; Engineers; Quality Control; Recreation; Surveys*

**20040059229** Naval Postgraduate School, Monterey, CA
**Toward Managing & Automating CyberCIEGE Scenario Definition File Creation**
Johns, Kenneth W., Jr; Mar. 2004; 484 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422159; No Copyright; Avail: CASI; A21, Hardcopy

The CyberCIEGE project seeks to create an alternative to traditional Information Assurance (IA) training and education approaches by develops an interactive entertaining commercial-gm-de PC-based computer game/virtual laboratory. CyberCIEGE will provide a robust flexible and extensible gaming environment where each instance of the game is based on a fully customizable scenario. These scenarios are written CyberCIEGE Scenarios Definition Language. Unfortunately, the trade-off for flexibility, extendibility and fully customizable Scenarios is syntax complexity in the Scenarios definition language. This thesis will solve this real world problem by showing that the complexity of scenarios definition language syntax can be managed through a software tool. This thesis will develop such a tool and further demonstrate that progress can be made toward automating Scenarios generation.
DTIC
*Computer Programs; Personnel Management*

**20040059237** Naval Postgraduate School, Monterey, CA
**Information Operations (IO) Organizational Design and Procedures**
Caldwell, Russell; Mar. 2004; 179 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422171; No Copyright; Avail: CASI; A09, Hardcopy

Multi National Force (MNF) operations recognize the existence of shared national interests in a specific geographic region. Furthermore, MNF operations seek to standardize some basic concepts and processes that will promote habits of cooperation, increased dialogue, and provide for baseline Coalition/Combined Task Force (CCTF) operational concepts. This thesis and its' recommendation for a Standard Operating Procedure (SOP) are aimed at improving interoperability and CCTF operational readiness. The SOP will focus on the spectrum of Information Operations (10) with regards to Military Operations Other Than War (MOOTW) and Small Scale Contingencies (SSC) during MNF operations. First, existing doctrine and cases will be analyzed to develop a foundation for this study. This thesis will seek to identify the existing 10 procedures to be utilized during MNF operations. Next, exercise observations and lessons learned reviews serve as the basis for 10 SOP Annex development to support the MNF SOP.
DTIC
*Io; Military Operations; Warfare*

**20040059241** Naval Postgraduate School, Monterey, CA
**Scripting Quality of Security Service (QoSS) Safeguard Measures for the Suggested INFOCON System**
Guild, Jennifer; Mar. 2004; 144 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422176; No Copyright; Avail: CASI; A07, Hardcopy

The existing INFOCON system is an information warning system that the DOD maintains. It is not formally correlated to other warning systems, such as DEFCON, FPCON/THREATCON, WATCHCONs, SANS INFOCON, or the Homeland Security Advisory System Threat condition, The criteria for each INFOCON level are subjective. The INFOCON recommended actions are a mix of policy and general technical measures. The INFOCON system vaguely follows the Defense in Depth network defense methodology. This thesis examines the foundations for the existing INFOCON system and presents an evolved INFOCON system. The focus will be on the security of the DOD information infrastructure and the accomplishment of the mission, as well as the usability and the standardization of the INFOCON warning system. The end result is a prototype that is a set of predefined escalation scripts for the evolved INFOCON system's safeguard measures.
DTIC
*Information Systems; Safeguard System; Security; Warning Systems*

**20040059705** National Defense Univ., Washington, DC, USA
**Right Makes Might: Freedom and Power in the Information Age**
Gompert, David C.; May 1998; 86 pp.; In English
Report No.(s): AD-A421899; No Copyright; Avail: CASI; A05, Hardcopy

China's emergence begs a fresh look at power in world affairs-more precisely, at how the spread of freedom and the integration of the global economy, due to the information revolution, are affecting the nature, concentration, and purpose of power. Perhaps such a look could improve the odds of responding wisely to China's rise. The natural worry of Americans who came of age during the Cold War is that the makings exist for another bipolar confrontation. For decades, the growth of Soviet power relative to U.S. power was deemed so alarming that the USA would go to any length and any cost-trillions of dollars!-to preserve parity. From such history, American anxiety about China should surprise no one, not even the Chinese. The timing of China's ascendance is especially eerie: Exactly a century ago, German leaders convinced themselves that England had no

right to deny equality to their rising state and would be Germany's main enemy for trying. The British regarded this German attitude, particularly the building of a high-seas fleet, as menacing. England's response building dread naughts fast enough to stay ahead-gave German hawks the enemy they sought. The ensuing hegemonic rivalry spiraled into conflict.
DTIC
*China*

**20040059961** Ohio State Univ., Columbus, OH, USA
**Identification of Bridges in Bars Database Related by WSD Method and an Intelligent Decision Support System to Convert the WSD-Based Rating to LFD-Basing Rating**
Adeli, H.; Jan. 2004; 78 pp.; In English
Report No.(s): PB2004-105151; No Copyright; Avail: CASI; A05, Hardcopy

An intelligent decision support system (IDSS) has been developed to help bridge engineers convert a WSDbased bridge rating to the LFD-based rating using two different soft computing approaches: case-based reasoning (CBR) and artificial neural networks. The former is used to predict the lateral bracing requirements and the latter is used to determine the LFD-based section properties. The LFD-based rating of steel bridges requires a detailed description of the steel girders geometric properties that may not be available. A counterpropagation neural (CPN) network model is presented for estimating the detailed section properties of steel bridge girders needed in the LFD-based rating based on the three cross-sectional properties used in the WSD-based rating of bridges: cross-section area, moment of inertia, and section modulus. It is demonstrated that with proper training of the CPN network using both standard wideflange shapes and representative plate girder data, the proposed model can generate the detailed section properties needed for LFD-based rating of steel bridges accurately. The training set for the CPN network was based on the AISC W-shape database plus 100 plate girder designs. It can be readily extended to include additional plate girder designs. The CBR module for determining the steel bridge girder lateral bracing requirements is developed using lateral bracing design data from ODOT standard bridge design drawings dating as far back as 1939 and as recently as 1997. The IDSS has been developed using the object-oriented features of Microsoft Visual Basic and the spreadsheet program, Microsoft Excel (the version released in 2000). The computational models and the IDSS created in this research can be used by bridge engineers as an intelligent decision support system to convert the WSD-based bridge rating to LFDbased bridge rating substantially faster than the conventional approach.
NTIS
*Girders; Object-Oriented Programming; Mathematical Models*

**20040059965** Institute of Museum and Library Services, Washington, DC, USA
**Assessment of End-User Needs in IMLS-Funded Digitization Projects**
Oct. 2003; 46 pp.; In English
Report No.(s): PB2004-105184; No Copyright; Avail: CASI; A03, Hardcopy

During the last decade, there has been rapid growth in digitization of museum and library collections across the USA. Digitization project teams and managers have become more sophisticated in their use of technology and in the ways in which they make collections accessible. The volume of content now available online has made digitization a well-established means of showcasing materials for teaching and learning. According to the Status of Technology and Digitization in the Nation's Museums and Libraries: 2002 Report, published by the Institute of Museum and Library Services (IMLS), 'digitization is an emerging focus in museums and libraries.' More than 78 percent of all State Library Administrative Agencies (SLAAs) reported digitization activities, followed by 34 percent of academic libraries, 32 percent of museums, and 25 percent of public libraries. How do museums and libraries assess the needs of their users in relation to the digital products and services they are developing. What can institutions do to determine whether or not they have successfully met users' needs. To answer these questions, IMLS commissioned a study of the needs-assessment practices used in digitization projects funded through National Leadership Grants (NLG) and grants to State Library Administrative Agencies (SLAAs) over a three-year period (Federal fiscal years1998, 1999, and 2000). We learned that consensus on the definition of 'needs assessment' among library and museum professionals must be strengthened, and that models and tools for conducting needs assessment are not widely adopted. Additional models and tools would also be helpful to museum and library professionals.
NTIS
*Libraries; User Requirements; Museums*

**20040059968** Office of Management and Budget, Washington, DC
**Federal Government Information Security Reform, FY2002 Report to Congress**
May 2003; 136 pp.; In English
Report No.(s): PB2004-105209; No Copyright; Avail: CASI; A07, Hardcopy

The Federal government has made significant strides in identifying and addressing long-standing information technology (IT) security problems that are both serious and pervasive. As a result of focused efforts over the past year, Federal agencies are demonstrating progress. However, as this report details, much work remains, and while the Administration has applied more rigorous IT security reviews, more threats and vulnerabilities have also materialized. The purpose of this report is to inform Congress on agency IT security activities and results during FY 2002, as required under the Government Information Security Reform Act (GISRA). GISRA directs Federal agencies to conduct annual IT security reviews and Inspectors General (IGs) to perform annual independent evaluations of agency programs and systems and report their results to OMB. To ensure consistent reporting across agencies, OMB issued guidance that included specific reporting instructions along with quantitative performance measures to more effectively determine agency status and progress. Additionally, the OMB guidance directed agencies to develop plans of action and milestones (POA&Ms) to remediate program and system level IT security weaknesses.
NTIS
*Security; Information Systems*

## 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.

**20040056112** Swedish Defence Research Establishment, Stockholm, Sweden
**Autopilot for Autonomous Ground Vehicle, Modelling, Design and Implementation**
Alm, A.; Sep. 2002; 46 pp.; In English
Report No.(s): PB2004-104134; FOI-R-0770-SE; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the design implementation of a controller that guides a ground vehicle from its current position to a predefined target. The controller is part of an Application Program Interface, API, together with lower level functions for controlling individual actuators and obtaining data from sensors, and some other middle level controllers for various purposes. These functions are all accessible from applications based on various algorithms with the purpose of exhibiting autonomous behavior. This particular controller observes position, velocity, and course based on information obtained from a satellite navigation sensor, a GPS receiver. It uses other functions to control speed and steering on the platform, currently based on an electrically driven Radio-controlled car, about 0.5 m long. The controllers are executed on a one chip computer, PC-104 standard, Pentium-class PC running the Debian GNU/Linux operating system.
NTIS
*Automatic Pilots; Mathematical Models; Autonomous Navigation; Control Systems Design; Surface Vehicles*

## 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*.

**20040056062** Hawaii Univ., Honolulu, HI, USA
**Oxygen Isotopic Compositions of the Al-rich Chondrules in the CR Carbonaceous Chondrites: Evidence for a Genetic Link to Ca-Al-rich Inclusions and for Oxygen Isotope Exchange During Chondrule Melting**
Krot, A. N.; Libourel, G.; Chaussidon, M.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Al-rich (>10 wt% Al2O3) chondrules are compositionally most similar to CAIs and can potentially provide a clue for understanding genetic relationship between CAIs and Fe,Mgchondrules. Based on the mineralogical and textural observations, it was previously inferred that Al-rich chondrules in carbonaceous chondrites formed by melting of CAIs largely composed of spinel, anorthite, and diopside, and ferromagnesian precursors compositionally similar to Type I chondrules[1,2]. This model, however, appears to be inconsistent with O-isotopic compositions of Al-rich chondrules from unequilibrated ordinary chondrites (UOCs) Chainpur (LL3.4), Inman (L3.4), Quinyambie (L3.4), and Sharps (H3.4), which on a three-oxygen isotope diagram define a slope of approx.0.8, distinct from a slope of approx.1 along which most CAIs plot. In order to minimize possible effects of isotope exchange during thermal metamorphism and to test the model of [1,2], we measured in situ

O-isotopic compositions of the Al-rich and Fe,Mgchondrules in CR carbonaceous chondrites, which although experienced varying degrees of aqueous alteration, show no evidence for thermal metamorphism.
Derived from text
*Carbonaceous Chondrites; Oxygen Isotopes; Aluminum Oxides; Melting; Meteoritic Composition; Genetics; Isotope Separation*

**20040058055** McDonnell-Douglas Space Systems Co., Huntsville, AL, USA
**ECLSS Integration Analysis: Advanced ECLSS Subsystem and Instrumentation Technology Study for the Space Exploration Initiative**
October 1990; 313 pp.; In English
Contract(s)/Grant(s): NAS8-36407
Report No.(s): MDC-W5658; MMC-TDC-826-2064-85; No Copyright; Avail: CASI; A14, Hardcopy

In his July 1989 space policy speech, President Bush proposed a long range continuing commitment to space exploration and development. Included in his goals were the establishment of permanent lunar and Mars habitats and the development of extended duration space transportation. In both cases, a major issue is the availability of qualified sensor technologies for use in real-time monitoring and control of integrated physical/chemical/biological (p/c/b) Environmental Control and Life Support Systems (ECLSS). The purpose of this study is to determine the most promising instrumentation technologies for future ECLSS applications. The study approach is as follows: 1. Precursor ECLSS Subsystem Technology Trade Study - A database of existing and advanced Atmosphere Revitalization (AR) and Water Recovery and Management (WRM) ECLSS subsystem technologies was created. A trade study was performed to recommend AR and WRM subsystem technologies for future lunar and Mars mission scenarios. The purpose of this trade study was to begin defining future ECLSS instrumentation requirements as a precursor to determining the instrumentation technologies that will be applicable to future ECLS systems. 2. Instrumentation Survey - An instrumentation database of Chemical, Microbial, Conductivity, Humidity, Flowrate, Pressure, and Temperature sensors was created. Each page of the sensor database report contains information for one type of sensor, including a description of the operating principles, specifications, and the reference(s) from which the information was obtained. This section includes a cursory look at the history of instrumentation on U.S. spacecraft. 3. Results and Recommendations - Instrumentation technologies were recommended for further research and optimization based on a consideration of both of the above sections. A sensor or monitor technology was recommended based on its applicability to future ECLS systems, as defined by the ECLSS Trade Study (1), and on whether its characteristics were considered favorable relative to similar instrumentation technologies (competitors), as determined from the Instrumentation Survey (2). The instrumentation technologies recommended by this study show considerable potential for development and promise significant returns if research efforts are invested.
Derived from text
*Environmental Control; Habitats; Life Support Systems; Mars Missions; Pressure Sensors; Space Exploration; Temperature Sensors*

**20040059332** Naval Postgraduate School, Monterey, CA
**Halo Orbit Design and Optimization**
McCaine, Gina; Mar. 2004; 56 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422350; No Copyright; Avail: CASI; A04, Hardcopy

A Halo orbit about a libration point of a restricted three-body system provides additional opportunities for surveillance communication and exploratory missions in lieu of the classical spacecraft orbit. Historically libration point missions have focused on Halo orbits and trajectories about the Sun-Earth System. This thesis will focus on libration point orbit solutions in the Earth-Moon system using the restricted three body equations of motion with three low- thrust control functions. These classical dynamics are used to design and optimize orbital trajectories about stable and unstable libration points of the Earth-Moon system using DIDO, a dynamic optimization software. The solutions for the optimized performance are based on a quadratic cost function. Specific constraints and bounds were placed on the potential solution set in order to ensure correct target trajectories. This approach revealed locally optimal solutions for orbits about a stable and unstable libration point.
DTIC
*Astrophysics; Design Optimization; Halos; Solar Orbits; Trajectory Optimization*

**20040062027** NASA Johnson Space Center, Houston, TX, USA

**Space Rocks Tell Their Secrets: Space Science Applications of Physics and Chemistry for High School and College Classes: Update**

Lindstrom, M. M.; Tobola, K. W.; Stocco, K.; Henry, M.; Allen, J. S.; McReynolds, Julie; Porter, T. Todd; Veile, Jeri; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration; 2004; 2 pp.; In English; See also 20040062024; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As the scientific community studies Mars remotely for signs of life and uses Martian meteorites as its only available samples, teachers, students, and the general public continue to ask, How do we know these meteorites are from Mars? This question sets the stage for a six-lesson instructional package Space Rocks Tell Their Secrets. Expanding on the short answer It s the chemistry of the rock , students are introduced to the research that reveals the true identities of the rocks. Since few high school or beginning college students have the opportunity to participate in this level of research, a slide presentation introduces them to the labs, samples, and people involved with the research. As they work through the lessons and interpret authentic data, students realize that the research is an application of two basic science concepts taught in the classroom, the electromagnetic spectrum and isotopes.

Derived from text

*Technology Utilization; Instructors; Electromagnetic Spectra; Isotopes; Meteorites; Schools*

**20040062028** National Optical Astronomy Observatories, Tucson, AZ, USA

**Teacher Leaders in Research Based Science Education: K-12 Teacher Retention, Renewal, and Involvement in Professional Science**

Croft, S. K.; Pompea, S. M.; Walker, C. E.; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration; 2004; 1 pp.; In English; See also 20040062024; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Teacher Leaders in Research Based Science Education (TLRBSE) is a K-12 teacher professional development program that has been created at the National Optical Astronomy Observatory (NOAO) in Tucson, AZ. It integrates several prominent trends in American science education, including the use of technology in the classroom, the development of inquiry-based science curricula closely modeling professional science practice, teacher retention and renewal, and the creation of communities of science learners consisting of both teachers and students. The project has reached a certain level of maturity, having run for four years as the Research Based Science Education (RBSE) project that emphasized bringing research and scientific data into the classroom, and two years as TLRBSE that adds a teacher retention and renewal component. RBSE was a set duration project funded by the National Science Foundation (NSF) separately from the general NOAO budget (also funded by NSF). TLRBSE was approved as a project that would transition from a fully NSF-funded project to a fully NOAO-funded project over a period of five years. We are currently half-way through that transition. Incorporation of the TLRBSE program as part of the NOAO core program assures its continuation into the future.

Derived from text

*Education; Instructors; Observatories*

**20040062029** Arizona State Univ., Tempe, AZ, USA

**Utilizing Mars Data in Education: Delivering Standards-based Content by Exposing Educators and Students to Authentic Scientific Opportunities and Curriculum**

Klug, S. L.; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration; 2004; 2 pp.; In English; See also 20040062024; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Today, in many K-12 classrooms across the country, teachers are losing ground in exciting and maintaining a long-term interest in the essential core areas of science, technology engineering, and mathematics (STEM subjects). Teachers are looking for materials that will deliver the content that they are charged with teaching, yet be engaging enough to inspire and ignite that spark of learning that will grow and become an enduring flame. The Red Planet beacons. The planned robotic missions that NASA has designated to launch every 26 months gives educators a sustained pipeline of exciting STEM materials that can be utilized as teaching unique opportunities. NASA has a deep commitment to education, and because of that commitment, the engineering challenges and discoveries revealed by the exploration of another world are now being brought into K-12 classrooms on a regular basis. NASA, recognizing that it has space exploration expertise that it can provide to enrich K-12 education, has put forth a new emphasis in involving students in NASA research. The Mars Program has embraced the

opportunity to impact and mold tomorrow's scientists, engineers, and technologists.
Derived from text
*Education; Space Exploration; Launching; Instructors*

**20040062031** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Training Informal Educators Provides Leverage for Space Science Education and Public Outreach**
Allen, J. S.; Tobola, K. W.; Betrue, R.; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration; 2004; 1 pp.; In English; See also 20040062024; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

How do we reach the public with the exciting story of Solar System Exploration? How do we encourage girls to think about careers in science, math, engineering and technology? Why should NASA scientists make an effort to reach the public and informal education settings to tell the Solar System Exploration story? These are questions that the Solar System Exploration Forum, a part of the NASA Office of Space Science Education (SSE) and Public Outreach network, has tackled over the past few years. The SSE Forum is a group of education teams and scientists who work to share the excitement of solar system exploration with colleagues, formal educators, and informal educators like museums and youth groups. One major area of the SSE Forum outreach supports the training of Girl Scouts of the USA (GS) leaders and trainers in a suite of activities that reflect NASA missions and science research. Youth groups like Girl Scouts structure their activities as informal education.
Derived from text
*Space Exploration; Education; NASA Programs; Research and Development; Training Devices; Aerospace Sciences*

**20040062032** Arizona State Univ., Tempe, AZ, USA
**Telling the Tale of Two Deserts: Teacher Training and Utilization of a New Standards-based, Bilingual E/PO Product**
Kadel, S. D.; Greeley, R.; Figueredo, P. H.; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration; 2004; 2 pp.; In English; See also 20040062024; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

'A Tale of Two Deserts' is a set of educational exercises that introduces educators, students and the public to water-formed features in desert environments on Earth and potentially similar landforms on Mars [1]. These computer-based exercises familiarize educators and students with landforms important to NASA's 'follow the water' strategy for Mars exploration to help them share more actively in the discoveries from ongoing and future Mars missions. The exercises are student-centered, inquiry-based, include a hands-on modeling component, and have been designed in direct alignment with state and national science teaching standards (e.g., the National Research Council's National Science Education Standards.
Derived from text
*Deserts; Education; Planetary Geology; Landforms; Water; Mars Surface; Mars Exploration*

**20040062120** University of Central Florida, Orlando, FL, USA
**Meteorite Porosities and Densities: A Review of Trends in the Data**
Britt, D. T.; Consolmagno, G. J.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Among the most fundamental physical characteristics of any planetary body are its density and porosity. These data provide insight into the body's accretion, evolution, impact history, mineralogy, internal strength, and structure. The density and porosity of meteorite groups are fundamental 'ground truth' for the composition and structure of asteroids. We have complied a data base of meteorite and density measurements published up to 2001 and these data have some interesting implications for future meteorite and asteroid studies.
Author
*Composition (Property); Density Measurement; Meteorites; Porosity*

# 89
# ASTRONOMY

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

**20040058044** Smithsonian Astrophysical Observatory, Cambridge, MA, USA
**Astrometric Follow-Up of Faint Near Earth Objects**
Morgan, T., Technical Monitor; Spahr, Timothy; April 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-11444; No Copyright; Avail: CASI; A01, Hardcopy

The observing program at Mt. Hopkins using the 48‘ reflector and funded by the Near- Earth Object Observation Program continues to excel. As in the past, all requested observing time was granted. Minor improvements continue to be made. For example, the telescope is set up to track and non-sidereal rates. This allows the user to track on the target object, rather than relying exclusively on the shift- and-stack technique. Other improvements made by the staff include automatic focus routines, automatic seeing-measurement routines, and improvement in dome seeing and mirror stabilization. The net result is better focus, better seeing, and the ability to expose longer in order to acquire the faintest and most important objects. During the proposal period, this program ranked again very high worldwide in terms of faint Near Earth Objects observed. During this latest proposal cycle, fewer objects were observed than previous cycles, but this was due to the strict targeting of only the faintest observable objects. The follow-up programs of observatory codes 926 (led by P. Holvorcem) and 291 (led by Dr. B. McMillan) have greatly increased their capacity, and as a result less bright objects are in urgent need of follow-up than in years past. Even with this new object selection and additional competition, code 696 still ranked second to code 291 in terms of objects observed fainter than V = 20. Minimal scripting is now in place to allow the telescope to run autonomously for 30-45 minutes at a time.
Author
*Astrometry; Faint Objects; Near Earth Objects; NASA Space Programs; Astronomical Observatories*

**20040059778** Planetary Science Inst., Tucson, AZ, USA
**A New Source of High Resolution Lunar Images: Amateur Astronomers!**
Wood, C. A.; Pau, K. C.; Daversin, B.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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 45 years since Luna 2 crudely imaged the Moon’s farside, yet no comprehensive high resolution image data set exists for the Moon. Currently, the most complete image collections are from Clementine, Lunar Orbiter IV, and the Lunar & Planetary Laboratory. Each of these has strengths and weaknesses. We review existing image collections and present information about a new and growing collection of high-resolution lunar images that is little known to lunar scientists, but of potential value to them.
Derived from text
*Lunar Laboratories; Lunar Orbiter; Images*

**20040062171** Arizona Univ., Tucson, AZ, USA
**Interpretation of the Meteoritic Extinct Radioactivity: Mean Life Relation**
Cameron, A. G. W.; Lodders, Katharina; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The report by Lodders and Cameron showed that the abundances of extinct radioactivities (relative to reference nuclei) in chondrites, achondrites, and irons are proportional to the squares of their mean lives, whereas no such abundance-mean life relationship is apparent for the data of calcium-aluminum rich inclusions (CAIs). Here these results are interpreted in terms of galactic and solar nebula processes. One of the implications of the abundance-mean life relationship is that chondrites, achondrites and irons sampled extinct radioactivities which had accumulated in a common reservoir, the solar nebula, while extinct radioactivities in CAIs did not share this history. We identify the production source for most of these radioactivities to be a variety of core-collapse supernovae.
Author
*Chondrites; Solar Nebula; Mathematical Models; Radioactivity*

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

**20040056060** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040056061 - 20040056069
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The Special Session: Oxygen in the Solar System, II, included the following reports:Evolution of Oxygen Isotopes in the Solar Nebula; Disequilibrium Melting of Refractory Inclusions: A Mechanism for High-Temperature Oxygen; Isotope Exchange in the Solar Nebula; Oxygen Isotopic Compositions of the Al-rich Chondrules in the CR Carbonaceous Chondrites: Evidence for a Genetic Link to Ca-Al-rich Inclusions and for Oxygen Isotope Exchange During Chondrule Melting; Nebular Formation of Fayalitic Olivine: Ineffectiveness of Dust Enrichment; Water in Terrestrial Planets: Always an Oxidant?; Oxygen Barometry of Basaltic Glasses Based on Vanadium Valence Determination Using Synchrotron MicroXANES; A New Oxygen Barometer for Solar System Basaltic Glasses Based on Vanadium Valence; The Relationship Between Clinopyroxene Fe3+ Content and Oxygen Fugacity ; and Olivine-Silicate Melt Partitioning of Iridium.
Derived from text
*Solar Nebula; Oxygen Isotopes*

**20040056152** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Origin of Planetary Systems**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040056153 - 20040056159
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session'Origin of Planetary Systems' presented the following reports:Planetary Formation in the the Gamma Cephei System by Core:Accretion; Accretion and Heating of Particles by Supersonic Planetesimals; Planetesimal Accretion in Close Binary Systems; Collisions, Gas Flow, and the Formation of Planetesimals; Hydrodynamic Escape of a Proto-Atmosphere Just After a Giant Impact; X-Ray Flare Induced Shock Waves and Chondrule Formation in Upper Solar Nebula; and Making Water Worlds: The Role of 26Al.
Derived from text
*Protoplanets; Planetary Evolution*

**20040058057** Smithsonian Astrophysical Observatory, Cambridge, MA, USA
**X-Ray Emission from the Halo of M31**
Mushotzky, Richard, Technical Monitor; DiStefano, Rosanne; April 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-13090; No Copyright; Avail: CASI; A01, Hardcopy

Our goal was to use short (10 ksec) observations of selected fields in the halo of M31, to determine the size and characteristics of its X-ray population and to study the connection between globular clusters and X-ray sources. The program of observations has yet to be successfully completed. We received acceptable data from just 2 of the 5 approved fields. Nevertheless, the results were intriguing and we have submitted a paper based on this data to Nature. We find that the X-ray source density is significantly enhanced in the vicinity of one GC, providing the first observational evidence supporting the ejection hypothesis. We also find additional X-ray sources, including some which are very soft, in large enough numbers to suggest that not all could have been formed in GCs. That is, some must be descended from the same primordial halo population that produced any compact stars comprising part of the halo's dark matter. Extrapolating fiom the X-ray source population, we estimate that stellar remnants and dim old stars in the halo could comprise as much as 25% of the estimated mass (approx. 10(exp 12) Solar Mass) of the halo. These results suggest that the other approved fields should be observed soon and also provide strong motivation for the future XMM-Newton programs.
Derived from text
*Halos; X Ray Sources; Emission; Globular Clusters; Ejection*

**20040059990** Lawrence Livermore National Lab., Livermore, CA

**Astrometry with the MACHO Data Archive**

Drake, A. J.; Alcock, C.; Allsman, R. A.; Alves, D. R.; Axelrod, T. S.; Oct. 15, 2000; 14 pp.; In English

Report No.(s): DE2004-15006131; UCRL-JC-141875; No Copyright; Avail: Department of Energy Information Bridge

We present the preliminary results of our astrometric study of stellar motions along the lines of sight of the Magellanic Clouds and the Galactic bulge. We find that we are able to select stars with proper motions as small as 0.03 inch/yr from five years of PSF photometry due to the characteristic nature of the shapes the light curves of HFM stars. This shape arises from the proper motion of the object relative to the initial fixed centroid location where all photometry of the object is performed. By selecting such light curves and performing astrometry on candidate HPM stars we have discovered 154 new high proper motion (HPM) stars in 50(sup)open-square))(sup o) from amongst the (approx.) 55 million of stars observed by the MACHO project in these fields.

NTIS

*Astrometry; Centroids; Line of Sight; Galactic Bulge*

**20040062143** Tokyo Univ., Japan

**Formation of Recent Martian Gullies by Avalanches of CO2 Frost**

Ishii, T.; Sasaki, S.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The observation of recent gullies related to a possibility of the existence of liquid water on present Mars is much debated in recent years. However, liquid water cannot be stable on the surface of present Mars, because average surface temperature is far below 273K and average surface pressure is slightly below water s triple point of 6.1 mbar. There are some regions on present Mars where temporarily liquid water is stable, but the regions have little correlation with the distribution of gullies. About 95% of the Martian atmosphere is composed About 95% of the Martian atmosphere is composed of CO2 and the volatile dominating present Mars may not be H2O but CO2. A scene of CO2 frost which is condensed on gully landforms like terrestrial H2O snow is displayed by the MOC image. Musselwhite et al. suggest a possibility of the gully formation by liquid CO2 eruptions. But this scene is probably associated with avalanches of CO2 frost condensed on the slope because no spouts of liquid CO2 from the inside of the slope are observed in the image. We infer the gully formation by avalanches of CO2 frost and demonstrate that this hypothesis can explain the distribution, orientation and morphological features of gullies.

Author

*Avalanches; Carbon Dioxide; Mars Atmosphere; Frost; Morphology*

**20040062170** Chicago Univ., Chicago, IL, USA

**Determination of Primordial Refractory Inclusion Compositions**

Simon, S. B.; Grossman, L.; Hutcheon, I. D.; Williams, R. W.; Galy, A.; Fedkin, A. V.; Clayton, R. N.; Mayeda, T. K.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Both the chemical and isotopic bulk compositions of Types A (melilite-rich) and B (pyroxene- rich) refractory inclusions from CV3 chondrites suggest that they may be evaporative residues of high-temperature condensate assemblages. The MgO and SiO2 contents of these objects are generally consistent with the degrees of evaporation implied by the isotopic compositions that have been measured, but direct evidence of this process is sparse because there are few inclusions for which bulk chemical and bulk Mg and Si isotopic data exist. We are addressing this problem by obtaining these data for a suite of inclusions from Allende, Efremovka, and Leoville. Here, we report new bulk Mg isotopic compositions for inclusions whose bulk chemical compositions we have recently determined. Their bulk Si and O isotopic compositions will also be measured as part of this study, allowing us to calculate their original bulk compositions based on the implied amounts of evaporative losses.

Author

*Refractories; Chemical Composition; Inclusions; Meteoritic Composition; Magnesium Isotopes; Evaporation*

**20040062213** Indiana Univ., Bloomington, IN, USA

**Groundwater-fed Iron-rich Microbial Mats in a Freshwater Creek: Growth Cycles and Fossilization Potential of Microbial Features**

Schieber, J.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Much of earth's sedimentary iron deposits can be attributed to microbial activity either directly or indirectly. Precambrian Banded Iron Formations are characterized by extensive hematite laminae that may be due to blooms of photosynthetic algae, and also contain stromatolites with hematitic laminae and hematitic oncoids. Benthic microbial mat deposits in Proterozoic carbonaceous shales can be heavily mineralized with pyrite, and concretionary pyrite from various periods in earth history contains mineralized microbial remains. Microbial remains have also been recovered from Phanerozoic iron-stones. While in many instances iron precipitation may merely be a byproduct of microbial metabolism (e.g. BIF's), it is also well established that microbes can precipitate iron either within cells or in the sheaths surrounding microbial filaments.

Derived from text

*Ground Water; Iron; Microorganisms; Fresh Water; Deposits*

**20040062258** NASA, Washington, DC, USA

**Northern and Southern Permafrost Regions on Mars with High Content of Water Ice: Similarities and Differences**

Mitrofanov, I. G.; Litvak, M. L.; Kozyrev, A. S.; Sanin, A. B.; Tretyakov, V. I.; Kuzmin, R. O.; Boynton, W. V.; Hamara, D. K.; Shinohara, C.; Saunders, R. S.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The measurements by neutron detectors on Odyssey have revealed two large poleward regions with large depression of flux of epithermal and high energy neutrons. The flux of neutrons from Mars is known to be produced by the bombardment of the surface layer by galactic cosmic rays. The leakage flux of epithermal and fast neutrons has regional variation by a factor of 10 over the surface of Mars. These variations are mainly produced by variations of hydrogen content in the shallow subsurface. On Mars hydrogen is associated with water. Therefore, the Northern and Southern depressions of neutron emission could be identified as permafrost regions with very high content of water ice. These regions are much larger than the residual polar caps, and could contain the major fraction of subsurface water ice. Here we present the results of HEND neutron data deconvolution for these regions and describe the similarities and differences between them.

Author

*Hydrogen; Ice; Mars Surface; Permafrost; Polar Caps; Surface Layers*

## 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*.

**20040055984** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Cerberus Fossae and Elysium Planitia Lavas, Mars: Source Vents, Flow Rates, Edifice Styles and Water Interactions**

Sakimoto, S. E. H.; Gregg, T. K. P.; Lunar and Planetary Science XXXV: Mars Tectonism and Volcanism; 2004; 2 pp.; In English; See also 20040055983; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cerberus Fossae and Elysium Planitia regions have been suggested as some of the youngest martian surfaces since the Viking mission, although there was doubt whether the origins were predominantly volcanic or fluvial. The Mars Global Surveyor and Mars Odyssey Missions have shown that the region is certainly young in terms of the topographic preservation and the youthful crater counts (e.g. in the tens to a few hundred million yrs.). Numerous authors have shown that fluvial and volcanic features share common flow paths and vent systems, and that there is evidence for some interaction between the lava flows and underlying volatiles as well as the use by lavas and water of the same vent system. Given the youthful age and possible water-volcanism interaction environment, we'd like constraints on water and volcanic flux rates and interactions. Here, we model ranges of volcanic flow rates where we can well-constrain them, and consider the modest flow rate results

results in context with local eruption styles, and track vent locations, edifice volumes, and flow sources and data.
Author
*Lava; Mars Surface; Planetary Geology; Water; Fluid Flow*

**20040055985** Nevada Univ., Reno, NV, USA
**Displacement-Length Scaling of Faults on Earth, Mars, and Beyond**
Schultz, Richard A.; Okubo, Chris H.; Wilkins, Scott J.; Lunar and Planetary Science XXXV: Mars Tectonism and Volcanism; 2004; 2 pp.; In English; See also 20040055983; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Faults on Mars exhibit ~1/5 of the maximum displacement Dmax of terrestrial faults for any given length L. This systematic shift to smaller D submax/L ratios results from the gravity dependence of shear driving stress, yield strength of rock at the fault tipline, and stiffness (modulus) of the surroundings. To first order, the D submax/L ratio scales with gravity, so faults of any type on smaller planets and satellites will accumulate smaller displacements per unit length than faults on Earth. This reduction is modulated by the lithology and pore-pressure state of the lithosphere.
Author
*Geological Faults; Mars Surface*

**20040055986** Arizona Univ., Tucson, AZ, USA
**Stratigraphy of Eastern Coprates Chasma, Mars**
Beyer, R. A.; McEwen, A. S.; Lunar and Planetary Science XXXV: Mars Tectonism and Volcanism; 2004; 2 pp.; In English; See also 20040055983; 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 Orbital Camera (MOC) onboard the Mars Global Surveyor (MGS) spacecraft has observed extensive layering near the martian surface and in the Valles Marineris system. Layering seen in the walls of terrestrial canyons is often sedimentary in nature, with new layers being put down by the slow process of deposition from rivers, lakes, or oceans. Alternately, volcanic processes with multiple episodes can deposit many layers of volcanic rocks and/or tephra, and intrusive magmatism can also create layered sequences at depth that are later revealed by erosion and uplift. The Valles Marineris is the only canyon that cuts deep into the martian crust. The origin of the layers is unknown, but there are hypotheses for both sedimentary and volcanic origins. Also relevant to the exposures that we see today are the formation processes of the giant chasma system itself and what geologic changes the region has gone through since that time. The synthesis of imaging datasets like MOC and the Thermal Emission Imaging System (THEMIS) with well-controlled topographic data from the Mars Orbital Laser Altimeter (MOLA) has allowed us to analyze the stratigraphy of the eastern portion of Coprates Chasma, in the Valles Marineris system.
Author
*Stratigraphy; Mars Surface; Canyons; Planetary Geology*

**20040055988** Nevada Univ., Reno, NV, USA
**Temporal Variability in Tharsis Stress State Based on Wrinkle Ridges and Strike-Slip Faulting**
Okubo, Chris H.; Schultz, Richard A.; Lunar and Planetary Science XXXV: Mars Tectonism and Volcanism; 2004; 2 pp.; In English; See also 20040055983; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Wrinkle ridges are widespread on Mars, and with a few localized exceptions, wrinkle ridge growth is generally constrained to within the L. Noachian to E. Hesperian . Given that normal faulting and graben formation appears to have occurred throughout much of Mars history , how and why was wrinkle ridge growth generally constrained to this limited period of time? In order to investigate how wrinkle ridge growth began and ended, we evaluated temporal variations in the causative near-surface stress states from chronologically-distinct sets of crosscutting thrust fault-related folds (wrinkle ridges) and strike-slip faults along the periphery of the Tharsis rise in southern Amazonis Planitia.
Author
*Mars Surface; Geological Faults*

**20040055990** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Topographic Evidence for Eruptive Style Changes and Magma Evolution of Small Plains-style Volcanoes on Earth and Mars**

Hughes, S. S.; Sakimoto, S. E.H.; Gregg, T. K. P.; Chadwick, D. J.; Brady, S. B.; Farley, M. A.; Holmes, A. A. .; Semple, A. M.; Weren, S.L.; Lunar and Planetary Science XXXV: Mars Tectonism and Volcanism; 2004; 2 pp.; In English; See also 20040055983; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Topographic profiles and surface characteristics of small (5 - 25 km diameter) plains-style shield volcanoes on the eastern Snake River Plain (ESRP) provide a method to evaluate eruptive processes and magmatic evolution on Martian volcanic plains. The ESRP is an ideal place to observe Mars-like volcanic features where hundreds of small monogenetic basaltic shields dominate the volcanic-sedimentary depositional sequence, and numerous planetary analogues are evident: coalescent mafic shields, hydromagmatic explosive eruptions, the interaction of lava flows with surficial water and glacial ice, and abundant eolian sand and loess. Single flows cannot be correlated over great distances, and are spatially restricted. These relations are useful for planetary exploration when inferring volcanic evolutionary patterns in lava plains represented by numerous eruptive vents. High spatial resolution imagery and digital topographic data for Mars from MOC, MOLA, and THEMIS is allowing for improvements in the level of detail of stratigraphic mapping of fields of small (< 25 km in diameter) volcanoes as well as studies of the morphological characteristics of individual volcanoes. In order to compare Mars and Earth volcanic features, elevation data from U.S.G.S. 10-meter digital elevation models (DEMs) and high-precision GPS field measurements are used in this study to generate approx. 20m spacing topographic profiles from which slope and surface morphology can be extracted. Average ESRP flank and crater slopes are calculated using 100 - 200 m spacing for optimum comparison to MOLA data, and to reduce the effects of surface irregularities.

Author

*Planetary Geology; Mars Volcanoes; Topography; Volcanic Eruptions*

**20040055991** California Univ., Davis, CA, USA

**State of Stress in the Martian Lithosphere**

Turcotte, D. L.; Lunar and Planetary Science XXXV: Mars Tectonism and Volcanism; 2004; 1 pp.; In English; See also 20040055983; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The state of stress in and rheology of planetary lithospheres remain poorly understood. The existence of old planetary topography requires long term elastic support. In this paper we present a quantitative analysis of the state of stress associated with the preservation of the Hellas impact basin on Mars. Assuming that the basin is in isostatic equilibrium, the geoid (areoid) anomaly over the basin can be used to infer the state of stress in the elastic lithosphere.

Author

*Lithosphere; Mars Surface; Structural Basins; Topography; Stress Analysis; Planetary Geology*

**20040055992** Brock Univ., Saint Catherines, Ontario, Canada

**Structural Attitudes of Large Scale Layering in Valles Marineris, Mars, Calculated from Mars Orbiter Laser Altimeter Data and Mars Orbiter Camera Imagery**

MacKinnon, P.; Fueten, F.; Stesky, R. M.; Lunar and Planetary Science XXXV: Mars Tectonism and Volcanism; 2004; 2 pp.; In English; See also 20040055983; Original contains color and black and white illustrations

Contract(s)/Grant(s): NRCan-01-0102; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Preliminary work has demonstrated that Mars Orbiter Laser Altimeter(MOLA) and Mars Orbiter Camera(MOC) data can be successfully combined in Orion to determine accurately the attitudes of large scale planar features in Valles Marineris. Initial results indicate that layering in the eastern portion of Valles Marineris dips fairly consistently into the canyon. While this study is still in the early stages, it is clear that it has the potential to provide much needed data on the basic structure of Valles Marineris. Future work will examine layers and faults over the entire Valles Marineris region. This data will enable a better understanding of the development of this large Martian feature and therefore of the evolution of the planet Mars as a whole.

Author

*Mars Surface; Image Analysis*

**20040056008** Chicago Univ., Chicago, IL, USA

**Preliminary Results from the Dust Flux Monitoring Instrument During the Encounter of Stardust Spacecraft with Wild-2 Comet**

Tuzzolino, A. J.; Economou, T. E.; McDonnell, J. A. M.; Lunar and Planetary Science XXXV: Stardust Mission; 2004; 1 pp.; In English; See also 20040056007; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On January 2nd, 2004, the Stardust spacecraft successfully encountered the Wild 2 comet. The Dust Flux Monitoring Instrument (DFMI) provided quantitative measurements of dust particle fluxes and particle mass distributions throughout the entire flythrough. The Dust flux Monitoring Instrument: The DFMI on the Stardust mission was designed, constructed and tested at the University of Chicago [1]. The DFMI consists of two different dust detector systems a polyvinylidene fluoride (PVDF) dust sensor unit (SU), which measures particles with mass < Less than approx. 10(exp -4) g, and a dual acoustic sensor system (DASS), which utilizes two piezoelectric accelerometers mounted on the first two layers of the spacecraft Whipple dust shield to measure the flux of particles with mass larger than 10(exp -4) g. The entire Whipple shield structures provided the large effective area required for detection of the expected low flux of high-mass particles. The analysis of the acoustic sensors will be undertaken by the Open University, U.K.

Derived from text

*Wild 2 Comet; Stardust Mission; Mass Distribution; Dust; Signal Detectors; Particle Mass*

**20040056009** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Stardust: A Successful Encounter with the Remarkable Comet Wild 2**

Brownlee, D. E.; Anderson, J. D.; Atkins, K.; Bhaskaran, S.; Cheuvront, A. R.; Clark, B. C.; Duxbury, T. C.; Economou, T.; Hanner, M. S.; Hoerz, F., et al.; Lunar and Planetary Science XXXV: Stardust Mission; 2004; 2 pp.; In English; See also 20040056007; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On January 2, 2004 the Stardust spacecraft completed a close flyby of comet Wild2 (P81). Flying at a relative speed of 6.1 km/s within 237km of the 5 km nucleus, the spacecraft took 72 close-in images, measured the flux of impacting particles and did in-situ compositional analysis of freshly released dust with a time-of-flight mass spectrometer. The primary goal of the mission is to collect >500 particles >15 m diameter and return them to Earth on January 15, 2006. The cometary particles ranging in size from a micron to approx.100 microns were collected in low density silica aerogel. After returning over a hundred 2x4x3 cm aerogel collection cells will be processed at the curatorial facility at the NASA Johnson Space Center and 5 to 100 micron size extracted cometary particles will be distributed to analysts by a system that will be based on the allocation procedures for cosmic dust, Antarctic meteorites and lunar samples.

Derived from text

*Comets; Cosmic Dust; Aerogels; Stardust Mission; Meteorites; Flyby Missions*

**20040056010** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Stardust Dynamic Science at Wild 2: First Look**

Anderson, J. D.; Lau, E. L.; Clark, B. C.; Asmar, S. W.; Lunar and Planetary Science XXXV: Stardust Mission; 2004; 2 pp.; In English; See also 20040056007; 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 Dynamic Science investigation on the STARDUST mission has been described previously. The data delivered by the STARDUST Project is multifold, but basically it consists of radio Doppler data from the Deep Space Network (DSN) and attitude control data (ACS) from the spacecraft. Doppler data were successfully recorded by JPL's Navigation System (closed-loop data) and also by its Radio Science System (open-loop data) at DSN stations DSS43 near Canberra Australia and at DSS14 at Goldstone California. Attitude control data were also successfully delivered to the Dynamic Science Team. Here we describe a preliminary analysis of the data. Beyond a closest approach distance of 150 km, a Doppler detection of a the Wild 2 nucleus mass was not expected. The current best estimate of the closest approach distance is 236.4 km, and as expected, any mass signal in the Doppler data is hopelessly buried in the noise. We have attempted to fit the data to a mass model with no success. However, analysis of the Doppler data and the ACS data for particle impacts on the spacecraft's Whipple shields is in progress, and will be reported at the meeting. The DSS43 closed-loop Doppler residuals are plotted as a function of time from the current best estimate of the time of Wild 2 closest approach, 2 January 2004, 19:43:11.7 UTC, Earth-receive time at the station.

Author (revised)

*Stardust Mission; Wild 2 Comet; Data Processing; Doppler Radar*

**20040056011** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Stardust Sample Collection at Wild 2 and Its Preliminary Examination**
Tsou, P.; Brownlee, D. E.; Hoerz, F.; Newburn, R. L.; Sandford, S. A.; Sekanina, Z.; Zolensky, M. E.; Lunar and Planetary Science XXXV: Stardust Mission; 2004; 2 pp.; In English; See also 20040056007; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The primary objective of STARDUST is to collect coma samples from 81P/Wild 2. This was made on January 2, 2004. Before the encounter three significant model predictions existed for the number and size of samples to be captured. Three investigations during the Wild 2 encounter (Dust Flux Monitor, Comet and Interstellar Dust Analyzer and Dynamic Science) made in situ measurements of the dust. Spectacular images were captured of the Wild 2 nucleus and dust jets. This abstract compares the model predictions with the in situ measurements and Wild 2 images and assesses the likely samples to be returned for analysis on January 15, 2006. To give some lead time for sample analysts to prepare for the analyses of the returned samples, the organization of the Preliminary Examination is presented.
Derived from text
*Stardust Mission; Wild 2 Comet; Cosmic Dust; Measuring Instruments*

**20040056012** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Stardust Imaging of Comet Wild 2: First Look**
Newburn, R.; Acton, C.; Bhaskaran, S.; Brownlee, D.; Cheuvront, A.; Duxbury, T.; Hanner, M.; Semenov, B.; Sandford, S.; Tsou, P.; Lunar and Planetary Science XXXV: Stardust Mission; 2004; 1 pp.; In English; See also 20040056007; 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

On 2 January 2004 during its historic flight to return cometary dust samples to earth, the STARDUST spacecraft flew within the coma of comet Wild 2 and also took 72 images where the surface was resolved during the flyby. A combination of long and short exposures was used to observe the jets and the surface. Comet Surface: The images revealed a planetary body, one not having a significant atmosphere, quite different from any other such body seen from other spacecraft. Surface depressions, potentially a combination of craters and vents, were not bowl-shaped but typically had steep walls and flattened floors. One depression considered to be a vent, the source of a jet, had a depth to diameter ratio of approx.0.4, with near vertical walls. Jets: At least 10 to possibly 20 jets were active during the flyby. Some were traced back to the surface where they seem to originate from the near vertical walls of depressions (vents) that were facing the sun, having the highest solar insolation.
Derived from text
*Imaging Techniques; Flyby Missions; Stardust Mission; Wild 2 Comet; Craters*

**20040056013** Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, Germany
**Stardust: First Results from the Cometary and Interstellar Dust Analyzer**
Kissel, J.; Silen, J.; Lunar and Planetary Science XXXV: Stardust Mission; 2004; 1 pp.; In English; See also 20040056007; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cometary and Interstellar Dust Analyzer CIDA was active during the Flyby at comet Wild-2. For about 90 seconds around the spacecrafts closest approach to the nucleus impacts of dust particles were registered and mass spectra taken.
Author
*Cosmic Dust; Stardust Mission; Mass Spectra*

**20040056014** NASA Ames Research Center, Moffett Field, CA, USA
**Streaming Clumps Ejection Model and the Heterogeneous Inner Coma of Comet Wild 2**
Clark, B. C.; Economou, T. E.; Green, S. F.; Sandford, S. A.; Zolensky, M. E.; Lunar and Planetary Science XXXV: Stardust Mission; 2004; 2 pp.; In English; See also 20040056007; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The conventional concept of cometary comae is that they are dominated by fine particulates released individually by sublimation of surface volatiles and subsequent entrainment in the near-surface gas. It has long been recognized that such particulates could be relatively large, with early estimates that objects perhaps up to one meter in size may be levitated from the surface of the typical cometary nucleus. However, the general uniformity and small average particulate size of observed comae and the relatively smooth, monotonic increases and decreases in particle density during the Giotto flythrough of comet Halley s coma in 1986 reinforced the view that the bulk of the particles are released at the surface, are fine-sized and inert.

Jets have been interpreted as geometrically constrained release of these particulates. With major heterogeneities observed during the recent flythrough of the inner coma of comet Wild 2, these views deserve reconsideration.
Derived from text
*Cometary Atmospheres; Comet Nuclei; Comets; Particulates; Giotto Mission; Wild 2 Comet; Clumps*

**20040056015** NASA Johnson Space Center, Houston, TX, USA
**Preliminary Sample Analysis Plan for the Cometary and Interstellar Samples Being Returned by the Stardust Spacecraft**
Zolensky, M.; Sandford, S.; Hoerz, F.; Brownlee, D.; Tsou, P.; Clark, B.; Lunar and Planetary Science XXXV: Stardust Mission; 2004; 2 pp.; In English; See also 20040056007; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The NASA Stardust comet sample return mission is proceeding very well, and the science team breathed a collective sigh of relief following the successful comet sample collection phase which occurred during a 6.1 km/s, 340km-close flyby of comet Wild-2 on Jan 2 of this year. Multiple images of the comet nucleus were obtained and a variety of onboard instruments returned in situ data on the spatial distribution, particle size frequency and composition of the dust in the comet s coma. These data are currently being processed and analyzed. It is expected that 500-1000 comet particles >15 m were collected by impact into low density silica aerogel, as well as many more smaller grains. Previous tests with hypervelocity guns firing small particles into aerogel indicate that material should have successfully been collected by the Stardust aerogel [1&2]. In addition, many (~100) grains of interstellar material newly entering the Solar System should have been collected by the spacecraft during its cruise phase to the comet.
Derived from text
*Stardust Mission; Cometary Atmospheres; Aerogels; Flyby Missions; Dust; Particle Size Distribution; Wild 2 Comet*

**20040056022** Australian National Univ., Canberra, Australia
**Planetary Science: A New Discipline?**
Taylor, Stuart Ross; Lunar and Planetary Science XXXV: Plenary Session; 2004; 2 pp.; In English; See also 20040056021; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Planets are individuals formed by stochastic processes. They resist generalizations and pigeonholes. Their study needs a new discipline between the historical approach of the geological sciences and the mathematical sophistication of astrophysics.
Author
*Planetary Evolution; Planetary Composition; Stochastic Processes*

**20040056024** Kharkov State Univ., Ukraine
**Is It Possible to Detect Magnetic Materials on Venus with Bistatic Radar Probing?**
Starukhina, L. V.; Kreslavsky, M. A.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040056023; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As thermodynamic calculations have shown, under Venus conditions magnetite Fe3O4 is an expected weathering product of basaltic minerals. Magnetite is a ferrimagnetic with the Curie point 853 K; below this temperature, that is everywhere on the Venus surface, magnetite has non-negligible magnetic permeability . Thus, magnetic properties of surface materials are likely to influence radiophysical measurements. Magnetite is an endmember of several series of substitutional solid solutions with spinel crystal structure and ferrimagnetic behavior. The Curie point decreases in these series from the magnetite endmember and reaches the temperature range of the surface for some compositions. Hematite Fe2O3 is also an endmember of a series of minerals with peculiar magnetic behavior.
Derived from text
*Magnetic Materials; Venus (Planet); Surface Properties; Multistatic Radar; Ferrimagnetic Materials; Curie Temperature; Magnetite*

**20040056025** Academy of Sciences (USSR), Moscow, USSR
**Airfall Crater Deposits on the Surface of Venus: Do We See Them in the Venera Panoramas?**
Basilevsky, A. T.; Head, J. W.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040056023; 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

There is broad agreement that impact craters on Venus (with D>11 km) in the process of their formation acquire radar-dark parabolas (DP) composed of airfall deposits. With time the parabolas degrade and shrink into clear dark halo (CH), then to faint halo (FH) and finally completely disappear (NH = no halo). So the DP-CH-FH-NH sequence is the age sequence with DP craters being the most recent and the NH craters being the most ancient. In this work we study the areal distribution of presently observed and partly or completely degraded airfall deposits in the vicinities of the Venera-Vega landing sites and consider the surface panoramas in the light of information on the Venus surface acquired by the landers.
Derived from text
*Craters; Deposits; Halos; Landing Sites; Venus (Planet); Venus Surface*

**20040056026** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**An Admittance Survey of Large Volcanoes on Venus: Implications for Volcano Growth**
Brian, A. W.; Smrekar, S. E.; Stofan, E. R.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040056023; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Estimates of the thickness of the venusian crust and elastic lithosphere are important in determining the rheological and thermal properties of Venus. These estimates offer insights into what conditions are needed for certain features, such as large volcanoes and coronae, to form. Lithospheric properties for much of the large volcano population on Venus are not well known. Previous studies of elastic thickness (Te) have concentrated on individual or small groups of edifices, or have used volcano models and fixed values of Te to match with observations of volcano morphologies. In addition, previous studies use different methods to estimate lithospheric parameters meaning it is difficult to compare their results. Following recent global studies of the admittance signatures exhibited by the venusian corona population, we performed a similar survey into large volcanoes in an effort to determine the range of lithospheric parameters shown by these features. This survey of the entire large volcano population used the same method throughout so that all estimates could be directly compared. By analysing a large number of edifices and comparing our results to observations of their morphology and models of volcano formation, we can help determine the controlling parameters that govern volcano growth on Venus.
Derived from text
*Surveys; Venus Surface; Volcanoes; Planetary Crusts; Planetary Geology; Lithosphere; Rheology*

**20040056027** Rice Univ., Houston, TX, USA
**Crustal Thickening Above a Convecting Mantle with Application to Venus and Mars**
Cooper, C. M.; Lenardic, A.; Nimmo, F.; Moresi, L.; Lunar and Planetary Science XXXV: Venus; 2004; 1 pp.; In English; See also 20040056023; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Understanding the response of a near surface chemical layer to the deforming nature of a convecting mantle is useful for addressing several problems of planetary tectonics. It has been suggested that highlands on Venus (Ishtar, in particular) have formed via crustal thickening, be it viscous thickening or thrust stacking, over regions of mantle downwelling. It has also been suggested that the Martian highlands may have formed via crustal thickening above a mantle downwelling. To help in evaluating the physical plausibility of these hypotheses, we explore a simplified system of chemical layer thickening above a convecting mantle. The simple system allows us to develop insight into the physical condition that does or does not allow for crustal thickening above a convecting mantle. Chemical layers can be stabilized from deformation by possessing a higher viscosity and/or a higher plastic yield strength than the convecting mantle. Numerical simulations were conducted to determine the transitions between viscous and localized plastic deformation of a chemical layer within a convecting mantle. Several deformation responses were mapped, as were the parameter conditions required for lithosphere stability. As the Rayleigh number increases, the buoyancy ratios and chemical boundary layer (CBL) thicknesses required for stability decrease. The viscosity contrast that leads to stability decreases with the CBL thickness and extent and is independent of the Rayleigh number. As the Rayleigh number increases, the friction coefficients and CBL thicknesses required for stability decrease. These results are consistent with simple physical scaling laws. Outside of the stability parameter windows, both localized and distributed deformation modes were observed. It is in these parameter windows that crustal thickening above mantle downflows becomes viable. Further scaling laws are being developed to help physically explain the parameter space transitions from localized to distributed deformation regimes. A preliminary conclusion is that crustal thickening on Mars and Venus can be achieved via localized deformation even in presence of high viscosity (i.e., dry and/or cold) crust that would inhibit viscous deformation.
Author
*Crusts; Surface Layers; Convection; Boundary Layer Thickness; Venus (Planet); Mars (Planet); Deformation*

**20040056028** Lunar and Planetary Inst., Houston, TX, USA

**Rift System Architecture on Venus**

Kiefer, Walter S.; Swafford, Laura C.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040056023; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Terrestrial rift systems are composed of structures with a variety of length scales. At the shortest length scale, individual faults form discrete rift basins. These basins link together to form more complex rift systems. For example, the East African Rift system can be subdivided into several distinct rift branches, the Ethiopian Rift, the Kenya Rift, and the Western Rift. In turn, each of these rift branches is composed of numerous distinct rift basins. For example, the Western Rift has been subdivided into 23 distinct segments in its northern region and an additional 9 segments in the southern Malawi rift region on the basis of boundary fault geometry. These individual rift segments frequently form distinct topographic basins, as manifested by the numerous rift valley lakes in eastern Africa. Devana Chasma has long been recognized as one of the major examples of rifting on Venus. In this work, we use topographic profiles across Devana Chasma to assess the basin scale structure of this rift system. We focus on a 2500 km long segment of Devana between 20 degrees North and 4 degrees South which lies in the plains between Beta Regio and Phoebe Regio. There is a 600 km offset in the trend of Devana Chasma near 8 degrees North. Interpretation of the gravity anomaly along the rift, the decreased fault density in the offset region, and the virtual absence of rift flank topography within the offset suggest that Devana should actually be considered to be two distinct rifts. One of the rifts propagated southward from Beta Regio and the other propagated northward from Phoebe Regio. Here, we consider examples from both the Beta and Phoebe branches of Devana Chasma.

Author

*Structural Basins; Venus (Planet); Venus Surface; Geological Faults; Topography*

**20040056029** Minnesota Univ., Duluth, MN, USA

**Constraints on Deformation Belt Evolution on Venus**

Young, D. A.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040056023; 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

Deformation belts are regions of approximately linear deformation found in lowland regions of Venus. They often correlate with planitia, broad topographic lows demonstrated to be dynamically supported. Belts have been hypothesized to represent a response to regional contraction due to large scale mantle convection (1; 2; 3). In the Rusalka Planitia region, the interaction between the belts Oya Dorsa and Polunista Dorsa and regional structures, the presence of evidence for local volcanism, and aspects of the belt deformation suggest an intriguing alternative hypothesis for their formation: local lithospheric delamination.

Derived from text

*Deformation; Topography; Delaminating; Venus (Planet)*

**20040056030** Massachusetts Univ., Amherst, MA, USA

**Ages of Venusian Ridge Belts Relative to Regional Plains**

McGill, G. E.; Campbell, B. A.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040056023; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The nature of the global geologic history of Venus continues to be controversial. On one hand is a 'directional' model that involves a series of depositional and deformational events that are approximately coeval globally. On the other hand is a 'non-directional' model that does not require globally coeval events. Regardless of one's opinion of the directional model, it serves a very useful purpose because it is testable. The systematic evolution of volcanic styles that is inherent in the directional model is likely not real, and the implied single age for wrinkle ridge formation is demonstrably not correct. An important element in the directional model is the proposed single age for formation of ridge belts. In the directional model these belts are globally older than the areally dominant regional plains. This study is a test of this aspect of the directional model.

Author

*Venus Surface; Plains; Mathematical Models; Geochronology; Regions; Ridges*

**20040056031** Minnesota Univ., Duluth, MN, USA

**Plumes as a Mechanism for Equilibrium Resurfacing of Venus**

Hansen, V. L.; Young, D. A.; Lunar and Planetary Science XXXV: Venus; March 19, 2004; 2 pp.; In English; See also 20040056023; Copyright; Avail: CASI

Venus hosts approx.1000 apparently pristine impact craters distributed in near random fashion. Two hypotheses have been proposed to account for crater observations: catastrophic volcanic resurfacing, and equilibrium (steady state) volcanic resurfacing. Neither hypothesis addresses all aspects of the crater database, and both assume that craters are removed only through volcanic burial. We propose that crater destruction by crustal annealing allows consideration of a hybrid hypothesis for Venus surface evolution.
Derived from text
*Venus Surface; Plumes; Craters; Venus (Planet); Volcanoes*

**20040056032** Russian Academy of Natural Sciences, Moscow, Russia
**Geological Mapping of Venus: Interpretation of Geologic History and Assessment of 'Directional' and 'Non-Directional' Models**
Ivanov, M. A.; Head, J. W.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040056023; 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 this paper we report on the results of geological mapping in four quadrangles (V-4, V-13, V-55, and V- 61) mapped under the USGS Program of geological mapping of Venus and with the results of mapping within a geotraverse that extends continuously around the Venus globe at 30degN. The areas of mapping are widely distributed and comprise about 17% of the surface of Venus. We believe that such a significant fraction of the surface is likely to be generally representative of the entire planet and provides a significant view of the interpreted geological history. In turn, this data set and interpreted stratigraphic record enables us to assess the applicability of proposed end-member models of Venus' geologic history.
Derived from text
*Planetary Geology; Planetary Mapping; Venus (Planet); Stratigraphy*

**20040056034** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Oxygen in the Solar System**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040056035 - 20040056037
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Oxygen in the Solar System' contained the following reports: Oxygen Isotopes in Lunar Metal Grains: A Natural Genesis Experiment; Determining Possible Building Blocks of the Earth and Mars; and Oxygen Fugacity of the Martian Mantle from Pigeonite/Melt Partitioning of Samarium.
Derived from text
*Oxygen Isotopes; Mars Surface*

**20040056035** Australian National Univ., Canberra, Australia
**Oxygen Isotopes in Lunar Metal Grains: A Natural Genesis Experiment**
Ireland, T. R.; Holden, P.; Norman, M.; Clarke, J.; Lunar and Planetary Science XXXV: Oxygen in the Solar System; 2004; 2 pp.; In English; See also 20040056034; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The oxygen isotopic compositions of materials from the solar nebula are highly diverse and uniquely represent a myriad of potential effects from diverse nucleosynthetic inputs, high-temperature fractionations through to low temperature alteration, with non-mass-dependent and mass dependent isotope fractionations. The main variation in solar system materials is in the abundance of 16(sup)O. In standard three-isotope plots, 16(sup)O as the most abundant isotope is used as the denominator and so variations in 16(sup)O abundance lie on a 1:1 correlation line with enrichment in 16(sup)O towards the origin (Figure 1). Most solid materials (as bulk meteorites, terrestrial, lunar) of the solar system lie within less than 1 % or so of each other in terms of normalized 16O abundance. The earliest known objects in the solar system, refractory inclusions and related objects have large enrichments of 16(sup)O up to 7% relative to terrestrial. Chondrules can show 16(sup)O enrichments up to a few percent.In effect, we do not know the isotopic composition of solar oxygen within a range of nearly 10 %. This is of course a major priority of the Genesis mission in that a sample of solar wind is to be collected and returned to Earth for analysis. In preparation for this return, we have begun an experiment with lunar materials in an effort to at least constrain possible endmembers of the solar composition.
Derived from text
*Isotope Ratios; Oxygen Isotopes; Lunar Soil*

**20040056036** NASA Johnson Space Center, Houston, TX, USA
**Oxygen Fugacity of the Martian Mantle from Pigeonite/Melt Partitioning of Samarium, Europium and Gadolinium**
Musselwhite, D. S.; Jnes, J. H.; Shearer, C.; Lunar and Planetary Science XXXV: Oxygen in the Solar System; 2004; 2 pp.; In English; See also 20040056034; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This study is part of an ongoing effort to calibrate the pyroxene/melt REE oxybarometer for conditions relevant to the martian meteorites. These efforts have been motivated by reports of redox variations among the shergottites . We have conducted experiments on martian composition pigeonite/melt rare earth element partitioning as a function of fO2.
Derived from text
*SNC Meteorites; Meteoritic Composition; Mars Surface*

**20040056037** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Determining Possible Building Blocks of the Earth and Mars**
Burbine, T. H.; OBrien, K. M.; Lunar and Planetary Science XXXV: Oxygen in the Solar System; 2004; 2 pp.; In English; See also 20040056034; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the fundamental questions concerning planetary formation is exactly what material did the planets form from? All the planets in our solar system are believed to have formed out of material from the solar nebula. Chondritic meteorites appear to sample this primitive material. Chondritic meteorites are generally classified into 13 major groups, which have a variety of compositions. Detailed studies of possible building blocks of the terrestrial planets require samples that can be used to estimate the bulk chemistry of these bodies. This study will focus on trying to determine possible building blocks of Earth and Mars since samples of these two planets can be studied in detail in the laboratory.
Author
*Planetary Evolution; Meteoritic Composition; Mars (Planet); Earth (Planet)*

**20040056046** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy**
2004; 25 pp.; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040056047 - 20040056059
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The session 'Martian Meteorites: Hot and Steamy' contained the following reports:Li Isotopic Composition of the NWA 480 Shergottite; Light Lithophile Abundances and Isotopic Ratios in Shergottites; Alkalic Volcanism on Mars?; Petrology of Primitive Olivine-Orthopyroxene-Phyric Shergottites NWA 2046 and NWA 1195: Analogies with Terrestrial Boninites and Implications for Partial Melting of Hydrous Martian Mantle; Evidence for a Wet, Reduced Martian Interior; The Edge of Wetness: The Case for Dry Magmatism on Mars; The Differentiation History of Mantle Reservoirs on Mars from W and Nd Isotopic Compositions of SNC Meteorites; Signatures in Martian Volatiles and the Magma Sources of NC Meteorites; Yamato 980459: The Most Primitive Shergottite?; Yamato 980459: Crystallization of Martian Magnesian Magma; Rb-Sr and Sm-Nd Isotopic Studies of Shergottite Y980459 and a Petrogenetic Link Between Depleted Shergottites and Nakhlites; Rare Earth Element Measurements of Multi-Generational(?) Carbonate in Martian Meteorite Allan Hills 84001; and Cryogenic Calcite: A Morphologic and Isotopic Analog to the ALH84001 Carbonates.
Derived from text
*SNC Meteorites; Mars Volcanoes*

**20040056047** NASA Johnson Space Center, Houston, TX, USA
**Yamato 980459: Crystallization of Martian Magnesian Magma**
Koizumi, E.; Mikouchi, T.; McKay, G.; Monkawa, A.; Chokai, J.; Miyamoto, M.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recently, several basaltic shergottites have been found that include magnesian olivines as a major minerals. These have been called olivinephyric shergottites. Yamato 980459, which is a new martian meteorite recovered from the Antarctica by the Japanese Antarctic expedition, is one of them. This meteorite is different from other olivine-phyric shergottites in several key

features and will give us important clues to understand crystallization of martian meteorites and the evolution of Martian magma.
Derived from text
*Crystallization; Mars (Planet); Magma; Shergottites; SNC Meteorites; Basalt*

**20040056048** National Museum of Natural History, Washington, DC, USA
**Rare Earth Element Measurements of Multi-Generational(?) Carbonate in Martian Meteorite Allan Hills 84001**
Corrigan, C. M.; Wadhawa, M.; Harvey, R. P.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Carbonates in the oldest martian meteorite, ALH 84001, offer potentially important clues to understanding ancient fluid-rich environments on Mars. Abundances of a variety of trace elements have previously been reported in ALH84001 carbonates. The motivation for this trace element investigation of ALH 84001 carbonates was to test the hypothesis that these carbonates were formed as a result of complex processes involving precipitation followed by one or more stages of alteration (including shock and thermal decomposition). Additionally, it was hoped that using trace elements as fluid tracers and stratigraphic markers might help shed light on whether or not the slab carbonates, rims and post-slab magnesites represent multiple generations of carbonate formation.
Derived from text
*Rare Earth Elements; Carbonates; SNC Meteorites; Mars (Planet); Trace Elements*

**20040056049** NASA Johnson Space Center, Houston, TX, USA
**Cryogenic Calcite: A Morphologic and Isotopic Analog to the ALH84001 Carbonates**
Niles, P. B.; Leshin, L. A.; Socki, R. A.; Guan, Y.; Ming, D. W.; Gibson, E. K.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Martian meteorite ALH84001 carbonates preserve large and variable microscale isotopic compositions, which in some way reflect their formation environment. These measurements show large variations (>20%) in the carbon and oxygen isotopic compositions of the carbonates on a 10-20 micron scale that are correlated with chemical composition. However, the utilization of these data sets for interpreting the formation conditions of the carbonates is complex due to lack of suitable terrestrial analogs and the difficulty of modeling under non-equilibrium conditions. Thus, the mechanisms and processes are largely unknown that create and preserve large microscale isotopic variations in carbonate minerals. Experimental tests of the possible environments and mechanisms that lead to large microscale isotopic variations can help address these concerns. One possible mechanism for creating large carbon isotopic variations in carbonates involves the freezing of water. Carbonates precipitate during extensive CO2 degassing that occurs during the freezing process as the fluid s decreasing volume drives CO2 out. This rapid CO2 degassing results in a kinetic isotopic fractionation where the CO2 gas has a much lighter isotopic composition causing an enrichment of 13C in the remaining dissolved bicarbonate. This study seeks to determine the suitability of cryogenically formed carbonates as analogs to ALH84001 carbonates. Specifically, our objective is to determine how accurately models using equilibrium fractionation factors approximate the isotopic compositions of cryogenically precipitated carbonates. This includes determining the accuracy of applying equilibrium fractionation factors during a kinetic process, and determining how isotopic variations in the fluid are preserved in microscale variations in the precipitated carbonates.
Derived from text
*Cryogenics; Carbonates; SNC Meteorites; Oxygen; Isotopes; Carbon Dioxide; Chemical Composition*

**20040056050** NASA Johnson Space Center, Houston, TX, USA
**Rb-Sr and Sm-Nd Isotopic Studies of Shergottite Y980459 and a Petrogenetic Link Between Depleted Shergottites and Nakhlites**
Shih, C.-Y.; Nyquist, L. E.; Wiesmann, H.; Misawa, K.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Y980459 was found near the Minami-Yamato Nunataks, Antarctica in 1998 and was recently classified as an olivine-bearing shergottite. It petrographically resembles many other olivine-phyric shergottites mostly found in hot deserts, e.g. DaG476/489, SaU005/094, Dohfar 019, NWA 1068/1110, NWA 1195 and EETA 79001 lith.A. However, Y980459 is

unique among these meteorites in several respects. It is apparently very fresh and only weakly shocked. Also, it completely lacks plagioclase, but contains abundant residual volcanic glass. This group of olivine-phyric shergottites is characterized by variable crystallization ages from approx.172 Ma to approx.575 Ma and ejection ages from approx.1 Ma to approx.20 Ma. They probably represent volcanic melts originated from the deep Martian mantle. We performed Rb-Sr and Sm-Nd isotopic analyses on Y980459 to determine its crystallization age and compared its age and isotopic signatures with those obtained from other olivine-phyric shergottites and QUE 94201, the other Antarctic olivine-free shergottite. QUE 94201 and some olivine-phyric shergottites e.g. DaG, SaU, Doh and EETA lith A have similar depleted-LREE patterns and are herein referred to as depleted shergottites. A petrogenetic model correlating depleted shergottites and nakhlites is also proposed. Preliminary Rb-Sr and Sm-Nd isotopic data for Y980459 were presented earlier at the NIPR, Japan, in 2003.
Derived from text
*Shergottites; Isotopes; Nakhlites; Meteorites; Mars (Planet); Planetary Structure; Planetary Mantles; Crystallization*

**20040056051** California Univ., San Diego, La Jolla, CA, USA
**Signatures in Martian Volatiles and the Magma Sources of NC Meteorites**
Marti, K.; Mathew, K. J.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046
Contract(s)/Grant(s): NAG5-12983; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report nitrogen and xenon isotopic signatures in Yamato nakhlites and use the data to assess properties of the magma source of NC meteorites in planet Mars. The Chassigny meteorite was investigated by Floran et al, who classified it as a cumulate dunite with hydrous amphibole-bearing melt inclusions with no preferred orientation of the olivines. Their inferred composition of the parent magma, which was based on electron microprobe analyses, has been questioned. The trace and minor elements in minerals were analyzed in nakhlites and in Chassigny and the authors conclude that nakhlites may represent samples from different horizons of the same lithologic unit, but that Chassigny was not co-magmatic with the nakhlites.
Derived from text
*Meteoritic Composition; Atmospheric Composition; Trace Elements; Xenon; Nitrogen; Mars (Planet)*

**20040056052** NASA Johnson Space Center, Houston, TX, USA
**Yamato 980459: The Most Primitive Shergottite?**
McKay, G.; Le, L.; Schwandt, C.; Mikouchi, T.; Koizumi, E.; Jones, J.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Antarctic Research Center of the Japanese National Institute of Polar Research (NIPR) recently announced the discovery of a new Martian shergottite, Y98(0459). This sample is a member of the subgroup of basaltic shergottites that contain abundant olivine phenocrysts, and are thus olivine- phyric. Y98 may have special significance among the basaltic shergottites because (1) it appears to have been the most magnesian Martian magma yet found, and thus can provide valuable clues to magma petrogenesis on Mars; (2) it contains no late-crystallizing phases, but instead contains approx. 30% interstitial glass, which can provide unambiguous incompatible element patterns of the parent melt; and (3) it carries an LREE-depleted signature similar to QUE 94201, whose isotopic characteristics are the most primitive of all basaltic shergottites.
Derived from text
*Shergottites; Petrogenesis; Signatures; Mars (Planet); Magma; Basalt*

**20040056053** NASA Johnson Space Center, Houston, TX, USA
**The Edge of Wetness: The Case for Dry Magmatism on Mars**
Jones, J. H.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The issue of whether martian magmas are wet or dry is an important one. The answer to this basic question has profound consequences for how we think about Mars as a planet. Recently, several lines of evidence have been presented that collectively suggest that shergottite parent magmas were once wet. These include: (i) phase equilibria studies that indicate that the Shergotty parent magma required ~2 wt.% water in order to be co-saturated with both pigeonite and augite, (ii) reverse zoning of light lithophile elements (Li and B) in shergottite pyroxenes, suggesting the exsolution and removal of an aqueous fluid, and (iii) measurement of D/H ratios in SNC minerals that are much lower than atmospheric, suggesting that there may

be juvenile (primordial) mantle water. Below I will review the evidence for the diametrically opposite case, that shergottite magmas were effectively dry (<< 1 wt.% H2O).
Derived from text
*Magma; Mars (Planet); Shergottites; Drying; Meteoritic Composition*

**20040056054** Tennessee Univ., Knoxville, TN, USA
**Light Lithophile Abundances and Isotopic Ratios in Shergottites**
Lentz, R. C. F.; McSween, H. Y., Jr.; Fayek, M.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Light lithophile element abundances have previously been analyzed in the Martian shergottites with an aim towards establishing whether the basaltic parent magmas contained any water. Measured depletions in B and Li between pyroxene cores and rims in both Shergotty and Zagami were interpreted as marking a loss of magmatic water between the time of core crystallization at depth and rim formation at the surface, post-eruption. Here we present data that 1) verifies our previous results and 2) tests our original interpretation further using B isotopic analyses. Boron isotopic ratios are affected by the presence of water because of a link between the coordination state of B and its phase state. B bound in silicate minerals is tetrahedrally coordinated, while in hydrous fluids, B favors the trigonal state, particularly under conditions of increased acidity. Furthermore, 11B favors the trigonal state. Therefore, when a melt is in contact with a hydrous fluid, B will preferentially move from the melt into the fluid and be isotopically fractionated in the process. The fluid becomes isotopically heavy while the melt becomes B-depleted and isotopically lighter. Thus, we propose to establish whether there is any shift in isotopic composition from the cores to rims of the shergottite pyroxenes which would be expected from water interaction.
Derived from text
*Shergottites; Abundance; Isotopes; Magma; Basalt; Meteoritic Composition; Mars (Planet)*

**20040056055** Washington Univ., Seattle, WA, USA
**Petrology of Primitive Olivine-Orthopyroxene-Phyric Shergottites NWA 2046 and NWA 1195: Analogies with Terrestrial Boninites and Implications for Partial Melting of Hydrous Martian Mantle**
Irving, A. J.; Bunch, T. E.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Research on Martian meteorites has led to the recognition of several shergottite subgroups, namely the relatively evolved basaltic shergottites, the lherzolitic shergottites, and the more primitive olivine-phyric shergottites. NWA 1195 had been classified as an olivine-phyric shergottite, but the discovery in 2003 of the 30th known Martian meteorite near Lakhbi, Algeria (provisional number NWA 2046) has led to the realization that both of these Mg-rich samples (containing preferentially aligned, prismatic phenocrysts of orthopyroxene in addition to olivine) properly belong to a separate shergottite subgroup.
Derived from text
*Petrology; Shergottites; Mars (Planet); Melting; Olivine; Planetary Mantles*

**20040056056** Mount Holyoke Coll., South Hadley, MA, USA
**Evidence for a Wet, Reduced Martian Interior**
Dyar, M. D.; Mackwell, S. J.; Seaman, S. J.; Marchand, G. J.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046
Contract(s)/Grant(s): NAG5-10424; NAG5-12848; NAG5-12687; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Knowledge of the oxygen fugacity and hydrogen content of the source regions of martian meteorites is of paramount importance in constraining phase equilibria, crystallization sequences, and geodynamic processes of the martian interior, as well as models of the planet's evolution. To date, these interpretations have been hindered by the paucity in SNC meteorites of Fe-Ti oxides used in conventional oxybarometry, and by the presence of secondary alteration products that make it impossible to quantify primary hydrogen abundances in SNC minerals and melts based on whole rock samples. We present here the first transmission FTIR spectra of individual mineral grains from SNC meteorites, and interpret those results along with Mossbauer data on mineral separates from the same meteorites. Our goal is to quantify the amount of water and the

oxygen fugacity present in the source regions for the rocks comprising the meteorites.
Derived from text
*Hydrogen; SNC Meteorites; Crystallization; Mars (Planet); Planetary Evolution; Oxygen; Geodynamics*

**20040056057** Ecole Normale Superieure, Lyon, France
**Li Isotopic Composition of the NWA 480 Shergottite**
Beck, P.; Barrat, J.-A.; Chaussidon, M.; Gillet, P.; Bohn, M.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Li abundance in pyroxenes from the Zagami and Shergotty martian meteorites, suggested that Li was lost by their parent magmas. Such a behavior suggested the involvement of an aqueous fluid during the crystallization of the meteorites because of the strong affinity of Li with water-rich fluids. Because Shergotty and Zagami are petrographically similar, it was crucial to extend these observations to shergottites of different types. Therefore we studied in detail the Li behavior in the Northwest Africa 480 shergottites (NWA 480) using the CRPG-CNRS ims 3f ion microprobe. In addition to Li abundance measurements, Li isotopic composition were determined. Lithium concentrations and isotopic compositions were measured in individual grains of pyroxene, and in a few maskelynites and Caphosphates grains.
Derived from text
*Lithium; Meteoritic Composition; Meteorites; Shergottites; Crystallization; Isotopic Labeling; Magma*

**20040056058** Field Museum of Natural History, Chicago, IL, USA
**The Differentiation History of Mantle Reservoirs on Mars from W and Nd Isotopic Compositions of SNC Meteorites**
Foley, C. N.; Wadhwa, M.; Borg, L.; Janney, P. E.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The 182Hf-182W short-lived chronometer (t(sub 1/20 approx.9 Ma) has previously been used to estimate the timing of metal-silicate differentiation on Mars. Hf and W are highly refractory and assumed to be present in approximately chondritic relative abundances on the terrestrial planets. During core formation, the lithophile Hf preferentially partitions into the silicate reservoir, whereas the siderophile W partitions into the metallic core. If this event occurred during the lifetime of 182Hf (within approx.50 Ma of solar system formation), the bulk silicate reservoir will have an excess of 182W relative to chondritic meteorites. Moreover, silicate differentiation occurring within the first approx.50 Ma of the solar system may result in further Hf-W fractionation, and produce silicate reservoirs characterized by different 182W values.
Derived from text
*Planetary Mantles; SNC Meteorites; Mars (Planet); Isotopic Labeling; Chondrites; Silicates*

**20040056059** State Univ. of New York, Stony Brook, NY, USA
**Alkalic Volcanism on Mars?**
Nekvasil, H.; Filiberto, J.; Lindsley, D. H.; Lunar and Planetary Science XXXV: Martian Meteorites: Hot and Steamy; 2004; 2 pp.; In English; See also 20040056046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Chassigny meteorite is of particular importance for placing constraints on martian magmatism. Its two primary mineral assemblages have been well characterized by many workers. The cumulate dunite consists of Fo68 olivine, En50Wo34Fs16 (mol%) augite, En63Wo12Fs25 pigeonite and unexsolved orthopyroxene En68Wo4Fs28 [1], whereas the polyphase melt inclusion assemblages contain kaersutite, (Tibiotite), augite, low-Ca pyroxene, chlorapatite, chromite, and silica-rich glass [1, 2]. These assemblages have been compared with those determined experimentally along the fractionation paths of terrestrial intraplate suites in order to constrain the nature of parental and evolved liquids, crystallization pressures, and volatile contents. Table 1 shows the mineral assemblages obtained experimentally along the fractionation path of a hawaiite from the Nandewar Volcano of Australia for 9.3 kbar pressure and 2 wt % initial water content. On Earth, these assemblages give rise to silica-saturated alkalic suites (with the lava sequence mildly alkalic basalt - hawaiite - mugearite - benmoreite - trachyte - rhyolite) found on some ocean islands (e.g., Ascension Island [3] and the Azores [4]) and continental hotspots regimes (e.g., Miocene volcanoes of New South Wales, Australia). The Chassigny cumulate and melt inclusion assemblages bear marked similarities to these assemblages. Work is ongoing to explore the implications of these similarities.
Derived from text
*Meteoritic Composition; Magma; Olivine; Mars Volcanoes; Mars (Planet); Crystallization; Mineral Deposits; Pyroxenes*

**20040056061** Chicago Univ., Chicago, IL, USA

**Nebular Formation of Fayalitic Olivine: Ineffectiveness of Dust Enrichment**

Fedkin, A. V.; Grossman, L.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The mean mole fraction fayalite, X(sub Fa), in olivine of unequilibrated ordinary chondrites (UOCs) is 0.18-0.23. Equilibrium thermodynamic calculations predict that X(sub Fa) approximately equal to 0 when olivine first condenses from a gas of solar composition at high temperature, and rises with falling temperature. A solar gas is so reducing, however, that X(sub Fa) is predicted to reach the level found in UOCs only below 600K, where Fe-Mg interdiffusion rates in olivine are negligible, preventing X(sub Fa) from reaching this level in the bulk of condensate olivine, and leaving the problem of how chondrites obtained their FeO contents unsolved. This situation was reviewed thoroughly and the conclusion reached that chondritic olivine with nonnegligible XFa formed at higher temperature, and thus in a nebular region more oxidized than solar gas, presumably due to enrichment in dust prior to its vaporization. Since then, the problem became more severe due to additional data on solar abundances of C and O, making the nebula more reducing; and Fe-Mg interdiffusion rates in olivine, making diffusion slower; as well as recognition of non-ideality in olivine solid solutions, lowering the solubility of Fa in it. Derived from text

*Dust; Fayalite; Olivine; Solar Nebula; Chondrites*

**20040056063** New Mexico Univ., Albuquerque, NM, USA

**A New Oxygen Barometer for Solar System Basaltic Glasses Based on Vanadium Valence**

Karner, J. M.; Sutton, S. R.; Papike, S. R.; Delaney, J. S.; Shearer, C. K.; Newville, M.; Eng, P.; Rivers, M.; Dyar, M. D.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060; 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 oxidation conditions for basaltic magmas derived by the melting of planetary mantles is critical to our understanding of the nature and evolution of planetary interiors. Yet, these determinations are compromised in terrestrial and especially extraterrestrial basalts by our analytical and computational methods for estimating oxygen fugacity (fO2). For example, mineralogical barometers (1, 2) can be reduced in effectiveness by subsolidus re-equilibration of mineral assemblages, inversion of mineralogical data to melt characteristics, and deviations of the natural mineral compositions from ideal thermodynamic parameters.

Derived from text

*Barometers; Basalt; Valence; Vanadium; Planetary Mantles; Mineral Deposits; Oxygen*

**20040056064** Brown Univ., Providence, RI, USA

**The Relationship Between Clinopyroxene Fe3+ Content and Oxygen Fugacity**

McCanta, M. C.; Rutherford, M. J.; Dyar, M. J.; Delaney, J. S.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060

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The intrinsic oxygen fugacity (fO2) imposed on a magma has the ability to influence the crystallization sequence of the melt, as well as the composition of the resulting minerals. fO2 is an easily controlled parameter in the lab, either through gas-mixing equilibria or with a solid-state buffer assemblage. In nature, the fO2 of a closed system is imposed on the system internally through multivalent equilibria involving the phenocryst-melt assemblage. This results in a characteristic oxidation state. The physical parameter used to quantify oxidation state is oxygen fugacity. Iron is the only major rock forming element in basaltic melts to exist in multiple valence states and, therefore, it is commonly used to assess fO2. Traditional methods to quantify fO2 utilize the ferric content of glasses or coexisting Fe-Ti oxides. However, many rocks, such as the Martian meteorites, do not contain the necessary phases or have oxides which have suffered reequilibration, thereby rendering them unmeasureable by current techniques. For these rocks, new methods, utilizing other phases are needed. Mafic minerals have Fe(3+)/SigmaFe ratios that are a function of two factors: 1) crystal chemistry and 2) their intrinsic fO2 during crystallization. Olivine and orthopyroxene, for example, have steric constraints on the extent to which Fe(3+) can be incorporated in their structures, and may not record changes in magmatic fO2 in a way that can easily be measured. The chemistry of clinopyroxene, however, allows for extensive incorporation of Fe(3+) in its crystal structure, making it a potentially useful oxybarometer. To date, there have been few, if any, systematic experimental studies of the variation of the Fe(3+)/SigmaFe

ratio as a function of fO2 in clinopyroxene. This study seeks to address this lack of data.
Derived from text
*Oxygen; Pyroxenes; Mineralogy; Iron Oxides; Petrology*

**20040056065**
**Olivine-Silicate Melt Partitioning of Iridium**
Brenan, J. M.; McDonough, W. F.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Much of our current knowledge of the phases that control the distribution of the platinum group elements (PGEs) during igneous differentiation is empirical, and although it is well established that sulphide or alloy phases concentrate the PGEs, the affect of primary liquidus minerals on their behaviour remains poorly characterised. Our recent experimental work [1] has shown that some PGEs are compatible in olivine (mineral/melt or D of >1; Ru and Rh), whereas others are rejected (D<1; Pt and Pd). This is consistent with the behaviour of these elements in sulfide-undersaturated mafic and ultramafic rocks [2,3], and suggests olivine may play a significant role in PGE fractionation during crust-mantle differentiation. Previous attempts to measure the olivine-melt partitioning behaviour of the most refractory PGEs, Ir and Os, have been thwarted, however, owing to difficulties in achieving a homogeneous distribution of these elements in mineral and melt phases. Thus, the signature of olivine control on PGE fractionation is incomplete. Here we present results of experiments in which a homogeneous distribution of iridium is achieved by adding molten gold to the experiment.
Derived from text
*Platinum; Melts (Crystal Growth); Iridium; Fractionation; Mineralogy*

**20040056066** Yale Univ., New Haven, CT, USA
**Disequilibrium Melting of Refractory Inclusions: A Mechanism for High-Temperature Oxygen Isotope Exchange in the Solar Nebula**
Greenwood, James P.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Oxygen isotope compositions of individual minerals in calcium-, aluminum-rich inclusions (CAI) show a large isotopic range. The oxygen isotope compositions of CAI minerals are incongruous with simple crystallization of CAI composition melts in a changing oxygen reservoir, in that spinel and fassaite are generally O-16-rich, while melilite is O-16 poor. Since melilite crystallizes before fassaite, and during equilibrium melting, fassaite will begin melting before melilite, we have an oxygen isotope paradox. Here, I propose a simple solution to this paradox.
Derived from text
*High Temperature; Inclusions; Melting; Solar Nebula; Oxygen Isotopes; Mineralogy; Refractories*

**20040056067** NASA Johnson Space Center, Houston, TX, USA
**Water in Terrestrial Planets: Always an Oxidant?**
Righter, K.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060; 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 commonly assumed to be an oxidant in many planetary settings. Because it can affect Fe-FeO-Fe2O3 equilibria and thus bulk compositional properties of planets and asteroids, this is an important ingredient to understand. The role of water in two settings will be addressed - magmas, and mantles during accretion - along with the implications for planet growth and evolution.
Derived from text
*Water; Terrestrial Planets; Oxidation; Planetary Geology*

**20040056068** Chicago Univ., Chicago, IL, USA
**Oxygen Barometry of Basaltic Glasses Based on Vanadium Valence Determination Using Synchrotron MicroXANES**
Sutton, S. R.; Karner, J. M.; Papike, J. J.; Delaney, J. S.; Sjearer, C. K.; Newville, M.; Rivers, M.; Dyar, M. D.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A promising proxy for oxygen fugacity is the valence of vanadium because it has a large number of valence states in nature (2+, 3+, 4+ and 5+) and is ubiquitous in earth and planetary materials . We describe here a new, non-destructive method for valence determinations of vanadium and oxygen fugacity estimates for basaltic glasses with spatial resolution of a few micrometers using synchrotron x-ray absorption near edge structure (XANES) spectroscopy. Details of this method and applications to martian, lunar and terrestrial glasses are described in [1] and in accompanying abstracts [2,3].
Derived from text
*Vanadium; Valence; Planetary Composition; Spatial Resolution; Spectroscopy; X Ray Absorption*

**20040056069** California Univ., Los Angeles, CA, USA
**Evolution of Oxygen Isotopes in the Solar Nebula**
Lyons, J. R.; Young, E. D.; Lunar and Planetary Science XXXV: Special Session: Oxygen in the Solar System, II; 2004; 2 pp.; In English; See also 20040056060; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Clayton recently proposed that self shielding of CO at the X-point of the solar nebula was responsible for the formation of an (16)O-poor gas capable of shifting the oxygen isotopes of the rocky component of the inner solar system approx. + 50% in both (17)O and (18)O. In this proposed model the most refractory mineral phases (e.g., CAI's) retained their original (interstellar) isotope ratios, and self shielding of CO produced H2O strongly depleted in (16)O. Although we believe that self shielding at the X-point would be difficult, we also believe that self shielding is an excellent mechanism for the formation of distinct oxygen isotope reservoirs, especially in the surface region of the nebula. We recently showed that large fractionations will result from CO photodissociation at the surface of a static nebula. Here we calculate the time-evolution of fractionation during CO photodissociation in a disk that undergoes vertical mixing. We evaluated the self-shielding at the nebula surface by employing a one-dimensional photochemical model to compute the time-dependent CO isotopomer mole fraction profiles. The model is still quite rudimentary but allows us to explore isotopic evolution and the (17)O/(18)O ratio in the nebular gas. Radiative transfer is treated in one-dimension only, namely along the normal axis of the disk, rather than along the path from the central protostar. This simplification greatly reduces computational requirements without sacrificing any of the fundamental physical processes, and is likely a fair representation of photodissociation via enhanced far ultraviolet (FUV) radiation in a star-forming region.
Author
*Oxygen Isotopes; Solar Nebula; Carbon Monoxide; Photodissociation; Fractionation*

**20040056070** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040056071 - 20040056095
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

Reports from the session, 'Mars Volcanology and Tectonics' include:Martian Shield Volcanoes; Estimating the Rheology of Basaltic Lava Flows; A Model for Variable Levee Formation Rates in an Active Lava Flow; Deflections in Lava Flow Directions Relative to Topography in the Tharsis Region: Indicators of Post-Flow Tectonic Motion; Fractal Variation with Changing Line Length: A Potential Problem for Planetary Lava Flow Identification; Burfellshraun:A Terrestrial Analogue to Recent Volcanism on Mars; Lava Domes of the Arcadia Region of Mars; Comparison of Plains Volcanism in the Tempe Terra Region of Mars to the Eastern Snake River Plains, Idaho with Implications for Geochemical Constraints; Vent Geology of Low-Shield Volcanoes from the Central Snake River Plain, Idaho: Lessons for Mars and the Moon; Field and Geochemical Study of Table Legs Butte and Quaking Aspen Butte, Eastern Snake River Plain, Idaho: An Analog to the Morphology of Small Shield Volcanoes on Mars; Variability in Morphology and Thermophysical Properties of Pitted Cones in Acidalia Planitia and Cydonia Mensae; A Volcano Composed of Light-colored Layered Deposits on the Floor of Valles Marineris; Analysis of Alba Patera Flows: A Comparison of Similarities and Differences Geomorphologic Studies of a Very Long Lava Flow in Tharsis, Mars; Radar Backscatter Characteristics of Basaltic Flow Fields: Results for Mauna Ulu, Kilauea Volcano, Hawaii;and Preliminary Lava Tube-fed Flow Abundance Mapping on Olympus Mons.
Derived from text
*Mars Volcanoes; Tectonics; Topography*

**20040056071** Nevada Univ., Reno, NV, USA

**Dike Intrusions Along Pre-existing Graben Border Faults South of Arsia Mons**

Goudy, C. L.; Schultz, R. A.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Graben in the area around the Tharsis region that extend several thousands of kilometers: including Memnonia, Sirenum, Icaria and Thaumasia Fossae have most recently been suggested to result from a radiating dike swarm. The most common models of dike-related graben formation associate lithospheric deformation with the formation of Tharsis. Graben that result primarily from a volcanic process have a characteristically unique topographic profile to graben resulting from the combination of dike intrusion and faulting. A combined process will produce a profile where the two peaks are concave-up, and a volcanically controlled profile has two peaks that are concave-down with a much smaller uplift (tens of meters or less). MOLA profiles in the Tharsis region reveal both volcanic and tectonic graben formation. The purpose of this study is to locate and differentiate zones of volcanically and tectonically controlled graben in the area south of Tharsis.

Author

*Planetary Geology; Rock Intrusions; Geological Faults; Mars Volcanoes*

**20040056072** Universidad Rey Juan Carlos, Madrid, Spain

**A Possible Dike System on Atlantis Basin Region, Sirenum Terrae, Mars**

dePablo, M. A.; Marquez, A.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The MOC/MGS images has shown new features of the martian surface, between them there are possible dikes . Due to these images the large radial fracture systems to Tharsis like Sirenum, Memnonia, or Thaumasia have been related to dikes action , and new places where different types of dikes have been located . In this work some features interpretable like dikes are located near to Atlantis Basin, through the employment of the Mars Odyssey THEMIS images.

Author

*Mars Surface; Landforms*

**20040056073** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Geomorphologic Studies of a Very Long Lava Flow in Tharsis, Mars**

Peitersen, M. N.; Zimbelman, J. R.; Irwin, R.; Christensen, P. R.; Rice, J. W.; Bare, C.; Neumann, G. A.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

CEPS has undertaken an extended study of long lava flows on the terrestrial planets, their location, morphology, and potential modes of emplacement. As part of this ongoing investigation, we have concentrated on a single large flow in Tharsis, with noted similarities to several terrestrial analogs. An impressive series of lava flows emerges from the topographic saddle between Ascraeus and Pavonis Mons. The most prominent of these (hereafter referred to as the 'Saddle Flow') has distinct margins that can be traced for over 480 km in the Viking images, although its exact source cannot be identified. A multimodal approach is utilized in the examination of the Saddle Flow, including image interpretation (VIKING and THEMIS, MOLA topographic analysis and flow profiling, downflow behavior statistical analysis, rheologic modeling, and GIS modeling and integration.

Derived from text

*Geomorphology; Lava; Fluid Flow; Mars Surface; Planetary Geology*

**20040056074** Lancaster Univ., UK

**How Lateral Density Gradients Affect the Distribution of Multiple Magma Chambers Within Martian Shield Volcanoes**

Scott, Evelyn D.; Wilson, Lionel; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070

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

We propose that the reason why certain martian volcanoes produce multiple summit calderas is that the locations of

successive underlying magma chambers migrate under the influence of lateral density gradients that form within the edifice. Author
*Mars Volcanoes; Calderas*

**20040056075** Fernbank Science Center, Atlanta, GA, USA
**Plutons (Laccoliths?) on the Margins of Ancient Martian Impact Basins**
Jaret, S. J.; Albin, E. F.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 1 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Evidence for volcanism in association with martian impact basins is widespread. Volcanic plains and patera volcanoes are most easily discerned on low-resolution imagery. However, evidence for fissure vents and other small-scale volcanic features require the highest resolution MOC images for identification. We suggest that upon the removal of non-indurated basin ejecta, plutonic features are exposed at the surface. These may include sills, dikes, and laccoliths . In this investigation, we focus our study on domed structures interpreted as laccoliths.
Author
*Mars Volcanoes; Mars Craters*

**20040056076** Lancaster Univ., UK
**Estimating the Rheology of Basaltic Lava Flows**
Ellis, B.; Wilson, L.; Pinkerton, H.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We use detailed information on the advance of Hawaiian lava flows to deduce down-flow trends of viscosity, yield strength and cooling.
Author
*Basalt; Lava; Rheology; Hawaii; Mathematical Models; Fluid Flow*

**20040056077** Colorado Univ., Boulder, CO, USA
**Plume-induced Topography and Geoid Anomalies and Their Implications for the Tharsis Rise on Mars**
Roberts, James H.; Zhong, Shi-Jie; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Tharsis rise represents one of the most significant topographic features on Mars and the most significant longwavelength geoid anomaly. Two main models have been proposed to explain the longwavelength topography associated with Tharsis. Either a buoyant mantle plume may be supporting Tharsis from below, or the topography is due to incompletely compensated volcanic construction. Analysis considering both surface and buoyancy loading of the lithosphere shows that dynamic topography can generate more than 15% of the observed longwavelength geoid for reasonable lithospheric thicknes (100 200 km). However, the extent to which plume buyancy can contribute to the observed geoid and topography depends on the elastic lithospheric thickness, (100-200 km). However, the extent to which plume buoyancy can contribute to the observed geoid and topography depends on the elastic lithospheric thickness, T(sub e) and the depth, D(sub p) of the long-wavelength components of plume buoyancy. We formulated a finiteelement convection model with a temperatureand depthdependent viscosity to study the relationship between T(sub e) and D(sub p), and their effects on the dynamic geoid. We found that for a large parameter space in Rayleigh number, activation energy, activation volume, and heating mode, D(sub P) is about 1.8 times T(sub e). Since the convection models assume a purely viscous rheology, we apply an elastic filter to the resulting surfact topography to account for the flexural effects of the lithosphere. The reduction in surface topography and associated geoid caused by this filtering cancels the geoid from the plume buoyancy nearly perfectly. The total dynamic geoid is very small (less than 25 m) at degree 4 and negative (-50 m) at dgree 2. The ratio of geoid to topography at these wavelengths is also quite small (less than 2%). We find that although internal loading can dynamically support aloarg fraction of the observed topography, it fails to reproduce the geoid or the ratio of geoid to topography. We conclude that the polume buoyancy cannot be a dominant mechanism for the present-day support of Tharsis.
Derived from text
*Anomalies; Geoids; Mars Surface; Planetary Geology; Plumes; Topography; Mars Volcanoes*

**20040056078** Nevada Univ., Reno, NV, USA

**Critical Fault Tip Gradients, Yield Strengths, and Fault Propagation on Earth and Mars**

Polit, A. T.; Schultz, R. A.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We demonstrate that a critical fault tip gradient is associated with fault propagation through its connection to material yield strength. This method of relating fault tip gradient to yield strength is applied to four Martian normal faults in the Tempe Terra region of northeast Tharsis, with tip gradients ranging between 0.126 and 0.212 , corresponding to yield strengths between 9 and 17 MPa. These values are dependent on the lithology and water content in the crust, so our methods can be used to examine how rock type and water content vary spatially across Mars.

Author

*Mars Surface; Geological Faults*

**20040056079** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Field and Geochemical Study of Table Legs Butte and Quaking Aspen Butte, Eastern Snake River Plain, Idaho: An Analog to the Morphology of Small Shield Volcanoes on Mars**

Brady, S. M.; Hughes, S. S.; Sakimoto, S. E. H.; Gregg, T. K. P.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Orbiter Laser Altimeter (MOLA) data allows insight to Martian features in great detail, revealing numerous small shields in the Tempe region, consisting of low profiles and a prominent summit caps . Terrestrial examples of this shield morphology are found on the Eastern Snake River Plain (ESRP), Idaho. This plains-style volcanism [2] allows an analog to Martian volcanism based on topographic manifestations of volcanic processes . Recent studies link the slope and morphology of Martian volcanoes to eruptive process and style . The ESRP, a 400km long, 100km wide depression, is host to hundreds of tholeiitic basalt shields, which have low-profiles built up over short eruptive periods of a few months or years . Many of these smaller scale shields (basal diameters rarely exceed 5km) display morphology similar to the volcanoes in the Tempe region of Mars . Morphological variations within these tholeiitic shields are beautifully illustrated in their profiles.

Author

*Mars Volcanoes; Morphology*

**20040056080** Colorado Univ., Boulder, CO, USA

**Results of Axial Surface Mapping on Solis Planum, Mars: Implications for Linked Low-Relief Arches and Wrinkle Ridges**

Vidal, A.; Mueller, K.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Wrinkle ridges in the Tharsis region of Mars form in response to planetary-scale loading and uplift. Wrinkle ridges are the surface expressions of folds that overlie blind thrust faults that collectively accommodate low bulk strains in comparison to terrestrial analogues, such as basement-cored Laramide folds. Models are based on MOLA (Mars Orbiter Laser Altimeter) topographic data and use methods of cross section construction developed for terrestrial analogs based on both kinematic and mechanical techniques. Previous work based on elevation offsets across ridges and their backlimb geometry suggest blind thrusts on Solis Planum penetrate deeply into the Martian crust. Axial surface mapping and forward and inverse modeling of wrinkle ridges on Solis Planum using topographic data from MOLA are used to constrain fault geometry and the depth at which thrust faults flatten.

Author

*Mapping; Mars Surface; Planetary Geology; Topography*

**20040056081** Proxemy Research, Inc., Bowie, MD, USA

**Analysis of Alba Patera Flows: A Comparison of Similarities and Differences**

Shockey, K. M.; Glaze, L. S.; Baloga, S. M.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Four Martian lava flows originating from Alba Patera are analyzed in order to compare and contrast characteristics such

as relative viscosity increase, degree of degassing, emplacement times, and levee building. Alba Patera's summit is located at 41 N, 250 E. Two of the flows, Alba I and Alba III, are located south east of the summit. The other two flows, Alba V and Alba VI, are located west north west of the summit. Our objective is to identify correlations between rheology and emplacement environment, such as sensitivities to local slope and topographic variability. The data sets used in this study include Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) and Mars Orbiter Laser Altimeter (MOLA), along with recent Mars Odyssey Thermal Emission Imaging System (THEMIS) data and Viking data. The unprecedented volume, quality, and coverage of these data make it now possible to apply mature theoretical models that can help resolve long-standing scientific issues about emplacement of large lava flows on Mars.
Author
*Mars Volcanoes; Lava; Fluid Flow; Planetary Geology; Mars Surface*

**20040056082** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**A Model for Variable Levee Formation Rates in an Active Lava Flow**
Glaze, L. S.; Baloga, S. M.; Mouginis-Mark, P.; Crisp, J.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Channelized lava flows on Mars and the Earth often feature levees and collateral margins that change in volume along the path of the flow. Consistent with field observations of terrestrial flows, this suggests that the rate of levee formation varies with distance and other factors. Previous models have assumed a constant rate of levee growth, specified by a single parameter, lambda. The rate of levee formation for lava flows is a good indicator of the mass eruption rate and rheology of the flow. Insight into levee formation will help us better understand whether or not the effusion rate was constant during an eruption, and once local topography is considered, allows us to look at cooling and/or rheology changes downslope. Here we present a more realistic extension of the levee formation model that treats the rate of levee growth as a function of distance along the flow path. We show how this model can be used with a terrestrial flow and a long lava flow on Mars. The key statement of the new formulation is the rate of transfer from the active component to the levees (or other passive components) through an element dx along the path of the flow. This volumetric transfer equation is presented.
Derived from text
*Channel Flow; Fluid Flow; Lava; Rheology; Mathematical Models; Mars (Planet); Earth (Planet)*

**20040056083** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Deflections in Lava Flow Directions Relative to Topography in the Tharsis Region: Indicators of Post-Flow Tectonic Motion**
Chadwick, D. J.; Hughes, S. S.; Sakimoto, S. E. H.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

High-resolution topographic data for Mars from the Mars Orbiter Laser Altimeter (MOLA), and imagery from the Mars Orbiter Camera (MOC) and the Thermal Emission Imaging System (THEMIS) allow for the first accurate assessment of lava flow directions relative to topographic slopes in the Tharsis region. Tharisis has long been recognized as the dominant tectonic and volcanic province on the planet, with a complex geologic history. In this study, lava flow directions on Daedalia Planum, Syria Planum, Tempe Terra, and near the Tharsis Montes are compared with MOLA topographic contours to look for deviations of flow directions from the local slope direction. The topographic deviations identified in this study are likely due to Tharsis tectonic deformation that has modified the regional topography subsequent to the emplacement of the flows, and can be used to model the mechanisms and magnitudes of relatively recent tectonism in the region. A similar approach was used to identify possible postflow tectonic subsidence on the Snake River Plain in Idaho.
Derived from text
*Deflection; Lava; Tectonics; Topography; Fluid Flow; Mars Volcanoes; Mars Surface*

**20040056084** Geological Museum, Copenhagen, Denmark
**Burfellshraun: A Terrestrial Analogue to Recent Volcanism on Mars**
Haack, H.; Dall, J.; Rossi, M.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The up to 2000 km long and very young lava flows from Elysium Planitia to Amazonis Planitia on Mars often include

km-sized rafting plates. We have studied the unique Burfellshraun lava field east of lake Myvatn in Iceland that, although on a much smaller scale, share many characteristics of the Martian flows. Up to km-sized plates have flowed several km downsteam from the vent area. Our remote sensing studies and field work suggest that the type of eruption seen in Burfellshraun can be found nowhere else on Earth. The only similar lava flows that we have found are those on Mars. Our study of the formation of Burfellshraun provides new constraints and insight into the extensive recent volcanic activity on Mars.
Derived from text
*Mars Volcanoes; Planetary Geology; Remote Sensing; Lava; Fluid Flow*

**20040056085** Tennessee Univ., Knoxville, TN, USA
**Lava Domes 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 XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is widely accepted that the volcanic rocks present on the surface of Mars are dominantly basic to intermediate in composition. This restricted range has resulted in a conceptual model of the martian crust that involves little magma differentiation, relative to the terrestrial crust. A few locations on Mars, however, have been considered by some workers as possibly consisting of silicic (dacitic or rhyolitic) volcanic rocks, based primarily on morphologic considerations. If it could be demonstrated that silicic volcanism occurred on the surface of Mars then the poorly-differentiated, basic to intermediate crust model would have to be discarded in favor of a more magmatically diversified one. Past efforts at demonstrating the presence of silicic volcanic rocks at these locations, however, were thwarted by the lack of spatial and spectral resolution of the data available at the time. One of these locations, the Tyndall Volcanic Field (TVF)* the in western Arcadia Planitia region of Mars, possesses numerous (greater than 600) small domes (diameters approximately 0.5-6 km) that morphologically resemble terrestrial lava domes. A brief review of the area was studied, observing that the domes possess a strong (morphologic) resemblance to the rhyolite domes of Mono Craters, California. Using shadow-length measurements derived from Viking orbital imagery, it was estimated that the 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 and a nearby, unnamed rhyolite dome (0.04 to 0.13). The crudeness of the measuring technique, dictated by the limitations of the then state-of-the-art imagery, precluded a more definitive investigation. Our work uses presently available, investigation. Our work uses presently available, higher-precision data to make the first comprehensive study of the domes of the TVC. A main goal of the project is to determine the identities of the lithologies that make up the material of the domes.
Derived from text
*Lava; Mars Surface; Domes (Geology); Planetary Geology; Mars Volcanoes; Lithology*

**20040056086** New Mexico Univ., Albuquerque, NM, USA
**Closed System Behavior of Trace Elements During Basalt Crystallization in the Makaopuhi Lava Lake, Hawaii: A Natural Laboratory for Understanding Basaltic Magmatism on Terrestrial Planets**
Hagerty, J. J.; Shearer, C. K.; Vaniman, D. T.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Makaopuhi Lava Lake formed during an eruption of Kilauea volcano in March 1965. During a U.S.G.S. study of the lava lake, direct measurements were made of the lava lake s thermal history, oxygen fugacity, volatile content, petrography-chemistry, viscosity, and density. These careful measurements provided a natural laboratory for the study of the closed system behavior of an evolving basaltic magma. The observations also provide a unique opportunity to place trace element behavior into the context of a well-defined, natural magmatic system. These insights in turn, can be used to examine other basaltic systems in more detail. In particular we can extend these observations of trace element behavior to obtain a better understanding of planetary basalts where geological constraints are limited (i.e., meteorites and returned samples). Samples used in this study (thin sections M-18, M23-24, M21-26, M22-18, M1-6, and M5-13) were collected at temperatures between 1160 and 990 C and at an approximate fO2 between QFM the Ni-NiO buffers. All samples represent coexisting crystals and glass (i.e., minerals + melt). The crystallization sequence within the lake was: olivine plus or minus spinel --> augite --> plagioclase --> ilmenite --> pigeonite --> magnetite --> apatite. Three types of crystal-liquid differentiation were

observed in this system: (1) gravitative settling of olivine, (2) filter pressing into open fractures, and (3) downward concentration of pyroxene and plagioclase during convective flow.
Derived from text
*Basalt; Crystallization; Magma; Terrestrial Planets; Trace Elements; Volcanic Eruptions; Lakes*

**20040056087** Black Hills State Univ., Spearfish, SD, USA
**Fractal Variation with Changing Line Length: A Potential Problem for Planetary Lava Flow Identification**
Hudson, Richard K.; Anderson, Steven W.; McColley, Shawn; Fink, Jonathan H.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070
Contract(s)/Grant(s): NAG5-11655; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Fractals are objects that are generally self similar at all scales. Coastlines, mountains, river systems, planetary orbits and some mathematical objects are all examples of fractals. Bruno et al. used the structured walk model of Richardson to establish that lava flows are fractals and that lava flow morphology could be determined by looking at the fractal dimension of flow margins. They determined that Hawaiian a.a flows have fractal dimensions that range from 1.05 to 1.09 and that the pahoehoe lava flows have a fractal dimension from 1.13 to 1.23. We have analyzed a number of natural and simulated lava flow margins and find that the fractal dimension varies according to the number and length of rod lengths used in the structured walk method. The potential variation we find in our analyses is sufficiently large so that unambiguous determination of lava flow morphology is problematic for some flows. We suggest that the structured walk method can provide meaningful fractal dimensions if rod lengths employed in the analysis provide a best-fit residual of greater than 0.98, as opposed to the 0.95 cutoff used in previous studies. We also find that the use of more than 4 rod lengths per analysis also reduces ambiguity in the results.
Derived from text
*Fluid Flow; Lava; Planetary Geology; Fractals; Geomorphology; Dimensional Analysis*

**20040056089** Nevada Univ., Reno, NV, USA
**3D Fault Interaction and Depth of Strike-Slip Faulting on Mars**
Artita, K. S.; Schultz, R. A.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We identify two distinct types of strike-slip fault stepover geometries (push-up ridges) on Mars: 'large' and 'small'. We first mapped strike-slip faults and push-up ridges in the Thaumasia region using GIS. Next we reproduced push-ups seen in MOLA-based topography by modeling 'large' and 'small' stepovers using the dislocation software Coulomb. By classifying and analyzing stepover geometries, depth of faulting can be determined for both Martian and terrestrial strike-slip fault systems.
Author
*Geological Faults; Planetary Geology; Mars (Planet)*

**20040056090** Geological Survey, Flagstaff, AZ, USA
**A Volcano Composed of Light-colored Layered Deposits on the Floor of Valles Marineris**
Lucchitta, B. K.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The perceived horizontality and great lateral extent of the interior layered deposits in the Valles Marineris led to the hypothesis of lacustrine origin , a notion that was recently reinforced by some observations from high-resolution MOC and THEMIS images ]. However, the idea that some of the deposits may be volcanic has also been strengthened . For instance, many observations suggest that the mesas inside the Valles Marineris are tuyas (table-mountain volcanoes) formed in an aqueous or sub-ice environment . Now, MOLA elevations, combined with Viking, MOC, and THEMIS images viewed in 3-D perspectives, make it even more plausible that some of the interior mesas are volcanic. Particularly striking is a mound surrounded by outward-dipping beds located on the floor of southwestern central Candor Chasma. I here propose that this structure is a volcano.
Author
*Mars Volcanoes; Mars Surface*

**20040056091** Arizona State Univ., Tempe, AZ, USA

**Preliminary Lava Tube-fed Flow Abundance Mapping on Olympus Mons**

Bleacher, J. E.; Greeley, R.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Our objective is to characterize effusive martian volcanism based on the percentage of lava flows emplaced via lava tubes, based on an approach to characterize and contrast the eruptive processes of Kilauea, Mauna Loa, and Mount Etna. We are mapping the flows of Olympus Mons to estimate the percentage of surface flows that were emplaced via lava tubes, channels, or sheets, using the Themis daytime IR images, supplemented with Themis VIS and MOC images. Preliminary results indicate that the latest stage of effusive activity was typified by channel forming eruptions, which are often diverted around and embay tube-fed flows.

Author

*Mars Volcanoes; Lava; Planetary Mapping*

**20040056092** Minnesota Univ., Morris, MN, USA

**Magmatic Evolution of Impact Induced Martian Mantle Plumes and the Origin of Tharis**

Reese, C. C.; Solomatov, V. S.; Baumgardner, J. R.; Stegman, D. R.; Vezolainen, A. V.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Tharsis is one of the most prominent features on Mars. Volcanism and tectonism associated with the plateau by far exceed the levels of activity in other areas of the planet. This monopolar distribution of tectonism and volcanism led to the suggestion that the planform of mantle convection on Mars is dominated by a single, long lived, thermal plume originating at the core-mantle boundary similar to a terrestrial plume but much larger. Although the plume model explains some features of Tharsis, there are both observational and theoretical reasons to consider alternatives. First, the plume model has not reproduced Tharsis development on timescales consistent with observations. Second, constructional volcanism seems to be a major contributor to Tharsis elevation. A thermal plume contributes only a fraction to the present day topography and areoid. Third, the plume hypothesis implies an actively convecting mantle and a sufficiently large heat flux from the Martian core. However, in the absence of plate tectonics, convection in the Martian mantle is likely to be sluggish or absent and mantle heating shuts off any core heat flux and associated plume activity. Finally, large variations in Sm/Nd and Lu/Hf ratios among shergottites suggest a heterogeneous mantle which retains an isotopic signal of initial differentiation. This also argues against vigorous convective mixing. An alternative hypothesis is that Tharsis could be associated with a large impact early in Martian history. Geodynamical consequences of this hypothesis were investigated. It was shown that impact-induced plumes can survive for the entirety of planetary evolution and can contribute to the presentday areoid. Production of Tharsis by such a longlived, impact-related plume requires neither globally occurring convection nor generation of plumes at the coremantle boundary. In the present study, we explore if this hypothesis can also explain the magmatic evolution of Tharsis.

Derived from text

*Mars Surface; Planetary Evolution; Planetary Geology; Magma; Mathematical Models; Plumes; Topography*

**20040056093** Space Science Inst., Boulder, CO, USA

**Variability in Morphology and Thermophysical Properties of Pitted Cones in Acidalia Planitia and Cydonia Mensae**

Farrand, W. H.; Gaddis, L. R.; Blundell, S.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070

Contract(s)/Grant(s): NAG5-10577; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The northern plains of Mars contain a number of unique landforms and are unique in terms of their topography and composition . Much of the speculation about the northern plains centers on whether there was ever a northern ocean, and if there was, was it long-lived or ephemeral? The northern plains also hosts the Vastitas Borealis Formation which has been variously interpreted as the residue from a northern ocean , and pre-existing material reworked by cold-weather processes . In this work we examine a set of unusual features resident on the northern plains, the pitted cones originally recognized in Viking data . Our focus is on the pitted cones in Acidalia and Cydonia regions. The pitted cones of the northern plains have been hypothesized as being equivalent to terrestrial cinder cones , rootless cones , pingos , and mud volcanoes . To examine the Acidalia and Cydonia regions, multispectral data from the Mars Odyssey THEMIS, gridded topography from Mars Global Surveyor (MGS) MOLA, images from MGS MOC, and mineralogic and thermal inertia information from MGS TES have

been assembled in a Geographic Information System. Analysis of MOC Narrow Angle camera images
Author
*Mars Surface; Landforms*

**20040056094** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Comparison of Plains Volcanism in the Tempe Terra Region of Mars to the Eastern Snake River Plains, Idaho with Implications for Geochemical Constraints**
Weren, S. L.; Sakimoto, S. E. H.; Hughes, S. S.; Gregg, T. K. P.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 2 pp.; In English; See also 20040056070
Contract(s)/Grant(s): NAG5-12287; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Eastern Snake River Plains (ESRP) in Idaho have long been considered a terrestrial analog for the plains volcanism like that evident in Syria Planum and Tempe Terra, Mars. Both the ESRP and Tempe Terra are sediment-blanketed volcanic fields in areas with significant extensional faulting. Similar volcanic features can be observed throughout both study areas using field analysis and DEMs of the ESRP and the Mars Global Surveyor (MGS) data from Mars. These features include flow fields, low shields, shields with steep summits, and fissure eruptions. A few other volcanic features, such as cinder cones, which suggest variable compositions, volatile interactions, and multiple volcanic events can be seen in both areas. The eruptions in both the ESRP and Tempe Terra generally originate from the fissures creating elongate, multi-vent shields as well as isolated or aligned single vent shields. Many of these show evidence of radial flow patterns from summit craters as well as lava tube fed flows. The volcanoes of Tempe Terra display some of the global latitudinal parameter trends of small volcanoes on Mars. Some of these trends may be explained by the variation of volatile content and compositional variation across Mars. However, within Tempe Terra no significant local latitudinal trends can be seen in edifice attributes and not all variations are explained by global trends. This study builds upon previous studies of the Tempe Terra region and the ESRP in order to develop a more detailed representation of features and topographic data. Using these data we attempt to help constrain the composition and eruptive style of the Tempe Terra volcanoes by correlating them with the similar and quantified ESRP variations.
Derived from text
*Planetary Geology; Mars Volcanoes; Plains; Rivers; Geochemistry; Idaho*

**20040056095** Brigham Young Univ., Provo, UT, USA
**Vent Geology of Low-Shield Volcanoes from the Central Snake River Plain, Idaho: Lessons for Mars and the Moon**
Christiansen, E. H.; Hurst, M.; Lunar and Planetary Science XXXV: Mars Volcanology and Tectonics; 2004; 1 pp.; In English; See also 20040056070; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A volcanic terrain is the result of a complex interaction between many factors, including not only the chemical composition of the magma involved but the style of eruption and the mode of emplacement as well. The Snake River Plain in southern Idaho is typical of basaltic plains an important style of volcanism also found on Mars and the Moon.The major vent- related features in the central Snake River Plain are small shield volcanoes with diameters of 1 to 15 km and heights of less than 200 m. The volcanoes have a variety of shapes ranging from very broad with gently sloping flanks (that merge imperceptibly with a long lava flow or flow field) to those with steep summit regions. To help ascertain the origin of these differences, the vent geology and inferred eruptive histories for five low-shield volcanoes from the central Snake River Plain (Fig. 1) were studied using field mapping, geomorphic analysis of digital elevation models, as well as petrography and geochemical analysis of samples. The observations are used to formulate a generalized model for low shield eruptions and the landforms that result.
Author
*Moon; Mars Volcanoes*

**20040056142** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars All Over: Geologic Mapping**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040056143 - 20040056148
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles presented in this session include: 1) 'Geology of Noachian Martian Highlands Surrounding the Gusev Crater'; 2) 'The History of Deposition and Nature of Material in Hellas Basin, Mars'; 3) 'Geologic Mapping of the Medusae Fossae Formation on Mars'; 4) 'Geology of the Aram Chaos from MGS-Mars Odyssey Missions and Mars Express HRSC Data'; 5) 'Toward a Comprehensive Stratigraphic Column of Mars'; 6 'The Olympus Mons Aureole Deposits: Constraints on Emplacement Scenarios Based on Remotely Sensed Data'.
CASI
*Planetary Mapping; Planetary Geology; Geological Surveys; Mars Surface*

**20040056143** Smithsonian Institution, Washington, DC, USA
**Geologic Mapping of the Medusae Fossae Formation on Mars**
Shockey, K. M.; Zimbelman, J. R.; Friedmann, S. J.; Irwin, R. P.; Lunar and Planetary Science XXXV: Mars All Over: Geologic Mapping; 2004; 2 pp.; In English; See also 20040056142; 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 in the eastern part of MFF between 210 and 218 E longitude. The MFF is a friable, extensive Amazonian deposit that overlies the crustal dichotomy boundary and adjacent lowlands between approximately 130 and 240 E longitude, between the Tharsis and Elysium volcanic provinces. Yardangs and pedestal craters attest to considerable aeolian deflation of the MFF in recent geologic time. Although diverse explanations for the MFF have been proposed, recent work has focused on deposition of loess or ignimbrite by aeolian processes. The origins of MFF are still controversial; the current mapping should provide new constraints for testing the many hypotheses of origin.
Derived from text
*Mars Surface; Planetary Geology; Planetary Mapping; Escarpments; Mars Volcanoes; Geochronology*

**20040056144** International Research School of Planetary Sciences, Pescara, Italy
**Geology of the Aram Chaos from MGS-Mars Odyssey Missions and Mars Express HRSC Data**
Ori, G. G.; Lunar and Planetary Science XXXV: Mars All Over: Geologic Mapping; 2004; 2 pp.; In English; See also 20040056142; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Aram Chaos is an important feature with a complex geological history. Moreover, within the chaos is located one of the most extensive zone with hematite. The area is extensively studied, but new data may bring some hints about the chaos evolution and the meaning of the presence of hematite. Geological analysis has been performed using MOLA, MOC and THEMIS data that formed the base for a detailed map. One of the first targets of the High Resolution Stereo Camera will be the Aram Chaos and some data would be available at the time of the LPSC.
Derived from text
*2001 Mars Odyssey; Mars Global Surveyor; High Resolution; Stereophotography; Mars Photographs; Mars Craters; Mars Express; Planetary Geology*

**20040056145** Oulu Univ., Finland
**The History of Deposition and Nature of Material in Hellas Basin, Mars**
Raitala, J.; Ivanov, M.; Aittola, M.; Kostama, V.-P.; Korteniemi, J.; Lunar and Planetary Science XXXV: Mars All Over: Geologic Mapping; 2004; 2 pp.; In English; See also 20040056142; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Hellas impact basin is among the deepest depressions known in the Solar System and was formed very early in the Martian geological record. Thus, Hellas has served as a major sink for various materials during the entire Mars' history. In order to understand the history of filling of Hellas, detailed studies of Martian volcanism and erosion along with possible paths of transport of material and mode of its deposition are required. In this study, we consider different aspects of depositional history that has led to accumulation of a suite of material units on the floor of Hellas. We analyzed details of the two large regions, Hellas basin and Hesperia Planum, thought to have been coupled in their geologic evolution. As the basis of our analysis we used the hi-res MOLA topography and imagery from Viking through THEMIS to MOC. The results will be supplemented with the MEX-HRSC data.
Author
*Mars Craters; Planetary Composition; Planetary Geology*

**20040056146** Louisiana Univ., Monroe, LA, USA
**Toward a Comprehensive Stratigraphic Column of Mars**
DeHon, R. A.; Lunar and Planetary Science XXXV: Mars All Over: Geologic Mapping; 2004; 2 pp.; In English; See also 20040056142; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the absence of onsite drilling, seismic stratigraphy appears to be the only viable technic to fully decipher the planet s complex sedimentary history.
Author
*Stratigraphy; Mars Surface; Seismology; Geochronology*

**20040056147** Science and Technology International Corp., Honolulu, HI, USA
**The Olympus Mons Aureole Deposits: Constraints on Emplacement Scenarios Based on Remotely Sensed Data**
Chittenden, Donielle; McGovern, Patrick J.; Lunar and Planetary Science XXXV: Mars All Over: Geologic Mapping; 2004; 2 pp.; In English; See also 20040056142; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Olympus Mons is one of the most extensively studied planetary volcanoes due to its vast overall size and unique physical characteristics. Located northwest of the Tharsis Plateau of Mars, the volcano is almost 23 km tall and 600 km in diameter. Surrounding the base of the volcano are four main aureole lobes, which are characterized by a hummocky terrain of several ridges, deep troughs and grabens. The main aureole lobes extend radially from the edifice, up to a distance of 750 km, in the NE, N, NW, and W directions. Another significant feature of this volcano is the scarp that encircles the base, acting as an abrupt margin between the edifice and aureole deposits. This basal escarpment truncates the edifice at approximately 300 km from the caldera, and ranges in height from 2 to 10 km. High-resolution images from the Mars Orbital Camera (MOC) and topographic data from the Mars Orbiter Laser Altimeter (MOLA) enable detailed study of small- and medium-scale surface features (such as lava flows, channels, terraces, and faults) on and around the Olympus Mons edifice and aureole deposits. Here we describe the assemblage of a detailed database of 19 types of surface features, with the ultimate objective of illuminating the processes contributing to the emplacement of the aureole deposits and the evolution of the edifice and basal escarpment.
Author
*Mars Volcanoes; Landforms; Planetary Geology; Mars Surface*

**20040056148** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
**Geology of Noachian Martian Highlands Surrounding the Gusev Crater**
Zegers, T. E.; Conan, Y. G.; Foing, B.; Lunar and Planetary Science XXXV: Mars All Over: Geologic Mapping; 2004; 2 pp.; In English; See also 20040056142; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

About 40% of the total Martian crust consists of heavily cratered Noachian highland crust older than 3.7 Ga. Only one of the Martian meteorites found so far is derived from these old terrains. The ALH84001 orthopyroxenite meteorite contains carbonate blebs, which may contain evidence for ancient life on Mars in the form of biogenically produced magnetite grains and reduced carbon. The pyroxenite itself was dated at approx. 4.5 Ga, whereas the carbonate blebs were dated at approx. 4 Ga. These ages indicate that this meteorite originated from the Martian Highland area, and therefore provides the unique 'ground truth' of the Martian highlands. Part of the Martian highlands, centered on 180 deg, exhibits large magnetic anomalies. However the origin of the magnetic anomalies remains enigmatic. In 2004, one of the MER Lander Spirit landed in the Gusev crater, which lies in the northern part of the highlands that contain the remanent magnetization. To characterize the highland areas neighboring the landing site craters we study the available visual and IR image data (THEMIS, MOC), TES spectroscopy data and MOLA altimetry data. In addition, we plan to use Mars Express HRSC data from and early Spirit flyover.
Author
*Planetary Geology; Highlands; Mars Surface; Planetary Evolution*

**20040056153** NASA Ames Research Center, Moffett Field, CA, USA
**Accretion and Heating of Particles by Supersonic Planetesimals**
Ciesla, F. J.; Hood, L. L.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040056152; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recently, nebular shock waves have become one of the leading candidates for explaining the presence of chondrules in primitive meteorites. While shocks have been shown to be capable of explaining many of the features of chondrules, a major problem with the theory is that the source of the shocks remains unidentified. Among the suggested sources of the shocks are bow shocks created by supersonic planetesimals in the nebula. Recently, we studied the structure of the shocks that would form around such supersonic planetesimals. We found that particles that encountered the shocks at distances greater than 2 planetesimal radii from the planetesimal would cool too quickly to form the textures observed in chondrules. While the region of the shock far away from the planetesimal may not allow chondrules to form, the region closer in has not been studied in detail. In this work we consider the dynamical and thermal evolution of particles that encounter supersonic planetesimals in this region.
Derived from text
*Protoplanets; Shock Waves; Supersonic Speed; Particles; Meteoritic Composition; Heating; Deposition*

**20040056154** Tokyo Univ., Japan
**Hydrodynamic Escape of a Proto-Atmosphere Just After a Giant Impact**
Genda, H.; Abe, Y.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040056152; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The recent works on the planetary formation show that several tens of Mars-sized protoplanets are formed through a successive accretion of planetesimals in the terrestrial planet region. Then, these protoplanets collide each other as their orbit crosses owing to gravitational interaction among them. Therefore, it is generally thought that several giant impacts of Mars-sized proto-planets occur at the late stage of the terrestrial planet formation. Protoplanets would have a mixed protoatmosphere of an impact-induced gas and a gravitationally-attracted solar-type gas. The giant impacts modify such a proto-atmosphere. First, a large amount of the proto-atmosphere may be blown-off by the globally strong ground motion caused by a giant impact (the mechanical escape). Second, release of enormous impact energy may heat the atmosphere as well as the planet, and the hydrodynamic outflow of the proto-atmosphere may occur (the thermal escape). Therefore, thermal escape as well as mechanical escape should have affected the origin and evolution of planetary atmosphere. Genda and Abe clarified that significant fraction of the proto-atmosphere (35-90%) survived the mechanical blow-off event. In this study, we investigate the thermal escape, especially the hydrodynamic escape of a proto-atmosphere.
Derived from text
*Planetary Atmospheres; Planetary Evolution; Hydrodynamics; Protoplanets; Mars (Planet)*

**20040056155** Kobe Univ., Japan
**Planetesimal Accretion in Close Binary Systems**
Moriwaki, K.; Nakagawa, Y.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040056152; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Among more than 110 extrasolar planets discovered, only one tenth of them are confirmed to be in binary systems (Eggenberger, Udry, & Mayor 2003). However, most stars in the galaxy are in binary or multistellar systems (Allen 1973); hence, they are considered to have been born as such systems, probably together with some planets. It is, therefore, expected that the number of planets discovered orbiting binary systems will increase. We will examine a circumbinary zone where planetesimals can accrete to form a Ptype planet such as MACHO-97-BLG 41 lens system (Bennett et al. 1999). The planets of this type orbit outside both of the binary stars. In order to form Ptype planets, a circumbinary disk, like one around GG Tau (Roddier et al. 1996; Itoh et al. 2002), must be formed first. The presence of disks around binaries strongly suggest that the accretion process occurs in a similar way in single and binary systems. Even if the planetesimals have once been formed in such a circumbinary disk, the gravitational perturbations from the binary system excite eccentricities of the planetesimals. The excited eccentricities may prevent planetesimals from accreting. The purpose of our study is to find a planetesimal accretion zone in a circumbinary disk by performing longterm numerical integration of the planetesimal orbital motion in the frame work of the coplanar elliptic restricted three-body problem.
Derived from text
*Extrasolar Planets; Protoplanets; Accretion Disks; Numerical Integration; Binary Stars*

**20040056156** Tsukuba Univ., Japan

**X-Ray Flare Induced Shock Waves and Chondrule Formation in Upper Solar Nebula**

Nakamoto, T.; Kita, N. T.; Tachibana, S.; Hayashi, M. R.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040056152; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chondrules are thought to have formed through some heating events in the early solar nebula. Though the specific heating mechanism has not yet been understood clearly, the shock-wave heating is considered to be the most plausible mechanism to explain the various properties of chondrules. However, the source of shock waves and the place of the shocks in the nebula are still under debate. Proposed models include bow shocks in front of fast moving planetesimals, accretion shocks at the surface of nebula, and spiral density waves induced by the disk self-gravity, though every model has some drawbacks. Here, we propose an alternative model: shock waves in the upper solar nebula induced by X-ray flares associated with the young Sun. X-ray flares, common among T Tauri stars, emit plasma gas, which cools to be a strong neutral gas wind. The energy, the dimension, and the frequency of X-ray flares associated with T Tauri stars are much larger than those of the current Sun. Typical luminosity in the X-ray wavelength region is of the order of 1030 erg s-1, which is about two orders of magnitude higher than the current solar flare. Such energetic flares emerge about once a day, almost three orders of magnitude more frequently than the current Sun. Because of the enormous amount of energy released by the X-ray flares, the flares should have significant effects on the dynamics and energetics of a disk around the star. Observations of X-ray flares around young T Tauri stars indicate that their activity decreases with a time scale of the order or 106 yr, which is similar to the range of chondrule ages, i.e., from about 1 Myr to 3 Myr. In this work, we estimate the influence of the X-ray flares to the nebula and evaluate the possibility of chondrule-forming shock waves in the nebula. Here, we focus on shock waves at the upper solar nebula in the present asteroid region (in a range 2 - 4 AU from the Sun). Although our analysis is still crude, we can see that it may be possible to form chondrules by shock waves in the upper solar nebula induced by X-ray flares.

Derived from text

*Chondrule; Shock Waves; Solar Nebula; X Ray Sources; Meteoritic Composition*

**20040056157** Arizona State Univ., Tempe, AZ, USA

**Making Water Worlds: The Role of Al-26**

Desch, S. J.; Leshin, L. A.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040056152; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Planets such as Earth are the end products of complex formation histories. These formation histories render some planets habitable, especially if those planets inherit life enablers such as liquid water. We seek to explore important astronomical and planetary factors that affect the likelihood of forming waterworlds like the Earth in other solar systems, so that we may better assess the probability that other nominally Earthlike planets may harbor oceans capable of supporting life. In this abstract, we consider the effect of the astronomical setting of a forming solar system, and specifically its effect on the abundance of Al-26, which, we argue, is a significant factor controlling the water content of Earthlike planets. We attribute the source of the short-lived (t(sub 1/2) = 0.7Myr) radionuclide Al-26 in our solar system and others to a nearby supernova, so that a solar system s initial abundance of Al-26 is set by the essentially random distance to the supernova explosion. Our solar system very plausibly could have received much less Al-26 than it did, which would have led to a wetter Earth.

Derived from text

*Water; Aluminum Isotopes; Solar System Evolution; Planetary Geology; Astronomy*

**20040056158** Muenster Univ., Germany

**Collisions, Gas Flow, and the Formation of Planetesimals**

Wurm, G.; Krauss, O.; Paraskov, G.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040056152; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is widely believed that planets at least terrestrial planets form through collisions of km-sized planetesimals in protoplanetary disks. It is not yet settled though how these planetesimals form. The standard model assumes that they form through collisions of smaller bodies from micron-sized dust particles all the way up to planetesimals. However, as bodies of approximately m-size would emerge from this growth, collision velocities with smaller bodies could reach 50 meters per second or more, depending on the model disk. So far all experiments show that such a collision on its own will lead to erosion

of colliding bodies not growth. This is a fundamental problem of planetesimal formation. Collisions, gas flow and porosity of the boundary layer are summarized.
Derived from text
*Gas Flow; Protoplanetary Disks; Protoplanets; Planetary Evolution; Particle Collisions*

**20040056159** Observatoire de Paris, France
**Planetary Formation in the the Gamma Cephei System by Core-Accretion**
Thebault, P.; Marzari, F.; Barbieri, M.; Turrini, D.; Vanzani, V.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040056152; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Among the presently known binary star systems harboring extra solar planets, Gamma Cephei is that with the closest companion star. The planet detected around the primary star, a K0 III giant star, has a mass M sin i = 1.7 +/- 0.4 Jupiter masses and an orbital semimajor axis of 2.13 AU. We analyse via numerical modelling the growth of planetary embryos starting from kilometer sized planetesimals, and the later stage when large embryos collide to form the core of the giant planet. This last phase precedes that of rapid gas accretion which begins when a substantial mass is accumulated on the core. It is possibly an oversimplification to separate the stages of planetary formation in planetesimal accretion, protoplanet accumulation, and final gas infall. Collisions between embryos start when planetesimal accretion is still going on, and gas trapping begins while the core is still capturing massive planetesimals. However, by modelling separately the different phases, we can at least gain some insights in the major events that characterize each stage. Our modelling of core formation by accumulating massive protoplanets of a few Lunar masses is a sort of intermediate stage between the planetesimal accretion phase and the stage described by models simulating the evolution of the solid core and a gaseous envelope. We have performed several numerical simulations modelling the planetesimal dynamical evolution under the effects of the gravitational pull of the secondary star and gas drag. In order to estimate the relative velocities we use the code already exploited in previous similar studies that enables to follow in a deterministic way the evolution of a swarm of massless particles under the influence of one or several gravitational perturbers and of gas drag. All mutual encounters are tracked and the corresponding relative velocities are computed. We follow the evolution of a swarm of 3000 test planetesimals initially distributed between 0.3 5AU. The initial eccentricities e and inclinations i are chosen such that i = e/2 while the average encounter velocities are (Delta v) approx. 10 m/s.
Derived from text
*Planetary Evolution; Protoplanets; Binary Stars*

**20040057988** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars Missions**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040057989 - 20040058002
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Mars Missions' included the following reports:Future Planetary Surface Imager Development by the Beagle 2 Stereo Camera System Team; Localization, Localization, Localization; Preliminary Assessment of Mars Exploration Rover Landing Site Predictions; Spirit at Gusev Crater: Preliminary Observations, Potential Processes and Hypotheses; MER Field Geologic Traverse in Gusev Crater, Mars: Initial Results From the Perspective of Spirit; Coordinated Observations of Aeolian Features from the Mars Exploration Rovers (MER) and the Mars Express High Resolution Stereo Camera and Other Orbiters; Soil and Rock Physical Properties at the Mars Exploration Rover Landing Sites: Early Returns; Transient Liquid Water as a Mechanism for Induration of Soil Crusts on Mars; First Results of the Athena Microscopic Imager Investigation; APXS on Mars: Analyses of Soils and Rocks at Gusev Crater and Meridiani Planum; Mars Exploration Rover Panoramic Camera Multidimensional Analyses and Surface Spectral Variability ; Hematite at Meridiani Planum: Detailed Spectroscopic Observations and Testable Hypotheses; Maussbauer Spectroscopy of Soils and Rocks at Gusev Crater and Meridiani Planum; and Student Interns Work on Mars.
Derived from text
*Mars Exploration; Mars Express*

**20040057989** NASA Ames Research Center, Moffett Field, CA, USA
**Spirit at Gusev Crater: Preliminary Observations, Potential Processes and Hypotheses**
Cabrol, N. A.; desMarais, D.; Farmer, J.; Crumpler, L.; Grin, E. A.; Milam, K.; Grant, J.; Greeley, R.; Anderson, R. C.;

Grotzinger, J., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Spirit landed in a flat plain in Gusev crater with local undulations at meters scales generated by ridges covered with blocks, some of them looking rounded. Several, flat-topped, mesas are visible in the far field in direction of Ma adim Vallis. A set of north/south oriented hills reaches approximately 150 m elevation to the east of the landing site (LS). A dipping brighter unit with possibly some scarps is associated with it. This setting could be consistent with layering observed on the MOC images of the hills, local exposure of material with variable dust cover, or deflated or allochtonous material. Numerous small depressions are visible from LS referred to as 'Columbia Memorial Station'* (CMS). Floors are partially filled with finer-grained, high albedo material. At least one of them, nicknamed 'Sleepy Hollow'* (approximately 30 m diameter) may be an eroded secondary impact crater. It is unclear if they can all be related to small impact structures. Some of them are elongated and aligned with the ridges. The morphology of rocks and soil at this Gusev Crater is presented. Evidence of dynamic aeolian action along this Crater is also discussed.

Derived from text

*Geomorphology; Mars Surface; Mars Craters; Planetary Geology*

**20040057990** NASA Ames Research Center, Moffett Field, CA, USA

**Coordinated Observations of Aeolian Features from the Mars Exploration Rovers (MER) and the Mars Express High Resolution Stereo Camera and Other Orbiters**

Greeley, R.; Thompson, S. D.; Whelley, P. L.; Squyres, S.; Neukum, G.; Arvidson, R.; Malin, M.; Kuzmin, R.; Christensen, P.; Rafkin, S., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988 Contract(s)/Grant(s): NAG5-12803; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Surface features associated with aeolian (wind) processes at the Mars Exploration Rover (MER) landing sites for Spirit (Gusev crater) and Opportunity (Sinus Meridiani) were observed from the surface and from orbit through coordinated observations by the rovers and the Mars Express orbiter High Resolution Stereo Camera and compared with features seen in other orbiter data and with wind vectors predicted by a numerical mesoscale model of the atmosphere.

Author

*Mars Surface; Wind Effects; Mars Landing Sites*

**20040057991** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**APXS on Mars: Analyses of Soils and Rocks at Gusev Crater and Meridiani Planum**

Rieder, R.; Gellert, R.; Brueckner, J.; Clark, B. C.; Dreibus, G.; dUston, C.; Economou, T.; Klingelhoefer, G.; Lugmair, G. W.; Waenke, H., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Newly developed APXS (Alpha Particle X-Ray Spectrometers) are part of the Athena payload of the Mars Exploration Rovers Spirit and Opportunity [1]. The APXS determines the chemical composition of soils and rocks along the traverse of the two rovers. Spirit and Opportunity operate at Gusev Crater and Meridiani Planum, respectively. First results of soil X-ray spectra at both landing sites support the hypothesis of a global homogenization of the soil by large dust storms and impact processes in the northern and southern hemisphere.

Author

*Mars Surface; Mars Craters*

**20040057992** NASA Johnson Space Center, Houston, TX, USA

**Moessbauer Spectroscopy of Soils and Rocks at Gusev Crater and Meridiani Planum**

Klingelhoefer, G.; Morris, R. V.; Bernhardt, B.; Schroeder, C.; Rodionov, D.; deSouza, P. A., Jr.; Yen, A.; Renz, F.; Wdowiak, T.; Squyres, S., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

For the first time in history a Moessbauer spectrometer was placed on the surface of another planet. The miniaturized Moessbauer spectrometer MIMOS II is part of the Athena payload of NASA's twin Mars Exploration Rovers (MER) Spirit,and Opportunity. It determines the Fe-bearing mineralogy of Martian soils and rocks at the Rovers respective landing sites, Gusev crater and Meridiani Planum. First results of soil and rock measurements at both landing sites confirm a generally basaltic composition of Martian surface materials.

Author

*Mars Surface; Mineralogy*

**20040057994** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Localization, Localization, Localization**

Parker, T.; Malin, M.; Golombek, M.; Duxbury, T.; Johnson, A.; Guinn, J.; McElrath, T.; Kirk, R.; Archinal, B.; Soderblom, L., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Localization of the two Mars Exploration Rovers involved three independent approaches to place the landers with respect to the surface of Mars and to refine the location of those points on the surface with the Mars control net: 1) Track the spacecraft through entry, descent, and landing, then refine the final roll stop position by radio tracking and comparison to images taken during descent; 2) Locate features on the horizon imaged by the two rovers and compare them to the MOC and THEMIS VIS images, and the DIMES images on the two MER landers; and 3) 'Check' and refine locations by acquisition of MOC 1.5 meter and 50 cm/pixel images.

Author

*Mars Roving Vehicles; Mars Landing; Positioning; Spacecraft Tracking*

**20040057995** NASA Ames Research Center, Moffett Field, CA, USA

**MER Field Geologic Traverse in Gusev Crater, Mars: Initial Results From the Perspective of Spirit**

Crumpler, L.; Cabrol, N.; desMarais, D.; Farmer, J.; Golmbek, M.; Grant, J.; Greely, R.; Grotzinger, J.; Haskin, L.; Arvidson, R., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This report casts the initial results of the traverse and science investigations by the Mars Exploration Rover (MER) Spirit at Gusev crater [1] in terms of data sets commonly used in field geologic investigations: Local mapping of geologic features, analyses of selected samples, and their location within the local map, and the regional context of the field traverse in terms of the larger geologic and physiographic region. These elements of the field method are represented in the MER characterization of the Gusev traverse by perspective-based geologic/morphologic maps, the placement of the results from Mossbauer, APXS, Microscopic Imager, Mini-TES and Pancam multispectral studies in context within this geologic/morphologic map, and the placement of the overall traverse in the context of narrow-angle MOC (Mars Orbiter Camera) and descent images. A major campaign over a significance fraction of the mission will be the first robotic traverse of the ejecta from a Martian impact crater along an approximate radial from the crater center. The Mars Exploration Rovers have been conceptually described as 'robotic field geologists', that is, a suite of instruments with mobility that enables far-field traverses to multiple sites located within a regional map/image base at which in situ analyses may be done. Initial results from MER, where the field geologic method has been used throughout the initial course of the investigation, confirm that this field geologic model is applicable for remote planetary surface exploration. The field geologic method makes use of near-field geologic characteristics ('outcrops') to develop an understanding of the larger geologic context through continuous loop of rational steps focused on real-time hypothesis identification and testing. This poster equates 'outcrops' with the locations of in situ investigations and 'regional context' with the geology over distance of several kilometers. Using this fundamental field geologic method, we have identified the basic local geologic materials on the floor of Gusev at this site, their compositions and likely lithologies, origins, processes that have modified these materials, and their potential significance in the interpretation of the regional geology both spatially and temporally.

Author

*Mars Craters; Mars Exploration; Planetary Geology; Mars Roving Vehicles*

**20040057996** NASA Johnson Space Center, Houston, TX, USA

**Soil and Rock Physical Properties at the Mars Exploration Rover Landing Sites: Early Returns**

Ming, D. W.; Anderson, R. C.; Arvidson, R. E.; Bell, J. F., III; Biesiadecki, J.; Christensen, P. H.; Gorevan, S. P.; Ehlmann, B. L.; Guinness, E. A.; Graff, T. G., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The purpose of this paper is to report the 'early returns' on the physical properties of soil units and rocks at the MER landing sites. Because we are still very early in the mission at Meridiani Planum, results from the Gusev Crater Landing Site are emphasized here.

Derived from text

*Mars Landing Sites; Mars Surface Samples; Soils*

**20040057997** NASA Glenn Research Center, Cleveland, OH, USA

**Transient Liquid Water as a Mechanism for Induration of Soil Crusts on Mars**

Landis, G. A.; Blaney, D.; Cabrol, N.; Clark, B. C.; Farmer, J.; Grotzinger, J.; Greeley, R.; McLennan, S. M.; Richter, L.; Yen, A., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Viking and the Mars Exploration Rover missions observed that the surface of Mars is encrusted by a thinly cemented layer tagged as 'duricrust'. A hypothesis to explain the formation of duricrust on Mars should address not only the potential mechanisms by which these materials become cemented, but also the textural and compositional components of cemented Martian soils. Elemental analyzes at five sites on Mars show that these soils have sulfur content of up to 4%, and chlorine content of up to 1%. This is consistent with the presence of sulfates and halides as mineral cements. . For comparison, the rock 'Adirondack' at the MER site, after the exterior layer was removed, had nearly five times lower sulfur and chlorine content , and the Martian meteorites have ten times lower sulfur and chlorine content, showing that the soil is highly enriched in the saltforming elements compared with rock.Here we propose two alternative models to account for the origin of these crusts, each requiring the action of transient liquid water films to mediate adhesion and cementation of grains. Two alternative versions of the transient water hypothesis are offered, a top down hypothesis that emphasizes the surface deposition of frost, melting and downward migration of liquid water and a bottom up alternative that proposes the presence of interstitial ice/brine, with the upward capillary migration of liquid water.

Derived from text

*Mars Surface; Soils; Mars Craters*

**20040057998** Arizona State Univ., Tempe, AZ, USA

**Hematite at Meridiani Planum: Detailed Spectroscopic Observations and Testable Hypotheses**

Glotch, T. D.; Christensen, P. R.; Wyatt, M. B.; Bandfield, J. L.; Graff, T. G.; Rogers, D.; Ruff, S. W.; Hayes, A. G.; Morris, R. V.; Farrand, W., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The landing site of the Mars Exploration Rover Opportunity was selected largely on the basis of the discovery of gray crystalline hematite by the Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES) currently in orbit around Mars. Since the initial discovery, several authors have performed detailed spectroscopic and/or geomorphological studies of the gray hematite-bearing regions of Mars. Initial observations by the Mini-TES instrument on Opportunity have confirmed the presence of hematite at Meridiani Planum. Additional detailed measurement by Mini-TES as well as subsequent observations by the Mossbauer spectrometer and Pancam will help to place the hematite in a geologic and geochemical context. Hypotheses regarding the formation of gray hematite on Mars fall into two general categories wet and dry. Hematite formational mechanisms involving water include (1) low temperature precipitation of Fe-oxides or hydroxides from standing, oxygenated, Fe-rich water, followed by subsequent alteration to gray hematite, (2) low-temperature leaching of iron-bearing silicates and other materials leaving a Fe-rich residue (laterite-style weathering) which is subsequently altered to gray hematite, (3) direct precipitation of gray hematite from Fe-rich circulating fluids of hydrothermal or other origin, and (4) formation of gray hematite surface coatings during weathering. Formation of gray hematite under dry conditions occurs by the thermal oxidation of magnetite.

Author

*Mars Surface; Planetary Composition; Spectroscopy*

**20040057999** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**First Results of the Athena Microscopic Imager Investigation**

Herkenhoff, K.; Squyres, S.; Archinal, B.; Arvidson, R.; Bass, D.; Barrett, J.; Becker, K.; Becker, T.; Bell, J., III; Burr, D., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Athena science payload on the Mars Exploration Rovers (MER) includes the Microscopic Imager (MI). The MI is a fixed-focus camera mounted on an extendable arm, the Instrument Deployment Device (IDD). The MI acquires images at a spatial resolution of 30 microns/pixel over a broad spectral range (400 - 700 nm). The MI uses the same electronics design as the other MER cameras but its optics yield a field of view of 31 x 31 mm across a 1024 x 1024 pixel CCD image. The MI acquires images using only solar or skylight illumination of the target surface. A contact sensor is used to place the MI slightly closer to the target surface than its best focus distance (about 69 mm), allowing concave surfaces to be imaged in good focus. Coarse focusing (approx. 2 mm precision) is achieved by moving the IDD away from a rock target after contact is

sensed. The MI optics are protected from the Martian environment by a retractable dust cover. This cover includes a Kapton window that is tinted orange to restrict the spectral bandpass to 500 - 700 nm, allowing crude color information to be obtained by acquiring images with the cover open and closed. The MI science objectives, instrument design and calibration, operation, and data processing were described by Herkenhoff et al. Initial results of the MI experiment on both MER rovers ('Spirit' and 'Opportunity') are described below.
Author
*Microscopy; Mars Surface; Mars Exploration*

**20040058000** NASA Johnson Space Center, Houston, TX, USA
**Mars Exploration Rover Panoramic Camera Multidimensional Analyses and Surface Spectral Variability**
Seelos, F. P., IV; Soderblom, J. M.; Farrand, W. H.; Johnson, J. R.; Morris, R. V.; Blaney, D. L., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Exploration Rover (MER) panoramic camera system (Pancam) has provided surface-based multispectral image data with unprecedented spatial and radiometric fidelity. The spectral coverage of the camera system allows for the discrimination of important Fe2+ and Fe3+ bearing minerals expected to occur on the Martian surface . This paper explores the spatially coherent and structurally consistent spectral variability present at both the Spirit and Opportunity landing sites using multidimensional analysis of representative Pancam multispectral scenes.
Derived from text
*Mars Surface; Image Analysis*

**20040058001** Mullard Space Science Lab., Dorking, UK
**Future Planetary Surface Imager Development by the Beagle 2 Stereo Camera System Team**
Griffiths, A. D.; Coates, A. J.; Josset, J. -L.; Paar, G.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Stereo Camera System (was designed to provide the Beagle 2 lander with wide-angle 48) multi-spectral stereo imaging with an angular resolution of 0.75 milliradians . Based on the SpaceX Modular Micro-Imager, the SCS is composed of twin cameras and filter wheel units (each with 12 filters and a 1 Mega pixel frame transfer CCD digitized to 10 bits/pixel) mounted 209 mm apart. The SCS team now plans to build on the SCS design heritage to provide improved panchromatic stereo capabilities to future ESA missions; in particular the Pasteur payload of the Aurora ExoMars rover . The PICS (Panoramic Imaging Camera System) instrument is designed to fulfil the digital terrain mapping requirements of the mission as well as providing multispectral geological imaging, colour and stereo panoramic imaging and water vapour abundance and dust optical depth measurements. PICS can also be used to image retrieved subsurface samples before ingestion into the rest of the Pasteur payload.
Derived from text
*Mars Express; Imaging Techniques; Panoramic Cameras*

**20040058002** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Preliminary Assessment of Mars Exploration Rover Landing Site Predictions**
Golombek, M.; Grant, J.; Parker, T.; Crisp, J.; Squyres, S.; Carr, M.; Haldemann, A.; Arvidson, R.; Ehlmann, B.; Bell, J., et al.; Lunar and Planetary Science XXXV: Mars Missions; 2004; 2 pp.; In English; See also 20040057988; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Selection of the Mars Exploration Rover (MER) landing sites took place over a three year period in which engineering constraints were identified, 155 possible sites were downselected to the final two, surface environments and safety considerations were developed, and the potential science return at the sites was considered. Landing sites in Gusev crater and Meridiani Planum were selected because they appeared acceptably safe for MER landing and roving and had strong morphologic and mineralogical indicators of liquid water in their past and thus appeared capable of addressing the science objectives of the MER missions, which are to determine the aqueous, climatic, and geologic history of sites on Mars where conditions may have been favorable to the preservation of evidence of possible pre-biotic or biotic processes. Engineering constraints important to the selection included: latitude (10 N-15 S) for maximum solar power; elevation (<-1.3 km) for sufficient atmosphere to slow the lander; low horizontal winds, shear and turbulence in the last few kilometers to minimize horizontal velocity; low 10-m scale slopes to reduce airbag spinup and bounce; moderate rock abundance to reduce abrasion

or stroke-out of the airbags; and a radar-reflective, load-bearing and trafficable surface safe for landing and roving that is not dominated by fine-grained dust. In selecting the MER landing sites these engineering constraints were addressed via comprehensive evaluation of surface and atmospheric characteristics from existing remote sensing data and models as well as targeted orbital information acquired from Mars Global Surveyor and Mars Odyssey. This evaluation resulted in a number of predictions of the surface characteristics of the sites, which are tested in this abstract. Relating remote sensing signatures to surface characteristics at landing sites allows these sites to be used as ground truth for the orbital data, is essential for selecting and validating landing sites for future missions, and is required for correctly interpreting the surfaces and materials globally present on Mars.
Author
*Mars Roving Vehicles; Mars Landing Sites; Site Selection*

**20040058003** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars: New Methods and Techniques**
2004; In English; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques, 15-19 Mar. 2004, Houston, TX, USA; See also 20040058004 - 20040058012
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Mars: New Methods and Techniques' included the following reports: Intensity-based Rock Detection for Acquiring Onboard Rover Science; Effect of Palagonite Dust Deposition on the Automated Detection of Carbonate Vis/NIR Spectra; Mapping Rock and Soil Units in the MPF SuperPan Using a Kohonen Self Organizing Map; Automatic Crater Counts on Mars; Preparing for Themis Controlled Global Mars Mosaics; Thematic Maps of Martian Topography Generated by a Clustering Algorithm; High-Resolution Topomapping of Mars: Life After MER Site Selection; Assessing Photogeologic Mapping Techniques in Reconstructing the Geologic History of Mars; and Mars Express Planetary Geoscience Information System (MEGIS) Project.
Derived from text
*Mars Surface; Geomorphology; Photomapping*

**20040058004** California Univ., Santa Cruz, CA, USA
**Automatic Crater Counts on Mars**
Plesko, C.; Brumby, S.; Asphaug, E.; Chamberlain, D.; Engel, T.; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact features are some of the most interesting, and most common, features on the surface of Mars. They provide clues about the relative age, local composition, and local erosional history of the surface, and are interesting features of themselves in that the processes by which they form and distribute their ejecta are not entirely clear. An enormous amount of surface image data has been gathered in the last decade. It is now necessary to develop automated tools for feature extraction. We will present the latest results in an ongoing effort to develop feature extraction algorithms for the Martian surface, specifically a suite of automated crater counting tools.
Author
*Mars Craters; Cratering; Mars Surface; Planetary Geology; Counting*

**20040058005** Space Science Inst., Boulder, CO, USA
**Mapping Rock and Soil Units in the MPF IMP SuperPan Using a Kohonen Self Organizing Map**
Farrand, W.; Merenyi, E.; Murchie, S.; Barnouin-Jha, O.; Johnson, J.; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003
Contract(s)/Grant(s): NAG5-13294; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The 1997 Mars Pathfinder mission provided information on a site in the Ares Vallis floodplain. Initial analysis of multispectral data from the Imager for Mars Pathfinder (IMP) indicated the presence of only a single rock type, the 'gray rock' spectral class and various coated variants thereof (e.g., 'maroon rock'). Continued analysis of the IMP 'SuperPan' mosaic has confirmed multiple examples of a second 'black rock' spectral class existing as small cobbles in the near field and as boulders in the far field. These results are consistent with recent analysis of MGS Thermal Emission Spectrometer (TES) data which indicates that there is likely a mix of both 'Surface Type 1' (ST1) and 'Surface Type 2' (ST2) spectral classes at the MPF

landing site. Nominally, the black rock spectral class would correspond to ST1 (basalts) and 'gray rock' would correspond to ST2 (andesites). Orbital remote sensing has also revealed the pervasive presence of layering on Mars. Recently it was suggested that there are extensive outcrops of the black rock spectral class in the SuperPan far field on the flanks of the Twin Peaks and on the rim of Big Crater. These authors suggested that these exposures represented outcrops of black rock from beneath a surficial, flood deposited layer. In this work, we have reexamined the MPF IMP SuperPan mosaic using an artificial neural network self organizing map (SOM) processing architecture in order to classify the distribution of spectral classes within the SuperPan. In this paper, we present initial results from that work and draw specific attention to a subset of the identified spectral classes in order to address questions relating to whether there are extensive exposures of black rock in the IMP far field, what other materials might be exposed in the far field, and what evidence there is for subsurface layering at the MPF landing site.
Author
*Planetary Mapping; Mars Surface; Planetary Composition; Planetary Geology; Soil Mapping*

**20040058006** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**High-Resolution Topomapping of Mars: Life After MER Site Selection**
Kirk, R. L.; Howington-Kraus, E.; Hare, T. M.; Soricone, R.; Ross, K.; Weller, L.; Rosiek, M.; Redding, B.; Galuszka, D.; Haldemann, A. F. C., et al.; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this abstract we describe our ongoing use of high-resolution images from the Mars Global Surveyor Mars Orbiter Camera Narrow-Angle subsystem (MGS MOC-NA) to derive quantitative topographic and slope data for the martian surface at 3 - 10-m resolution. Our efforts over the past several years focused on assessment of candidate landing sites for the Mars Exploration Rovers (MER) and culminated in the selection of sites in Gusev crater and Meridiani Planum as safe as well as scientifically compelling. As of this writing, MER-A (Spirit) has landed safely in Gusev and we are performing a limited amount of additional mapping near the landing point to support localization of the lander and rover operations planning. The primary focus of our work, however, has been extending our techniques to sample a variety of geologic terrains planetwide to support both a variety of geoscientific studies and planning and data analysis for missions such as Mars Express, Mars Reconnaissance Orbiter, and Phoenix.
Author
*Mars Surface; Planetary Mapping; Topography*

**20040058007** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Preparing for Themis Controlled Global Mars Mosaics**
Archinal, B. A.; Weller, L.; Sides, S.; Cushing, G.; Kirk, R. L.; Soderblom, L. A.; Duxbury, T. C.; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have begun work to prepare for producing controlled 2001 Mars Odyssey THEMIS infrared (IR) and visible (VIS) global mosaics of Mars. This effort is being coordinated with colleagues from Arizona State University and on the THEMIS team who plan to address radiometric issues in making such mosaics. We are concentrating on geometric issues. Several areas of investigation are now in progress, including: a) characterizing the absolute pointing accuracy of THEMIS images; b) investigating whether automatic tie point matching algorithms could be used to provide connections between overlapping THEMIS images; c) developing algorithms to allow for the photogrammetric (bundle) adjustment of the THEMIS IR (line scanner) camera images. Our primary goal in this pilot study effort will be to make several test control THEMIS mosaics and better determine which methods could be used, which require development, and what level of effort is required, in order to make large regional or global controlled THEMIS mosaics.
Author
*Planetary Mapping; Mars Surface; Mosaics*

**20040058008** Geological Survey, Flagstaff, AZ, USA
**Assessing Photogeologic Mapping Techniques in Reconstructing the Geologic History of Mars**
Tanaka, K. L.; Crumpler, L. A.; Dohm, James M.; Hare, Trent M.; Skinner, James A., Jr.; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We are first selecting areas on Earth that have similarities with terrains on Mars that are sites of geologic significance and having potential for future exploration. Three of us (Tanaka, Crumpler, and Dohm) are selecting volcanic regions modified by tectonic deformation and fluvial erosion in Arizona and New Mexico, where we individually have field and research experience. Volcanic rocks provide the best radiometric ages and thus would likely be a prime target on Mars for sample return to pin down the cratering history of the planet. Also, the ages of such materials can be used to constrain ages of tectonic and fluvial features, which has been done extensively on Mars. On Earth, such features may have complex, long-lived histories that include diverse styles of activity. For example, fault reactivation caused by differing stress orientation, intensity, and build-up rates has resulted in multiple offsets and styles of deformation associated with a single fault or fault system. In the desert Southwest, present-day fluvial activity is commonly governed by flash floods and spring runoff, whereas more sustained precipitation would have been characteristic of the same region during the Pleistocene. In addition, another site (chosen by Skinner) will be a coastal subaerial and marine environment where sedimentation and various coastal aqueous and geologic processes control surface morphology. Such an area should be pertinent to assessing mapping of the northern plains boundary (currently underway by Tanaka, Skinner, and Hare) and potentially of highland areas where fluvial dissection transitions to deposition (e.g., Gusev crater).
Derived from text
*Photogeology; Planetary Mapping; Planetary Geology; Mars (Planet)*

**20040058009** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Intensity-based Rock Detection for Acquiring Onboard Rover Science**
Castano, A.; Anderson, Robert C.; Castano, R.; Estlin, T.; Judd, M.; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Missions to Mars already under study call for very long autonomous traverses (on the order of hundreds of meters per sol) during which there will be limited contact with Earth. The Onboard Autonomous Science Investigation System (OASIS) is a technology for increasing science return during rover traverses by prioritizing data onboard, and identifying and reacting to unanticipated science opportunities. By prioritizing data for downlink onboard, it is expected that the set of images selected for downlink by OASIS will have a consistently higher scientific interest than any set of equal number of images of the same traverse obtained using random or periodic sampling. Thus, OASIS can be used to increase the science returned from a long traverse. OASIS prioritizes data and identifies science opportunities by extracting information from image data and then using this information to prioritize the data and identify potential newscience opportunities. Currently the information extracted from the images is the location of the rocks in the image and several properties of these rocks such as size, albedo, texture and shape. In this paper we give an overview of the role of rock detection in the OASIS system and describe the functionality of the rock detector. We then present results on representative images.
Author
*Mars Missions; Rocks; Autonomy; Detection; Mars Roving Vehicles*

**20040058010**
**Mars Express Planetary Geoscience Information System (MEGIS) Project**
Ori, G. G.; Flamini, E.; Rossi, A. P.; DiLorenzo, S.; Lorenzoni, L. V.; Marinangeli, L.; DiIorio, A.; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Express Geosciences Information System (MEGIS) is a pilot project to develop a planetary geoscience data archive for Mars in the framework of the Mars Express mission. A demonstrative Planetary Geosciences Information System for Mars has been built up at IRSPS using available Mars data from Viking, Mars Global Surveyor and Mars Odyssey missions under an Italian Space Agency (ASI) grant. The project also focuses on the development of a European network of geo-scientific institutions to provide geological mapping of the Martian data. Geological mapping is one of the most important outcomes of planetary missions. Europe has to develop the proper skills in order to provide the data analysis of the planetary missions that are in preparation. The MEGIS project leader (G. G. Ori) is Co-I of the HRSC and MARSIS and IDS for the geological analysis of Mars Express. This favorable situation has allowed MEGIS to be directly involved in the data analysis and mission operations. Leila V. Lorenzoni has been the ASI contract Project manager.
Derived from text
*Geophysics; Mars Express; NASA Space Programs; Space Missions; Geographic Information Systems*

**20040058011** Houston Univ., TX, USA

**Thematic Maps of Martian Topography Generated by a Clustering Algorithm**

Vilalta, R.; Stepinski, T. F.; Lunar and Planetary Science XXXV: Mars: New Methods and Techniques; 2004; 2 pp.; In English; See also 20040058003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have developed a method for autonomous construction of thematic maps of Martian terrain from digital topography. These maps show spatial distribution of topographical features and are generated by a computer algorithm that classifies pixels on the basis of topographical information they carry. We apply our technique to generate a thematic map of Tisia Valles region on Mars.

Author

*Planetary Mapping; Thematic Mapping; Mars Surface; Topography*

**20040058013** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Io, with a Dash of Titan**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040058014 - 20040058026

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Io, with a Dash of Titan' contained the following reports:A Deep Lava Channel on Io ; Volcanic Activity at Tvashtar Catena, Io; Characterization of Activity at Loki from Galileo and Ground-based Observations; Active and Passive Lava Resurfacing Processes on Io: A Comparative Study of Loki Patera and Prometheus; Loki Patera as the Surface of a Magma Sea; Lava Lakes on Io: New Perspectives from Modeling; Global Distribution of Active Volcanism on Io as Known at the End of the Galileo Mission Relationships Between Paterae, Mountains, and Hotspots on Io from a Global Database; Lithospheric Recycling on Io: The Role of Delamination; Building Mountains on Io: Implications for Io s Lithosphere ; The Effect of Large Melt Fraction on the Deformation Behavior of Peridotite: Implications for the Rheology of Io s Mantle; Matching Various Observations of Io with DSMC Modeling: Plume, Plume Shadow, Sodium Field Around Pele; and How Does Titan Retain a Finite Orbital Eccentricity?

Derived from text

*Io; Volcanology*

**20040058017** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**How Does Titan Retain a Finite Orbital Eccentricity?**

Bills, Bruce G.; Nimmo, Francis; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There is appreciable evidence for a significant hydrocarbon ocean on the surface of Titan. However, it has long been appreciated that tidal dissipation within a putative hydrocarbon ocean on Titan easily yields an orbital eccentricity damping time e which is short compared to the age of the solar system. Unless Titan s present eccentricity (e = 0.0288) were acquired recently, it requires that either: the ocean has a configuration which limits dissipation, or some mechanism exists which effectively maintains the eccentricity against dissipative damping. We argue for the latter. Specifically, the proximity of Jupiter and Saturn to a 5:2 mean motion resonance may provide a sufficient excitation source, and thereby effectively remove dynamical constraints on the dissipation and configuration of the Titan ocean.

Derived from text

*Eccentricity; Titan; Orbits; Hydrocarbons; Dissipation*

**20040058026** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Loki Patera as the Surface of a Magma Sea**

Matson, D. L.; Davies, A. G.; Veeder, G. J.; Rathbun, J. A.; Johnson, T. V.; Lunar and Planetary Science XXXV: Io, with a Dash of Titan; 2004; 2 pp.; In English; See also 20040058013; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Inspired by the finding of Schubert et al that Io's figure is consistent with a hydrostatic shape, we explore the consequences of modeling Loki Patera as the surface of a large magma sea. This model is attractive because of its sheer

simplicity and its usefulness in interpreting and predicting observations. Here, we report on that work.
Author
*Io; Seas; Magma; Satellite Surfaces; Hydrostatics*

**20040058027** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Special Session: Mars Missions**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040058028 - 20040058040
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Special Session: Mars Missions' contained the following reports:Initial Results from the MER Athena Science Investigation at Gusev Crater and Meridiani Planum; Geomorphology of the Mars Exploration Rover (MER-A) Landing Site from Observations by the Spirit Rover; Geology of Meridiani Planum as Inferred from Mars Exploration Rover: Observations;Preliminary Mineralogy and Geochemistry Results at the MER-A Landing Site in Gusev; A First Look at the Mineralogy and Geochemistry of the MER-B Landing Site in Meridiani Planum; Mini-TES Observations of the Gusev and Meridiani Landing Sites; Preliminary Results of the Magnetic Properties Experiments on the Mars Exploration Rovers, Spirit and Opportunity; Pancam Imaging of the Mars Exploration Rover Landing Sites in Gusev Crater and Meridiani Planum; Atmospheric Science with the Mars Exploration Rovers: Things are Looking Up; The Mars Express Mission:Initial Scientific Results from Orbit; The HRSC Experiment in Mars Orbit: First Results; The OMEGA/Mars Express First Results; and SPICAM on Mars Express: First Results and First Observations of Water Ice at South.
Derived from text
*Mars Surface; Imaging Techniques*

**20040058028** Malin Space Science Systems, San Diego, CA, USA
**Geomorphology of the Mars Exploration Rover (MER-A) Landing Site from Observations by the Spirit Rover**
Malin, M. C.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; 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

MER-A, consisting of an entry, descent, and landing subsystem and the Spirit rover, successfully landed on Mars at 2034 PST on 3 January 2004. The landing location at 14.5692 S, 184.5271 W is within a variagated but generally low albedo zone that trends NW/SE across the center of Gusev Crater. Local relief is dominated by a cluster of well-defined, small (< 200 m diameter), low relief (< 15 m depth) impact craters and much smaller (approx. 10 s meters diameter) crudely circular swales and poorly-defined swells and ridges less than a few meters in relief. More distant features include a ridge of low-lying (<100 m high) hills 2-4 km east of the lander, and an isolated knob 7.6 km SW of the lander.
Derived from text
*Geomorphology; Mars Exploration; Landing Sites; Craters*

**20040058030** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Preliminary Results of the Magnetic Properties Experiments on the Mars Exploration Rovers, Spirit and Opportunity**
Hviid, S. F.; Bertelsen, P.; Goetz, W.; Kinch, K. M.; Knudsen, J. M.; Madsen, M. B.; Squyres, S. W.; Bell, J. F., III; Yen, A.; Johnson, M. J., et al.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; 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 each carry a set of Magnetic Properties Experiments designed to investigate the properties of the air-borne dust in the Martian atmosphere. It is a preferred interpretation of previous experiments (Viking 1 & 2, 1976 and Mars Pathfinder, 1997) that the airborne dust in the Martian atmosphere is primarily composed by composite silicate particles containing one or more highly magnetic minerals as a minor constituent, this minor constituent probably being dominated by the mineral maghemite (gamma-Fe2O3). The ultimate goal of the magnetic properties experiments on the Mars Exploration Rover mission is to provide some information/constraints on whether the dust is formed by volcanic, meteoritic, aqueous, or other processes. In detail, the objectives are: a) To identify the magnetic mineral(s) in the dust, soil and rocks on Mars. b) To establish if the magnetic material is present in the form of nanosized (d < 10 nm) superparamagnetic crystallites embedded in the micrometer sized airborne dust part icles. c) To establish if the magnets are culling a subset of strongly magnetic particles or if essentially all particles of the airborne dust are sufficiently magnetic to be attracted by the magnets.

d) Detect compositional differences between the airborne dust and the soil and rock sites which are investigated at two landing sites. To accomplish these goals the Mars Exploration Rovers each carry a set of permanent magnets of several different strengths and sizes. Each magnet has its own specific objective.
Derived from text
*Magnetic Properties; Dust; Roving Vehicles; Trace Elements; Magnetic Materials*

**20040058034** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
**The Mars Express Mission: Initial Scientific Results from Orbit**
Chicarro, A. F.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 1 pp.; In English; See also 20040058027; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ESA Mars Express mission was successfully launched on 02 June 2003 from Baikonur, Kazakhstan, onboard a Russian Soyuz rocket with a Fregat upper stage. The mission comprises an orbiter spacecraft, which has been placed in a polar martian orbit, and the small Beagle-2 lander, due to land in Isidis Planitia but whose fate remains unknown. In addition to global studies of the surface, subsurface and atmosphere of Mars, with an unprecedented spatial and spectral resolution, the unifying theme of the mission is the search for water in its various states everywhere on the planet. Mars Express is the first European planetary mission ever. The specific scientific objectives of the Mars Express orbiter are: global high-resolution imaging and imaging of selected areas with super-resolution, global infrared mineralogical mapping, sounding of the subsurface structure down to a few km, global atmospheric circulation study and mapping of the atmospheric composition, study of ozone, CO2, H2O and dust as main drivers of the climate, study of the interaction of the interplanetary medium with the upper atmosphere, as well as study of gravity anomalies and surface roughness with radio science. The scientific payload on the Mars Express orbiter includes a Super/High-Resolution Stereo Colour Imager (HRSC), an IR Mineralogical Mapping Spectrometer (OMEGA), a Subsurface-Sounding Radar Altimeter (MARSIS), a Planetary Fourier Spectrometer (PFS), an UV and IR Atmospheric Spectrometer (SPICAM), an Energetic Neutral Atoms Analyser (ASPERA), and a Radio Science Experiment (MaRS). The mass of the orbiter instruments is about 110 kg. Mars Express was captured into orbit on 25 December 2003 and was placed soon after in a highly elliptical martian orbit with closest approach of 250 km, orbit inclination of 86.35 and period of about 6.75 hours. The nominal orbiter lifetime of one martian year (687 days), following an almost seven-month cruise, is to be extended by another martian year to complete global coverage and observe all martian seasons twice. To fulfill its objectives, the Mars Express orbiter is 3-axis stabilized. Following the spacecraft commissioning, the orbiter experiments began their commissioning in mid- January 2004 and started to acquire scientific data from Mars and its environment. The radar antennas will be deployed later in order to maximise early daylight operations of the other instruments, before the pericentre natural drift to the Southern latitudes. Thus, instrument operations will start their routine phase in early March and early April 2004 (without and with the radar, respectively). Already all experiments have acquired extraordinary and unexpected scientific data. ESA has provided the launcher, the orbiter and the operations, while the instruments were provided by scientific institutions through their own funding. The ground segment includes the ESA station at Perth, Australia, and the mission operations centre at ESOC. The Mars Express Prime Contractor was Astrium in Toulouse, France, and a large number of European companies were involved as subcontractors. The ESA engineering and scientific teams are located at ESTEC.
Author
*Mars Express; Infrared Imagery; Atmospheric Composition; Mars Surface; Mineral Deposits*

**20040058035** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Pancam Imaging of the Mars Exploration Rover Landing Sites in Gusev Crater and Meridiani Planum**
Bell, J. F., III; Squyres, S. W.; Arvidson, R. E.; Arneson, H. M.; Bass, D.; Cabrol, N.; Calvin, W.; Farmer, J.; Farrand, W. H., et al.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Exploration Rovers carry four Panoramic Camera (Pancam) instruments (two per rover) that have obtained high resolution multispectral and stereoscopic images for studies of the geology, mineralogy, and surface and atmospheric physical properties at both rover landing sites. The Pancams are also providing significant mission support measurements for the rovers, including Sun-finding for rover navigation, hazard identification and digital terrain modeling to help guide long-term rover traverse decisions, high resolution imaging to help guide the selection of in situ sampling targets, and acquisition of education and public outreach imaging products.
Derived from text
*Imaging Techniques; Landing Sites; Mars Exploration; Roving Vehicles; Mineralogy*

**20040058036** Space Science Inst., Boulder, CO, USA

**Atmospheric Science with the Mars Exploration Rovers: Things are Looking Up**

Wolff, M. J.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 1 pp.; In English; See also 20040058027; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although at first glance, the Mars Exploration Rover (MER) payload may be perceived as primarily suited to geological investigation, it is in fact quite well-suited to carry out a robust and dynamic program of atmospheric monitoring and characterization. More to the point, it has already begun to do so from both the Gusev and Meridiani locations. Current atmospheric observations include: (1) periodic thermal infrared spectra of the Martian sky by the Miniature Thermal Emission Spectrometer (Mini-TES). The actual sequences consist of both standard 200-second integrations and long 'stares' of up to (almost) an hour. These data are highly diagnostic of vertical thermal structure (from 10 meters to 3-5 kilometers), aerosol optical depth along with particle size, and under the right conditions, the water column. (2) direct solar imaging using the Panchromatic Camera (Pancam) and 440/880 nm + neutral density (ND5) filters, providing accurate measurement visible optical depths. (3) near-sun and 'sky-arc' sequences using the full suite of geological filters, intended to capture the forward-diffraction peak and the phase function characteristics of the aerosol particles. (4) carbon dioxide (15 micrometer band) profiling of the Mini-TES surface observations, providing an average near-surface (1 m) air temperature. The above activities have been (and will continue to be) used to characterize diurnal and secular temporal trends and to examine the spatial variability of such trends. In addition, serendipity has provided the unique opportunities of watching the decay of a moderate dust storm from two widely-separated sites as well as of multiple simultaneous orbiter-rover observing 'campaigns.' The latter includes thus far the Mars Express over-flights of Spirit on sols 13A and 29A and the nearly-nadir Mars Global Surveyor over-flight of Opportunity on sol 22B. During our presentation, we will summarize the atmospheric results obtained and analyzed through the end of February (2004), highlighting the unique contributions/ capabilities of each instrument and the synergy which comes from combining the two, e.g., visible- to-infrared optical ratio.

Author

*Thermal Emission; Atmospheric Chemistry; Environmental Monitoring; Mars Express*

**20040058037** Freie Univ., Berlin, Germany

**The HRSC Experiment in Mars Orbit: First Results**

Neukum, G.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 1 pp.; In English; See also 20040058027; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Early January 2004, the ESA Mars Express mission started its science phase in orbit around Mars. Imaging and mapping the Martian surface by the High Resolution Stereo Camera (HRSC) is one of the main goals of Mars Express. The HRSC experiment is a pushbroom scanning instrument with 9 CCD line detectors mounted in parallel on the focal plane. Its unique feature is the ability to nearly simultaneously obtain imaging data of a specific site at high resolution, with along-track triple stereo, with four colours, and at five different phase angles, thus avoiding any time-dependent variations of the observation conditions. An additional Super-Resolution Channel (HRSC-SRC) a framing device will yield nested-in images in the meter-range thus serving as the sharpening eye for detailed photogeologic studies. The spatial resolution from the nominal periapsis altitude of 250 km will be 10 m/pixel for the HRSC proper and 2.3 m/pixel for the SRC. During the nominal operational lifetime of the mission of 1 Martian year, it will be possible to cover at least 50% of the Martian surface at a spatial resolution of better than 20 m/pixel.

Derived from text

*Imaging Techniques; Mars Express; Mars Surface; Photogeology*

**20040058038** Centre National de la Recherche Scientifique, Verrieres-Le Buisson, France

**SPICAM on Mars Express: First Results and First Observations of Water Ice at South Pole**

Bertaux, Jean-Loup; Quemerais, E.; Perrier, S.; Korablev, Oleg; Fedorova, A.; Muller, C.; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 2 pp.; In English; See also 20040058027; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

SPICAM, a lightweight (4.8 kg) UV-IR dual spectrometer on board Mars Express orbiter, is dedicated primarily to the study of the atmosphere and ionosphere of Mars, but has also provided important results on the surface albedo of Mars [1]. A UV imaging spectrometer (118 - 320 nm, resolution 1 nm, intensified CCD) is dedicated to nadir viewing, limb viewing and atmospheric vertical profiling by stellar and solar occultation. An IR spectrometer (1.0-1.7 microns, resolution 0.5-1.2 nm, or gamma/delta-gamma = 1300, mass 0.8 kg) is dedicated primarily to nadir measurements of H2O abundances [2]. It is based

on AOTF technology; and it is the first time that such a spectrometer is flying in deep space. The whole instrument was built as a cooperative effort of the three institutes (see affiliations), under overall management of Service d A ronomie.
Derived from text
*Imaging Spectrometers; Stellar Occultation; Mars Surface; Planetary Ionospheres; Mars Atmosphere*

**20040058039** Centre National de la Recherche Scientifique, Orsay, France
**The OMEGA/Mars Express First Results**
Bibring, Jean-Pierre; Lunar and Planetary Science XXXV: Special Session: Mars Missions; 2004; 1 pp.; In English; See also 20040058027; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

OMEGA is a spectral imager, operating from 0.35 to 5.1 microns, acquiring Mars images from the ESA/Mars Express orbiter. Its IFOV (1.2 mrad) leads to ground resolution from 300 m (at periapsis) to a few kilometers, depending on the altitude of observation. OMEGA is constituted of 3 co-aligned spectrometers, covering the spectral domain in 352 contiguous channels, with spectral sampling varying from 7nm in the visible, to 20nm at 5 ?m. The SNR per spectrum demonstrated to be higher than 100 over the entire spectral range, up to 1000. This allows to extract information from spectral features down to a percent level, enabling to potentially identify unambiguously major and minor constituents of the surface and atmosphere (gas and aerosols). Less than two weeks following Mars Orbit Insertion, it was possible to start the mapping of the Mars surface and atmosphere, although the S/C had not arrived yet to its final working orbit. In the first month, more than 15 tracks were acquired, several thousands km long, across most major areas at all latitudes. With an initial pericenter location close to the equator, the resolution decreases with increasing latitudes. We shall present the very first results derived from these preliminary data, with an emphasize on the mapping of the South polar water ice identified on the summer South perennial polar cap.
Author
*Mars Express; Imaging Techniques; Mars Surface; Extraction; Ice*

**20040058060** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040058061 - 20040058072
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Lunar Remote Sensing: Seeing the Big Picture' contained the following reports:Approaches for Approximating Topography in High Resolution, Multispectral Data; Verification of Quality and Compatibility for the Newly Calibrated Clementine NIR Data Set; Near Infrared Spectral Properties of Selected Nearside and Farside Sites ; Global Comparisons of Mare Volcanism from Clementine Near-Infrared Data; Testing the Relation Between UVVIS Color and TiO2 Composition in the Lunar Maria; Color Reflectance Trends in the Mare: Implications for Mapping Iron with Multispectral Images ; The Composition of the Lunar Megaregolith: Some Initial Results from Global Mapping; Global Images of Mg-Number Derived from Clementine Data; The Origin of Lunar Crater Rays; Properties of Lunar Crater Ejecta from New 70-cm Radar Observations ; Permanent Sunlight at the Lunar North Pole; and ESA s SMART-1 Mission to the Moon: Goals, Status and First Results.
Derived from text
*Lunar Geology; Regolith*

**20040058062** Johns Hopkins Univ., Laurel, MD, USA
**Permanent Sunlight at the Lunar North Pole**
Bussey, D. B. J.; Robinson, M. S.; Fristad, K.; Spudis, P. D.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The spin axis of the Moon is nearly perpendicular to the ecliptic plane. This results in the possibility of extreme lighting conditions at the lunar poles. The floors of impact craters may never see the Sun, whilst, theoretically, topographically high regions near the poles could be constantly sunlit. Permanently shadowed regions are the most likely locations for ice deposits believed to exist at both poles. Regions which are permanently sunlit represent ideal locations as future landing sites. Not only would there be the availability of constant solar power generation but these areas would permit operations in a reasonably

benign thermal environment. It has been modeled that the temperature of a permanently sunlit region close to a lunar pole would be 223 +/- 10 K.
Author
*Lunar Surface; Sunlight; Polar Regions; Illumination*

**20040058063** Smithsonian Institution, Washington, DC, USA
**Properties of Lunar Crater Ejecta from New 70-cm Radar Observations**
Ghent, R. R.; Leverington, D. W.; Campbell, B. A.; Hawke, B. R.; Campbell, D. B.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We use recently acquired radar observations at 70-cm wavelength to examine the distribution of ejecta around lunar impact craters. Numerous craters with haloes characterized by low 70-cm radar return occur throughout the maria and highlands. These haloes extend 1-2 crater diameters from the rim, outboard of a zone of radar-bright rough ejecta that varies in width between craters; in some instances the radar-dark halo reaches the rim of the crater. We focus here on Aristarchus and Petavius craters. Two possible explanations for these haloes are examined. The low-return areas may indicate the presence of a regolith component with relatively high loss tangent. For the mare craters, this would imply a layer of higher-TiO2 basalt within the underlying lava flow units. For the highland craters, this would require excavation of mare basalt and its incorporation into the terra regolith; the mixed deposit would have a lower total radar echo than pure highlands material. The second model involves a relatively block-free mantling deposit produced by the impact process. The second model has advantages in that it does not require fortuitous subsurface deposits of high-loss materials in the target area. Thermal infrared observations of craters also support the mantling deposit hypothesis. Both mechanisms may occur to varying degrees, however, depending upon the stratigraphy of the target site. The new 70-cm radar observations allow detailed analysis of the backscatter variations associated with these dark haloes. Clementine multispectral data are used to infer mineralogical and maturity properties. Taken together, these data permit development of a more robust model for the physical and chemical partitioning of ejecta deposits.
Author
*Lunar Craters; Ejecta; Radar Astronomy*

**20040058064** Hawaii Univ., Honolulu, HI, USA
**Testing the Relation Between UVVIS Color and TiO2 Composition in the Lunar Maria**
Gillis, J. J.; Lucey, P. G.; Lawrence, S. J.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This study addresses the degree of correlation between Ti and UVVIS color via a focused examination of lunar soils and a quantitative understanding of their optical properties and the optical properties of their components. It is clear that lunar basalts show strong and consistent variations in UVVIS color that certainly can be used for mapping flow boundaries; but to what extent these variations in any individual mare deposit are dependent upon Ti or other compositional parameters is not well established. Opaque minerals certainly must at least contribute to lunar UVVIS color as they vary from 0 to almost 25% by volume. As suggested by Staid et al, soil mineralogy is a factor influencing spectral variation. Thus, we test the relation between UVVIS color and various factors that include mineralogy and mineral chemistry. Improving the correlation between these two parameters will result in increasing the accuracy of TiO2 estimated using remotely sensed data.
Derived from text
*Lunar Maria; Remote Sensing; Titanium Oxides; Light (Visible Radiation); Color; Mineralogy; Ultraviolet Radiation*

**20040058065** Hawaii Univ., Honolulu, HI, USA
**The Origin of Lunar Crater Rays**
Hawke, B. R.; Blewett, D. T.; Gillis, J. J.; Lucey, P. G.; Peterson, C. A.; Smith, G. A.; Bell, J. F., III; Campbell, B. A.; Gaddis, L. R.; Robinson, M. S.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar rays are filamentous, high albedo deposits occurring radial or subradial to impact craters. The nature and origin of lunar crater rays has long been the source of major controversies. Some workers have proposed that rays are dominated by primary crater ejecta, while others have emphasized the role of secondary craters in producing rays. Pieters et al. presented

the results of a remote sensing study of a portion of the ray system north of Copernicus. They provided evidence that the present brightness of the Copernicus rays in this sector is due largely to the presence of a component of highland ejecta intimately mixed with local mare basalt and that an increasing component of local material is observed in the rays at progressively greater radial distances from the parent crater. These results have been questioned, and the origin of lunar rays is still uncertain. In an effort to better understand the processes responsible for the formation of lunar rays, we have utilized a variety of remote sensing data to study selected rays associated with Tycho, Olbers A, Lichtenberg, and the Messier crater complex. The data include near-IR reflectance spectra (0.6-2.5 microns) and 3.8- and 70-cm radar maps. In addition, Clementine UV-VIS images were utilized to produce high-resolution FeO, TiO2, and optical maturity maps for the various rays using the methods presented by Lucey and co-workers.
Derived from text
*Lunar Craters; Lunar Rays; Albedo; Lunar Evolution; Remote Sensing*

**20040058066** Hawaii Univ., Honolulu, HI, USA
**Global Images of Mg-Number Derived from Clementine Data**
Lucey, P. G.; Gillis, J. J.; Steutel, D.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mg number (Mg*), the ratio of Mg to the sum of Mg and Fe on an atomic basis, is an important disciminator in defining and understanding lunar rocks. Mg* is also the most important control on the spectral properties of lunar mafic silicates. For stoichiometric orthopyroxene and olivine, Mg* is mathematically linked to the Fe content that controls the overall reflectance and intensity of absorption. The changes in band centers and shape that accompany the structural changes as Fe substitutes for Mg along the solid solution series have long been recognized; these changes are highly correlated with Mg*. In clinopyroxene, the strong effect of Ca on structure makes this element important, but Mg* has the dominant effect on reflectance and a comparable effect on spectral shape. Because the visible and near-IR spectral properties of lunar soils are dominated by mafic minerals, Mg* has a dominant effect on spectral properties of lunar soils. Understanding the relationship between soil spectral properties and composition is incomplete without explicit treatment of Mg*. The dominance of Mg* also suggests that if the compositional properties of the lunar surface can be otherwise constrained, Mg* can be derived from lunar spectral properties. In a ongoing effort to map the mineralogy of the Moon using Clementine data, we produced a spectral model of the Moon based on the work of Bruce Hapke, and including the Mg* dependent spectral properties of mafic minerals. We have found that at Clementine spectral sampling and resolution, Clementine data cannot unambiguously define a lunar composition; modeled spectra of many compositions produce spectra identical within the noise of the Clementine data set. However, these compositions show strong variations in the elemental composition defined stoichiometrically, including Fe and Ti. By adding these remotely measurable constraints (Fe and Ti content) compositions are highly constrained, and we find that Mg* is uniquely defined.
Author
*Lunar Composition; Magnesium; Abundance; Thematic Mapping; Spectra*

**20040058067** Johns Hopkins Univ., Laurel, MD, USA
**The Composition of the Lunar Megaregolith: Some Initial Results from Global Mapping**
Spudis, P. D.; Jackson, N.; Baloga, B.; Bussey, B.; Glaze, L.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The megaregolith is the name given to the kilometers-thick debris layer that covers the lunar highland crust. This debris is generated by the large-scale impact bombardment that produced the observed craters and basins in the highlands. As such, it consists of complex breccias and crushed plutonic rocks derived from an originally igneous crust and its composition should reflect the rocks from which it is derived. As the highlands megaregolith shows clear lateral heterogeneity, the implication is that the crust of the Moon is laterally heterogeneous. Exactly how the megaregolith varies in composition from place to place and what this might imply about sub-regolith highlands crustal 'bedrock' has not been systematically studied. Pieters summarized knowledge of the highlands crust as it then stood and noted that while Earth-based spectral data showed diversity at depth, globally, the highlands megaregolith appeared everywhere dominated by feldspar and low-Ca orthopyroxene. New Clementine data show that globally, the megaregolith does vary and its composition and variance may serve as a proxy to understanding the variation of the crust as a whole.
Author
*Lunar Surface; Lunar Rocks; Regolith; Lunar Composition; Lunar Craters; Ejecta*

**20040058068** Hawaii Univ., Honolulu, HI, USA

**Color Reflectance Trends in the Mare: Implications for Mapping Iron with Multispectral Images**

Wilcox, B. B.; Lucey, P. G.; Gillis, J. J.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Remotely mapping iron on the lunar surface requires the separation of the spectral effects of iron and maturity. Increasing iron causes a darkening and reduced reddening of soil between 950 and 750 nm, while increasing maturity causes a darkening and reddening of soil. The Lucey iron method was designed to enable the mapping of iron at the full resolution of Clementine (100 m/pixel) after separating out the effects of maturity. The Lucey method was based on an observation that trends of uniform composition but varying maturity form radial patterns on a plot of reflectance at 750 nm versus the ratio of reflectance at 950/750 nm. However, Staid and Pieters noted that in the mare trends were more parallel than radial. This suggests that the Lucey method might not be optimally compensating for maturity. Also, various calibrations of that technique give inconsistent results in terms of suppressing maturity anomalies. Both of these problems limit the usefulness of the Lucey method for mapping small-scale iron anomalies, which might be used for mapping vertical stratigraphy in the mare. Here we test whether the reflectance trends are more radial or more parallel in the mare and present a new method for separating the spectral effects of iron and maturity in lunar mare regions.

Author

*Thematic Mapping; Spectral Reflectance; Lunar Maria; Lunar Composition; Iron*

**20040058069** Hawaii Univ., Honolulu, HI, USA

**Verification of Quality and Compatibility for the Newly Calibrated Clementine NIR Data Set**

Cahill, J. T.; Lucey, P. G.; Gillis, J. J.; Steutel, D.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In February 1994, the Clementine spacecraft began orbiting the Moon with a suite of instrumentation that generated millions of images of the lunar surface. This instrumentation package included an ultraviolet-visible (UVVIS) imager that collected 5 spectral wavelengths (0.415, 0.75, 0.90, 0.95, and 1.00 micron) and a near-infrared (NIR) imager that collected 6 spectral wavelengths (1.10, 1.25, 1.50, 2.00, 2.60, and 2.78 microns) of information. Over the past decade, calibration of the NIR data set has been troublesome due to largely varying dark frame signals with time and orbit and uncertainties on gain and offset values. Several previous attempts to calibrate the Clementine NIR data set have been made. However, these calibrations were not easily automated. Recently, the USGS, Flagstaff released these data with a near final calibration. Here we show a preliminary study to verify the quality and compatibility of this data set using Earth-based telescopic data and previous calibrations of the Clementine NIR and UVVIS data sets.

Derived from text

*Clementine Spacecraft; Near Infrared Radiation; Ultraviolet Radiation; Light (Visible Radiation); Calibrating; Compatibility*

**20040058070** Hawaii Univ., Honolulu, HI, USA

**Near Infrared Spectral Properties of Selected Nearside and Farside Sites**

Steutel, D.; Lucey, P. G.; Gillis, J. J.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The 1994 Clementine mission to the Moon collected global multispectral imagery using two instruments: ultraviolet-visible (UVVIS, wavelengths 0.415, 0.750, 0.900, 0.950, & 1.000 micron) and near-infrared (NIR, wavelengths 1.10, 1.25, 1.50, 2.00, 2.60, & 2.78 microns) cameras. While the UVVIS data have been calibrated and high resolution global data have been available since 2000, the NIR data have only recently been calibrated and made available. In this study we examine the UVVIS and NIR spectral features of selected nearside and farside sites. Previous studies have compared derived properties of these or similar surfaces, but only now can the full visible and NIR spectral properties be directly compared.

Derived from text

*Clementine Spacecraft; Near Infrared Radiation; Spectra; Imaging Techniques*

**20040058071** Science Applications International Corp., Chantilly, VA, USA

**Approaches for Approximating Topography in High Resolution, Multispectral Data**

Tompkins, S.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Many authors have pointed out potential problems associated with analyzing reflectance spectra from steeply sloped areas (crater walls, peaks, etc.). Lucey et al. predicted absolute error of greater than 5 wt. %, in the calculated FeO value of steeply sloped surfaces within Clementine images acquired above +/- 20 deg latitude. Robinson and Joliff confirmed the error estimate when examining topographic corrections using a digital elevation model (DEM) (derived from an Apollo 17 high resolution map) against Clementine UVVIS camera data. However, because there is a dearth of existing topographic data at the resolutions required for application to Clementine images, work was begun last year on removing topographic effects by subtracting the effects of shade within a spectral mixture model.
Author
*Lunar Topography; Multispectral Photography; Image Processing; Spectrum Analysis*

**20040058072** Geological Survey, Flagstaff, AZ, USA
**Global Comparisons of Mare Volcanism from Clementine Near-Infrared Data**
Staid, M. I.; Gaddis, L. R.; Isbell, C. E.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Clementine ultraviolet-visible (UVVIS) data have been merged with empirically calibrated multispectral data from the Clementine near-infrared (NIR) camera in order to characterize the reflectance properties of the Moon's major mare deposits. The high spatial resolution and global coverage of the merged Clementine data provides an opportunity to compare the spectral properties (0.4 to 2.0 microns) of craters small enough to have sampled individual volcanic deposits. The spectral properties of optically immature craters are especially important targets for remote sensing because crystalline lunar materials exhibit diagnostic absorption features related to their mineralogy.
Derived from text
*Clementine Spacecraft; Remote Sensing; Near Infrared Radiation; Moon; Mineralogy; Volcanology; Data Processing*

**20040058108**
**Identifying the Parent Body of the Tagish Lake Meteorite and Characterizing its Internal Heating History and Surface Processes**
Hiroi, Takahiro; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-12847; No Copyright; Avail: CASI; A01, Hardcopy

This short (1-year) funded research encompassed laboratory measurements of the Tagish Lake meteorite samples, experiments of simulated space weathering on them, and comparison with D, T, and P asteroids in reflectance spectrum. In spite of its limited funding and period, we have performed said experiments here at Brown University and at University of Tokyo. Some of the major results were reported at the Lunar and Planetary Science Conference held in Houston in March, 2004. The Tagish Lake meteorite shows a unique visible reflectance spectrum identical to that of the D and T type asteroids. After the present heating experiments at even the lowest temperature of 100 C, the characteristic spectral slope of the Tagish Lake meteorite sample increased. On the other hand, after irradiating its pellet sample with pulse laser, the slope decreased. As the result, the Tagish Lake meteorite and its processed samples have come to cover a wide range of visible reflectance spectra in slope from the C-type asteroids to some extreme T/D-type asteroids, including the P-type asteroids in between. Therefore, logically speaking, our initial affirmation that the Tagish Lake meteorite must have come from one of the D-type asteroids can be wrong if such a meteoritic material is hidden under a space-weathered surface regolith of a C-type asteroid. However, such a case is likely to have a small probability in general. Other major hits of this research includes the first spectral fitting of the P-type asteroids using reflectance spectra derived from the present research. This topic needs more experiments and analysis to be addressed uniquely, and thus further efforts will be proposed.
Author
*Meteoritic Composition; Asteroids; Space Weathering; Heating; Computerized Simulation*

**20040058109** California Inst. of Tech., Pasadena, CA, USA
**Dynamical Modeling of Mars' Paleoclimate**
Richardson, Mark I.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-12915
Report No.(s): MIR.00005-1-NASA.000148; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes work undertaken under a one-year grant from the NASA Mars Fundamental Research Program. The goal of the project was to initiate studies of the response of the Martian climate to changes in planetary obliquity and

orbital elements. This work was undertaken with a three-dimensional numerical climate model based on the Geophysical Fluid Dynamics Laboratory (GFDL) Skyhi General Circulation Model (GCM). The Mars GCM code was adapted to simulate various obliquity and orbital parameter states. Using a version of the model with a basic water cycle (ice caps, vapor, and clouds), we examined changes in atmospheric water abundances and in the distribution of water ice sheets on the surface. This work resulted in a paper published in the Journal of Geophysical Research - Planets. In addition, the project saw the initial incorporation of a regolith water transport and storage scheme into the model. This scheme allows for interaction between water in the pores of the near subsurface (<3m) and the atmosphere. This work was not complete by the end of the one-year grant, but is now continuing within the auspices of a three-year grant of the same title awarded by the Mars Fundamental Research Program in late 2003.
Author
*Mars Atmosphere; Paleoclimatology; Climate Models*

**20040059282** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059283 - 20040059293
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM
The session 'Chondrules: The Never-Ending Story' included the following reports:Dust Size Distribution in Solar Nebula Inferred from Shock-Wave Heating Model for Chondrule Formation; Collisional Destruction of Chondrules in Shock Waves and Inferred Dust to Gas Mass Ratio; Evaporation and Accompanying Isotopic Fractionation of Sulfur from Fe-S Melt During Shock Wave Heating ; Evaporation During Chondrule Formation, Recondensation as Fine Particles, and the Condensation of S and Other Volatile Elements; Fe Isotopes and the Formation of Chondrules; Pristine and Processed Metal in CR Chondrites: Condensation in the Solar Nebula and Partial Reequilibration During Chondrule Formation; Variation of the Condensation Path of Supercooled Silicate Melt; Volatile and Moderately Volatile Trace Element Composition of Chondrules and Matrix from CM Chondrites: Implications for Chondrule Formation; Opaque Mineral Assemblages at Chondrule Boundaries in the Vigarano CV Chondrite: Evidence for Gas-Solid Reactions Following Chondrule Formation; Forsterite and Olivine in Sahara-97210 (LL3.2) and Chainpur (LL3.4) Chondrules: Compositional Evolution and the Influence of Melting; The Vaguries of Pyroxene Nucleation and the Resulting Chondrule Textures; Contemporaneous Formation of Chondrules in the Al-26-Mg-26 System for Ordinary and CO Chondrites; and Al-Mg Isotopic Systematics in Ferromagnesian Chondrules from the Unequilibrated Ordinary Chondrite.
Derived from text
*Chondrule; Meteoritic Composition*

**20040059592** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059593 - 20040059605
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM
The session 'Asteroids, Meteors, and Comets' contained the following reports:Ejecta Generation and Redistribution on 433 Eros: Modeling Ejecta Launch Conditions; Macroscopic Voids in Small Asteroids: Effects of Cohesion; The Seismic Effect of Impacts on Asteroid Surface Morphology: Early Modeling Results; Photometric Studies of Eros from NEAR Data; Quantitative Aspects of Space Weathering: Implications for Regolith Breccia Meteorites and Asteroids; Diversity of Types of Hydrated Minerals on C-Class Asteroids; Mineralogical Variations Among High Albedo E-Type Asteroids: Implications for Asteroid Igneous Processes; Multi-Wavelength Observations of 2100 Ra-Shalom: Radar and Lightcurves; What are the P-type Asteroids Made Of?; Sodium Overabundance in Meteoroids from Meteor Spectroscopy; Migration Processes and Volatiles Inventory to the Inner Planets; Characterization of the Surface Properties of MUSES-C/Hayabusa Spacecraft Target; Asteroid 25143 Itokawa; and Sample Return Science by Hayabusa Near-Earth Asteroid Mission.
Derived from text
*Asteroids; Mineralogy*

**20040059593** NASA Johnson Space Center, Houston, TX, USA

**Characterization of the Surface Properties of MUSES-C/Hayabusa Spacecraft Target Asteroid 25143 Itokawa (1998 SF36)**

Lederer, S. M.; Domingue, D. L.; Vilas, F.; Abe, M.; Farnham, T. L.; Jarvis, K. S.; Lowry, S. C.; Ohba, Y.; Weissman, P. R.; French, L. M., et al.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Several spacecraft missions have recently targeted asteroids to study their morphologies and physical properties (e.g. Galileo, NEAR Shoemaker), and more are planned. MUSES-C is a Japanese mission designed to rendezvous with a near-Earth asteroid (NEA). The MUSES-C spacecraft, Hayabusa, was launched successfully in May 2003. It will rendezvous with its target asteroid in 2005, and return samples to the Earth in 2007. Its target, 25143 Itokawa (1998 SF36), made a close approach to the Earth in 2001. We collected an extensive ground-based database of broadband photometry obtained during this time, which maximized the phase angle coverage, to characterize this target in preparation for the mission. Our project was designed to capitalize on the broadband UBVRI photometric observations taken with a series of telescopes, instrumentation, and observers. Photometry and spectrophotometry of Itokawa were acquired at Lowell, McDonald, Steward, Palomar, Table Mountain and Kiso Observatories. The photometric data sets were combined to calculate Hapke model parameters of the surface material of Itokawa, and examine the solar-corrected broadband color characteristics of the asteroid. Broadband photometry of an object can be used to: (1) determine its colors and thereby contribute to the understanding of its surface composition and taxonomic class, and (2) infer global physical surface properties of the target body. We present both colors from UBVRI observations of the MUSES-C target Itokawa, and physical properties derived by applying a Hapke model to the broadband BVRI photometry.

Derived from text

*Surface Properties; Stellar Spectrophotometry; Asteroids; Characterization*

**20040059594** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Sample Return Science by Hayabusa Near-Earth Asteroid Mission**

Fujiwara, A.; Abe, M.; Kato, M.; Kushiro, I.; Mukai, T.; Okada, T.; Saito, J.; Sasaki, S.; Yano, H.; Yeomans, D.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Assigning the material species to each asteroid spectral type and finding out the corresponding meteorite category is crucial to make the global material map in the whole asteroid belt and to understand the evolution of the asteroid belt. Recent direct observations by spacecrafts are revealing new intriguing aspects of asteroids which cannot be obtained solely from ground-based observations or meteorite studies. However identification of the real material species constituting asteroids and their corresponding meteorite analogs are still ambiguous. Space weathering makes difficult to identify the true material, and there is still a great gap between the remote sensing data on the global surface and the local microscopic data from meteorites. Sample return from asteroids are inevitable to solve these problems. For this purpose sample return missions to asteroids belonging to various spectral classes are required. The HAYABUSA spacecraft (prelaunch name is MUSESC) launched last year is the first attempt on this concept. This report presents outline of the mission with special stress on its science.

Derived from text

*Sample Return Missions; Near Earth Asteroid Rendezvous Mission; Space Missions; Remote Sensing; Topography; Spacecraft Design*

**20040059595** North Dakota Univ., Grand Forks, ND, USA

**Mineralogical Variations Among High Albedo E-Type Asteroids: Implications for Asteroid Igneous Processes**

Gaffey, Michael J.; Kelley, Michael S.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592

Contract(s)/Grant(s): NAG5-10345; NAG5-13792; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The link between the E-type asteroids and the enstatite achondrites (aubrites) was first proposed for the original E-asteroid, 44 Nysa. The association was based on the high albedos and the featureless spectra shared by the E-asteroids and the aubrites. Among the plausible geologic and meteoritic materials, only enstatite (the magnesium end-member of the pyroxene solid solution series) is sufficiently abundant to comprise asteroid-sized bodies. However, the presence of a weak 0.89 m absorption feature in the spectrum of 44 Nysa indicates that its pyroxene contains a small amount of Fe(2+) but still substantially more than any aubrite present in the meteorite collection. The original E-class was defined based on its high

albedo and flat to slightly reddish spectrum. In the absence of albedo data, the E-type was degenerate with the M- and P-types, and together these were designated as X-types. Recently, a taxonomy has been proposed to identify E-types in the absence of albedo data. In this newer classification system three subdivisions of the X-type have been proposed, including Xc, Xe and Xk. Of nine albedo-defined E-types [d], this newer non-albedo based taxonomy produced the following classifications: X-1 asteroid; Xc-2 asteroids; Xe-5 asteroids; and Xk-1 asteroid. Although the Xe subtype includes the largest number of albedo-defined E-types, most of the remaining 24 Xe-types can be excluded based on their low measured IRAS albedos, ranging from 0.116 to 0.329, which are below the lower albedo limit of the E-class (0.34) and substantially below that of the lowest albedo an actual E-type asteroid (0.41). The present discussion will be limited to unambiguous E-type asteroids determined on albedo criteria.
Derived from text
*Albedo; Asteroids; Mineralogy; Igneous Rocks*

**20040059596** Arizona Univ., Tucson, AZ, USA
**The Seismic Effect of Impacts on Asteroid Surface Morphology: Early Modeling Results**
Richardson, J. E.; Melosh, H. J.; Greenberg, R.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592
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

In recent years, spacecraft observations of asteroids 951 Gaspra, 243 Ida, 253 Mathilde, and 433 Eros have shown the overriding dominance of impact processes with regard to the structure and appearance of these small, irregular bodies. One currently unanswered question is: to what degree does seismic shaking from impacts affect the surface morphology of these bodies? Through detailed modeling, we begin to address this question.
Derived from text
*Asteroids; Seismology; Morphology; Mathematical Models*

**20040059597** Maryland Univ., College Park, MD, USA
**Photometric Studies of Eros from NEAR Data**
Li, Jian-Yang; AHearn, M. F.; McFadden, L. A.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Phase functions of small bodies are related to their surface physical properties and are of importance in establishing thermal balance. However, for asteroids, the irregular shapes make it ambiguous in defining their phase functions. Previous studies showed that, without the knowledge of their shapes, the most common way of constructing phase functions from the means or the maxima of lightcurves could lead to errors if the phase function is fitted by a disintegrated Hapke phase function assuming a spherical shape. The NEAR mission provided us with tremendously detailed data with very high resolution. The multispectral imager (MSI) onboard the NEAR spacecraft acquired images covering phase angles between 50 degrees and 120 degrees from visible wavelengths through near-infrared, with resolution less than 20 m/pix. From these images, the shape model of Eros was obtained. Then using the shape model, the geometric effect could be separated from photometric properties with very high accuracy. In this paper, the MSI images taken through the F1 filter centered at 550 nm have been used, combined with earlier ground based photometric data at phase angles less than 60 degrees, to construct an improved photometric model for Eros.
Derived from text
*Photometry; Eros Asteroid; Near Earth Asteroid Rendezvous Mission; Data Processing*

**20040059598** NASA Johnson Space Center, Houston, TX, USA
**Quantitative Aspects of Space Weathering: Implications for Regolith Breccia Meteorites and Asteroids**
Noble, S. K.; Pieters, C. M.; Keller, L. P.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592
Contract(s)/Grant(s): NGT9-66; NAG5-11763; RTOP 344-31-40-07; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Space weathering is defined as the physical and optical changes incurred by material exposed to the space environment. Through studies of lunar soils, these changes are becoming well understood. However, the effects of space weathering are dependent on the physical environment to which the host materials are exposed, and thus, the effects will likely vary from body

to body. The optical effects of space weathering result from nanophase iron (npFe(sup 0)) created during micrometeorite bombardment and solar wind sputtering. In the asteroid belt, bodies are farther from the sun than our Moon, and are widely known to incur less solar wind implantation and sputtering. The velocity of impacts is smaller resulting in less melting and vaporization, and therefore fewer space weathering products. The impact rate in the asteroid belt is greater, which will result in more comminution, further diluting any weathering products. Ergo, asteroidal regoliths should contain fewer space weathering products than lunar soils. However, even very small degrees of space weathering can have dramatic consequences for the optical properties of soils. A discussion on the optical effects of space weathering is presented.
Derived from text
*Breccia; Micrometeorites; Regolith; Space Weathering; Asteroids*

**20040059599** Johns Hopkins Univ., Laurel, MD, USA
**Macroscopic Voids in Small Asteroids: Effects of Cohesion**
Cheng, A. F.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The NEAR mission found surprisingly low densities for the C-asteroid Mathilde and the S-asteroid Eros, lower than bulk densities of likely meteorite analogs. A key question is whether there is significant macroscopic void space between major structural components of asteroids, which may cause the asteroid bulk densities to be significantly less than that of the components. If fines can drain into fractures, as appears to be the case at the surface of Eros, then the structural components must be underdense compared with meteorite analogs. Previous analyses have shown that friction does not prevent fines from filling fractures, but previous work has not considered cohesion. This paper shows that for fines to drain into the deep interior of an asteroid the size of Eros, the cohesion must be much smaller than that of lunar soils. The required cohesion to prevent filling of fractures decreases further for smaller asteroids. At the 400-meter mean diameter of 25143 Itokawa, which will be visited by MUSES-C in 2005, the cohesion can be up to approximately 10(exp -3) of lunar values, or else fines cannot fall into cracks. A low density is therefore predicted for S-type Itokawa, less than or comparable to that of Eros, as Itokawa must have been shattered by impacts or perhaps turned into a rubble pile.
Derived from text
*Cohesion; Fractures (Materials); Meteoritic Composition; Eros Asteroid*

**20040059600** Academy of Sciences (USSR), Moscow, USSR
**Migration Processes and Volatiles Inventory to the Inner Planets**
Marov, M. Y.; Ipatov, S. I.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592
Contract(s)/Grant(s): NAG5-10776; RFBR-02-02-16165; RFBR-01-02-17540; INTAS-00-240; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Comets and asteroids colliding with the terrestrial planets can deliver volatiles and organic or prebiotic compounds to the planets, thereby depositing on the planets the fundamental building-blocks for life. The inner planets contain heavier and cosmically less abundant elements in an iron-silicate matrix than the giant planets. This can be caused by the following three mechanisms: uneven fractionation and condensation in the accretionary disk; unequal degree of degassing of the composed matter; and heterogeneous accretion. Asteroid-size bodies consisting of the last low-temperature condensates (similar to most primitive chondritic meteorites, and enriched in hydrated silicates and trapped gases) are believed to have fallen onto the inner planets during the process of the giant planets formation. The relative contribution of either endogenous (i.e. outgassing) or exogenous (i.e. asteroid/comet collisions) sources is difficult to assess, although it is constrained by the pattern of noble gas abundances in the planetary atmospheres.
Derived from text
*Terrestrial Planets; Volatility; Asteroid Collisions; Gas Giant Planets; Inventories; Exobiology*

**20040059601** Southwest Research Inst., Boulder, CO, USA
**Ejecta Generation and Redistribution on 433 Eros: Modeling Ejecta Launch Conditions**
Durda, D. D.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The NEAR-Shoemaker mission to asteroid 433 Eros presents an unprecedented opportunity to gain fundamental new

knowledge about the processes governing regolith formation and redistribution on small bodies. NEAR-Shoemaker's high resolution imaging of the surface of Eros makes the asteroid a valuable and heretofore unparalleled laboratory for the detailed study of impact ejecta reaccretion and regolith redistribution on low-gravity (of order 10(exp -3) g) objects. Regolith is produced on asteroids by impact cratering, and the existence of regolith on the smallest solar system bodies supports the view that some of the ejecta from impact events on such objects may be retained. Impact craters and retained ejecta on low gravity objects like Eros represent valuable natural laboratories for evaluating various models of impact cratering processes, since they may present crater structures or ejecta features that either do not form or are hidden on higher-gravity bodies like the Moon. Further, quantifying the extent to which impact processes generate and redistribute regoliths on small body surfaces (excavation depths, retained fraction, turnover timescales, etc.) is pivotal to the issue of how to relate meteoritical samples to their asteroidal parent bodies when surficial processes (i.e., space weathering ) may disguise or cover up underlying material and confound the ability of remote sensing techniques to provide reliable mineralogical assays of the parent objects. The rich variety of data on Eros regolith properties and distribution returned by NEAR-Shoemaker now require detailed analysis in order to take full advantage of the clues these observations offer for elucidating details of the impact cratering process on small bodies. Complicating simple interpretations of crater and ejecta morphology are dynamical effects on ejecta emplacement resulting from Eros irregular shape, rapid (5.27 hr) rotation, and low gravity. It is shown that the very different ejecta deposit morphology that can result if the effects of rotation alone are neglected. Considering the additional complicating factors of Eros irregular shape and complex gravitational field, simple calculations of the extent and thickness of ejecta blankets and the spatial distribution of ejecta blocks from basic crater scaling laws or numerical hydrocodes alone do not suffice. In order to fully interpret the suite of NEAR-Shoemaker observations of regolith features across the surface of Eros and to evaluate various impact models for specific craters on the asteroid, detailed dynamical modeling of the deposition of crater ejecta from those craters is required. Here, I describe some modifications and improvements to the dynamical model being used for these studies.

Derived from text

*Ejecta; Eros Asteroid; Near Earth Asteroid Rendezvous Mission; Dynamic Models; Launching*

**20040059602** Massachusetts Inst. of Tech., Cambridge, MA, USA

**Diversity of Types of Hydrated Minerals on C-Class Asteroids**

Rivkin, A. S.; Howell, E. S.; Bus, S. J.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The C class asteroids include many large asteroids: 1 Ceres, 2 Pallas, and 10 Hygiea (three of the four largest) are members of the C class or related subclasses. The Themis family, one of the largest and longest recognized asteroid dynamical families is also composed of C class asteroids. Numerically, the C class and related asteroids dominate the asteroid belt as a whole. Understanding these asteroids is essential to under standing the asteroid belt as a whole. Absorption features in the 3 micron region are diagnostic for water-and hydroxl-bearing minerals (hereafter 'hydrated minerals') on airless, rocky bodies like the asteroids. Although hydrated minerals have been found on members of practically every asteroid spectral class, the C-class asteroids in particular have the deepest features and the largest fraction of hydrated members. The carbonaceous chondrite meteorites are the best analogs to the C asteroids. These common meteorites also often contain hydrated minerals to the C asteroids. Rivkin et al. adapted techniques developed for spectral studies of carbonaceous chondrites to measure the H/Si ratio in 16 C class asteroids, finding many of the hydrated ones to have H/Si ratios consistent with the hydrated CM type carbonaceous chondrites. The data in that study were taken using the UK Infrared Telescope (UKIRT) from 1996 2000. Additional data have been taken over the last two years using SpeX on the IRTF. Inspection of the spectra reveals that there are two different band shapes in the 3-micron region for C-class asteroids, shown. While most of the bodies with detectable 3-micron absorptions have band shapes like 2 Pallas and 48 Doris (and consistent with CM meteorites), there are also several asteroids with shapes like 1 Ceres. Before recent observations, it was thought that Ceres had a unique band shape among asteroids. However, we have found that it is shared by the asteroids 10 Hygiea and 24 Themis, as well as others. This band shape is unknown in the meteorites, and has been attributed to either ammonium-bearing phyllosillicates or a thin water ice frost. Neither one was necessarily expected on asteroid surfaces. The asteroids involved are important ones for a number of reasons: the Themis family is thought to provide a significant fraction of zodiacal dust and IDPs and understanding the surface mineralogy of Themis will help us place IDP samples in context. Ceres is by far the largest asteroid, and it is unclear whether its history and composition is unusual as a result. It is shown that the distribution of the different band shapes with semi major axis. Although the sample size is still small, the objects with Ceres like band shapes appear to be concentrated at a few specific places while the Pallas like objects are spread throughout the belt. We will present these data and discuss the cause of the Ceres

like band shape, and possible causes for the distribution of these two classes of hydrated asteroids.
Derived from text
*Asteroids; Mineralogy; Hydration; Planetary Geology; Asteroid Belts*

**20040059603** NASA Johnson Space Center, Houston, TX, USA
**What are the P-type Asteroids Made Of?**
Hiroi, T.; Pieters, C. M.; Rutherford, M. J.; Zolensky, M. E.; Sasaki, S.; Ueda, Y.; Miyamoto, M.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592
Contract(s)/Grant(s): NAG5-12847; NAG5-13609; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The P-type asteroids, together with the D asteroids, had been believed to be one of the most primitive asteroid classes having surface materials rich in carbon and/or organics. Upon a fall of a new type of meteorite, Tagish Lake in 2000, we came to have a possible sample of the D (and/or T) asteroids. In both spectrally and distance from the sun, the P asteroids are located in between the C/G/B/F asteroids and the D asteroids. Because it is believed that the former group are similar to (thermally metamorphosed) CI/CM chondrites and the latter the Tagish Lake meteorite, the surface material of the P asteroids may be understood in combination of those two meteorite groups. Taking that direction, this paper presents possibly the first quantitative characterization of the P asteroids in terms of carbonaceous chondrites and their experimental derivatives.
Author
*Asteroids; Meteoritic Composition*

**20040059604** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Multi-Wavelength Observations of 2100 Ra-Shalom: Radar and Lightcurves**
Shepard, M. K.; Clark-Joseph, B. E.; Benner, L. A. M.; Giorgini, J. D.; Kusnirak, P.; Margot, J.-L.; Nolan, M. C.; Ostro, S. J.; Pravec, P.; Sarounova, L., et al.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 1 pp.; In English; See also 20040059592
Contract(s)/Grant(s): A3003204; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We conducted a multi-wavelength campaign to study the near-Earth asteroid (NEA) 2100 Ra-Shalom during its August 2003 encounter. Rotationally resolved observations were acquired at Arecibo (12.6 cm radar), the IRTF (0.8-2.5 micron and 3 micron), McDonald Observatory (0.48-0.92 micron), Palomar Observatory (8-15 micron), and Ondrejov Observatory (optical lightcurves). Our objectives were to determine Ra-Shalom's size and shape, and the composition and physical state of its near-surface material. Preliminary results from radar and lightcurve measurements will be presented here.
Author
*Near Earth Objects; Light Curve; Radar Measurement; Asteroids*

**20040059605** California Univ., Los Angeles, CA, USA
**Sodium Overabundance in Meteoroids from Meteor Spectroscopy**
Trigo-Rodriguez, J. M.; Llorca, J.; Lunar and Planetary Science XXXV: Asteroids, Meteors, and Comets; 2004; 2 pp.; In English; See also 20040059592; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The relative abundances of Na in meteoroids have been estimated by averaging the composition of the radiating gas along the fireball path produced during their atmospheric entry. We used the method of thermal equilibrium for thirteen fireballs produced by meteoroids mainly of cometary origin. The results show greater sodium abundances than those expected for IDPs and chondritic meteorites, and interesting differences with the sodium abundance of 1P/Halley comet dust has been found.
Derived from text
*Abundance; Meteoroids; Sodium; Spectroscopy*

**20040059765** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059766 - 20040059786
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Lunar Remote Sensing: Fire, Ice, and Regolith' included the following:Compositional and Structural Study of the Aristarchus Plateau from Integrated UV-VIS-NIR Spectral Data; Clementine 2.7-?m Data: Mapping the Mare and Searching for Water; On the Search for Water at the Lunar Poles: Results of Forward Modeling of Permanently Shaded Areas and Lunar Prospector Measurements; Searching the Moon for Aluminous Mare Basalts Using Compositional Remote-Sensing Constraints I: Finding the Regions of Interest; Semi-automated Extraction of Contours from Lunar Topographic Maps; Basalts in Mare Humorum and S.E. Procellarum; The Hansteen and Helmet Volcanic Dome Regions on the Moon: Stratigraphy and Ages; Derivation of Elemental Abundance Maps at 15-km Spatial Resolution from the Merging of Clementine Optical and Lunar Prospector Geochemical Data; Remote Sensing and Geologic Studies of the Balmer Region of the Moon; Lava Flows in Mare Nubium and Mare Cognitum: A Geological History Based on Analysis of Multispectral Data; Development of Ground-based Lunar VIS/NEAR IR Spectral Imager; A BRDF Measurement Apparatus for Lab-based Samples; A New Source of High Resolution Lunar Images: Amateur Astronomers! ; Leakage of Gamma Rays and Neutrons from Thick Targets Bombarded by Energetic Protons; Progress on Reviving Lunar Orbiter: Scanning, Archiving, and Cartographic Processing at USGS; Modeling Lateral and Vertical Mixing by Impact Cratering with Applications for the Moon; Optical Maturity Study of Stuart#s Crater Candidate Impact; Evidence for Three Basins Beneath Oceanus Procellarum; and Ellipses of the South Pole-Aitken Basin: Implications for Basin Formation.
Derived from text
*Topography; Lunar Exploration; Lunar Surface; Remote Sensing*

**20040059766** Massachusetts Inst. of Tech., Cambridge, MA, USA
**Ellipses of the South Pole-Aitken Basin: Implications for Basin Formation**
Garrick-Bethell, I.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The South Pole-Aitken (SPA) basin is believed to have stripped away a portion of the Moon's upper crust, possibly exposing mantle material. The SPA basin is characterized by a topographic depression, iron enriched mafic material, and higher thorium abundances than the surrounding Feldspathic Highland Terrane. The shape of SPA s topography, iron, and thorium features can give insight into how the basin was formed, and how the thorium was emplaced. Fitting ellipses to these features provides a quantitative method for characterizing their shapes. quantitative method for characterizing their shapes. The topography map of the Moon used is the 0.25 degree/pixel resolution map from the Clementine laser altimeter. The thorium and iron abundance maps are 0.5 degree/pixel maps produced by the Lunar Prospector gamma-ray spectrometer. The ellipse fitting methods are summarized.
Derived from text
*Ellipses; Structural Basins; Moon; Lunar Topography; Planetary Geology*

**20040059767** Notre Dame Univ., IN, USA
**Searching the Moon for Aluminous Mare Basalts Using Compositional Remote-Sensing Constraints I: Finding the Regions of Interest**
Kramer, Georgiana Y.; Jolliff, Bradley L.; Neal, Clive R.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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 high-Al basalts returned from the Moon are not high in alumina by terrestrial basaltic standards; however, they are characterized by the highest alumina contents of lunar basalts (12 to 15 wt% Al2O3). Other key oxide concentrations include MgO=7-12 wt%, FeO=13-17 wt%, TiO2=1.5-3 wt%, and Th concentrations are 0.1-3 ppm. The high-Al basalts have a relatively narrow range in major element composition, one that can be modeled with simple fractional crystallization. However, Dickinson et al. and Shervais et al. noted the incompatible trace element concentrations display an eight-fold increase between the lowest and highest abundances, and require a more complex petrogenetic model. From the work of Papanastassiou & Wasserburg, Barnes et al., Compston et al., Nyquist et al., Taylor et al., Dasch et al., Shih & Nyquist and Dasch et al., the high-Al basalt ages of 13 samples returned from the Fra Mauro region by Apollo 14 were found to fall into one of three age groups: 3.9 Ga, 4.1 Ga, and 4.3 Ga. Using isotopic and trace element data, Kramer and Neal modeled three distinct melting events of a common source and subsequent assimilation and fractional crystallization (AFC) to produce the high-Al basalts. They also demonstrated that these basalts are true basalts and not impact melts. In addition to Apollo 14 samples, the Soviet Union Luna 16 mission returned high-Al basalts from Mare Fecunditatis. These basalts differ from the Apollo 14 basalts in their higher TiO2 content (up to 6 wt%) and greater abundance of light REE compared to their heavy REE. Luna 16 high-Al basalts were also found to be younger than Apollo 14 high-Al basalts, approximately 3.4 Ga. Apollo

12 also returned one aluminous basalt fragment (12038) that was dated at 3.1 Ga. The old ages of the Apollo 14 aluminous basalt clasts coupled with the fact that they occur as clasts in breccias probably formed by the Imbrium impact suggests that they could be a significant component of ancient basalts that are now buried beneath impact deposits (cryptomare). The existence of younger aluminous basalts in the Apollo 12 samples and at the Luna 16 site suggests that aluminous basaltic volcanism spanned over a billion years. Despite the occurrence of samples within the collection, however, the extent of aluminous basaltic volcanism is poorly known. They are difficult to distinguish owing to (1) burial and disruption of flows that predate some of the large impacts and (2) similarity of their compositions to mixtures of Fe-rich mare basalts and aluminous nonmare materials. In this abstract, we present an approach using compositional remote sensing to search for regions that might contain significant amounts of aluminous basalts. In a companion abstract, we evaluate several candidate regions.
Derived from text
*Aluminum Oxides; Basalt; Lunar Maria; Moon; Remote Sensing; Volcanology*

**20040059768** Hawaii Univ., Honolulu, HI, USA
**Remote Sensing and Geologic Studies of the Balmer Region of the Moon**
Hawke, B. R.; Gillis, J. J.; Giguere, T. A.; Blewett, D. T.; Lawrence, D. J.; Lucey, P. G.; Smith, G. A.; Spudis, P. D.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Balmer region is located just east of Mare Fecunditatis on the east limb of the Moon. The region is centered on the Balmer basin which is a pre-Nectarian impact structure that exhibits two rings, approximately 210 and 450 km in diameter. This impact basin played a major role forming the topography of the region. The interior of the basin exhibits extensive light plains deposits of Imbrian and Nectarian age. Wilhelms and El-Baz described these light plains units as part of a Young Volcanic Province that may have been produced by an episode of non-mare volcanism. Support for this hypothesis was provided by Haines et al.. These workers identified a Th enhancement associated with selected light plains deposits in the Balmer region. Additional studies of the Apollo orbital chemistry data sets identified a variety of geochemical anomalies in the Balmer region. The association of exogenic dark-haloed craters (DHCs) with light plains deposits that exhibit mafic chemical anomalies has been cited as evidence of ancient mare volcanism in the region. We have used Clementine multispectral images, Lunar Prospector (LP) gamma ray spectrometer (GRS) data, and a variety of spacecraft imagery to investigate the composition and origin of geologic units in the Balmer basin region. The goals of this study include the following: 1) To search for geochemical anomalies in the region and determine their origins; 2) To identify and map the distribution of DHCs in the region; 3) To search for possible cryptomare and to investigate the processes responsible for their formation; 4) To determine the compositions and ages of any buried mare units; 5) To investigate the origin of the light plains deposits in the Balmer region.
Author
*Lunar Craters; Lunar Geology; Lunar Composition; Lunar Maria*

**20040059769** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**The Hansteen and Helmet Volcanic Dome Regions on the Moon: Stratigraphy and Ages**
Wagner, R.; Head, J. W., III; Wolf, U.; Neukum, G.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Emplacement of basaltic low viscosity mare materials was the dominant volcanic process on the Earth's moon. A spatially less abundant mode of volcanic activity is associated with domical features formed by lava materials of much higher viscosity. These volcanic domes are morphogically and spectrally distinct from their surrounding mare or highland materials. The domes are termed red spots and are spectrally characterized by (1) high albedo, (2) a strong absorption in the ultraviolet, and also (3) by a wide range of morphologies. From photogeologic mapping and measuring crater frequencies on these domes and associated units, we expect to put constraints on the crustal evolution throughout the Imbrian and Eratosthenian periods of lunar geologic history.
Derived from text
*Cones (Volcanoes); Moon; Stratigraphy; Volcanoes; Geochronology; Domes (Geology); Lunar Geology*

**20040059770** Mount Hebron High School, Ellicott City, MD, USA
**Modeling Lateral and Vertical Mixing by Impact Cratering with Applications for the Moon**
Agrawal, A.; Barnouin-Jha, O, S.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On planets such as the Moon, where no liquid water and atmosphere are present, the formation of craters are one of the main processes by which planetary surfaces change over time. These craters are the primary contributors to mixing among different geological units. During the cratering process, excavated ejecta comprised of material from one geological unit can be thrown laterally to obscure a contact between a neighboring unit. In addition, a geological unit present at depth, but obscured by the thin surface unit could be transported vertical by this same impact to further complicate the relationship between the surface units observed. A better understanding of how such lateral and vertical mixing occurs on the Moon could be useful in further deciphering the history of the surface of this planet. We have begun a simple numerical modeling effort to investigate how lateral and vertical mixing via cratering might operate, in order to re-evaluate how factors such as crater size, pre-exiting thickness of geological units, and the efficiency of secondary cratering might influence the evolution of boundaries between geological units.
Author
*Lunar Geology; Lunar Craters; Cratering; Mixing*

**20040059771** University Coll., London, UK
**Lava Flows in Mare Nubium and Mare Cognitum: A Geological History Based on Analysis of Multispectral Data**
Bugiolacchi, R.; Spudis, Paul D.; Guest, John E.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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 geological map of the Nubium/ Cognitum Maria region (0-30 deg. W, 0-30 deg. S) is produced together with new compositional and morphological data derived from Clementine multispectral images. Most of the exposed maria unit flows are identified, outlined, and classified according to their titanium and iron weight percentage content and their estimated age. Minerals with spectral absorption bands centered near 1 micron are also revealed by use of filter ratios (750/950 nm), and help identify late extrusive materials, fresh impact ejecta, and newly exposed regolith. Compositional variations in the ejecta blankets of several craters are used to estimate the maximum mare thickness at the time of impact.
Author
*Lava; Lunar Maria; Fluid Flow; Lunar Composition; Thematic Mapping*

**20040059772** Image Again, Middletown, NJ, USA
**Evidence for Three Basins Beneath Oceanus Procellarum**
Byrne, C. J.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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

Oceanus Procellarum is the largest area of mare surface on the Moon. It is unusual not only because of its size but because of its shape, roughly in the form of an arc. There once was a consensus that Oceanus Procellarum flooded part of the floor of a great basin, first named the Gargantuan basin and then the Procellarum basin. This theory was called into question with a proposal that flooding of an outer trough of the Imbrium multi-ringed basin formed Oceanus Procellarum.
Derived from text
*Lunar Maria; Oceans; Moon*

**20040059773** Nottingham Univ., UK
**Semi-automated Extraction of Contours from Lunar Topographic Maps**
Willoughby, N. J.; Cook, A. C.; Robinson, M. S.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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

Lunar Topophotomaps generated using the Metric (200m contours and 10-20m spatial resolution) and Panoramic (20-10m contours and 1-2m spatial resolution) cameras on board Apollo's 15, 16, and 17 together cover approx. 20% of the lunar surface. However few of these maps have been converted into digital elevation models (DEMs). The two existing methods of paper map to DEM conversion involve either manual digitizing tables, or the use of contour map raster to vector digitization packages / companies. The former is both slow and labour intensive and may take an operator a week or more to correctly digitize all the contours on one map sheet. The latter can be expensive, is not fully automated, and is usually intended for maps with a plain background, not photomaps. We describe a low cost software package, LTMD (Lunar Topographic Map Digitizer) that will enable conventional A4 sized flat bed scanners to transfer lunar topographic maps (1:50,000-1:10,000) into DEMs

with a high degree of automation. This abstract describes the characteristics of the lunar topographic maps, the methods that we are using to digitize these maps, and the progress made to date.
Author
*Lunar Maps; Digital Elevation Models; Computer Aided Mapping; Relief Maps; Digital Techniques; Applications Programs (Computers)*

**20040059774** Observatoire de Midi-Pyrenees, Toulouse, France
**Optical Response and Surface Physical Properties of the Lunar Regolith at Reiner Gamma Formation from Clementine Orbital Photometry: Derivation of the Hapke Parameters at Local Scale**
Pinet, P. C.; Cord, A.; Chevrel, S.; Daydou, Y.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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

In the last decade, integrated telescopic and spaceborne photometric observation of planetary regolith has progressively evolved from whole-disk toward disk-resolved measurements at regional scales, and more recently toward local scale studies. Intriguing areas named swirls have been identified for long as they display regional and local anomalous photometric behaviors. In particular, previous investigations conducted from UVVIS telescopic and Clementine spectral images have established the peculiar optical behavior of the lunar regolith at Reiner Gamma Formation. We present here the derivation of the set of Hapke parameters for this area, using a multiangular dataset derived from Clementine orbital imaging.
Author
*Lunar Surface; Photometry; Ultraviolet Astronomy; Surface Properties; Regolith*

**20040059776** NovaSol, Honolulu, HI, USA
**Optical Maturity Study of Stuart's Crater Candidate Impact**
Blewett, D. T.; Hawke, B. R.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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

Optical maturity (OMAT) images are an important a tool for investigating features on the lunar surface whose origins are related to maturity and albedo. An interesting case is 'Stuart's crater', whose formation may have been photographed by an amateur astronomer half a century ago. Buratti and Johnson used a Clementine ratio image to identify a particular feature as a candidate impact for the flash photographed by L. H. Stuart in 1953. Other workers have cast doubt on the interpretation. We employ Clementine optical maturity and compositional images to carry out further study of the candidate Stuart's crater and the geology of the area where the flash occurred.
Author
*Lunar Craters; Ultraviolet Astronomy; Lunar Photographs*

**20040059777** MacAlester Coll., Saint Paul, MN, USA
**Ideal Landing Sites near the Lunar Poles**
Fristad, K.; Bussey, D. B. J.; Robinson, M. S.; Spudis, P. D.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent studies have indicated that there are areas of permanent shadow and possibly also permanent illumination in the region surrounding the lunar poles. These facts, in addition to the possible presence of volatiles, make the lunar poles the ideal locations for future landing sites.
Author
*Lunar Landing Sites; Polar Regions; Site Selection*

**20040059779** Miyagi Univ. of Education, Japan
**Development of Ground-based Lunar VIS/NEAR IR Spectral Imager**
Matsushita, M.; Takata, T.; Ikeda, Y.; Hirao, N.; Saito, M.; Chiba, Y.; Takeyama, Y.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In order to obtain 3dimentional spectral images of mare on the nearside of the moon, we have developed a ground based

Lunar Spectral Imager. It focuses on the absorption band of 950 nm. The resolutions of the space and the wavelength are 9 km and 10 nm (VIS), and 20 km and 20 nm (IR).
Author
*Near Infrared Radiation; Absorption Spectra*

**20040059780** Hawaii Univ., Honolulu, HI, USA
**Clementine 2.7-Micron Data: Mapping the Mare and Searching for Water**
Gillis, J. J.; Lucey, P. G.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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 Clementine Mission acquired nearly global data with a near infrared (NIR) camera, which included 6 wavelengths of data (1.1, 1.25, 1.5, 2.0, 2.6, and 2.7 micron). The Herculean task of calibrating the NIR data is nearly complete. The data are of sufficient quality to allow first order scientific examination. A full description of the data calibration techniques and error analysis are provided in other papers presented at this conference. recognized. Flow units of various compositions become readably detectable. The 2.7 micron image makes the task of mapping mare basalt units, which typically have similar reflectance and low relief, much easier. These data may also help with understanding how factors other than ilmenite content in the maria affect UVVIS color. And last, the 2.7 mm data allow easier separation
Derived from text
*Near Infrared Radiation; Clementine Spacecraft; Calibrating; Water*

**20040059781** Geological Survey, Flagstaff, AZ, USA
**Progress on Reviving Lunar Orbiter: Scanning, Archiving, and Cartographic Processing at USGS**
Becker, T.; Weller, L.; Gaddis, L.; Soltesz, D.; Cook, D.; Bennett, A.; Galuszka, D.; Redding, B.; Richie, J.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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

Lunar Orbiter (LO) images were photographic products acquired on the spacecraft in five missions (LO-I through -V) while in orbit over the lunar surface in the late 1960's. LO data were transmitted to Earth as analog data after onboard scanning of the original film into a series of strips. We report on our ongoing effort to digitize, archive, and process a subset of these LO photographic data. The results of this work will be a global, cartographically accurate, cosmetically enhanced, digital photographic mosaic of the Moon. This LO mosaic will be coregistered to the Clementine 750-nm global mosaic. In addition to digitizing medium- and high-resolution LO data for global coverage, we are now scanning and processing a selected subset of the very high-resolution (VHR) data acquired by LO missions III and V.
Author
*Lunar Photographs; Data Storage; Lunar Maps*

**20040059782** Kharkov State Univ., Ukraine
**Derivation of Elemental Abundance Maps at 15-km Spatial Resolution from the Merging of Clementine Optical and Lunar Prospector Geochemical Data**
Shkuratov, Y.; Pinet, P.; Omelchenko, V.; Kaydash, V.; Stankevich, D.; Chevrel, S.; Daydou, Y.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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

Information about abundance of major elements (e.g, O, Fe, Ti, and Al) in the lunar surface has been obtained with the Lunar Prospector gamma ray (GRS) and neutron spectrometers. The data were presented as preliminary maps with sizes of pixels 150 km x 150 km at the equator. Unfortunately, this resolution is insufficient for regional applications in lunar geology. We develop in the following a methodology alleviating this problem by combining high resolution optical mineralogy data with GRS data. For this purpose an empirical technique is implemented to interpolate available GRS data using Clementine Spectral Reflectance (CSR) images acquired with UVVIS camera. The main idea is to use low resolution GRS data as a Ground Truth to establish relationships linking optical and geochemical information on the basis of the maximum of correlation, which permit the derivation of elemental abundance maps with intermediate spatial resolution, approximately 15 km.
Derived from text
*Geochemistry; Lunar Prospector; Spatial Resolution; Lunar Geology; Lunar Maps; Abundance; Trace Elements*

**20040059783** Los Alamos National Lab., NM, USA

**On the Search for Water at the Lunar Poles: Results of Forward Modeling of Permanently Shaded Areas and Lunar Prospector Measurements**

Elphic, R. C.; Lawrence, D. J.; Feldman, W. C.; Bussey, D. B. J.; Spudis, P. D.; Lucey, P. G.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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

Cold-trapped volatiles at the lunar poles would provide extremely valuable scientific information stretching back to the early solar system, and are also a potential resource for use in long-term human exploration. While Clementine radio science data was interpreted in favor of the presence of lunar polar ice, this has been disputed. Nevertheless, it is clear that there are polar enhancements of hydrogen, and it has been argued that these are in the form of shallowly buried ice. The Lunar Prospector neutron spectrometer data currently provides the most severe constraints on how much water may be present in the Moon's polar regions, and where it may be found. But how do the neutron spectrometer data compare to what we know of permanently shadowed areas at the lunar poles?

Derived from text

*Water; Lunar Surface; Polar Regions; Moon; Digital Elevation Models*

**20040059784** University Coll., London, UK

**Basalts in Mare Humorum and S.E. Procellarum**

Hackwill, Terence; Guest, John; Spudis, Paul; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The presence of basaltic lava flows on the surface of the moon is indicative of volcanic activity and study of their sequence of eruption and volumes may help to indicate the amount of heating required to produce them. We have studied the mare basalts of Mare Humorum and S.E.Procellarum (30 deg. W - 50 deg. W, 0 - 40 deg. S) using Clementine and Lunar Orbiter IV images to age the basaltic units and indicate their depths. This is part of a larger, on-going project that is being coordinated by P.D.Spudis using the same method to assess the history and depth or eruptions for all of the mare on the lunar surface.

Author

*Lunar Maria; Basalt; Geochronology; Lunar Geology*

**20040059785** Observatoire de Midi-Pyrenees, Toulouse, France

**Compositional and Structural Study of the Aristarchus Plateau from Integrated UV-VIS-NIR Spectral Data**

Chevrel, S. D.; Pinet, P. C.; Daydou, Y.; Baratoux, D.; Costard, F.; LeMouelic, S.; Langevin, Y.; Erard, S.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Fire, Ice, and Regolith; 2004; 2 pp.; In English; See also 20040059765; 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 Aristarchus Plateau is one of the most complex region on the Moon. It is an old rectangular elevated crustal block about 170x220 km, with its west and east borders approximately concentric to the Imbrium basin, surrounded by younger mare basalts of Oceanus Procellarum. The Plateau shows extensive dark mantling deposit (DMD) of volcanic pyroclastic origin, cratering (Aristarchus crater; 40 Km wide), and mare basalt flooding. This region is important to understand the nature of the lunar crust and its relation with the early volcanism. Data analysis of the integrated UV-VIS-NIR spectra is summarized.

Derived from text

*Plateaus; Volcanology; Ultraviolet Spectra; Visible Spectrum; Mineralogy; Data Processing; Lunar Geology*

**20040059790** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Impact-Related Deposits**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059791 - 20040059810

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Impact-Related Deposits' included:Evidence for a Lightning-Strike Origin of the Edeowie Glass; 57Fe M ssbauer Spectroscopy of Fulgurites: Implications for Chemical Reduction; Ca-Metasomatism in Crystalline Target Rocks from the Charlevoix Structure, Quebec, Canada: Evidence for Impact-related Hydrothermal Activity; Magnetic Investigations of

Breccia Veins and Basement Rocks from Roter Kamm Crater and Surrounding Region, Namibia; Petrologic Complexities of the Manicouagan Melt Sheet: Implications for 40Ar-39Ar Geochronology; Laser Argon Dating of Melt Breccias from the Siljan Impact Structure, Sweden: Implications for Possible Relationship to Late Devonian Extinction Events; Lunar Impact Crater, India: Occurrence of a Basaltic Suevite?; Age of the Lunar Impact Crater, India: First Results from Fission Track Dating; The Fluidized Chicxulub Ejecta Blanket, Mexico: Implications for Mars; Low Velocity Ejection of Boulders from Small Lunar Craters: Ground Truth for Asteroid Surfaces; Ejecta and Secondary Crater Distributions of Tycho Crater: Effects of an Oblique Impact; Potassium Isotope Systematics of Crystalline Lunar Spherules from Apollo 16; Late Paleocene Spherules from the North Sea: Probable Sea Floor Precipitates: A Silverpit Provenance Unproven; A Lithological Investigation of Marine Strata from the Triassic-Jurassic Boundary Interval, Queen Charlotte Islands, British Columbia, Including a Search for Shocked Quartz; Triassic Cratered Cobbles: Shock Effects or Tectonic Pressure?; Regional Variations of Trace Element Composition Within the Australasian Tektite Strewn Field; Cretaceous-Tertiary Boundary Microtektite-bearing Sands and Tsunami Beds, Alabama Gulf Coastal Plain; Sand Lobes on Stewart Island as Probable Impact-Tsunami Deposits; Distal Impact Ejecta, Uppermost Eocene, Texas Coastal Plain; and Continental Impact Debris in the Eltanin Impact Layer.
Derived from text
*Craters; Ejecta; Geochronology*

**20040059791** Barnard Coll., New York, NY, USA
**Continental Impact Debris in the Eltanin Impact Layer**
Petreshock, K.; Abbott, D.; Glatz, C.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy

There are about 165 known terrestrial craters on earth, 80% of which were formed on continental crust. Because the ocean floor covers about 60% of the Earth's surface, it is expected that many deep-ocean impact craters exist. The Eltanin crater, located in the Bellinghausen Sea, south of the Pacific Ocean, is a possible result of an abyssal oceanic impact event of the late Pliocene. It is centered at 53 deg. 7 min S, 90 deg. 1 min. W with an estimated diameter of 132 5 km. The Eltanin impact layer was first discovered as an Iridium anomaly in 1981. Meteoritic fragments of a basaltic achrondite were found in sediment cores. Ni-rich spherules, like those found in the Chixculub impact have also been found in cores. Samples from the cores ELT 13-4 and ELT 13-3 are accepted to be part of this oceanic impact layer. These cores showed the original Iridium anomalies. An additional four Conrad cores (RC18-33, RC12-230, RC12-228, and RC17-211) are believed to be a part of the Eltanin layer because they have the same biostratigraphic date, are 1 to 7 meters thick, and have high magnetic susceptibility. Two of these cores have tektites within the layer of high magnetic susceptibility. We report on findings suggestive of impact origin for the layer in RC18-33 and on associated continental impact debris in core ELT13-4.
Derived from text
*Debris; Hypervelocity Impact; Lunar Craters; Earth Crust; Meteoritic Composition*

**20040059797** Tennessee Univ., Chattanooga, TN, USA
**Potassium Isotope Systematics of Crystalline Lunar Spherules from Apollo 16**
Symes, S. J.; Alexander, C. M. OD.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Crystalline lunar spherules (CLS) are small, rounded silicate assemblages with diverse igneous textures and are found in 5-10 vol% abundances in Apollo 14 and 16 regolith breccias. CLS diameters are typically 40-500 microns, with 200 microns being very common. They are thought to have been formed as impact melt droplets that achieved their igneous textures as a result of slow cooling during flight. Their major element compositions do not match local soils or host breccia, suggesting that the CLS are chemically exotic to their respective sampling sites. To be consistent with these observations, it has been suggested that CLS derive from fairly large scale impact events capable of balistically transporting entrained melt droplets over large distances. (41)K/(39)K and (39)K/(27)Al ratios were measured with a Carnegie Cameca 6f ion microprobe. We used a 12.5-kV O-primary beam in the shaped or flat-bottomed illumination mode, a 10-kV secondary accelerating voltage, a 50-eV energy window, and a 100-micron field aperture. Primary beam currents were 4-6.5 nA and spot sizes were approx. 20 microns across. All analyses were preceded by a 5 minute presputter. Potassium isotopic measurements were made on plagioclase phenocrysts in the CLS. Instrumental mass fractionation was corrected by reference to clastic feldspars in the breccias themselves. The 1-sigma reproducibility of a standard glass was approx. 0.5 %. However, for reasons that are unclear, the reproducibility of the clastic plagioclases was much worse, with 1-sigma errors that are typically approx. 2-3%. Elemental

ratios were determined by ion microprobe using sensitivity factors measured on a BHVO basaltic glass.
Derived from text
*Potassium Isotopes; Spherules; Lunar Composition; Lunar Soil*

**20040059798** Kobe Univ., Japan
**Ejecta and Secondary Crater Distributions of Tycho Crater: Effects of an Oblique Impact**
Hirata, N.; Nakamura, A. M.; Saiki, K.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although it is well known that most impact events on planetary surfaces are oblique to some degree, our understandings on oblique impacts are not enough in past decades because of difficulties in theoretical modeling and laboratory experiments of oblique impacts. Recently, however, more improved works on oblique impact cratering with both theoretical and experimental methods make it possible to reveal the effects of impact angle on the cratering process. In an attempt to verify the recent results of theoretical and experimental studies, we have undertaken a new analysis on a lunar crater Tycho using remote sensing data. Tycho (85 km in diameter) is located on the southern nearside of the Moon (43 deg S, 349 deg E), and is one of the most typical craters formed by an oblique impact. The suggested impact angle is less than 30 deg, based on the asymmetric ejecta distribution and a subtle uprange offset of the central peak.
Author
*Tycho Crater; Ejecta*

**20040059803** Arizona Univ., Tucson, AZ, USA
**A Lithological Investigation of Marine Strata from the Triassic-Jurassic Boundary Interval, Queen Charlotte Islands, British Columbia, Including a Search for Shocked Quartz**
Patzer, A.; Kring, D. A.; Goodwin, D. H.; Ward, P. D.; Haggart, J. W.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We examined 42 thin sections of marine sedimentary rocks retrieved from Kennecott Point on Graham Island of the Queen Charlotte Islands (British Columbia, Canada). Kennecott Point harbors one of the best preserved and least disrupted stratigraphic sequences spanning the Triassic-Jurassic (T-J) boundary. The samples comprise thinly-bedded, alternating limy shales, silts, and mudstones with intermittent bands of greywacke, lithic arenite, and volcaniclastic micro-conglomerate. The strata are assigned to the Sandilands Formation (uppermost Norian, Hettangian, and Sinemurian) of the Kunga Group. They are believed to be silicified and, with respect to the shale, organic-rich. The sequence has been variously interpreted to represent a deep basin setting that includes turbidite deposits and as a shallow-marine, potentially shelf, environment.
Derived from text
*Lithology; Quartz; Strata; British Columbia; Islands; Marine Environments; Boundaries*

**20040059804** Glidden (M.), Industry, TX, USA
**Distal Impact Ejecta, Uppermost Eocene, Texas Coastal Plain**
Glidden, M.; King, D. T., Jr.; Pope, K. O.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790; Copyright; Avail: CASI; A01, Hardcopy

In this paper we report the occurrence of distal impact ejecta, within uppermost Eocene strata of the Texas coastal plain. The ejecta are redeposited within fluvial facies of the gently coastward-dipping Whitsett Formation and occur in point-bar and thalweg deposits in discontinuous beds and lenses along a 120 km trace of outcrop strike. These ejecta include shocked and non-shocked materials. Layers of volcanic ash provide the basis for an interpolated date of 33.8 Ma for the alluvium containing the ejecta (assuming continuous sedimentation between two ash layers dated at 33.7 Ma and 34.93 Ma). This interpolated date is for the lowermost occurrence of the ejecta, which are found at several intervals throughout a 30-meter section. As this age does not match any of the known impact structures in the region, there is as yet no candidate structure for the origin of these ejecta, which range from fine sand size to 3 cm. The He-3-enriched interval within upper Eocene strata of the global stratotype section (GSSP) at Massignano, Italy has been interpreted as evidence of an increased incidence of comet activity within the inner solar system with consequences for a number of impacts dating to that age. These structures include Chesapeake Bay, eastern U.S., Popigai, Russia, and other smaller structures (Mistastin, Logoisk, and Chyly), plus less well-documented structures including Kilmichael (Mississippi). The ejecta reported here apparently derived from none of these structures,

judging from ejecta size and age. We suggest a heretofore unrecorded impact, one whose structure may no longer exist, as the source for these ejecta whose unusual characteristics we describe herein.
Derived from text
*Coastal Plains; Ejecta; Texas; Strata; Hypervelocity Impact; Lithology*

**20040059805** Humboldt Univ., Berlin, Germany
**The Fluidized Chicxulub Ejecta Blanket, Mexico: Implications for Mars**
Schoenian, F.; Stoeffler, D.; Kenkmann, T.; Wittmann, A.; Lunar and Planetary Science XXXV: Impact-Related Deposits; 2004; 2 pp.; In English; See also 20040059790
Contract(s)/Grant(s): DFG-GRK-503; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Fluidized ejecta blankets have been a principal argument for the existence of water or ice on Mars. Some authors suggested that these ejecta morphologies might be produced by turbulent atmospheric flows induced by ring vortices developing behind the advancing ejecta curtain and compare them to the ejecta outflows on Venus. The only known example of an ejecta blanket on Earth reaching runout distances similar to Mars and Venus (approx. 3 and >9 crater radii respectively) is that of the Chicxulub impact structure ( 180 km, 65 Ma). Its ejecta blanket could be traced up to distances of 5 crater radii. Since both a dense atmosphere and volatiles (water), are present on Earth, the Chicxulub ejecta blanket can provide field control on the processes of ejecta fluidization.
Derived from text
*Turbulent Flow; Mars (Planet); Water; Ejecta*

**20040059867** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Venus**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059868 - 20040059885
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Venus' included the following reports:Preliminary Study of Laser-induced Breakdown Spectroscopy (LIBS) for a Venus Mission; Venus Surface Investigation Using VIRTIS Onboard the ESA/Venus Express Mission; Use of Magellan Images for Venus Landing Safety Assessment; Volatile Element Geochemistry in the Lower Atmosphere of Venus; Resurfacing Styles and Rates on Venus: Assessment of 18 Venusian Quadrangles; Stereo Imaging of Impact Craters in the Beta-Atla-Themis (BAT) Region, Venus; Depths of Extended Crater-related Deposits on Venus ; Potential Pyroclastic Deposit in the Nemesis Tessera (V14) Quadrangle of Venus; Relationship Between Coronae, Regional Plains and Rift Zones on Venus, Preliminary Results; Coronae of Parga Chasma, Venus; The Evolution of Four Volcano/Corona Hybrids on Venus; Calderas on Venus and Earth: Comparison and Models of Formation; Venus Festoon Deposits: Analysis of Characteristics and Modes of Emplacement; Topographic and Structural Analysis of Devana Chasma, Venus: A Propagating Rift System; Anomalous Radial Structures at Irnini Mons, Venus: A Parametric Study of Stresses on a Pressurized Hole; Analysis of Gravity and Topography Signals in Atalanta-Vinmara and Lavinia Planitiae Canali are Lava, Not River, Channels; and Formation of Venusian Channels in a Shield Paint Substrate.
Derived from text
*Venus Surface; Topography*

**20040059868** Massachusetts Univ., Amherst, MA, USA
**Anomalous Radial Structures at Irnini Mons, Venus: A Parametric Study of Stresses on a Pressurized Hole**
Buczkowski, D. L.; McGill, G. E.; Cooke, M. L.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The V-20 quadrangle is roughly centered on Irnini Mons, a volcano crossed by two rift systems, capped by Sappho Patera (a possible corona) and surrounded by structural complexities that include one other volcano and four coronae. Flows and other deposits from Irnini Mons are superimposed on an older, regional plains material with abundant wrinkle ridges in at least two sets: one trending generally east-west and another concentric to Irnini Mons. Radial features on top of the Irnini flows were mapped as lineations or grabens, as resolution allowed. However, from approximately N45E to N75E the difference in radar backscatter in high resolution images (75 m/pixel) indicates that the radial features are topographic highs, although they

are too narrow to be resolved in altimetry data sets. The radial ridges are located on top of the Irnini flows, occurring between a set of radial grabens to the north and a small ridge belt to the south, interpreted by as older than the adjacent regional plains. Author

*Radar Astronomy; Venus Surface; Planetary Geology; Topography; Stresses*

**20040059869** California Inst. of Tech., Pasadena, CA, USA

**Analysis of Gravity and Topography Signals in Atalanta-Vinmara and Lavinia Planitiae**

Dennedy-Frank, P. J.; Simons, M.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ridge and fracture belts are the dominant tectonic features in portions of Lavinia and Atalanta-Vinmara Planitiae on Venus. These features are 100s to 1000s of km long and consist of two wavelengths of deformation in width, with groups of wrinkle ridges or fractures and faults on the order of 1-10 km making up topographic rises on the order of 200-300 km wide. The origin of these features is enigmatic. Previous work suggests that structures with two wavelengths of deformation can be formed by instability growth in a compressive system with a strong upper crust and mantle separated by a weak lower crust, resulting in an in-phase folding of the primary layers. This in-phase folding makes specific predictions about the relationship between gravity and topography in this region. Our work looks at the gravity and topography signals made available by recent reprocessing of the available data, and implies that they are not consistent with a folding-deformed lithosphere. We suggest instead that the larger scale deformation may be due to a series of thrust faults formed in a compressive regime.
Author

*Venus Surface; Planetary Geology; Planetary Gravitation; Topography*

**20040059870** Cambridge Univ., Cambridge, UK

**Coronae of Parga Chasma, Venus**

Martin, P.; Stofan, E. R.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Parga Chasma is a 10,000 km long fracture and trough system extending from Atla Regio to Themis Regio in the southern hemisphere of Venus. The Parga system consists of a main NW-SE trending chasma with 14 branching segments, and each of the segments have coronae along their length. The trough, fractures and coronae of the Parga system form a zone of deformation that ranges from approx. 150 to > 400km wide. Parga and other chasmata systems are thought to result from regional extension accompanied by upwelling to form coronae. As most coronae are located along rift systems, analysis of chasma coronae may further constrain the origin and evolution both of coronae and of the chasma systems. In this study, we examine the variations in size, topography, annulus characteristics, associated volcanism and relative timing of corona formation with respect to rifting along the Parga system, following an earlier preliminary study. We analyze 122 coronae, including coronae along the chasma as well as those up to 1,500 km away from the rift.
Author

*Venus Surface; Planetary Geology; Landforms*

**20040059871** Minnesota Univ., Duluth, MN, USA

**Formation of Venusian Channels in a Shield Paint Substrate**

Lang, N. P.; Hansen, V. L.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Venusian channels are globally distributed and are categorized as simple, complex, and compound based on their morphology. Although morphological differences exist, many of the more than 200 identified Venusian channels share broad characteristics including more or less constant width to depth ratios, meanders, and cutoffs. Many channels have indeterminable source and terminal regions and have been argued to form via constructional and erosional processes. Proposed mechanisms for channel formation include low viscosity, rapidly emplaced lavas, water laden sediment and tube-fed lava flows. In this abstract, we provide a new hypothesis for channel formation where channels form by mafic lavas thermally eroding a substrate composed of material sourced from small shields. This material, known as shield paint, potentially represents shallow point source melting of a once-upon-a-time hydrated Venusian crust.
Author

*Venus Surface; Fluid Flow; Landforms*

**20040059872** University Coll., London, UK

**The Evolution of Four Volcano/Corona 'Hybrids' on Venus**

Grindrod, P. M.; Stofan, E. R.; Brian, A. W.; Guest, J. E.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Magellan mission to Venus revealed a planet with widespread volcanism and tectonism. Synthetic Aperture Radar (SAR) images revealed numerous large volcanoes and coronae widely distributed across the planet. Large volcanoes are defined as volcanic centers with diameters = 100 km in diameter, which are dominated by radial flows and positive topography. Coronae are volcano-tectonic features that might be unique to Venus. They have a wide-range of morphologies and are thought to be the surface manifestation of buoyant mantle diapirs. Over 130 large volcanoes and over 500 coronae have been identified on the surface of Venus. However, as a result of numerous volcanoes and coronae showing characteristics typical of both feature types, some have been classified as both large volcanoes and coronae by different authors. To date, only a handful of these 'hybrid' structures have been studied in detail (e.g. Anala Mons and Sappho Corona, Mbokomu Mons and Kunhild and Ereshkigal Montes). We are conducting a detailed analysis of four volcano/corona 'hybrids' (Api, Atai, Kokyanwuti and Uti Hiata Montes). We are using photogeologic methods to determine superposition relationships between different units and tectonic features and thus a geologic evolutionary sequence for each feature. The aim is to further understand the formation processes and conditions of large volcanoes and coronae on Venus.

Author

*Venus Surface; Planetary Geology; Tectonics; Volcanoes*

**20040059873** Academy of Sciences (USSR), Moscow, USSR

**Calderas on Venus and Earth: Comparison and Models of Formation**

Krassilnikov, A. S.; Head, J. W.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867 Contract(s)/Grant(s): RFBR-02-05-65068; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Calderas on Earth are defined as large, more or less circular, volcanic collapse depressions with diameters considerably larger than any included vent resulting from collapse into partially drained near-surface magma reservoir. They have been defined as having diameters >1 km, with smaller depressions being called craters. Usage of the term caldera includes features described as 'cauldrons', which represent a variably deeper erosional level of the same fundamental structures. Three morphological classes are important on the Earth: basaltic shield volcano calderas, Crater-lake-type of calderas, and ash flow calderas. Calderas on Venus are described as 'circular to elongate depressions not associated with a well-defined edifice and are characterized mainly by concentric patterns of enveloping fractures'. They are most common 40-80 km in diameter. The 'Catalog of Volcanic structures of Venus' includes 97 calderas. Our goals are to compare venusian and terrestrial caldera geology, topography and mechanism of formation. We used our observations and previous work for analysis of venusian calderas. We have studied the topography and geology of all 97 calderas from the list and their surroundings by way of detailed geological mapping. For comparison with terrestrial calderas we summarized aspects of terrestrial caldera formation using models of caldera formation, maps and description of typical calderas, and overviews of calderas formation and classification.

Author

*Venus (Planet); Planetary Geology; Calderas*

**20040059874** Academy of Sciences of the Ukraine, Kharkov, Ukraine

**Depths of Extended Crater-related Deposits on Venus**

Bondarenko, N. V.; Head, J. W.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; 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

Extended radar dark diffuse features (DDF) associated with craters on Venus surface are interpreted as deposits (mantles) of loose material ejected and lifted by the impact. The DDF exhibit the diversity of shapes from roughly parabolic to nonuniform complex patterns on Magellan images and are observed for about one half of all impact craters on the planet. The presence of the mantles strongly affects the observable radiophysical properties of the surface, as well seen in the Magellan data. In the present work, we estimate the possible depths of the deposits responsible for the DDFs through the analyzing Magellan microwave emissivity and SAR data.

Author

*Venus Surface; Planetary Craters; Planetary Geology*

**20040059875** Pomona Coll., Claremont, CA, USA

**Potential Pyroclastic Deposit in the Nemesis Tessera (V14) Quadrangle of Venus**

Long, S. M.; Grosfils, E. B.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; 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

As part of an ongoing analysis of volcanic and tectonic features in the Nemesis Tessera (V14) quadrangle of Venus, we have identified an anomalous unit, centered at 44 deg N, 193 deg E, which exhibits unusual physical features, including very high radar emissivity values. Here we assess the possibility that this is a pyroclastic deposit. Several regions of Venus have previously been identified as potential pyroclastic flows. They are characterized by feathery margins, little internal texture, and distinctive radar properties. In general pyroclastic volcanism on Venus is unlikely to occur, except under very unusual circumstances, because the dense atmospheric pressure is expected to inhibit the rapid exsolution of volatiles required to create such explosive eruptions; most models predict that a minimum of approx. 1.5-5.0 wt% CO2 is necessary to create sufficient basaltic magma disruption. If sufficient volatile levels are achieved, however, the atmospheric pressure and temperature conditions should inhibit sustained plinian eruption columns and preferentially favor column collapse to yield pyroclastic flows. If the unit in Nemesis Tessera is of pyroclastic origin, this is quite significant because it indicates that unusually high volatile concentrations were present during the eruption.

Author

*Venus Surface; Planetary Geology; Volcanic Eruptions*

**20040059876** Proxemy Research, Inc., Bowie, MD, USA

**Resurfacing Styles and Rates on Venus: Assessment of 18 Venusian Quadrangles**

Stofan, E. R.; Brian, A. W.; Guest, J. E.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As part of the NASA/U.S. Geological Survey Planetary Mapping Program, we have mapped 8 Venus quadrangles, covering approximately 6.0 x 10(exp 7) sq km, representing about 30% of the planet. These quadrangles cover different types of terrain, including topographic rises (western Eistla (V31), Laufey (V30) and Themis Regiones (V53)), plains regions (Tinatin (V33) and Sedna Planitiae (V19)) and chasmata regions (portions of Hecate (V28), Parga (V39) and Juno Chasmata (V46)). The areas of Venus that we have mapped show a diversity of stratigraphic histories, resurfacing styles and degrees of resurfacing, and led us to assess end-member models of the geologic history of Venus. In light of the controversy over venusian resurfacing rates and the potential effects of widespread resurfacing (e.g., 4), we were motivated to attempt to quantify the sources and significance of resurfacing in our quadrangles. In order to broaden our results, we also assessed the resurfacing sources and significance in ten other quadrangles that have been published under the Planetary Mapping Program (quadrangles V5, 9, 20, 25, 37, 40, 43, 44, 55, 59). These quadrangles avoided large expanses of tessera highlands, in order to more fully characterize the plains that make up over 80% of the Venus surface. Our results indicate that the majority of plains resurfacing by volcanism can be tied to an identifiable source, that fields of small edifices contribute more to resurfacing that we had anticipated, and that resurfacing styles do not appear to have evolved over the time period represented by the surface geology in the mapped quadrangles.

Author

*Planetary Mapping; Planetary Geology; Venus Surface; Thematic Mapping; Geological Surveys*

**20040059877** Northwestern Univ., Evanston, IL, USA

**Stereo Imaging of Impact Craters in the Beta-Atla-Themis (BAT) Region, Venus**

Matias, Audeliz; Jurdy, Donna M.; Stoddard, Paul R.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; 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 distribution and density of craters has been used to study the resurfacing history and tectonic activity of Venus. Assuming that impact cratering has decreased since the early bombardment period of planet formation, planetary age can be estimated. In the case of Venus, it seems to have undergone a resurfacing event about 300-500 million years ago, perhaps one of a sequence. Venus hosts approximately 940 craters, of which about 158 are 'tectonized', and 55 'embayed', but only 19 planetwide are 'both tectonized and embayed'. These figures vary according to the database listing used. The highest concentration of modified craters is in the Beta-Atla-Themis (BAT) region (+/- 30 N, 180 deg - 300 deg E), the location of three rift zones defined in the global map of Venus. BAT appears to be tectonically active with the planetary geoid highs, profuse volcanism, and numerous coronae. The Beta and Atla Regiones are dominated by rifts and large volcanic edifices, with

Atla containing some of the largest volcanoes in the planet (i.e. Maat Mons) and Dali, Paga, Hecate and Ganis Chasmata. Theia Mons, a major volcano on Venus, overlies on the Devana Chasma at the Beta Regio. In our study we correlated Magellan radar images and topographic data to determine the tilting for both modified and unmodified craters in the BAT region. Here we concentrated on the use of stereo-imaging for those few craters with multiple Magellan cycle coverage to achieve higher resolution. In addition, the construction of basic maps clarified the degree of modification of these features. We used an updated version of a crater catalog for locations, sizes and modification. Tilting was obtained by fitting planes to the altimetry data.
Author
*Stereoscopy; Radar Imagery; Venus Surface; Planetary Craters; Planetary Geology*

**20040059878** Academy of Sciences (USSR), Moscow, USSR
**Relationship Between Coronae, Regional Plains and Rift Zones on Venus, Preliminary Results**
Krassilnikov, A. S.; Kostama, V.-P.; Aittola, M.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Original contains color illustrations
Contract(s)/Grant(s): RFBR-02-05-65068; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Coronae are large radial/concentric volcanic/ tectonic structures on Venus with diameters of approximately 100 to over 1000 km in diameter. Radial and concentric fracturing and compressional tectonic structures are common for them, massive volcanism is connected with some of coronae. Coronae are interpreted to be the result of updoming and fracturing on the surface due to interaction of hot mantle diapirs with the lithosphere and subsequent gravitational relaxation of the diapir. There are a few geological, numerical and analog models of coronae formation. For now there are few catalogs of coronae, and according to the most detailed there are 514 coronae on Venus. Coronae have been separated into two types: type 1 - coronae that have annuli of concentric ridges and/or fractures, and type 2 that have similar characteristics to type 1 but lack a complete annulus of ridges and fractures. Rift structures on Venus include chasmata and fracture belts. They were separated in two types - rifts that predate and postdate formation of regional plains with wrinkle ridges. Last study included global mapping of rift structures (scale 1:50,000,000); also two variety of rift zones were mapped - rifts that predate formation of regional plains and postdate their emplacement. The goals of the study were to: 1) Study the geology of sample of coronae (of both types) and their local surroundings. We studied 20% of the population, each 5th structure from the list, - 82 of type 1 and 22 of type 2, in total 104 coronae; 2) Study age and styles of tectonic and volcanic activity of these coronae; 3) Determine time and tectonic relationship of coronae activity with rift zones mapped by and with time of regional plains with wrinkle ridges (Pwr) emplacement, that has been proposed as stratigraphic marker for Venus.
Derived from text
*Venus Surface; Planetary Geology; Topography; Tectonics*

**20040059879** Michigan State Univ., East Lansing, MI, USA
**Topographic and Structural Analysis of Devana Chasma, Venus: A Propagating Rift System**
Swafford, Laura C.; Kiefer, Walter S.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; 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

Devana Chasma is a rift system on Venus that formed due to extensional stresses from the Beta Regio and Phoebe Regio mantle plumes. It has often been compared to the East African Rift system on Earth. Kiefer and Peterson modeled the gravity and topography of Devana Chasma in terms of crustal thickness variations and mantle density anomalies. They found that low-density material, interpreted as hotter than normal mantle, is present under most of Devana Chasma. There is a discontinuity in the mantle density anomaly near 8 deg North, where the trend of the rift is laterally offset by 600 km. Based on the rift offset, the low density of faulting within the offset zone, and the discontinuity in the inferred mantle structure, they interpreted Devana Chasma as being two distinct rifts. One propagated southward from the Beta Regio mantle plume, and the other propagated northward from the Phoebe Regio mantle plume. When the two rift tips approached each other within a critical distance, the interaction of the two stresses fields allowed the rift tips to propagate toward each other, forming the faults in the offset zone. To further test the propagating rift hypothesis, we have analyzed variations in rift zone topography and structure as a function of distance along the strike of the rift. Our study region is the portion of Devana Chasma in the plains between Beta Regio and Phoebe Regio, from 20 deg North to 4 deg South. We collected topographic profiles normal to the strike of the rift roughly every one-half degree of latitude (53 km). Several example profiles are shown. Using these profiles, we measured how the rift flank elevation, rift depth, rift width, and horizontal extension varied with distance along the rift. The rift zone width, measured as the distance between the east and west rift flank topographic highs, is typically 150 to 250

km wide but is occasionally wider. The maximum depth is typically 1 to 3 km relative to the mean planetary radius. Neither the rift width nor the maximum depth shows a strong trend along the strike of the rift.
Author
*Venus Surface; Topography; Planetary Geology; Valleys*

**20040059880** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Venus Surface Investigation Using VIRTIS Onboard the ESA/Venus Express Mission**
Marinangeli, L. L.; Baines, K.; Garcia, R.; Drossart, P.; Piccioni, G.; Benkhoff, J.; Helbert, J.; Langevin, Y.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Venus Express Mission is the first ESA mission to Venus that will be launched in November 2005. In April 2006 after ~150 days of cruise the spacecraft will be inserted into highly elliptical polar orbit around Venus. The observational phase will begin after about one month of commissioning phase. The nominal mission orbital life-time is two Venus sidereal days (~486 Earth days). The scientific goals of Venus Express are related to the global atmospheric circulation and atmosphere chemical composition, the surfaceatmosphere physical and chemical interactions, the physics and chemistry of the cloud layer, the thermal balance and role of trace gases in the greenhouse effect, and the plasma environment and its interaction with the solar wind.
Author
*Venus (Planet); Venus Atmosphere; Imaging Spectrometers*

**20040059881** Brown Univ., Providence, RI, USA
**Use of Magellan Images for Venus Landing Safety Assessment**
Kreslavsky, M. A.; Head, J. W.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; 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

Landing on Venus is challenging, because information about the details of its surface is limited to only a few places. Panoramas taken at 4 Venera landing sites gave examples of terrains that can be expected. Although the exact Venera landing site locations are unknown, analysis of the Magellan radar images of the landing ellipses led to conclusion that all 4 landers landed on plains and fairly well represent the variety of plains on the planet. It is crucial for future missions, however, to assess factors important for landing safety on other types of Venusian terrains, especially on the tessera. The general view that tessera is rough is generally correct, but this demands quantification. In the surface engineering models used for lander design and mission planning, the surface is usually described by probability distribution of slopes at several baselines and by rock population. Here we present a test study that can be considered as a prototype for a part of the work necessary in the course of site selection for a future landing mission.
Author
*Venus Surface; Landing Sites; Planetary Mapping; Radar Imagery; Radar Cross Sections*

**20040059882** Imperial Coll. of Science, Technology and Medicine, London, UK
**Canali are Lava, Not River, Channels**
Ghail, R. C.; Rolfe, S.; Watt, L.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; 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

Canali are erosional channels that were first identified in the lowland plains of Venus from Magellan data and studied by. They share many features with terrestrial rivers such as meanders, oxbow lakes and braiding, although with lower sinuosity , but their sources are frequently never seen or hard to identify. Thermal erosion was ruled out as a possible formation mechanism by 6800 km) and alkali carbonatite was proposed as the most likely fluid causing the mechanical erosion of the channels. Recently has proposed that the flows were aqueous and formed at a time when Venus had oceans. We have identified the source of several flows as a volcano in Aphrodite and have studied the morphology of two flows using stereo dems. Our research supports the conclusion of that canali were eroded by volcanically-derived carbonatites at a time when its surface temperature was ~100 K hotter than now. The interesting observation is that Venus once supported carbonatite lakes.
Author
*Venus Surface; Landforms*

**20040059883** Los Alamos National Lab., NM, USA

**Preliminary Study of Laser-induced Breakdown Spectroscopy (LIBS) for a Venus Mission**

Arp, Z. A.; Cremers, D. A.; Wiens, R. C.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; 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

Laser-Induced Breakdown Spectroscopy (LIBS) has been proposed as a candidate analysis system for missions to Mars, asteroids, and recently Venus. This technique has several distinct advantages over other techniques which have been used on past missions (X-Ray fluorescence on Viking 1 and 2, 1976; APXS on Pathfinder, 1997; MER, 2004). Two of the more important advantages LIBS has over other techniques for a mission to Venus is rapid elemental analysis of both high and low Z value elements and stand-off analysis at distances of many meters. Rapid elemental analysis and stand-off analysis are very important to missions to Venus due to the harsh environment at the planet surface. From the Venera missions it is known that on the Venusian surface the pressures are approximately 9.1 MPa (90 atm) and the temperature is near 735 K [1]. For these reasons, the Soviet Venera surface probes had operational lifetimes of less than 2 hours. Currently Venus is the target of one of four missions specifically mentioned for consideration for NASA s New Frontier Program with a launch date of 2010 or earlier. In light of this, it is beneficial to evaluate different analysis methods such as LIBS, which offer to greatly increase the scientific return from such a mission. Currently we have begun to evaluate LIBS detection

Author

*Laser-Induced Breakdown Spectroscopy; Venus (Planet)*

**20040059884** Brown Univ., Providence, RI, USA

**Venus Festoon Deposits: Analysis of Characteristics and Modes of Emplacement**

McColley, S. M.; Head, J. W., III; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; 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

Volcanic festoon deposits seen on Venus are classified as 'radar bright flows that show organized patterns of internal streamlines (looped or curved components) analogous to the ridge and flow bands typical of viscous terrestrial lava flows known as coulees'. Three volcanic festoon features have been identified on the surface of Venus. These deposits are important because their morphology is very distinctive compared to other volcanic landforms on the planet generally interpreted to be basaltic in nature. The festoon deposits have been interpreted to be formed by emplacement of much more viscous magma and thus their nature, setting, and mode of emplacement may provide critical clues to the crustal evolution of Venus. We have been characterizing these deposits to enhance understanding of their genesis and to determine the similarities and differences among the three deposits. A festoon deposit has been identified in the dark lowland plains of Atalanta Planitia, (the Atalanta festoon) dark lowland plains of Aino Planitia (the Artemis-Imdr festoon), and the tessera of central Ovda Regio (the Ovda festoon). We first describe the three deposits and then focus on an analysis of the boundaries to assess further information on their fractal dimension and their eruption characteristics.

Author

*Venus Surface; Volcanic Eruptions; Planetary Geology; Lava*

**20040059885** Washington Univ., Saint Louis, MO, USA

**Volatile Element Geochemistry in the Lower Atmosphere of Venus**

Schaefer, L.; Fegley, B., Jr.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040059867; Original contains color illustrations

Contract(s)/Grant(s): NAG5-11037; NAG5-11050; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We computed equilibrium abundances of volatile element compounds as a function of altitude in Venus lower atmosphere. The elements included are generally found in volcanic gases and sublimates on Earth and may be emitted in volcanic gases on Venus or volatilized from its hot surface. We predict: 1) PbS, Bi2S3, or possibly a Pb-Bi sulfosalt are the radar bright heavy metal frost in the Venusian highlands; 2) It should be possible to determine Venus' age by Pb-Pb dating of PbS condensed in the Venusian highlands, which should be a representative sample of Venusian lead; 3) The gases HBr, PbCl2, PbBr2, As4O6, As4S4, Sb4O6, BiSe, InBr, InCl, Hg, TlCl, TlBr, SeS, Se2-7, HI, I, I2, ZnCl2, and S2O have abundances greater than 0.1 ppbv in our nominal model and may be spectroscopically observable; 4) Cu, Ag, Au, Zn, Cd, Ge, and Sn are approx. 100 % condensed at the 740 K (0 km) level on Venus.

Author

*Venus Atmosphere; Geochemistry; Abundance; Atmospheric Chemistry; Planetary Meteorology*

**20040059886** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy**
2004; In English; See also 20040059887 - 20040059895
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Meteorites: Experiments and Spectroscopy' included the following reports:The Suitability of Laser Induced Breakdown Spectroscopy for Determining the Compositions of Extraterrestrial Material; Deconvolving Terrestrial Alteration Mineral Spectral Signatures from Meteorite Reflectance Measurements; Impacts of Ions and Micrometeorites on Mineral Surfaces: Reflectance and Chemical Changes Found in Ordinary Chondrites; FT-IR Micro-spectroscopy of Fine-grained Planetary Materials: Further Results; Effusion Cell Measurements of the Vapor Pressure of Cobalt at Temperatures up to 2000K: Comparisons with Iron and Nickel; Kinetics of Fe2+-Mg Order-Disorder in P21/c Pigeonite: Implications for Cooling Rates Calculations; Compressional and Shear Wave Velocities in Meteorites; Chemical and Mineralogical Size Segregation in the Impact Disruption of Anhydrous Stone Meteorites; and Shock Pressures of Impacts vs. Crystallization Pressures of Shock-induced Melt Veins of the chondrites.
Derived from text
*Meteoritic Composition; Spectral Signatures; Laser-Induced Breakdown Spectroscopy*

**20040059889** Pavia Univ., Italy
**Kinetics of Fe2+-Mg Order-Disorder in P2(sub 1)/c Pigeonite: Implications for Cooling Rates Calculations**
Domeneghetti, M. C.; Zema, M.; Schwartz, J. M.; Tazzoli, V.; Lunar and Planetary Science XXXV: Meteorites: Experiments and Spectroscopy; 2004; 2 pp.; In English; See also 20040059886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Pigeonite (Mg, Fe(2+), Ca) (Mg, Fe(2+)) (Si2O6) is a Ca-poor clinopyroxene frequently occurring in terrestrial and extraterrestrial volcanic rocks. At high temperature pigeonite is monoclinic C2/c but on cooling a displacive, reversible and composition-dependent phase transition takes place with change of space group to P2(sub 1)/c. In P2(sub 1)/c pigeonite, as well as in Pbca orthopyroxene and C2/c augite, a non-convergent order-disorder process involving the distribution of Fe(2+) and Mg between the structural sites M1 and M2 occurs and can be described by the intracrystalline exchange reaction: Fe(2+)(M1) + Mg(M2) reversible reaction Fe(2+)(M2) + Mg(M1). For pigeonite the temperature dependence of the Fe-Mg order-disorder under equilibrium conditions has been studied by X-ray single-crystal diffraction on two samples with different Mg/Fe ratios and Ca content. By linear regression of lnk(sub D) vs 1/T, two geothermometric calibrations were obtained which allow to calculate the closure temperature T(sub c) of the Fe-Mg order-disorder in a pigeonite-bearing rock. However, a kinetic study of Fe-Mg exchange reaction which can provide a quantitative evaluation of the cooling rates has never been performed for pigeonite. To this purpose, in our study a series of kinetic experiments were carried out on the pigeonite sample BTS308, which has a suitable Fe/Fe(+)Mg composition and proved to be free of exsolution products. The annealing temperature of the experiments ranges from 650 to 800 C, well below the transition temperature from P21/c to C2/c found for this sample between 875 and 925 C in the in situ HT XRD study. The Fe-Mg degree of order was measured by X-ray single-crystal diffraction (XRD) and the treatment of the kinetic data was performed on the basis of Mueller's model. According to this model the Fe-Mg exchange reaction in pigeonite was treated, as in orthopyroxene, as a homogeneous chemical reaction following a second-order kinetic law.
Derived from text
*Reaction Kinetics; Order-Disorder Transformations; Cooling; Igneous Rocks; Mathematical Models; Iron; Magnesium; Pyroxenes*

**20040059896** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Chondrules and CAIs**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059897 - 20040059905
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Chondrules and CAI's' included the following reports:Metallic Chondrules in NWA 1390 (H3-6): Clues to Their History from Metallic Cu; Relationship Between Bulk Chemical Composition and Formation Age of Chondrules in Bishunpur and Krymka; Relict Forsterite in Chondrules: Implications for Cooling Rates; An Evaluation of Quantitative Methods of Determining the Degree of Melting Experienced by a Chondrule; Rare Earth Element Fractionation in Chondrules; Mineralogy and Petrology of Chondrules in Carbonaceous Chondrite NWA 770; Isotopic Cosmobarometry: A Synthesis of

Concepts and Implications for Chondrule and CAI Formation Mechanisms; Further Investigations of Minor Element Distributions in Spinels in Type B CAIs; and Trace Element Compositions of the Sublayers Making Up W-L Rims on CAI .

Derived from text

*Chondrule; Mineralogy; Inclusions; Meteoritic Composition*

**20040059897** Hawaii Univ., Honolulu, HI, USA

**Mineralogy and Petrology of Chondrules in Carbonaceous Chondrite NWA 770**

Lawrence, S. J.; Krot, A. N.; Scott, E. R. D.; Bunch, T. E.; Keil, K.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; Copyright; Avail: CASI; A01, Hardcopy

The CH (ALH85085-like) chondrites are distinguished by the following characteristics: high abundance of Fe,Ni-metal (approximately 20 vol %), small chondrule sizes (less than 50-80 m), high abundance of cryptocrystalline chondrules, low abundance of Ca, Al-rich inclusions (CAIs) and amoeboid olivine aggregates (AOAs), the lack of fine-grained matrix rims around chondrules, CAIs and AOAs, and the presence of heavily hydrated matrix clasts. These unusual characteristics prompted some workers to suggest that CH chondrites were not nebular products, but instead a product of asteroid collisions. More recently, various workers concluded that chondrules, Fe,Ni-metal grains, CAIs, and AOAs in CHs are pristine, unaltered nebular products, and thus provide important new insights about high temperature processes in the solar nebula. CH chondrites are part of the CR clan, which also includes the CR (Renazzo-like) and CB (Bencubbinlike) chondrites. The CR clan meteorites share some chemical and isotopic features, including: high abundance and broad compositional range of Fe,Ni-metal grains, large depletion in moderately volatile elements, bulk O-isotopic compositions, and large enrichment in N-15. The chondritic components of the CH, CR, and CB chondrites, however, have distinct mineralogies, possibly due to different formation mechanisms. Despite their potential importance for understanding nebular processes, CH chondrites remain poorly characterized from a mineralogical and petrological standpoint. Only two CH chondrites, Acfer 182 and ALH85085, have been previously characterized in detail. Here, we describe the mineralogy and petrology of chondrules in the recently discovered CH chondrite NWA 770.

Derived from text

*Carbonaceous Chondrites; Chondrule; Mineralogy; Petrology; Meteoritic Composition*

**20040059898** Tokyo Univ., Hongo, Japan

**Relationship Between Bulk Chemical Composition and Formation Age of Chondrules in Bishunpur and Krymka**

Tomomura, S.; Nagahara, H.; Tachibana, S.; Kita, N. T.; Morishita, Y.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chondrules, the major component of chondrites, were solidified by rapid cooling of molten precursor materials in the early solar system. There still remain some enigmas for the chondrule formation events. Recent studies have shown that ferromagnesian chondrules in unequilibrated ordinary chondrites formed 1-3 Myr later than calcium aluminum-rich inclusions (CAIs). It is reported that there may be a correlation between A-26-Mg-26 relative formation ages and bulk chemical compositions, in particular Si/Mg ratios, of ferromagnesian chondrules in unequilibrated ordinary chondrites (Semarkona and Bishunpur). It is also proposed that younger chondrules tend to have higher Si/Mg ratios. Although such a correlation between ages and chemical compositions may provide an important constraint on chondrule formation events or even the chemical evolution of the early solar system, the number of chondrules reported is only sixteen, which is not enough for comprehensive discussion. For better understanding of the age composition correlation of chondrules, we have started a systematic study for bulk chemical compositions and Al-26-Mg-26 ages of chondrules from unequilibrated ordinary chondrites. Here we report bulk chemical compositions of 89 chondrules and age data for some chondrules as part of a broader study.

Derived from text

*Chemical Composition; Chondrites; Chondrule; Petrography; Geochronology*

**20040059899** Portland State Univ., OR, USA

**Relict Forsterite in Chondrules: Implications for Cooling Rates**

Greeney, S.; Ruzicka, A.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; Original contains color illustrations

Contract(s)/Grant(s): NAG5-13044; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Forsterite (Fo(sub 99-100)) is often present in chondrules as relict grains that did not crystallize in situ and as isolated grains outside of chondrules; both are surrounded by ferrous overgrowths which clearly formed at a later time, probably during chondrule formation. We performed microprobe analyses across forsterite-overgrowth interfaces in 12 chondrules and 4 isolated grains in the Sahara-97210 LL3.2 (Sahara), Wells LL3.3, and Chainpur LL3.4 chondrites and modelled diffusional exchange between forsterite and overgrowths, with the goal of constraining the thermal histories during chondrule formation. The cooling rates experienced by chondrules provide an important constraint on the origin and setting of these objects.
Derived from text
*Chondrule; Cooling; Forsterite; Granular Materials*

**20040059900** Centre de Recherches Petrographiques et Geochimiques, Nancy, France
**Rare Earth Element Fractionation in Chondrules**
Pack, A.; Shelley, J. M. G.; Palme, H.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Large and discontinuous fractionations of rare earth elements (REEs) are well known from highly refractory Ca- and Al-rich inclusions (CAIs) in primitive meteorites. REE patterns are used as one classification scheme for CAIs. Discontinuous C1-normalized REE distributions can be explained in terms of high-temperature gas/solid fractionation. In chondrules, mesostasis is the dominant REE carrier and largely controls their REE budget. Chondrules usually have unfractionated REE patterns with only Eu showing some variability. Only a few chondrules from carbonaceous chondrites were reported to show highly fractionated REEs with discontinuous patterns resembling those of CAIs, but with lower abundances. Chondrules with CAI like fractionated REEs may have acquired their REE patterns due to formation processes similar to those of CAIs or due to incorporation of CAI material into their precursors. We have conducted a LA-ICPMS study of olivine rich chondrules and chondrule mesostases from ordinary (OCs: Chainpur LL3.4, DaG369 L/H3, DaG378 H/L3) and carbonaceous chondrites (CCs: Allende CV3, Vigarano CV3). The results for 12 chondrules are reported. The laser spot diameter of 40 60 m did not, in all cases, allow uncontaminated mesostasis analyses. Analyses of barred olivine chondrules (DaG378/RF10, Vig1/RF14) overlapped with olivine and rather represent the REEs of the bulk chondrules. The analyses of cryptocrystalline chondrules Cha1/GC, DaG369/A and B represent the bulk composition of these chondrules.
Derived from text
*Chondrule; Fractionation; Rare Earth Elements; Mineralogy*

**20040059901** Arizona Univ., Tucson, AZ, USA
**Metallic Chondrules in NWA1390 (H3-6): Clues to Their History from Metallic Cu**
LaBlue, A. R.; Lauretta, D. S.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; Original contains color illustrations
Contract(s)/Grant(s): NAG5-13470; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A recent study of ordinary chondrites suggests that many long-recognized shock indicators in olivine and pyroxene minerals may be erased by post-shock annealing. Therefore, the presence of other indicators of shock, which can not be erased by subsequent heating, are important to fully characterize the history of chondritic meteorites. One such proposed indicator is metallic Cu, which occurs in at least 2/3 of ordinary chondrites. Here we present a comparative study of two metallic chondrules in the NWA1390 ordinary chondrite, both of which contain appreciable Cu in the Fe,Ni metal phase and one that is partially rimmed by metallic Cu.
Author
*Meteoritic Composition; Minerals; Chondrule*

**20040059902** NASA Johnson Space Center, Houston, TX, USA
**An Evaluation of Quantitative Methods of Determining the Degree of Melting Experienced by a Chondrule**
Nettles, J. W.; Lofgren, G. E.; Carlson, W. D.; McSween, H. Y., Jr.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; 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 workers have considered the degree to which partial melting occurred in chondrules they have studied, and this has led to attempts to find reliable methods of determining the degree of melting. At least two quantitative methods have been used in the literature: a convolution index (CVI), which is a ratio of the perimeter of the chondrule as seen in thin section divided

by the perimeter of a circle with the same area as the chondrule, and nominal grain size (NGS), which is the inverse square root of the number density of olivines and pyroxenes in a chondrule (again, as seen in thin section). We have evaluated both nominal grain size and convolution index as melting indicators. Nominal grain size was measured on the results of a set of dynamic crystallization experiments previously described, where aliquots of LEW97008(L3.4) were heated to peak temperatures of 1250, 1350, 1370, and 1450 C, representing varying degrees of partial melting of the starting material. Nominal grain size numbers should correlate with peak temperature (and therefore degree of partial melting) if it is a good melting indicator. The convolution index is not directly testable with these experiments because the experiments do not actually create chondrules (and therefore they have no outline on which to measure a CVI). Thus we had no means to directly test how well the CVI predicted different degrees of melting. Therefore, we discuss the use of the CVI measurement and support the discussion with X-ray Computed Tomography (CT) data.
Author
*Evaluation; Quantitative Analysis; Chondrule; Melting*

**20040059903** Monash Univ., Victoria, Australia
**Trace Element Compositions of the Sublayers Making Up W-L Rims on CAI's**
Wark, D. A.; Chu, K.-W.; Hill, D. H.; Boynton, W. V.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ca-Al-rich Inclusions (CAI s) and their rims hold unique clues to poorly understood, early high temperature events in the solar nebula. If we knew the trace element concentrations in, and degree of equilibration between, the microscopic, onion- like sublayers that make up Wark-Lovering (WL) rims on CAI s, we would be able to understand more about the temperature, duration and environment of the processes that created and then modified the rims and their host CAI s. Whole rims have been analyzed, but good trace element analyses of their 4 or 5 component sublayers are difficult to obtain because the sublayers are typically multiphase and very thin. We now describe a mathematical technique for calculating element concentrations in individual rim sublayers from bulk rim analyses and measurements of the thicknesses of the sublayers. Calculations: The weighted sum of the concentrations
Author
*Calcium; Aluminum; Trace Elements; Meteoritic Composition*

**20040059904** California Univ., Los Angeles, CA, USA
**Further Investigations of Minor Element Distributions in Spinels in Type B CAIs**
Taylor, D. J.; McKeegan, K. D.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Variations in minor element (Ti, V, Cr and Fe) concentrations within Mg-Al spinels in type B CAIs have provided insights into the early history of these objects, specifically the possibility that they may have experienced more than one episode of partial melting and recrystallization. Connolly and Burnett performed an extensive study on two Allende CAIs, TS-23 and TS-34, as well as a Leoville CAI 3537-2, in which they found Ti vs. V trends that cannot be explained by a single-stage crystallization history. Here we report minor element concentrations in spinels from Efremovka E-44, a CAI that has been extensively studied for its record of short-lived radioactivity, and compare it to further analyses of TS-23. Our goals are to examine the spinels of type B CAIs in another CV chondrite which has been less effected by alteration (as is the case for Allende), or by post-crystallization shock events (as is the case for Leoville), to see if the same trends are apparent.
Author
*Meteoritic Composition; Chondrites; Trace Elements; Spinel*

**20040059905** California Univ., Los Angeles, CA, USA
**Isotopic Cosmobarometry: A Synthesis of Concepts and Implications for Chondrule and CAI Formation Mechanisms**
Young, E. D.; Lunar and Planetary Science XXXV: Chondrules and CAIs; 2004; 2 pp.; In English; See also 20040059896; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Chondrules were once molten spheres in space and the expectation is that they should show evidence for evaporation. However, Mg, K, and Fe isotope data do not follow the trends expected if the molten spheres were present in a near vacuum. The lack of isotope fractionation in chondrules contrasts with the large fractionation effects seen in CAIs. The general lack of light-element mass fractionation in chondrules has been a vexing problem because these objects show evidence for

volatility-controlled variations in the concentrations of the very same elements lacking isotope fractionation, at odds with the expectations for free evaporation. A synthesis of recent models for volatilization of liquids is used here to constrain the astrophysical environments in which chondrules and CAIs formed. Results suggest that chondrules in general formed within less than or equal to 1 meter of one another while CAIs were more sparsely distributed during their formation.
Derived from text
*Calcium; Aluminum; Inclusions; Chondrule; Cosmology; Astrophysics; Magnesium Isotopes; Iron Isotopes; Potassium Isotopes*

**20040059906** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059907 - 20040059916
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Ordinary and Enstatite Chondrites' included the following reports:The Distribution of Molybdenum in the Indarch EH4 Chondrite; Cosmic-Ray Exposure Age and Heliocentric Distance of the Parent Body of E Chondrites ALH 85119 and MAC 88136; Further Observations of Fe-60-Ni-60 and Isotopic Systems in Sulfides from Enstatite Chondrites; Thermal Metamorphism in L Chondrites: Implications of Percent Mean Deviation in Olivine and Pyroxene; Cooling Rates and the Mn-53-Cr-53 Isotopic System of Yamato 86753, an Equilibrated Ordinary Chondrite; Production Rates of Cosmogenic Nuclides in the Knyahinya L-Chondrite; Preliminary Mineralogical Data from the Saratov (L4) Primitive Ordinary Chondrite; Phosphate Minerals in Semarkona; A Textural Comparison of Chondrules and Smelter-derived Dust: Implications Regarding Formation Conditions; and Modification of the Van Schmus & Wood Petrologic Classification for Lithic Fragments in the Chondritic Breccia Rumuruti.
Derived from text
*Chondrites; Meteoritic Composition; Mineralogy; Enstatite*

**20040059907** Graduate Univ. for Advanced Studies, Japan
**Cooling Rates and the Mn-53-Cr-53 Isotopic System of Yamato 86753, an Equilibrated Ordinary Chondrite**
Tomiyama, T.; Misawa, K.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The degrees of metamorphism of individual ordinary chondrites (OCs) reflect thermal histories on their parent bodies. The thermal structure of the OC parent body (i.e., the geological setting of each petrologic type of OC) is not well known, because metamorphic degree depends not only on metamorphic temperature but also on duration of metamorphism. Detailed study of thermal history is necessary for elucidating the thermal structure of the OC parent body. We performed two-pyroxene geothermometry, olivine-spinel (ol-sp) geothermometry and metallographic cooling rate estimates on equilibrated L chondrites, to determine individual thermal histories. Isotopic analyses of the Mn-53-Cr-53 system in olivines have been done on Yamato (Y) 86753, a rapidly cooled L5 chondrite.
Derived from text
*Chondrites; Cooling; Manganese Isotopes; Chromium Isotopes; Metamorphism (Geology); Microstructure; Geotemperature*

**20040059910** Geological Survey of Canada, Ottawa, Ontario, Canada
**A Textural Comparison of Chondrules and Smelter-derived Dust: Implications Regarding Formation Conditions**
Knight, R. D.; Herd, R. K.; Hunt, P. A.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A comparison of smelter-derived dust particles (RDK), and chondrules in primitive (LL3, L4) ordinary chondrites (RKH), indicates similar crystallization textures, as imaged in back-scattered-electron (BSE) and secondary-electron (SE) modes with a scanning-electron microscope (SEM). An energy-dispersive spectrometer (EDS) system on the SEM allowed qualitative identification of phases. The similarity of textures, first recognized by PAH, allows us to consider implications for the conditions of formation of the dust spherules and the chondrules. Here we compare a class 4 smelter-derived particle from the

Horne copper smelter, Rouyn-Noranda, Quebec, Canada, and a chondrule from the Saratov (L4) chondrite.
Derived from text
*Chondrule; Dust; Textures; Meteoritic Composition; Mineralogy*

**20040059911** New Mexico Univ., Albuquerque, NM, USA
**Production Rates of Cosmogenic Nuclides in the Knyahinya L-Chondrite**
Kim, K. J.; Reedy, R. C.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The production rates of spallogenic radionuclides and stable isotopes in the L-chondrite Knyahinya were investigated using the MCNPX code. Numerous cosmogenic nuclides had been measured in many Knyahinya samples. The pre-atmospheric size and sample locations of Knyahinya are well known, thus Knyahinya is a good test case for cosmogenic-nuclide production-rate calculations. Our calculated profiles were compared to the measurements to determine effective proton fluxes.
Derived from text
*Nuclides; Radioactive Isotopes; Chondrites; Meteoritic Composition; Spallation*

**20040059915** Arizona State Univ., Tempe, AZ, USA
**Further Observations of Fe-60-Ni-60 and Mn-53-Cr-53 Isotopic Systems in Sulfides from Enstatite Chondrites**
Guan, Y.; Huss, G. R.; Leshin, L. A.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906
Contract(s)/Grant(s): NAG5-11543; NAG5-10523; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent studies have shown that short-lived Fe-60 (t(sub 1/2) = 1.5 Ma) was present in some components of ordinary and enstatite chondrites when they formed. Here we report additional data on Fe-60 from sulfides in enstatite chondrites and on the potential relationship between the Fe-60-Ni-60 and Mn-53-Cr-53 systems.
Derived from text
*Chondrites; Enstatite; Iron Isotopes; Sulfides; Nickel Isotopes; Manganese Isotopes; Chromium Isotopes*

**20040059916** Kyushu Univ., Fukuoka, Japan
**Cosmic-Ray Exposure Age and Heliocentric Distance of the Parent Body of E Chondrites ALH85119 and MAC88136**
Nakashima, D.; Nakamura, T.; Okazaki, R.; Lunar and Planetary Science XXXV: Ordinary and Enstatite Chondrites; 2004; 2 pp.; In English; See also 20040059906; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Enstatite (E-) chondrite parent bodies are considered to have formed at regions closer to the Sun than other chondrites on the basis of mineralogy and chemical properties of E chondrites. However, there is no data indicating directly the heliocentric distances of the E chondrite parent bodies. Anders calculated the heliocentric distances of parent bodies of several kinds of meteorite classes based on noble gas data and two assumptions that (1) fluxes of solar wind (SW) and solar energetic particles (SEP) are in inverse relation to the square of heliocentric distance and (2) flux of galactic cosmic ray (GCR) is constant in the solar system. It was calculated that meteorite parent bodies could be distributed at the region of asteroid belt. Wieler et al. and Nakashima et al. calculated the heliocentric distances of ordinary chondrite parent bodies and parent body exposure ages, and confirmed that the parent bodies were distributed at asteroid belt. The purpose of this study is to determine the parent body exposure ages and the heliocentric distances of the two E chondrites ALH85119 and MAC88136. These chondrites are known to contain solar gases as well as cosmogenic ones. From the concentrations of solar Ne-20 (Ne-20So), Ar-36 (Ar-36So), and cosmogenic Ne-21(Ne-21Cos), the parent body exposure ages, the heliocentric distances, and the space exposure ages of the two E chondrites were calculated.
Derived from text
*Cosmic Rays; Exposure; Celestial Bodies; Chondrites; Geochronology; Enstatite; Solar Position*

**20040059917** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Martian Meteorites: Chemical Weathering**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059918 - 20040059921
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Martian Meteorites: Chemical Weathering' included the following reports:Chemical Weathering Records of Martian Soils Preserved in the Martian Meteorite EET79001; Synchrotron X-Ray Diffraction Analysis of Meteorites in Thin Section: Preliminary Results; A Survey of Olivine Alteration Products Using Raman Spectroscopy; and Rb-Sr and Sm-Nd Isotope Systematics of Shergottite NWA 856: Crystallization Age and Implications for Alteration of Hot Desert SNC Meteorites.
Derived from text
*SNC Meteorites; Crystallization; Mars Surface; Weathering*

**20040059918** Washington Univ., Saint Louis, MO, USA
**A Survey of Olivine Alteration Products Using Raman Spectroscopy**
Kuebler, K.; Jolliff, B. L.; Wang, A.; Haskin, L. A.; Lunar and Planetary Science XXXV: Martian Meteorites: Chemical Weathering; 2004; 2 pp.; In English; See also 20040059917
Contract(s)/Grant(s): NAG5-12114; NAG5-10703; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Identification of mineral alteration products will aid in the crucial task of interpreting past Martian environmental conditions, especially aqueous environments. Olivine has been identified at the surface of Mars and is readily altered in aqueous environments. Using Raman spectroscopy, we studied three rocks with altered olivine and compared the data with mineral chemistry from electron microprobe analysis. Although the alteration in all three samples has loosely been called iddingsite their appearances and modes of occurrences differ as described. Alteration products in all three samples are likely fine-grained mixtures.
Author
*Igneous Rocks; Mars Surface; Minerals; Olivine; Silicates*

**20040059919** NASA Johnson Space Center, Houston, TX, USA
**Chemical Weathering Records of Martian Soils Preserved in the Martian Meteorite EET79001**
Rao, M. N.; Wentworth, S. J.; McKay, D. S.; Lunar and Planetary Science XXXV: Martian Meteorites: Chemical Weathering; 2004; 2 pp.; In English; See also 20040059917; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact-melt glasses, rich in Martian atmospheric gases, contain Martian soil fines (MSF) mixed with other coarse-grained regolith fractions which are produced during impact bombardment on Mars surface. An important characteristic of the MSF fraction is the simultaneous enrichment of felsic component accompanied by the depletion of mafic component relative to the host phase in these glasses. In addition, these glasses yield large sulfur abundances due to the occurrence of secondary mineral phases such as sulfates produced during acid-sulfate weathering of the regolith material near the Martian surface. Sulfurous gases released into atmosphere by volcanoes on Mars are oxidized to H2SO4 which deposit back on the surface of Mars as aerosol particles. Depending on the water availability, sulfuric acids dissolve into solutions which aggressively decompose the Fe-Mg silicates in the Martian regolith. During chemical weathering, structural elements such as Fe, Mg and Ca (among others) are released into the transgressing solutions. These solutions leach away the soluble components of Mg, Ca and Na, leaving behind insoluble iron as Fe3(+) hydroxysulfate mixed with poorly crystalline hydroxide- precipitates under oxidizing conditions. In this study, we focus on the elemental distribution of FeO and SO3 in the glass veins of EET79001, 507 sample, determined by Electron Microprobe and FE SEM measurements at JSC. This glass sample is an aliquot of a bigger glass inclusion ,104 analysed by where large concentrations of Martian atmospheric noble gases are found.
Derived from text
*Atmospheric Composition; Chemical Composition; Crystallinity; Deposits; Impact Melts; Mars Surface; Meteorite Collisions; Sulfur Oxides*

**20040059920** NASA Johnson Space Center, Houston, TX, USA
**Rb-Sr and Sm-Nd Isotope Systematics of Shergottite NWA 856: Crystallization Age and Implications for Alteration of Hot Desert SNC Meteorites**
Brandon, A. D.; Nyquist, L. E.; Shih, C.-Y.; Wiesmann, H.; Lunar and Planetary Science XXXV: Martian Meteorites: Chemical Weathering; 2004; 2 pp.; In English; See also 20040059917; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Nakhlite NWA 998 was discovered in Algeria in 2001, and is unique among the six known members of this group of Martian meteorites in containing significant modal orthopyroxene. Initial petrologic and isotopic data were reported by Irving

et al. This 456 gram stone consists mainly of sub-calcic augite with subordinate olivine and minor orthopyroxene, titanomagnetite, pyrrhotite, chlorapatite, and intercumulus An(sub 35) plagioclase. We report here preliminary results of radiogenic isotopic analyses conducted on fragmental material from the main mass.
Derived from text
*Crystallization; Shergottites; SNC Meteorites; Rubidium Isotopes; Strontium Isotopes; Neodymium Isotopes; Samarium Isotopes; Radiogenic Materials*

**20040059921** Lunar and Planetary Inst., Houston, TX, USA
**Synchrotron X-Ray Diffraction Analysis of Meteorites in Thin Section: Preliminary Results**
Treiman, A. H.; Lanzirotti, A.; Xirouchakis, D.; Lunar and Planetary Science XXXV: Martian Meteorites: Chemical Weathering; 2004; 2 pp.; In English; See also 20040059917
Contract(s)/Grant(s): DE-FG02-92ER-14244; DE-AC02-98CH-10886; NAG5-8270; NAG5-12184; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

X-ray diffraction is the pre-eminent technique for mineral identification and structure determination, but is difficult to apply to grains in thin section, the standard meteorite preparation. Bright focused X-ray beams from synchrotrons have been used extensively in mineralogy and have been applied to extraterrestrial particles. The intensity and small spot size achievable in synchrotron X-ray beams makes them useful for study of materials in thin sections. Here, we describe Synchrotron X-ray Diffraction (SXRD) in thin section as done at the National Synchrotron Light Source, and cite examples of its value for studies of meteorites in thin section.
Author
*X Ray Diffraction; Meteorites*

**20040059922** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Martian Meteorites: Petrology**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040059923 - 20040059932
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Martian Meteorites: Petrology: included the following reports:Volatile Behavior in Lunar and Terrestrial Basalts During Shock: Implications for Martian Magmas; Problems with a Low-Pressure Tholeiitic Magmatic History for the Chassigny Dunite; Fast Cooling History of the Chassigny Martian Meteorite; Rehomogenized Interstitial and Inclusion Melts in Lherzolitic Shergottite ALH 77005: Petrologic Significance; Compositional Controls on the Formation of Kaersutite Amphibole in Shergottite Meteorites; Chemical Characteristics of an Olivine-Phyric Shergottite, Yamato 980459; Pb-Hf-Sr-Nd Isotopic Systematics and Age of Nakhlite NWA 998; Noble Gases in Two Samples of EETA 79001 (Lith. A); Experimental Constraints on the Iron Content of the Martian Mantle; and Mars as the Parent Body for the CI Carbonaceous Chondrites: New Data.
Derived from text
*Meteoritic Composition; SNC Meteorites*

**20040059923** Tokyo Univ., Hongo, Japan
**Fast Cooling History of the Chassigny Martian Meteorite**
Monkawa, A.; Mikouchi, T.; Koizumi, E.; Chokai, J.; Miyamoto, M.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Chassigny martian meteorite is a dunite with rare poikilitic Ca-poor pyroxenes containing lamellae of exsolved Ca-rich pyroxene. It has a modal composition of 90% olivine, 5% pyroxene, 2% feldspar, and 1.4 % chromite along with minor and trace phases such as sulfides, Fe-Ti oxides, and chlorapatite. The anhedral to subhedral olivine grains averaging 1.5 mm long are commonly in close contact with each other and occasionally form 120 triple junctions. Olivine is compositionally homogeneous in major elements throughout the samples having an average forsterite content of 68 mol%. Olivine usually includes euhedral chromite grains and rounded magmatic inclusions as large as 200 m in diameter. Some of these inclusions contain Ti-rich amphibole (kaersutite) associated with pyroxenes, chlorapatite, troilite, chromite, pentlandite and alkali feldspar-rich glass.
Derived from text
*Meteoritic Composition; SNC Meteorites; Chromites; Dunite*

**20040059924** State Univ. of New York, Stony Brook, NY, USA

**Problems with a Low-Pressure Tholeiitic Magmatic History for the Chassigny Dunite**

Filiberto, J.; Nekvasil, H.; Lindsley, D. H.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A variety of workers have proposed low-Al, high-Fe parental liquids for the SNC meteorites. This conclusion arose from the results of rock melting experiments and computational work on Shergotty and Zagami, and bulk melt inclusion approximations of the Chassigny and nakhite cumulates. In spite of the general acceptance of these proposed parental liquid characteristics, to-date, no phase equilibrium experiments on high-Fe, low-Al melt have produced the cumulate and melt inclusions assemblages of the SNC meteorites. For Chassigny and the nakhlites even the phases themselves have not been produced experimentally, much less their compositions. The strong deviations of natural assemblages for the Chassigny, for example, from those produced by postulated low-Al, high-Fe parental liquids under 'dry' and water-saturated conditions can be clearly seen by the experimental data of. Doubts about the accepted parental compositions

Derived from text

*Low Pressure; Aluminum; Iron; Meteoritic Composition; Nakhlites; SNC Meteorites*

**20040059925** Tokyo Metropolitan Univ., Hachiouji, Japan

**Chemical Characteristics of an Olivine-Phyric Shergottite, Yamato 980459**

Shirai, N.; Ebihara, M.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Among Martian meteorites, shergottites are predominant in number of specimens. Shergottites were further classified into two subgroups, basaltic shergottites and Iherzolitic shergottites. Following the recent finding of a lot of meteorites in hot desert, the third class of shergottites, namely olivinephyric shergottites has been recognized. According to petrographic features, Yamato (Y) 980459 discovered by the 1997-1999 Japanese Antarctic Expedition Team are classified as an olivine-phyric shergottite, to which EETA 79001A, DaG 476, SaU 005, Dho 019, NWA 1068 and NWA 1195 also belong. Many worker suggest that shergottites enriched in light rare earth elements (LREEs) were derived either from LREEs-enriched mantle sources or by the assimilation of LREEs-enriched components to their parental magmas. If so, LREEs-depleted shergottites were to be derived from LREE-depleted mantle sources and scarcely affected by the assimilation of LREEs-enriched crust components. In this study, we test whether a mixing model is valid in explaining chemical compositions of Y 980459.

Derived from text

*Chemical Composition; Olivine; Shergottites; Mars Surface; Petrography*

**20040059926** NASA Johnson Space Center, Houston, TX, USA

**Volatile Behavior in Lunar and Terrestrial Basalts During Shock: Implications for Martian Magmas**

Chaklader, Johny; Shearer, C. K.; Hoerz, F.; Newsom, H. E.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The amount of water in martian magmas has significant ramifications for the martian atmosphere-hydrosphere cycle. Large D-enrichments have been observed in kaersutitic amphiboles in Zagami, Chassigny and Shergotty meteorites (delta-D values up to 4400 per mil) suggesting that substantial amounts of H escaped Mars in its past. Furthermore, martian meteorites with inclusions of biotite and apatite imply possible origins in a hydrous mantle. However, whether martian magmas ever possessed considerable proportions of water remains controversial and unclear. The H-content of mica and amphibole melt inclusions has been found to be low, while bulk-rock H2O content is also low ranging from 0.013 to 0.035 wt. % in Shergotty. Hydrous martian magmas were considered responsible for light lithophile element (LLE) zoning patterns observed in Nakhlite and Shergottite pyroxenes. Since LLEs, such as Li and B, partition into aqueous fluids at temperatures greater than 350 C, workers interpreted Li-B depletions in pyroxene rims as evidence that supercritical fluid exsolution occurred during magma degassing. In that many martian basalts experienced substantial shock (15-45 GPa) it is possible that the magmatic volatile record preserved in martian basalts has been disturbed. Previous shock experiments suggest that shock processes may effect water content and H/D. To better understand the possible effects of shock on this volatile record, we are studying the redistribution of volatile elements in naturally and experimentally shocked basalts. Here, we report the initial results from

shocked basalts associated with the Lonar Crater, India and an experimentally shocked lunar basalt.
Derived from text
*Moon; Basalt; Terrestrial Planets; Magma; Mars Atmosphere; Meteoritic Composition*

**20040059927** New Mexico Univ., Albuquerque, NM, USA
**Experimental Constraints on the Iron Content of the Martian Mantle**
Agee, C. B.; Draper, D. S.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

High pressure experiments reveal that the CaO/Al2O3 of Martian basalt (shergottites) parent magmas can be derived by partial melting at 5 GPa of Homestead L5 chondrite, whose bulk composition is very similar to that of the Dreibus and W nke model Martian mantle. However, the experimental melts are much richer in FeO than are calculated Martian parent magmas. We conclude that Homestead L5 and the Dreibus and W nke composition may be too FeO-rich (Mg#, molar Fe/Fe+Mg, approx. 75) to be considered good candidates for the mantle source region of shergottite parent magmas. This mismatch is well illustrated by comparing the FeO/MnO trends of basaltic shergottites, chondrites, and high pressure partial melts of L-chondrite. From these comparisons we propose that the Martian mantle may be closer in major-element composition to the average value of H-chondrites with Mg# approx. 80. In order to test this hypothesis we are currently carrying out a series of high pressure partial melting experiments on the Farmville H4 chondrite.
Derived from text
*Mars (Planet); Planetary Mantles; Iron Oxides; Calcium Oxides; Aluminum Oxides; Experimentation*

**20040059928** Carnegie Institution of Washington, Washington, DC, USA
**Pb-Hf-Sr-Nd Isotopic Systematics and Age of Nakhlite NWA 998**
Carlson, R. W.; Irving, A. J.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Nakhlite NWA 998 was discovered in Algeria in 2001, and is unique among the six known members of this group of Martian meteorites in containing significant modal orthopyroxene. Initial petrologic and isotopic data were reported by Irving et al. This 456 gram stone consists mainly of sub-calcic augite with subordinate olivine and minor orthopyroxene, titanomagnetite, pyrrhotite, chlorapatite, and intercumulus An(sub 35) plagioclase. We report here preliminary results of radiogenic isotopic analyses conducted on fragmental material from the main mass kindly provided for this study by Adam and Greg Hupe.
Derived from text
*Nakhlites; Radiogenic Materials; Geochronology; Lead Isotopes; Hafnium Isotopes; Strontium Isotopes; Neodymium Isotopes*

**20040059929** Max-Planck-Inst. fuer Chemie, Mainz, Germany
**Noble Gases in Two Samples of EETA 79001 (Lith. A)**
Schwenzer, S. P.; Herrmann, S.; Ott, U.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Introduction: EETA 79001 is one of the most noted Martian meteorites with respect to noble gases, because it is the one in which Bogard in 1982 and Bogard & Johnson in 1983 found Martian atmospheric noble gas signatures for the first time. Since that time, various studies have been carried out on EETA 79001 [e. g. 1 8]. These efforts not only clarified the picture of the Martian atmospheric component , but also found evidence for another possible component, the so called EETV or 'crush'-component [6]. In this study we add the first pyroxene data to the picture.
Author
*SNC Meteorites; Meteoritic Composition; Mars Atmosphere*

**20040059930** Florida Space Inst., Cape Canaveral, FL, USA
**Mars as the Parent Body for the CI Carbonaceous Chondrites: New Data**
Brandenburg, J. E.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 1 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The CI are ancient (4.6Gyr) hydrated clays with olivine and pyroxene grains imbedded in them and no evidence of hypervelocity impacts or chondrules. Based on isotopic and other geochemical data the CI appear to share many features with MMs (Martian Meteorites) and have been considered as candidate Martian sediments. Isotopic data on MM hydrated materials has only recently been analyzed. A gap in isotopes between hydrated materials from CI s and a MM anhydrous rock was seen earlier and thought significant. Now, however, it is seen that the water on Mars was not in equilibrium with the lithosphere and so hydrated materials have a higher O17 reflecting that of the Martian hydrosphere. The net result is that the comparison of CI and MM newly obtained hydrated material oxygen isotopes now shows a good match and CI anhydrous and MM anhydrous now also show good correlations. CI and MM hydrated materials, in particular, are essentially indistinguishable. The idea of CI having an origin on Mars is not new, being actively considered by the Viking lander XRF experiment team, when they noted that a 50-50 CI and tholeitic basalt mixture gave a very good match to Viking landing site soil composition. Data on Chromium and Tungsten data will also be discussed. If the CI s are Martian they would represent samples of the Southern Martian Highlands regolith due to their 4.6 Gyr age. Implications of a possible Martian origin of CIs will be discussed, most importantly the fact that if the CIs are Martian, then the surface of early Mars was warm, wet, and rich in organic matter.
Author (revised)
*Meteoritic Composition; Carbonaceous Chondrites; Meteorite Parent Bodies*

**20040059931** Louisiana State Univ., Baton Rouge, LA, USA
**Compositional Controls on the Formation of Kaersutite Amphibole in Shergottite Meteorites**
Pitman, K. M.; Treiman, A. H.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922
Contract(s)/Grant(s): NAGW-12184; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The shergottite basalts, meteorites of Martian origin, contain rare small grains (approx. 10-100 microns diam.) of kaersutite, a Ca-amphibole rich in Al and Ti. Kaersutites have been used to estimate the water content of shergottites and the Martian mantle; however, questions remain about the original water content of the amphiboles and if they formed from magma. We investigated the petrographic settings of amphiboles in two shergottites and confirm that these amphiboles occur only in multiphase inclusions in pyroxene. In fact, kaersutite is found only in pigeonite. This suggests that the occurrence of amphibole is controlled in part by the composition of its host phase. Crystallization of host (cognate) pigeonite from a magmatic inclusion will enrich the remaining melt in Ca, Al, and Ti, supporting formation of kaersutite.
Derived from text
*Shergottites; Planetary Mantles; Meteorites; Mars (Planet); Crystallization; Amphiboles*

**20040059932** Brown Univ., Providence, RI, USA
**Rehomogenized Interstitial and Inclusion Melts in Lherzolitic Shergottite ALH77005: Petrologic Significance**
Calvin, C.; Rutherford, M.; Lunar and Planetary Science XXXV: Martian Meteorites: Petrology; 2004; 2 pp.; In English; See also 20040059922; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Melt inclusions may be used to help decipher the magmatic history of an igneous rock because they provide a record of the magma composition at the time of the mineral formation. Therefore, melt inclusions are of particular importance in analyzing Martian meteorites in an effort to understand their petrogenetic history. Among the many still unanswered questions regarding shergottites is their relationship to each other and the composition of their parental melt. One previous study proposes that olivine- phyric shergottites may be parent magmas to the lherzolitic and basaltic shergottites. An alternate model suggests that the composition of lherzolitic and basaltic shergottites can be explained through mixing, but the major element composition of the end members are not well constrained.
Derived from text
*Homogenizing; Interstitials; Melting; SNC Meteorites; Shergottites*

**20040059984** Lawrence Livermore National Lab., Livermore, CA
**Evolving Neural Networks for the Classification of Galaxies**
Cantu-Paz, E.; Kamath, C.; Feb. 26, 2002; 14 pp.; In English
Report No.(s): DE2004-15005953; UCRL-JC-147020; No Copyright; Avail: Department of Energy Information Bridge

The FIRST survey (Faint Images of the Radio Sky at Twenty-cm) is scheduled to cover 10,000 square degrees of the

northern and southern galactic caps. Until recently, astronomers classified radio-emitting galaxies through a visual inspection of FIRST images. Besides being subjective, prone to error and tedious, this manual approach is becoming infeasible: upon completion, FIRST will include almost a million galaxies. This paper describes the application of six methods of evolving neural networks (NNs) with genetic algorithms (GAs) to identify bent-double galaxies. The objective is to demonstrate that GAs can successfully address some common problems in the application of NNs to classification problems, such as training the networks, choosing appropriate network topologies, and selecting relevant features. The results indicate that most of the methods perform equally well on our data, but the feature selection method gives superior results.
NTIS
*Neural Nets; Galaxies*

**20040060002** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040060003 - 20040060015
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

Titles in this section include: 1) Giant Lowland Polygons: Relics of an Ancient Martian Ocean? 2) Lake Shorelines: Earth Analogs for Hypothesized Martian Coastal Features; 3) Complex Evolution of Paleolacustrine Systems on Mars: An Example from the Holden Crater; 4) Geomorphology and Hydraulics of Ma'adim Vallis, Mars, During a Noachian/Hesperian Boundary Paleoflood; 5) Geologic Evolution of Dao Vallis, Mars; 6) Advances in Reconstructing the Geologic History of the Chryse Region Outflow Channels on Mars; 7) Ravi Vallis, Mars - Paleoflood Origin and Genesis of Secondary Chaos Zones; 8) Walla Walla Vallis and Wallula Crater: Two Recently Discovered Martian Features Record Aqueous History; 9) Tharsis Recharge: a Source of Groundwater for Martian Outflow Channels; 10) Factors Controlling Water Volumes and Release Rates in Martian Outflow Channels; 11) Significance of Confined Cavernous Systems for Outflow Channel Water Sources, Reactivation Mechanisms and Chaos Formation; 12) Systematic Differences in Topography of Martian and Terrestrial Drainage Basins; 13) Waves on Seas of Mars and Titan: Wind-Tunnel Experiments on Wind-Wave Generation in Extraterrestrial Atmospheres.
Author
*Mars Environment; Paleoclimatology; Landforms; Water; Planetary Geology*

**20040060003** Freie Univ., Berlin, Germany
**Giant Lowland Polygons: Relics of an Ancient Martian Ocean?**
Werner, S. C.; vanGasselt, S.; Neukum, G.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Utopia and Acidalia Planitae are occupied by extensive areas of polygonal terrain, so called giant polygons. They consist of 200 to 800 meter wide steep walled and flat floored troughs some tens of meters deep and 5 km to 30 km in diameter. A number of hypotheses for the origin have been discussed such as thermal cooling and contraction in permafrost, desiccation of water saturated sediments, cooling of lava, and tectonic deformation. Pechmann has shown that none of these terrestrial analogs would lead to a satisfactory description of the mechanisms and scales involved. McGill and Hills besides others were able to explain the observed large size of the polygons and could account for the stresses responsible for the polygonal troughs by plate bending and finite element models which indicate the shrinkage of desiccating sediments or cooling of volcanics accompanied by differential compaction over buried topography. A primary tectonic origin being caused by uplift of the basin floor in the Utopia region has been discussed. The giant polygonal pattern is accompanied by ring or double ring like structures which are assumed to be buried craters (ghost craters) and have been used to estimate the thickness of the overburden.
Derived from text
*Polygons; Planetary Geology; Extraterrestrial Oceans; Terrain; Tectonics; Mars Volcanoes*

**20040060004** National Air and Space Museum, Washington, DC, USA
**Geomorphology and Hydraulics of Ma'adim Vallis, Mars, During a Noachian/Hesperian Boundary Paleoflood**
Irwin, R. P., III; Howard, A. D.; Maxwell, T. A.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

At 900 km long, 8-15 km wide and up to 2,100 m deep, Ma'adim Vallis is one of the largest valleys in the Martian

highlands. The valley descends northward and terminates at the landing site for the Spirit Mars Exploration Rover at Gusev Crater, which acted as a detention pond or terminal basin for Ma'adim flows. Previously we identified the valley head at the breached drainage divide of an enclosed basin in the mid-latitude highlands. Along with characteristics of the head basin, this feature suggested that the valley was carved primarily during a single paleolake overflow at the Noachian/Hesperian boundary (approx. 3.7 Ga). Earlier work had suggested that Ma'adim Vallis was carved over a prolonged period up to 1.8 Ga by episodic groundwater-fed flows. Here we investigate the valley's longevity using crater counting, topography, and flow hydraulics. These analyses provide quantitative support for development of the valley during a brief overflow, followed by a geologically brief period of tributary development.
Author
*Planetary Geology; Geomorphology; Mars Surface; Floods; Hydraulics*

**20040060005** Planetary Science Inst., Tucson, AZ, USA
**Geologic Evolution of Dao Vallis, Mars**
Crown, David A.; Bleamaster, Leslie F., III; Mest, Scott C.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dao, Harmakhis, and Reull Valles extend through the cratered highlands and sedimentary plains of the eastern Hellas region of Mars. Dao Vallis, along with its tributary Niger Vallis, extends for approximately 1200 km from the eastern margin of Hadriaca Patera into Hellas Planitia, where it contributed sediments and water/ice to the basin floor. The Dao Vallis system (approximately 6-50 km wide) is characterized by two steep-walled source depressions, regions of subsided plains, and prominent central canyons whose walls display gullies with associated depositional aprons covering parts of canyon floors. Analyses using Viking Orbiter images have suggested that Dao Vallis formed by a combination of collapse of sedimentary and volcanic plains and surface and subsurface flow events, as well as late-stage wall collapse that served to enlarge its main canyons and source areas. The present study is designed to utilize MOC images, MOLA topographic data, TES data, and THEMIS daytime and nighttime images to evaluate and refine the geologic evolution of Dao Vallis.
Derived from text
*Mars Volcanoes; Planetary Geology; Planetary Evolution; Topography*

**20040060006** National Air and Space Museum, Washington, DC, USA
**Lake Shorelines: Earth Analogs for Hypothesized Martian Coastal Features**
Zimbelman, J. R.; Williams, S. H.; Johnston, A. K.; Head, James W.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002
Contract(s)/Grant(s): NAG5-12746; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The possibility of oceans on Mars has generated a lot of interest in the science community, but conclusive evidence supporting or refuting the ocean hypothesis has remained somewhat elusive. Precise topographic measurements of fresh-appearing shorelines from glacial Lake Lahontan were collected recently in an effort to obtain well-constrained data for comparison with the hypothesized Martian shorelines. This report summarizes the first results of the on-going research project.
Author
*Planetary Geology; Mars Surface; Extraterrestrial Oceans; Shorelines; Analogs*

**20040060007** Southwest Research Inst., San Antonio, TX, USA
**Walla Walla Vallis and Wallula Crater: Two Recently Discovered Martian Features Record Aqueous History**
Dinwiddie, C. L.; Coleman, N. M.; Necsoiu, M.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

At least three Hesperian era outflow channels sourced by the pits of Ophir Catenae [name provisionally approved by the International Astronomical Union (IAU)] occur in Ophir Planum and Aurorae Planum to the west and south of Ganges Chasma. Here we discuss the most recently discovered outflow channel, Walla Walla Vallis (name provisionally approved by the IAU), which was unresolved until return of THEMIS images began in late 2002. These channels provide evidence that Hesperian lakes may have existed in ancestral canyons of the Valles Marineris. Average planetary surface elevations decline over the approximate 750 km distance between the rims of Candor Chasma and Ganges Chasma, while the aligned Ophir Catenae pit chains are observed to extend over the same expanse. The regional topographic slope between these two chasmata

would have favored easterly migration of groundwater and, if the surface expression of pit chains indicates dilational faulting with the same general orientation, this subsurface structure would also serve to enhance groundwater flow in the same direction.
Author
*Planetary Geology; Mars Surface; Canyons; Mars Craters*

**20040060008** Southwest Research Inst., Boulder, CO, USA
**Tharsis Recharge: A Source of Groundwater for Martian Outflow Channels**
Harrison, K. P.; Grimm, R. E.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The circum-Chryse outflow channels (OCs) are large drainage features carved predominantly during the Hesperian epoch by floodwaters reaching volumes greater than 10(exp 6) cubic kilometers. Emanating mostly from chaos regions east of the Tharsis rise, the OCs extend 100 s of km to the east and north, terminating in the low elevation Chryse Planitia. Floodwaters originated from a permeable aquifer, reaching the surface through disruptions in a confining cryosphere. Quantitative descriptions of OC formation remain poorly constrained. Estimated peak flow rates vary from 3 x 10(exp 6) cubic meters. per second to 10(exp 10) cubic meters.per second; durations of discrete flooding episodes vary from a few days to years; and inferred volumetric sediment-water ratios (S/W) vary from 10(exp -4) to 0.67. S/Ws even slightly less than the maximum lead to water volumes exceeding the regional storage capacity of the crust: a source of groundwater recharge is necessary. Clifford and Clifford and Parker proposed that melting at the base of a South Polar ice cap recharged the aquifer and provided a steady supply of water to the OCs. This model has certain disadvantages, including the requirement of hydraulic connectivity on a lateral scale of several thousands of kilometers, the inability to provide water to high elevation channels, and the possible restriction of groundwater flow by a thick polar cryosphere. We propose that recharge at the high elevation Tharsis rise immediately west of the circum-Chryse OCs overcomes these difficulties and explains previously suggested links between these regions. Qualitative arguments are presented utilizing the U.S. Geological Survey's three-dimensional finite-difference code MODFLOW-2000.
Derived from text
*Ground Water; Open Channel Flow; Mars Surface; Three Dimensional Models*

**20040060009** NASA Ames Research Center, Moffett Field, CA, USA
**Waves on Seas of Mars and Titan: Wind-Tunnel Experiments on Wind-Wave Generation in Extraterrestrial Atmospheres**
Lorenz, R. D.; Kraal, E. R.; Eddlemon, E. E.; Cheney, J.; Greeley, R.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The generation of waves by winds across Earth's water oceans is a topic of enduring fascination. However, the physics of the problem are rather forbidding and thus the relationships between real-world windspeed and sea state tend to be empirical. Such empirical relations are of limited utility in environments where the physical parameters are different, such as the surfaces of other planets. These environments have only recently come to oceanographers attention, with the discovery of ancient shorelines and lakes on Mars, and the prospects for and recent evidence of lakes and seas of liquid hydrocarbons on Saturn's moon Titan. We are aware of only one other published experimental wind-water tunnel study where the fluid parameters have been varied. This used artificially-generated mm-scale waves at 3.8-7.6 Hz in water, glycerol solutions (higher viscosity) and surfactant solutions (lower surface tension). Lower viscosity solutions had higher wave growth rates: surprisingly, higher surface tension led to more rapid wave growth. The liquid density was not appreciably varied, and 1 bar air was used throughout.We used the MARSWIT (Mars Wind Tunnel) operated by ASU at NASA Ames. A fiberglass tray (5 cm x 120 cm x 75 cm) was installed in the tunnel, with an approx. 1:5 ramp to prevent strong flow separation. The tray was filled to a depth of about 4 cm. Sensors were clamped to the tray itself or held by a steel and aluminium frame just above the water level. A towel was draped on the water surface at the downwind end of the tray to act as a damper to suppress wave reflection. Position-sensitive infrared (IR) reflection sensors (Sharp GP12D02) and ultrasonic rangers (Devantech DF-04) used in mobile robotics were used as water level sensors. The tray was observed with a video camera, whose output could be viewed on a monitor and recorded on VHS tape.
Derived from text
*Extraterrestrial Oceans; Waves; Wind Tunnel Tests*

**20040060010** Tokyo Univ., Hongo, Japan

**Significance of Confined Cavernous Systems for Outflow Channel Water Sources, Reactivation Mechanisms and Chaos Formation**

Rodriguez, J. A. P.; Sasaki, S.; Miyamoto, H.; Dohm, J. M.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The formation of outflow channels has been attributed to catastrophic discharges of ground water. To the present, the following hypotheses have been proposed to explain modes of confinement and release of ground water, trapped within the Martian cryosphere: Catastrophic release of groundwater stored within confined aquifers, both catastrophic and non-catastrophic release of groundwater segregated from the permafrost into confined cavernous systems, and catastrophic release of groundwater extracted from the permafrost by thermal convection. Ground water release resulted in the formation of chaotic terrains, broad areas of jostled blocks and knobs as much as 2 km deeper than the surrounding highlands, mostly located at the head source regions of the outflow channels. Their formation has been attributed to collapse of plateau material, possibly involving multiple events. Crater counting of the outflow channel floors indicates a late Hesperian age. In this abstract we discuss the geomorphology of a highland region (Hereafter referred to as The Subsided Plateau Region, located east of Valles Marineris and bounded to the South by the Aureum Chaos, to the West by the Hydraotes Chaos, and to the north by the Hydaspis Chaos. We propose a new hypothesis, which can potentially explain the following unresolved issues: (1) sources for the large volumes of water required to carve the outflow channels, (2) mechanisms of outflow reactivation, which do not involve recharging of the head source region. In this hypothesis we also propose an alternative mode of formation for chaotic terrains.

Author

*Water Flow; Mars Surface; Water Erosion; Planetary Geology*

**20040060011** Lunar and Planetary Inst., Houston, TX, USA

**Systematic Differences in Topography of Martian and Terrestrial Drainage Basins**

Stepinski, T. F.; Coradetti, S.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have computationally extracted and quantitatively analyzed a significant number of terrestrial and Martian drainage basins. The analysis reveals systematic differences between topography of drainage basins on the two planets. This dichotomy provides a direct and quantitative argument for an immaturity of Martian drainage basins with respect to fluvial erosion. Our findings indicate that Noachian surfaces on Mars did not experience runoff erosion of intensity and duration required to produce terrestrial-style basins.

Author

*Drainage; Mars Surface; Topography; River Basins; Dichotomies*

**20040060012** Geological Survey, Flagstaff, AZ, USA

**Advances in Reconstructing the Geologic History of the Chryse Region Outflow Channels on Mars**

Tanaka, K. L.; Skinner, J. A., Jr.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have updated our geologic mapping of the northern plains of Mars, based on analysis of Mars Odyssey (MO) Thermal Emission Imaging System (THEMIS) images and Mars Global Surveyor (MGS) Mars Orbiter Laser Altimeter (MOLA) and Mars Orbiter Camera (MOC) data. One of our objectives in the mapping has been the reconstruction of Chryse region outflow channel activity. Here, we present new findings that bear on channeling history, the northern plains ocean hypothesis, and hematite formation in Aram Chaos.

Derived from text

*Paleontology; Planetary Geology; Mars Surface; Mars Volcanoes; Planetary Mapping; Open Channel Flow*

**20040060013** National Academy of Sciences - National Research Council, Washington, DC, USA

**Ravi Vallis, Mars: Paleoflood Origin and Genesis of Secondary Chaos Zones**

Coleman, Neil M.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ravi Vallis is a large outflow channel in the Xanthe Terra region. It emerges from Aromatum Chaos, a large area of collapsed ground centered at 43.0 deg W, 1.2 deg S. The channel incised terrain of Noachian age (unit Npl2 of the plateau sequence). TES spectra indicate that basalts and andesites or weathered basalts dominate the Martian surface. Longitudinal grooves parallel to the flow are shown, consistent with fluvial erosion of layered rocks and similar to erosional features in basalts of the Channeled Scabland. At its eastern terminus, Ravi V. is truncated by a fault scarp at the western margin of Hydraotes Chaos. One researcher concluded that CO2 processes formed Ravi V. (and other outflow channels). However, the CO2 hypothesis lacks merit compared with an aqueous flood origin.
Author
*Planetary Geology; Mars Surface; Floods; Geomorphology*

**20040060014** Lancaster Univ., UK
**Factors Controlling Water Volumes and Release Rates in Martian Outflow Channels**
Wilson, L.; Head, J. W.; Leask, H. J.; Ghatan, G.; Mitchell, K. L.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002
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

We discuss estimates of water fluxes on Mars and suggest that many are overestimates. Even so, we can only explain very high martian outflow rates by either unusually permeable aquifer systems or sudden release of shallow concentrations of water.
Author
*Mars Surface; Shallow Water; Open Channel Flow; Planetary Cryospheres*

**20040060015** International Research School of Planetary Sciences, Pescara, Italy
**Complex Evolution of Paleolacustrine Systems on Mars: An Example from the Holden Crater**
Pondrelli, M.; Baliva, A.; DiLorenzo, S.; Marinangeli, L.; Rossi, A. P.; Lunar and Planetary Science XXXV: Ancient Mars Water and Landforms; 2004; 2 pp.; In English; See also 20040060002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lacustrine systems are extremely sensitive to environmental fluctuations and, thus, they represent an ideal geological setting to investigate for climatic changes. Among the putative Martian paleolakes, the Holden crater (26S/326E) shows a richness of fluvio-lacustrine features. The Holden crater is 130 km wide and lies on Noachian rocks of the southern-cratered terrains. The crater appears to interrupt a fluvial system of Hesperian age which likely connected the Argyre basin to the northern chaos-outflow channels system. The main valley, Uzboi Vallis, cuts the southern rim and debouches into the crater. The Uzboi Vallis and Holden crater floors have been previously mapped as same units of fluvio-lacustrine deposits origin reworked by wind activity. These deposits show a variety of sedimentary and morphological differences at MOC and THEMIS scale. The aim of this work is to: a) recognize the sedimentary sequence and morphologies originated by fluvio-lacustrine processes; b) reconstruct the evolution of the depositional systems through time.
Derived from text
*Mars Craters; Geomorphology; Paleontology; Mars Surface; Planetary Evolution; Lakes*

**20040060016** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Meteorites to and from the Moon and Mars: My Planet or Yours?**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040060017 - 20040060021
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Meteorites from Mars - Constraints from Numerical Modeling; 2) Iron Oxidation Products in Martian Ordinary Chondrite Finds as Possible Indicators of Liquid Water Exposure at Mars Exploration Rover Landings Sites; 3) Meteorites on Mars; 4) Sulfide Stability of Planetary Basalts; 5) Exposure and Terrestrial Histories of New Lunar and Martian Meteorites.
CASI
*SNC Meteorites; Meteorite Parent Bodies; Moon*

**20040060018** California Univ., Bodega Bay, CA, USA

**Exposure and Terrestrial Histories of New Lunar and Martian Meteorites**

Nishiizumi, K.; Hillegonds, D. J.; McHargue, L. R.; Jull, A. J. T.; Lunar and Planetary Science XXXV: Meteorites to and from the Moon and Mars: My Planet or Yours?; 2004; 2 pp.; In English; See also 20040060016

Contract(s)/Grant(s): W-7405-eng-48; NAG5-12846; NAG5-11979; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Cosmogenic nuclide studies of lunar and Martian meteorites have contributed significantly to our understanding of these objects. By measuring a combination of cosmogenic stable- and radionuclides, we can determine a number of important properties of those meteorites. Most lunar meteorites have complex cosmic ray exposure histories, having been exposed both at some depth on the lunar surface (2 irradiation) before their ejection and as small bodies in space (4 irradiation) during transport from the Moon to the Earth. On the other hand, we have not observed evidence of complex exposure history for any Martian meteorites, so far. These exposures were then followed by residence on Earth s surface, a time commonly referred to as the terrestrial age. In addition to their complement of galactic cosmic ray (GCR) produced nuclides some lunar and Martian meteorites contain nuclides produced by solar cosmic rays (SCR). Unraveling the complex history of these objects requires the measurement of at least four cosmogenic nuclides. The specific goals of these measurements are to constrain or set limits on the following shielding or exposure parameters: (1) the depth of the sample at the time of ejection from the Moon or Mars; (2) the transit time (4 exposure age) from ejection off the lunar or Martian surface to the time of capture by the Earth and (3) the terrestrial residence time. The sum of the transit time and residence time yield an ejection age. The ejection age, in conjunction with the sample depth on the Moon or Mars, can then be used to model impact and ejection mechanisms.

Derived from text

*Meteorites; Lunar Surface; Mars Surface; Radioactive Isotopes; Nuclides*

**20040060019** Minor Planet Research, Inc., Fountain Hills, AZ, USA

**Iron Oxidation Products in Martian Ordinary Chondrite Finds as Possible Indicators of Liquid Water Exposure at Mars Exploration Rover Landings Sites**

Ashley, J. W.; Wright, S. P.; Lunar and Planetary Science XXXV: Meteorites to and from the Moon and Mars: My Planet or Yours?; 2004; 2 pp.; In English; See also 20040060016; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The oxidation of reduced iron-nickel metal grains and ferrous iron in ordinary chondrite meteorites (OC) is observed in both hot and cold desert terrestrial environments, where liquid water is implied (and may be required) to produce their more recognizable effects. The study of such a meteorite in a Martian setting, should one become available to Mars Exploration Rover (MER) science packages, could contribute to our database of information concerning the past availability of liquid water on the planet. This abstract reviews the viability of using secondary iron oxides in OC meteorites as markers for Martian climatic behavior. We conclude that predicted concentration mechanisms for asteroidal material on Martian surfaces, combined with the capabilities of the MER Athena instrument payloads, yield promising expectations for this manner of investigation. Background:

Author

*Chondrites; Iron Oxides; Mars Environment; Water*

**20040060020** NASA Johnson Space Center, Houston, TX, USA

**Sulfide Stability of Planetary Basalts**

Caiazza, C. M.; Righter, K.; Gibson, E. K., Jr.; Chesley, J. T.; Ruiz, J.; Lunar and Planetary Science XXXV: Meteorites to and from the Moon and Mars: My Planet or Yours?; 2004; 2 pp.; In English; See also 20040060016; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The isotopic system, 187Re 187Os, can be used to determine the role of crust and mantle in magma genesis. In order to apply the system to natural samples, we must understand variations in Re/Os concentrations. It is thought that low [Os] and [Re] in basalts can be attributed to sulfide (FeS) saturation, as Re behaves incompatibly to high degrees of evolution until sulfide saturation occurs [1]. Previous work has shown that lunar basalts are sulfide under-saturated, and mid-ocean ridge, ocean-island and Martian (shergottites) basalts are saturated [2,3]. However, little is known about arc basalts. In this study, basaltic rocks were analyzed across the Trans-Mexican Volcanic Belt.

Derived from text

*Sulfides; Stability; Basalt; Mars (Planet); Magma; Crusts*

**20040060021** Konkoly Observatory, Budapest, Hungary
**Meteorites on Mars**
Illes-Almar, E.; Lunar and Planetary Science XXXV: Meteorites to and from the Moon and Mars: My Planet or Yours?; 2004; 2 pp.; In English; See also 20040060016; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is suggested that the boulders on a MOC image are meteorites fallen in ancient times to the surface of Mars.
Author
*Mars Surface; Mars (Planet); SNC Meteorites; Planetary Geology*

**20040060022** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040060023 - 20040060038
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Analysis of Orientation Dependence of Martian Gullies; 2) A Preliminary Relationship between the Depth of Martian Gullies and the Abundance of Hydrogen on Near-Surface Mars; 3) Water Indicators in Sirenum Terra and around the Argyre Impact Basin, Mars; 4) The Distribution of Gullies and Tounge-shaped Ridges and Their Role in the Degradation of Martian Craters; 5) A Critical Evaluation of Crater Lake Systems in Memnonia Quadrangle, Mars; 6) Impact-generated Hydrothermal Activity at Gusev Crater: Implications for the Spirit Mission; 7) Characterization of the Distributary Fan in Holden NE Crater using Stereo Analysis; 8) Computational Analysis of Drainage Basins on Mars: Appraising the Drainage Density; 9) Hypsometric Analyses of Martian Basins: A Comparison to Terrestrial, Lunar, and Venusian Hypsometry; 10) Morphologic Development of Harmakhis Vallis, Mars; 11) Mangala Valles, Mars: Investigations of the source of Flood Water and Early Stages of Flooding; 12) The Formation of Aromatum Chaos and the Water Discharge Rate at Ravi Vallis; 13) Inferring Hydraulics from Geomorphology for Athabasca Valles, Mars; 14) The Origin and Evolution of Dao Vallis: Formation and Modification of Martian Channels by Structural Collapse and Glaciation; 15) Snowmelt and the Formation of Valley Networks on Martian Volcanoes; 16) Extent of Floating Ice in an Ancient Echus Chasma/Kasei Valley System, Mars.
Author
*Mars (Planet); Mars Surface; Hydrology; Drainage; Valleys; Planetary Geology*

**20040060023** Planetary Science Inst., Tucson, AZ, USA
**Morphologic Development of Harmakhis Vallis, Mars**
Bleamaster, Leslie F., III; Crown, David A.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Harmakhis Vallis is one of three major vallis systems that dissect the cratered highlands and volcanic and sedimentary plains of the eastern Hellas region of Mars. Along with Dao and Reull Valles, Harmakhis Vallis represents a stage in regional geologic history intermediate to formation of channels and valleys within highland terrains in the Late Noachian and Early Hesperian Epochs and debris apron and gully formation in the Amazonian Period. Previous analyses, based on Viking Orbiter images, describe these large outflow channels as forming by a combination of plains collapse, subsurface flow and surface runoff, and late stage enlargement by wall collapse and mass movement. The current study of Harmakhis Vallis utilizes MOC images, MOLA topographic data, TES data, and THEMIS daytime and nighttime images to evaluate and refine the geologic history of Harmakhis Vallis and its surroundings.
Author
*Mars Surface; Geomorphology; Geological Faults; Valleys; Planetary Geology*

**20040060024** National Air and Space Museum, Washington, DC, USA
**Hypsometric Analyses of Martian Basins: A Comparison to Terrestrial, Lunar and Venusian Hypsometry**
Fortezzo, C. M.; Grant, J. A.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Martian valley networks and their associated basins have been the focus of a number of morphometric studies to

determine the dominant process, surface runoff or groundwater sapping. Previous studies have primarily relied on the derivation of linear and areal parameters to perform morphometric analyses. The high-resolution Mars Orbiter Laser Altimeter (MOLA) topographic data set is available and possesses sufficient resolution to enable quantitative assessment of the basin area versus elevation relationships. The hypsometric analyses completed using these data may allow for a better understanding of the dominant processes shaping basin surfaces on Mars.
Derived from text
*Planetary Geology; Mars Surface; Hypsography; Structural Basins; Venus (Planet); Lunar Geology; Terrestrial Planets; Topography*

**20040060025** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Water Indicators in Sirenum Terra and Around the Argyre Impact Basin, Mars**
Stern, J. G.; Frey, H. V.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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 examines the relationships between three temporally distinct indicators of water on Mars: ancient craters with fluidized ejecta, relatively more recent gullies inside those craters, and current abundance of near surface hydrogen around those craters. We find an association between gully occurrence and large-scale geologic features; analysis indicates unique depth/diameter ratios for gullied craters in Sirenum Terra. Numerical comparisons of fluidized and non-fluidized, gullied and non-gullied craters suggest that the Argyre region could have had a near-surface water table that receded before recent times, while Sirenum Terra may have had an ancient water table that persists to this day.
Author
*Water; Mars Surface; Ejecta; Hydrogen*

**20040060026** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Analysis of Orientation-dependence of Martian Gullies**
Mohan, S.; Bridges, N. T.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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 discovery of small Martian gullies has stimulated debate about the role that water plays on the Martian surface under current or recent conditions. Of critical importance in evaluating various gully hypotheses is reliable morphometric and orientation data. The former centers on such questions as whether the water (or another fluid) emanated from a surface or sub-surface source and the duration of flow. The latter ties into whether solar insolation has an important effect on formation of the initial water source and subsequent mobilization. Initial studies of gullies indicated a poleward orientation dependence, an observation which has recently been challenged. Herein we investigate the orientation of Martian gullies and the dependence of various parameters on the orientation. Whereas previous studies have been global or through most of the southern hemisphere, we focus on several specific regions. This approach offers some advantages in that regional variations are factored out, such that of lithology, ground water table depth (if any), surface thermal properties, and other parameters are more or less the same in a given region. Differences in gully attributes as a function of orientation within a region can more easily be attributable to solar insolation effects than is the case for global statistics. We use the orientation to constrain several classes of gully formation hypotheses. 1) A favored orientation toward the pole across all regions could indicate a process dominated by melting of cold trapped ice, snow, or condensed volatiles from incident sunlight during summer under current conditions. 2) Variations among all regions would be more consistent with mechanisms less strongly tied to current solar insolation, such as geothermal heating of ice. 3) Favored orientations within specific regions, but differing among regions, could indicate a preference for poleward ices and melting, with orientation being a function of age and dependent on variations in obliquity and precision. We find that the gullies fall into either categories 2 or 3, but not 1, indicating the recent melting of cold trapped condensates is unlikely the sole formation mechanism.
Derived from text
*Mars Surface; Ground Water; Mars (Planet); Lithology; Orientation*

**20040060027** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**A Preliminary Relationship Between the Depth of Martian Gullies and the Abundance of Hydrogen on Near-Surface Mars**
Frey, E. L.; Sakimoto, S. E. H.; Frey, H. V.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley

Systems; 2004; 2 pp.; In English; See also 20040060022; 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 compelling evidence has been presented to suggest the presence of near-surface water or water ice on Mars. The Mars Orbiter Camera (MOC) has photographed relatively young fluvial features in the form of gullies which have been attributed to groundwater seepage. The Gamma Ray Spectrometer (GRS) from the Mars Odyssey spacecraft has detected large amounts of hydrogen in the Martian soil, inferred to come from water or water ice within the upper meter of the surface. We explore the model of groundwater seepage as the mechanism of gully formation as opposed to other mechanisms. We investigate the abundance of hydrogen to the depth at which gully-like features form. We see a positive correlation, which implies the presence of a groundwater system for Mars.

Author

*Planetary Composition; Hydrogen; Mars Surface; Water Flow; Valleys; Planetary Geology*

**20040060028** Guigne International Ltd., Paradise, Newfoundland, Canada

**Extent of Floating Ice in an Ancient Echus Chasma/Kasei Valley System, Mars**

Woodworth-Lynas, Christopher; Guigne, Jacques Yves; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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

From images of the Echus Chasma/Kasei Valles valley system we present further, new observations of surficial Martian features that are interpreted to be the result of interactions between the keels of flat-bottomed floating ice floes with a submerged sediment. These features are proxy indicators of three basic environmental conditions: the former presence of a water body; the water body was seasonally, or perhaps permanently, covered by ice floes; the water area was large enough for winds, currents or both to drive the floes forward during ice/lakebed interaction. We also present an analysis of shorelines. These observations are made from analyses of Mars Global Surveyor Mars Orbiter Camera (MOC) images.

Derived from text

*Floating; Ice; Keels; Mars Surface*

**20040060029** Geological Survey, Flagstaff, AZ, USA

**Inferring Hydraulics from Geomorphology for Athabasca Valles, Mars**

Burr, D. M.; Keszthelyi, L.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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

Athabasca Valles, southeast of Elysium Mons, appear to be one of the youngest outflow channel systems on Mars. Its pristine appearance offers an exceptional opportunity to investigate outflow channel geomorphology. MOC, THEMIS and MOLA data provide tools for that investigation. Here we summarize past and on-going research into Athabasca Valles hydraulics based on analysis of the channel system s geomorphology.

Author

*Geomorphology; Mars Volcanoes*

**20040060030** Lunar and Planetary Inst., Houston, TX, USA

**Computational Analysis of Drainage Basins on Mars: Appraising the Drainage Density**

Stepinski, T. F.; Collier, M. L.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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 computationally extracted 26 Martian drainage basins from the dissected Noachian surfaces using digital topography data. The basins have been reconstructed and their drainage networks have been delineated by a computer algorithm. Summary of values for major properties characterizing the basins and their networks are given. A typical value of drainage density, calculated for individual basins, is D = 0.1/km. We argue that these, relatively high, values of D do not necessary imply past precipitation.

Author

*Algorithms; Computation; Drainage; Mars Surface*

**20040060031** Brown Univ., Providence, RI, USA

**Snowmelt and the Formation of Valley Networks on Martian Volcanoes**

Fassett, C. L.; Head, J. W., III; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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 formation mechanism for valley networks on the surface of Mars remains an open question despite the vast amount of new information that has been obtained about the planet in recent years. Distinguishing between the various models is difficult due to: (1) ongoing uncertainty in the morphological differences between Martian valleys and drainage systems on Earth, (2) the unknown relative importance of groundwater sapping and surface runoff, and (3) difficulty reconciling the observations which suggest minimal interaction of water with the Martian near-surface (e.g. unweathered olivine) with the widespread geomorphologic evidence for water erosion (such as the valley networks themselves).

Derived from text

*Snow Cover; Melting; Mars Volcanoes; Water Erosion; Geomorphology*

**20040060032** Arizona Univ., Tucson, AZ, USA

**Impact-generated Hydrothermal Activity at Gusev Crater: Implications for the Spirit Mission**

Abramov, O.; Kring, D. A.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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

Gusev crater is the landing site of the Spirit rover, the fourth spacecraft to successfully land on Mars. The crater is approx. 160 km in diameter; however, its original rim-to-rim diameter might have differed from the present due to post-impact erosion and partial crater rim collapse. Estimates for the age of the crater place it in the early to mid-Noachian, and there are indications of hydrogeologic activity in the crater up until approx. 0.7 Ga. The crater basin is largely filled with post-impact material including lacrustine, fluvial, aeolean deposits, ejecta from nearby impacts, and collapsed material from the crater wall. The thickness of the crater fill is likely a kilometer or more. Current estimates put the Spirit landing site 6 to 8 km south of the center of the crater. This mission is part of the 'follow the water' Mars exploration initiative. In this report, we explore the possibility of impact-generated hydrothermal activity and associated mineral signatures in Gusev crater.

Author

*Mars Craters; Mars Landing Sites; Hydrothermal Crystal Growth; Hydrothermal Systems; Planetary Geology*

**20040060033** Brown Univ., Providence, RI, USA

**Mangala Valles, Mars: Investigations of the Source of Flood Water and Early Stages of Flooding**

Ghatan, Gil J.; Head, James W.; Wilson, L.; Leask, H. J.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; Original contains color illustrations

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Mangala Valles, an approx. 900 km long north-south trending outflow channel located southwest of the Tharsis rise, extends northward from one of the Memnonia Fossae graben across the southern highlands, terminating at the dichotomy boundary. Previous Viking-based analyses suggest that the water that carved the channel was expelled from the graben, possibly during two distinct flood events, one in the Late Hesperian and one in the Latest Hesperian/Early Amazonian. The mechanism by which the water was transported to the graben, and ultimately to the surface remained ambiguous, although two general scenarios were proposed: melting of near surface ground ice via nearby Tharsis lava flows, and tapping of a near surface aquifer via faulting associated with the graben. Here we use MOLA altimetric data and MOC and THEMIS images to reexamine Mangala Valles and the surrounding region. Further, we develop a new model for the production and transport of the floodwater.

Author

*Mars Surface; Valleys; Planetary Geology; Water; Floods*

**20040060034** Lancaster Univ., UK

**The Formation of Aromatum Chaos and the Water Discharge Rate at Ravi Vallis**

Leask, Harald J.; Wilson, Lionel; Mitchell, Karl L.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; Original contains color 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 Aromatum Chaos depression - Ravi Vallis outflow channel system is sufficiently simple that water flow rate and volume estimates can be made that throw light on processes operating to form the Aromatum and Ravi features. Typical discharge rates through Ravi Vallis are estimated at 3 x 10(exp 6) cu m/s. By assuming a high sediment load in the water we find a minimum duration of approx. 2 months. Too much water flowed in the channel to be explained by cryosphere melting alone, and drainage of a local aquifer system delineated by intrusions is clearly implicated.
Author
*Mars Surface; Planetary Geology; Water Flow; Topography*

**20040060035** Colorado Univ., Boulder, CO, USA
**The Origin and Evolution of Dao Vallis: Formation and Modification of Martian Channels by Structural Collapse and Glaciation**
Arfstrom, J. D.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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 formation of large depressions on Mars with kilometer-scale relief has been attributed to ground collapse caused by removal of subsurface ice. One suggested terrestrial analog is a type of thermokarst feature know as alases, which are circular-to-irregular, flat-floored, steep-sided, shallow depressions, but relief of alases is on the order of meters or tens of meters. Ground collapse on the order of kilometers implies a volume of supersaturating ground ice (ice in addition to ice filling pore spaces) approaching the volume of the void space of the depression produced by the collapse, thus requiring a very high fraction of ice at depths unheard of on Earth.
Derived from text
*Evolution (Development); Mars Surface; Channels; Ice; Collapse*

**20040060036** Planetary Science Inst., Tucson, AZ, USA
**The Distribution of Gullies and Tongue-shaped Ridges and Their Role in the Degradation of Martian Craters**
Berman, D. C.; Hartmann, W. K.; Crown, D. A.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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 discovery of hillside gullies on Mars, interpreted by Malin and Edgett to be evidence for recent water release, and recognition of their apparently young ages has caused much excitement and debate. The gullies are mainly observed on the sloping walls of large craters or channels. Most of the gullies are between approx. 30 - 50 deg. latitude (most in the southern hemisphere) and are usually seen on polefacing slopes.
Author
*Degradation; Mars Craters; Mars Surface*

**20040060037** National Air and Space Museum, Washington, DC, USA
**A Critical Evaluation of Crater Lake Systems in Memnonia Quadrangle, Mars**
Leverington, D. W.; Maxwell, T. A.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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 craters with inner terraces and associations with inlet or outlet channels have previously been considered to be strong candidates for the sites of ancient Martian lakes. However, terrace and channel features in western Memnonia have morphologies that are inconsistent with their formation as interconnected lacustrine and fluvial elements within a regional system.
Author
*Evaluation; Lakes; Mars Craters*

**20040060038** California Inst. of Tech., Pasadena, CA, USA
**Characterization of the Distributary Fan in Holden NE Crater Using Stereo Analysis**
Lewis, K.; Aharonson, O.; Lunar and Planetary Science XXXV: Mars: Hydrology, Drainage, and Valley Systems; 2004; 2 pp.; In English; See also 20040060022; 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 discovery of a distributary fan in a large crater northeast of Holden by Malin and Edgett has been presented

as evidence for persistent flow of water on Mars. With at least three separate depositional lobes and a clearly layered structure, this feature is so far unique among sedimentary structures on Mars. This fan has been deposited by fluvial processes, and then subsequently eroded back from its original extent. This process has left behind an inverted topography, with the floors of former channels standing above the surrounding terrain. Several of the remnant channels in this formation appear to display meandering curves, which is the strongest evidence for a steady supply of water at this location. Further, persistent flow raises the possibility that this feature was, at one time, a lacustrine delta. In order to help characterize the Holden NE fan, we have used stereo analysis of MOC Narrow Angle images to derive topographical information about this site. For this study we have used high resolution

Author

*Craters; Water; Terrain; Mars Surface*

**20040060039** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040060040 - 20040060056

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Morphological Evidence for the Large-scale Evolution of Martian North Polar Troughs? 2) New Views of the Martian Polar Regions: The Latest Results from the Mars Odyssey THEMIS Investigation; 3) Observations at the Chasma Australe Re-Entrant, South Polar Region, Mars; 4) Stratigraphic Details of Uppermost Units within South Polar Layered Deposits on Mars; 5) Detailed Geologic Analysis of Part of the South Polar Layered Deposits, Planum Australe, Mars: Part II; 6) SHARAD: Radar Volume Scattering and the Polar Layered Terrains on Mars; 7) Arabia and Memnonia Equatorial Regions with High Content of Water: Data from HEND/Odyssey; 8) Alaskan Permafrost Analogs of Martian Small Valley Networks, Thermokarst, Terrain Softening, Terraces, and Volcanic Craters; 9) Periglacial Processes in the Southern Hemisphere of Mars; 10) Thermal Modeling of Possible Surface Water Ice Deposits in Juventae Chasma; 11) Modeling Depth to Ground Ice on Mars; 12) Ground Ice at the Phoenix Landing Site: A Preflight Assessment; 13) Possible Temperature-related Differences in Slope Angle between the North and South Walls of Coprates Chasma, Mars; 14) Seasonal Variations within Korolev Crater, Mars; 15) South Polar Ar Enhancement as a Tracer for Southern Winter Horizontal Meridional Mixing; 16) An Investigation of the Correlation of Water-Ice and Dust Retrievals via the MGS TES Data Set; 17) Observations of Plasma Waves near Mars and Their Implications for Atmospheric Loss.

CASI

*Mars (Planet); Mars Atmosphere; Polar Regions; Planetary Geology*

**20040060040** California Inst. of Tech., Pasadena, CA, USA

**Morphological Evidence for the Large-scale Evolution of Martian North Polar Troughs?**

Nomanbhoy, M.; Murray, B.; Pathare, A.; Koutnik, M.; Byrne, S.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; 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 kilometer-scale topography of the North Polar Layered Deposits (PLD) is dominated by arcuate troughs that appear to spiral outward from the pole. These troughs are typically asymmetric, with equatorward-facing (EWF) walls that are generally steeper than their poleward-facing (PWF) counterparts. Several mechanisms for trough evolution have been proposed, including: preferential sublimation from sunfacing EWF walls, eolian ablation by katabatic winds, and differential relaxation due to the slower relaxation rates of colder PWF walls.

Derived from text

*Mars (Planet); Troughs; Geomorphology; Planetary Evolution; Mineral Deposits*

**20040060041** University of Central Florida, Orlando, FL, USA

**Periglacial Processes in the Southern Hemisphere of Mars**

Langsdorf, E. L.; Britt, D. T.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; 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

On Earth a range of periglacial processes and morphologies are indicative of moisture-soil interactions in arctic terrain. Strikingly similar morphologies on Mars, at similar physical scales, have been identified in high resolution images taken by

the Mars Orbital Camera (MOC). Previously, polygons identified in MOC images have been mapped globally in both the southern and northern polar regions of Mars. The polygons were found in the range of 40 degrees N - 90 degrees N and likewise from -40 degrees S to -90 degrees S. Different types of polygons were found: small scale, large scale polygonal nets on level terrain, and large scale polygonal nets in craters. These polygons are thought to be caused from frost cracking, as opposed to any other processes that cause terrestrial polygonal features. The focus of our research is to systematically identify and map periglacial features in the southern polar regions of Mars. Identified features are mapped on Mars polar base map with a topographical overlay. This allows us to locate groups of polygons, establish their spatial relationships, and characterize any elevation controls on polygon formation. This will help us to understand the range of occurrence of periglaicial morphologies and any physical controls on the development of these morphologies.
Derived from text
*Mars Surface; Planetary Mapping; Southern Hemisphere; Glacial Drift; Geomorphology*

**20040060042** Washington Univ., Seattle, WA, USA
**Thermal Modeling of Possible Surface Water Ice Deposits in Juventae Chasma**
Wood, S. E.; Leovy, C. B.; Catling, D. C.; Montgomery, D. R.; Ginder, E. A.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As described in the companion abstract of Leovy et al., light-toned interior layer deposits (ILD) on the floor of Juventae Chasma and in other chasms and chaotic terrain in the martian tropics exhibit morphology and thermal inertias similar to that of the north polar layered deposits. To derive estimates for the thermal inertia and albedo of the various surface materials in Juventae Chasma, we used a one-dimensional diurnal and seasonal thermal model to match the observed THEMIS brightness temperatures at 3 pm and 3 am. This model has been used in many previous studies of planetary surface energy balance and thermal stability of water ice deposits on Mars, Mercury, and the Moon. Radiative and conductive heat balance is maintained at the surface, and the heat conduction equation is solved numerically for each of the 40 subsurface layers of increasing thickness extending to several times the annual thermal skin depth. Radiative heating of the surface by atmospheric thermal emission was parameterized as 2% of the local noontime insolation. For this study, each subsurface layer had identical thermophysical properties which remained constant for each model run. The model accounts for the effects of slope and orientation on direct insolation rates, and we obtained estimates of these angles (+/- 5 deg) for our study areas from the 128 pixel/degree MOLA topographic data.
Author
*Surface Water; Ice; Mars Surface; Planetary Geology*

**20040060043** Geological Survey, Flagstaff, AZ, USA
**Alaskan Permafrost Analogs of Martian Small Valley Networks, Thermokarst, Terrain Softening, Terraces, and Volcanic Craters**
Kargel, Jeffrey S.; Wessels, Rick; Beget, James E.; Eddy, Thomas; Lloyd, Sandra; Macaulay, Don; Proch, Mark; Skinner, Jim; Tanaka, Kenneth L., et al.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; 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 geomorphic landscape analog in the Bering Land Bridge National Preserve (Alaska) offers a model for Mars where (1) fluvial and alluvial deposition, volcanism, and other processes first produced a layered ice-rich upper crust, and then (2) severe permafrost conditions (mild by today's Martian standards) and heterogeneous heat flow and volcanism have modified this terrain to produce a geomorphic areal mosaic that is alternately dominated by (a) geothermal meltwater and sublimation (bottom-up heat flow) and (b) surface-driven meltwater and sublimation (top-down heat flow).
Derived from text
*Mars (Planet); Permafrost; Valleys; Mars Craters; Mars Volcanoes; Geomorphology; Terraces (Landforms)*

**20040060044** Arizona Univ., Tucson, AZ, USA
**South Polar Ar Enhancement as a Tracer for Southern Winter Horizontal Meridional Mixing**
Sprague, A. L.; Boynton, W. V.; Kim, K.; Reedy, R.; Kerry, K.; Janes, D.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039
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Measurements made by the Gamma Ray Spectrometer (GRS) on Mars Odyssey during 2002 and 2003 show an obvious increase in the gamma flux of 1294 keV gamma rays resulting from the decay of (41)Ar. (41)Ar is made by the capture of thermal neutrons by atmospheric (40)Ar. The increase measured above the southern polar region has permitted calculation of the increase in mixing ratio of Ar from L(sub s) 8 to 100 between latitudes 75 S and 90 S. The peak in Ar enhancement occurs about 200 Earth days after CO2 freeze-out has begun, indicating that up to this time equatorward meridional mixing is rapid enough to move enhanced Ar from the polar regions northward. Although the CO2 frost depth continues to increase from L(sub s) 110 deg to 190 deg, the Ar enhancement steadily decreases to its baseline value reached at about L(sub s) 200 deg. Our data permit an estimate of the horizontal eddy mixing coefficient useful for constraining equatorward meridional mixing during southern winter and a characteristic mixing time for the polar southern winter atmosphere. Also, using the drop in excess Ar measured by the GRS from L(sub s) 110 deg to 200 deg, we estimate an eddy coefficient appropriate for meridional mixing of the entire Ar excess back to the baseline value. The horizontal eddy mixing coefficients are derived using Ar as a tracer much as the vertical eddy mixing coefficient for the Earth's troposphere is derived using CH4 as a minor constituent tracer. The estimation of meridional mixing for high latitudes at Mars is important for constraining parameters used in atmospheric modeling and predicting seasonal and daily behavior. The calculations are order of magnitude estimates that should improve as the data set becomes more robust and improves our models.
Author
*Mars Atmosphere; Argon; Trace Elements; Atmospheric Circulation; Winter; Annual Variations; Atmospheric Chemistry*

**20040060045** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**An Investigation of the Correlation of Water-Ice and Dust Retrievals Via the MGS TES Data Set**
Qu, Z.; Tamppari, L. K.; Smith, M. D.; Bass, Deborah; Hale, A. S.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Water-ice in the Martian atmosphere was first identified in the Mariner 9 Infrared Interferometer Spectrometer (IRIS) spectra. The Viking Imaging Subsystem (VIS) instruments aboard the Viking orbiter also observed water-ice clouds and hazes in the Martian atmosphere. The MGS TES instrument is an infrared inferometer/spectrometer which covers the spectral range 6-50 micron with a selectable sampling resolution of either 5 or 10 per cm. Using the relatively independent and distinct spectral signatures for dust and water-ice, these two retrieved quantities have been retrieved simultaneously. Although the interrelations among the two quantities have been analyzed by Smith et al. and the retrievals are thought to be robust, understanding the impact of each quantity on the other during their retrievals as well as the impact from the surface for retrievals is important for correctly interpreting the science, and therefore requires close examination. An understanding of the correlation or a-correlation between dust and water-ice would aid in understanding the physical processes responsible for the transport of aerosols in the Martian atmosphere. In this presentation, we present an investigation of the correlation between water-ice and dust in the MGS TES data set.
Author
*Ice; Dust; Mars Atmosphere; Atmospheric Composition; Infrared Spectra*

**20040060046** Washington Univ., Saint Louis, MO, USA
**SHARAD: Radar Volume Scattering and the Polar Layered Terrains on Mars**
Nunes, D. C.; Phillips, R. J.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; 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 great effort has been made to understand the structure and composition of the Martian polar caps, as they are thought to hold crucial information on the climatic history and the hydrologic cycle of Mars. Most of what we know about the polar caps comes from observing surface properties and remote sensing of the upper few meters of these terrains. What is known about the interior of the caps, however, comes from modeling and extrapolating observations of their troughs and edges. Radar sounding offers the capability of filling in this observational gap. The MARSIS radar is now safely in orbit on Mars Express and the SHARAD radar is slated for the next launch window on Mars Reconnaissance Orbiter. Significant effort is being made to assess radar interaction with different Martian geologic units. Some of the main radar science goals for the polar regions are determining the ice distribution with depth, the existence of subsurface liquid water, and the structure of the layered terrains. Here we concentrate on the last of these topics by investigating the propagation of a SHARAD-like signal through a dielectric model of the Polar Layered Terrains.
Derived from text
*Climatology; Hydrological Cycle; Mars Surface; Planetary Geology; Polar Regions; Remote Sensing; Terrain*

**20040060047** California Inst. of Tech., Pasadena, CA, USA

**Stratigraphic Details of Uppermost Units Within South Polar Layered Deposits on Mars**

Gerstell, M. F.; Byrne, S.; Murray, B.; Nomanbhoy, M.; Koutnik, M.; Pathare, A.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; 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

In the present study, we examine details of fine-scale layers immediately above and below the main bench in 275 Mars Observer Camera (MOC) Narrow Angle images that cross one or more of the 10 scarps. On at least 8 of the 10 scarps, we find evidence for about 20 fine-scale layers immediately above the main bench and about half that number between the two benches. A similar stratigraphy is presented. Exposures of the individual layers range from a few meters to over 100 m in the direction of the topographic gradient, with those at the bottom of each stack often evolving into extended lobate forms that are strongly suggestive of flow. The erosion resulting from the possible flow of these layers may have contributed to the pitted appearance of the two benches identified by Byrne and Ivanov.

Derived from text

*Mars Surface; Planetary Geology; Stratigraphy; Polar Regions; Mineral Deposits*

**20040060048** NASA, Washington, DC, USA, Academy of Sciences (USSR), Moscow, USSR

**Arabia and Memnonia Equatorial Regions with High Content of Water: Data from HEND/Odyssey**

Mitrofaov, I. G.; Litvak, M. L.; Kozyrev, A. S.; Sanin, A. B.; Tretyakov, V. I.; Boynton, W. V.; Hamara, D. K.; Shinohara, C.; Saunders, R. S.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 1 pp.; In English; See also 20040060039; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

After one martian year of neutron mapping measurements by the High Energy Neutron Detector (HEND) onboard the Mars Odyssey spacecraft, a map of the planet was produced showing the summer season in each hemisphere when winter deposition of CO2 on the surface is absent. The data for northern and southern poleward water-rich regions are presented. Here we discuss the HEND results for two equatorial regions, Arabia and Memnonia, which were found to be associated with a rather strong depression of epithermal and high energy neutrons.

Derived from text

*2001 Mars Odyssey; Equatorial Regions; Moisture Content; Neutron Counters; Saudi Arabia*

**20040060049** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Ground Ice at the Phoenix Landing Site: A Preflight Assessment**

Mellon, M. T.; Arvidson, R. E.; Seelos, F.; Tamppari, L. K.; Boynton, W. V.; Smith, P.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; 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 objectives of the Mars Scout mission, Phoenix, is to characterize the present state of water in the martian environment, in a location where water may play a significant role in the present and past habitability of Mars. Given the generally dry and cold climate of Mars today any substantial amount of water is expected to occur in the form of ground ice (subsurface ice) within the regolith. The Mars Odyssey Gamma Ray Spectrometer has indicated abundant subsurface hydrogen and inferred ground ice at high latitudes. Therefore, the Phoenix mission will be targeted to land in the northern high latitudes (approximately 65 degrees N - 75 degrees N) where ground ice is expected to be abundantly available for analysis. The lander will be capable of excavating, sampling, and analyzing, dry and water-rich/icy soils. The location and depth of excavation necessary to achieve the goals of sampling and analysis of icy material become important parameters to assess. In the present work we ask two key questions: 1) At what depth within the regolith do we expect to find ice? 2) How might this depth vary over the region of potential landing sites? Numerous lines of evidence can be employed to provide an indication of the presence or absence of shallow ground ice at the potential landing sites. For example geomorphology, neutrons, gamma rays, and theory each contribute clues to an overall understanding of the distribution of ice. Orbital observations provide information on a variety of spatial scales, typically 10 s of meters (patterned ground) to 100 s of kilometers (gamma rays). While information on all of these scales are important, of particular interest is how the presence and depth of ground ice might vary on spatial scales comparable to the lander and its work area. While ground ice may be stable (and present) on a regional scale, local-scale slopes and changes in the physical characteristics of soils can result in significant variations in the distribution of ice.

Derived from text

*Ice; Mars Landing Sites; Mars Missions; Geomorphology; Mars Atmosphere*

**20040060050** Arizona Univ., Tucson, AZ, USA

**Modeling Depth to Ground Ice on Mars**

Chamberlain, M. A.; Boynton, W. V.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Soon after the first spacecraft to Mars confirmed the surface was cold and dry, it was recognized that ice could be stable at depth below the surface. Many places on the surface of Mars get cold enough to freeze water from the atmosphere in the form of frost, as seen at the Viking II Lander site. Only the poles stay cold enough so that this frost does not completely sublime back into the atmosphere when the surface heats up in the summer season. Temperatures at depth, however, do not reach the same extreme temperatures as the surface and it is possible for ground ice to be stable outside the polar regions. Mellon and Jakosky produced the first map showing the global distribution and depth to this ground ice that is stable to diffusion with the Martian atmosphere. The most convincing evidence of the ground ice so far is the hydrogen gamma ray and neutrons detected by the Gamma Ray Spectrometer (GRS) flying on the Mars 2001 Odyssey spacecraft. The distribution of the ground ice, shown in the initial GRS results, was in excellent agreement with the map produced by Mellon and Jakosky based on albedo and thermal inertia. Presented here are some sample results from models being developed to help understand the GRS results. GRS has detected ice in such high densities in the ground that it is more likely that ice was deposited by frost or snow than vapor diffusion. Though diffusion models can still determine the thickness of lag deposits that may later form over the frost or snow.

Derived from text

*Depth; Ice; Mars Surface; Models; Ground Water*

**20040060051** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Observations of Plasma Waves near Mars and Their Implications for Atmospheric Loss**

Espley, J. R.; Cloutier, P. A.; Brain, D. A.; Crider, D. H.; Acuna, M. H.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We use data from over 500 premapping orbits of Mars Global Surveyor magnetometer data to present statistical results on the characteristics of the plasma waves in the near Mars space. We find that plasma waves in the dayside Martian magnetosheath are primarily compressional waves (i.e. magnetosonic or mirror mode waves) and in the nightside magnetosheath and tail regions that the waves are primarily associated with ion gyromotion. Some of these waves are produced by gyrating oxygen ions and as such represent observations of the ongoing erosion of the Martian atmosphere by the solar wind.

Author

*Plasma Waves; Mars (Planet); Mars Atmosphere; Space Plasmas; Losses*

**20040060052** Arizona State Univ., Tempe, AZ, USA

**Detailed Geologic Analysis of Part of the South Polar Layered Deposits, Planum Australe, Mars, Part 2**

Kolb, E. J.; Tanaka, K. L.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

At the 3rd International Conference on Mars Polar Science and Exploration we presented some of the first results of our MGS- and Mars Odyssey-based 1:1,500,000-scale geologic mapping of the south polar layered deposits (SPLD) of Planum Australe. Those results described SPLD sequences that compose the southern extent of a radial trough system within the planum as well as the candidate modes of trough emplacement. In this abstract, we build upon this geologic mapping by describing our observations of the northern extent of the trough system. Within this region, the radial trough s western trough-enclosing wall marks the intersection between the radial trough and a system of spiral trough features. A key issue addressed in this study is the determination of the relative timing of formation of the radial and spiral trough features.

Derived from text

*Mineral Deposits; Mars Surface; Planetary Geology; Deposits; Geomorphology; Conferences; Plains*

**20040060053** Jernsletten (J. A.), Seabrook, TX, USA

**Possible Temperature-related Differences in Slope Angle Between the North and South Walls of Coprates Chasma, Mars**

Jernsletten, J. A.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; 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

This study is concerned with the effect of temperature on the topography of the near-equatorial trough of Coprates Chasma. One of the outstanding questions concerning the evolution of the Valles Marineris troughs, and of equatorial landforms in general, concerns the possible presence of ground ice and its role in landscape evolution. Over geologic time, surface heat (by its influence on the stability and rheology of ice-rich frozen ground) may be a factor in the evolution and morphology of the trough walls by controlling the distribution of ground ice. This study aims to determine whether the expected surface temperature difference between the north and south walls of Coprates Chasma, results in a measurable difference in trough wall stability, slope angle, and surface roughness.

Derived from text

*Mars Surface; Surface Temperature; Topography; Troughs*

**20040060054** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**New Views of the Martian Polar Regions: The Latest Results from the Mars Odyssey THEMIS Investigation**

Ivanov, A. B.; Byrne, S.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; 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 many questions of Martian exploration is to uncover the history of Mars, through analysis of the polar layered deposits (PLD). Martian polar ice caps hold most of the exposed water ice on the surface of Mars and yet their history and physical processes involved in their formation are unclear. In this work we present the latest imaging data acquired by the Mars Odyssey THermal EMission Imaging System (THEMIS) from the South Polar Residual Deposits (SPLD). We will concentrate our analysis on differences observed by THEMIS in winter/early spring and summer periods.

Derived from text

*2001 Mars Odyssey; Imaging Techniques; Thermal Emission; Mars Surface; Polar Regions*

**20040060055** Freie Univ., Berlin, Germany

**Observations at the Chasma Australe Re-Entrant, South Polar Region, Mars**

vanGasselt, S.; Werner, S. C.; Neukum, G.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 1 pp.; In English; See also 20040060039; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The south polar Chasma Australe re-entrant is a prominent arcuate elongated trough in the south-polar region at 90 E. Its formation has been discussed to be due to eolian processes, aqueous carving, subglacial volcanic processes as well as tectonically triggered catastrophic outflow events and basal melting. To understand its development we have mapped the circum Chasma Australe region on the basis of available imagery (Viking, Global Surveyor MOC, Odyssey THEMIS) at all resolutions and performed morphometric measurements on the basis of Laser Altimetry topographic data (MOLA) to evaluate outflow models proposed for the Chasma Australe development. A detailed description of the general morphology of the Chasma Australe has been provided.

Derived from text

*Mars Surface; Polar Regions; Geomorphology; Mars Volcanoes; Structural Basins*

**20040060056** Weber State Coll., Ogden, UT, USA

**Seasonal Variations Within Korolev Crater, Mars**

Armstrong, J. C.; Titus, T. N.; Kieffer, H. H.; Lunar and Planetary Science XXXV: Mars Polar Processes: Land and Sky; 2004; 2 pp.; In English; See also 20040060039; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Following the work of Kieffer and Titus, we present results of thermal IR observations of Korolev crater, located at 73 N, 196 W in the Martian northern polar region. Similar to techniques employed by Titus et al., we use thermal infrared images from the THEMIS instrument aboard Mars Odyssey to identify several units within the crater basin with distinct thermal properties. The THEMIS results show these regions exhibit both temperature and albedo variations, spatially within the crater

and throughout the Martian year. In addition to the variations identified in the THEMIS observations, Mars Global Surveyor Thermal Emission Spectrometer (TES) observations show differences in albedo and temperature of these units on both daily and seasonal cycles. Modeling diurnal and annual temperature variations of the surface, we use TES observations to examine the thermal properties of these units. This analysis reveals the units are likely thick layers (several meters) of high thermal inertia material (water ice, or extremely water-rich regolith) overlaid by a thin layer (several mm) of low thermal inertia material (dust). Variations of the physical properties of these units are likely due to variable dust content (caused by erosion and deposition patterns within the crater) and possibly variations in the subsurface material itself.
Author
*Annual Variations; Mars Environment; Mars Craters*

**20040061967** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Human Occupation of Space: Radiation, Risk, and Refuse**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040061968 - 20040061972
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Discrimination of Heavy Charged Particles in a Mixed Irradiation Using Optically Stimulated Luminescence Methods 2) MARIE: Current Status and Results from 20 Months of Observations at Mars 3) Mars Surface Analog Project: Preparing for Astronauts First Hours on Mars 4) The Need for Analogue Missions in Scientific Human and Robotic Planetary Exploration 5) Space Debris in the Geosynchronous Earth Orbit: Debris Environmental Asssessment and its Implications on Cost and Benefit Analysis.
Author
*Manned Space Flight; Aerospace Environments; Irradiation; Mars (Planet)*

**20040061968** NASA Johnson Space Center, Houston, TX, USA
**The Need for Analogue Missions in Scientific Human and Robotic Planetary Exploration**
Snook, K. J.; Mendell, W. W.; Lunar and Planetary Science XXXV: Human Occupation of Space: Radiation, Risk, and Refuse; 2004; 2 pp.; In English; See also 20040061967; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

With the increasing challenges of planetary missions, and especially with the prospect of human exploration of the moon and Mars, the need for earth-based mission simulations has never been greater. The current focus on science as a major driver for planetary exploration introduces new constraints in mission design, planning, operations, and technology development. Analogue missions can be designed to address critical new integration issues arising from the new science-driven exploration paradigm. This next step builds on existing field studies and technology development at analogue sites, providing engineering, programmatic, and scientific lessons-learned in relatively low-cost and low-risk environments. One of the most important outstanding questions in planetary exploration is how to optimize the human and robotic interaction to achieve maximum science return with minimum cost and risk. To answer this question, researchers are faced with the task of defining scientific return and devising ways of measuring the benefit of scientific planetary exploration to humanity. Earth-based and spacebased analogue missions are uniquely suited to answer this question. Moreover, they represent the only means for integrating science operations, mission operations, crew training, technology development, psychology and human factors, and all other mission elements prior to final mission design and launch. Eventually, success in future planetary exploration will depend on our ability to prepare adequately for missions, requiring improved quality and quantity of analogue activities. This effort demands more than simply developing new technologies needed for future missions and increasing our scientific understanding of our destinations. It requires a systematic approach to the identification and evaluation of the categories of analogue activities. This paper presents one possible approach to the classification and design of analogue missions based on their degree of fidelity in ten key areas. Various case studies are discussed to illustrate the approach.
Derived from text
*Analogs; Space Exploration; Simulation; Robotics*

**20040061971** NASA Johnson Space Center, Houston, TX, USA
**Mars Surface Analog Project: Preparing for Astronauts' First Hours on Mars**
Charles, J.; Evanoff, J.; Johnson, M.; Loerch, L.; Whelan, S.; Amonette, W.; Sanders, J.; Haralson, C.; Paloski, W.; Lunar and Planetary Science XXXV: Human Occupation of Space: Radiation, Risk, and Refuse; 2004; 1 pp.; In English; See also 20040061967; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Astronaut missions to Mars may be decades in the future, but contemporary estimates of the physical capabilities of the crewmembers upon arrival after prolonged transit can guide development of operational requirements to be imposed on them. Requirements for functional capacities will differ depending on whether they land in a spartan ascent vehicle or in a well-equipped habitat, but each of those options brings with it certain operational risks. Rehabilitation will be an important factor for crew health, safety and efficiency after the multi-month transit from Earth. Specific recommendations will be stipulated for the time to be allotted for on-planet rehabilitation before the first planned surface excursion, such as the transfer from the ascent-lander to the habitat-lander. Three sequential workshops (the third including extramural experts in appropriate fields) examined the likely capabilities of crewmembers shortly after landing on Mars, the predicted operational requirements they will face, and the near-term steps to close the gap between the requirements and capabilities.
Author
*Manned Mars Missions; Mars Landing; Spacecrews; Mars Surface; Space Flight Stress*

**20040061972** NASA Johnson Space Center, Houston, TX, USA
**MARIE: Current Status and Results from 20 Months of Observations at Mars**
Zeitlin, C.; Andersen, V.; Atwell, W.; Cleghorn, T. F.; Cucinotta, F. A.; Lee, K. T.; Pinsky, L.; Saganti, P.; Lunar and Planetary Science XXXV: Human Occupation of Space: Radiation, Risk, and Refuse; 2004; 2 pp.; In English; See also 20040061967; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The MARIE instrument aboard the 2001 Mars Odyssey spacecraft detects energetic charged particles in the Galactic Cosmic Radiation (GCR) and during solar particle events (SPE) [1]. As of this writing (January 2004), MARIE has been turned off, after losing communication with the spacecraft during the large SPE of October 28, 2003. However, during the prior 20 months, MARIE collected data almost continuously, observing several solar events and the nearly-constant GCR. There is still a possibility the instrument can be recovered, and troubleshooting efforts are scheduled to begin in May 2004, following the completion of the primary missions of MER-A (Spirit) and MER-B (Opportunity). At present, Odyssey is acting as a telecommunications relay for the rovers and only routine science operations are permitted in this mode.
Derived from text
*Charged Particles; Galactic Radiation; Solar Storms; 2001 Mars Odyssey*

**20040061980** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Image Processing and Earth Observations**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040061981 - 20040061989
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Expansion in Geographic Information Services for PIGWAD; 2) Modernization of the Integrated Software for Imagers and Spectrometers; 3) Science-based Region-of-Interest Image Compression; 4) Topographic Analysis with a Stereo Matching Tool Kit; 5) Central Avra Valley Storage and Recovery Project (CAVSARP) Site, Tucson, Arizona: Floodwater and Soil Moisture Investigations with Extraterrestrial Applications; 6) ASE Floodwater Classifier Development for EO-1 HYPERION Imagery; 7) Autonomous Sciencecraft Experiment (ASE) Operations on EO-1 in 2004; 8) Autonomous Vegetation Cover Scene Classification of EO-1 Hyperion Hyperspectral Data; 9) Long-Term Continental Areal Reduction Produced by Tectonic Processes.
CASI
*Image Processing; Planetary Mapping; Earth Observations (From Space)*

**20040061985** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Central Avra Valley Storage and Recovery Project (CAVSARP) Site, Tucson, Arizona: Floodwater and Soil Moisture Investigations with Extraterrestrial Applications**
Rucker, D. F.; Dohm, J. M.; Ferre, T. P. A.; Ip, Felipe; Baker, V. R.; Davies, A. G.; Castano, R.; Chien, S.; Doggett, T. C., et al.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; 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

Planetary geologists, geomorphologists, and hydrologists have hypothesized that Mars is a dynamic, water-enriched planet since the Mariner and Viking missions based on geologic, geomorphic, and topographic information. Recent acquisition of Gamma Ray and Neutron Spectrometer information has added further credence to this hypothesis. A unique investigation

is underway to work towards being able to successfully map the extent and depth of water on Mars. Researchers from the University of Arizona and members of the Autonomous Sciencecraft Experiment (ASE) have been compiling multiple layers of information in time and space at the Central Avra Valley Storage and Recovery Project (CAVSARP) site, Tucson, Arizona, for eventual comparative analysis. This information has been acquired from a variety of observational/scientific platforms in controlled conditions. CAVSARP facility:
Author
*Gamma Ray Spectrometers; Geomorphology; Mars Surface; Topography*

**20040061986** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**ASE Floodwater Classifier Development for EO-1 Hyperion Imagery**
Ip, Felipe; Dohm, J. M.; Baker, V. R.; Doggett, T.; Davies, A. G.; Castano, B.; Chien, S.; Cichy, B.; Greeley, R.; Sherwood, R., et al.; Lunar and Planetary Science XXXV: Image Processing and Earth Observations; 2004; 2 pp.; In English; See also 20040061980; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The objective of this investigation is to develop a prototype floodwater detection algorithm for Hyperion imagery. It will be run autonomously onboard the EO-1 spacecraft under the Autonomous Sciencecraft Experiment (ASE). This effort resulted in the development of two classifiers for floodwater, one of several classifier types that have been developed and will be uploaded to EO-1 in early 2004 in order to detect change related to transient processes such as volcanism, flooding, and ice formation and retreat.
Derived from text
*Autonomy; Classifiers; Hyperion; Imagery; Floods; Algorithms*

**20040061990** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Outer Solar System**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040061991 - 20040062013
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Outer Solar System' inlcuded:Monte Carlo Modeling of [O I] 630 nm Auroral Emission on Io; The Detection of Iron Sulfide on Io; Io and Loki in 2003 as Seen from the Infrared Telescope Facility Using Mutual Satellite and Jupiter Occultations; Mapping of the Zamama-Thor Region of Io; First Solar System Results of the Spitzer Space Telescope; Mapping the Surface of Pluto with the Hubble Space Telescope; Experimental Study on Fischer-Tropsch Catalysis in the Circum-Saturnian Subnebula; New High-Pressure Phases of Ammonia Dihydrate; Gas Hydrate Stability at Low Temperatures and High Pressures with Applications to Mars and Europa; Laboratory UV Photolysis of Planetary Ice Analogs Containing H2O + CO2 (1:1); The OH Stretch Infrared Band of Water Ice and Its Temperature and Radiation Dependence; Band Position Variations in Reflectance Spectra of the Jovian Satellite Ganymede; Comparison of Porosity and Radar Models for Europa s Near Surface; Combined Effects of Diurnal and Nonsynchronous Surface Stresses on Europa; Europa s Northern Trailing Hemisphere: Lineament Stratigraphic Framework; Europa at the Highest Resolution: Implications for Surface Processes and Landing Sites; Comparison of Methods to Determine Furrow System Centers on Ganymede and Callisto; Resurfacing of Ganymede by Liquid-Water Volcanism; Layered Ejecta Craters on Ganymede: Comparisons with Martian Analogs; Evaluation of the Possible Presence of CO2-Clathrates in Europa s Icy Shell or Seafloor; Geosciences at Jupiter s Icy Moons: The Midas Touch; Planetary Remote Sensing Science Enabled by MIDAS (Multiple Instrument Distributed Aperture Sensor); and In Situ Surveying of Saturn s Rings.
Derived from text
*Io; Planetary Surfaces*

**20040061991** Redlands Univ., CA, USA
**Io and Loki in 2003 as Seen from the Infrared Telescope Facility Using Mutual Satellite and Jupiter Occultations**
Rathbun, J. A.; Ellis, C. T.; Johnson, S. T.; Spencer, J. R.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; 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

We observed Io, one of the Galilean satellites of Jupiter and the most volcanically active body in the solar system, on 16 nights in 2003 using two similar techniques for separating individual volcanoes despite the relatively low resolution imaging

from NASA s Infrared Telescope Facility (IRTF). Jupiter occultations occur once every 1.7 days and can be used to separate the flux from individual volcanos, but can only determine locations in one dimension (Spencer et al., 1990). Every six years, including 2003, the Earth passes through the orbital plane of the Galilean satellites allowing mutual satellite occultations to be observed from earth (Goguen et al., 1988). Satellite occultations are superior to Jupiter occultations in two major respects and inferior in one. First, satellites provide occultations by a knife edge rather than by the diffuse Jovian limb, and thus provide higher spatial resolution. Second, Since the satellites are comparable in size to one another, a particular region on Io will be crossed by the occulting satellite s limb in one direction during ingress and likely a different direction during egress, enabling the computation of two dimensional images of these regions (Spencer et al., 1994). In addition, satellite occultations can occult any part of Io, while Jupiter occultations only occult the Jupiter facing hemisphere. Satellite occultations are inferior in one respect because while one half of all Jupiter occultations occur with Io in eclipse, it is extremely rare to find satellite occultations of an eclipsed Io (none were available in 2003). When Io is in eclipse, all near infrared light received is emitted by Io s volcanos with no contamination by reflected sunlight. Dates of observations and occulting body are shown in table 1.
Derived from text
*Io; Near Infrared Radiation; Occultation; Galilean Satellites; Imaging Techniques*

**20040061992** Arizona State Univ., Tempe, AZ, USA
**Mapping of the Zamama-Thor Region of Io**
Williams, D. A.; Keszthelyi, L. P.; Schenk, P. M.; Milazzo, M. P.; Rathbun, Julie A.; Greeley, R.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On September 21, 2003, NASA s Galileo Mission to Jupiter ended after almost 14 years in space and 35 orbits of Jupiter. As part of the ongoing Galileo data analysis, we have produced regional geologic maps of selected areas of Io s antijovian hemisphere, which was poorly-imaged by Voyager but well-imaged by Galileo. This abstract discusses our mapping of the Zamama-Thor region. Here we identify the primary geologic features, summarize the map units and structures that are present, and discuss the nature of volcanic activity in this region. based on color. Patera Floors occur in the caldera-like interiors of volcanic craters and span a wide range of colors, indicative of volcanic centers in various states of exhumation [7] or burial [6], and indicative of the emplacement of a variety of volcanic compositions including silicate, sulfur, and SO2. In this region we characterize two subunits: Bright (sulfur-dominated) and Dark (silicate-dominated). Flow materials are typified by their generally linear morphology (lengths >> widths) and sharp contacts [6]. Like the Patera Floors,
Derived from text
*Galileo Project; Morphology; Structural Properties (Geology); Volcanoes; Mapping; Io*

**20040061993** NASA Ames Research Center, Moffett Field, CA, USA
**First Solar System Results of the Spitzer Space Telescope**
VanCleve, J.; Cruikshank, D. P.; Stansberry, J. A.; Burgdorf, M. J.; Devost, D.; Emery, J. P.; Fazio, G.; Fernandez, Y. R.; Glaccum, W.; Grillmair, C., et al.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Spitzer Space Telescope, formerly known as SIRTF, is now operational and delivers unprecedented sensitivity for the observation of Solar System targets. Spitzer's capabilities and first general results were presented at the January 2004 AAS meeting. In this poster, we focus on Spitzer's performance for moving targets, and the first Solar System results. Spitzer has three instruments, IRAC, IRS, and MIPS. IRAC (InfraRed Array Camera) provides simultaneous images at wavelengths of 3.6, 4.5, 5.8, and 8.0 microns. IRS (InfraRed Spectrograph) has 4 modules providing low-resolution (R=60-120) spectra from 5.3 to 40 microns, high-resolution (R=600) spectra from 10 to 37 m, and an autonomous target acquisition system (PeakUp) which includes small-field imaging at 15 m. MIPS (Multiband Imaging Photometer for SIRTF) does imaging photometry at 24, 70, and 160 m and low-resolution (R=15-25) spectroscopy (SED) between 55 and 96 microns. Guaranteed Time Observer (GTO) programs include the moons of the outer Solar System, Pluto, Centaurs, Kuiper Belt Objects, and comets
Derived from text
*Space Infrared Telescope Facility; Imaging Techniques; Target Acquisition; High Resolution; Infrared Radiation*

**20040061994** Tokyo Univ., Japan
**Experimental Study on Fischer-Tropsch Catalysis in the Circum-Saturnian Subnebula**
Sekine, Y.; Sugita, S.; Shido, T.; Kadono, T.; Matsui, T.; Yamamoto, T.; Iwasawa, Y.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Fischer-Tropsch catalysis, which converts CO and H2 into CH4 on the surface of iron catalyst, has been suggested to play an important role in origin of CH4 in the Titan atmosphere. In the previous study [1], the methane formation rate due to this catalysis has been estimated by extrapolating an empirical power-law rate based on industrial laboratory data [2]. However the experimental conditions of laboratory data are limited to narrow temperature range (T = 513 - 553 K), fixed pressure (P = 1 bar), and low and narrow H2/CO ratio (H2/CO = 0.6 - 15.1), substantially different from the nebula condition. In this study, we conduct Fischer-Tropsch catalytic experiments under the conditions of the circum-planetary subnebula (P = 0.09 - 0.53 bar, T = 500 - 650 K, H2/CO = 1000). Then, using this experimental result, we discuss the origin of CH4 on Titan.
Author
*Experimentation; Saturn (Planet); Nebulae; Fischer-Tropsch Process*

**20040061995** University Coll., London, UK
**New High-Pressure Phases of Ammonia Dehydrate**
Fortes, A. D.; Wood, I. G.; Knight, K. S.; Marshall, W. G.; Brodholt, J. P.; Afredsson, M.; Vocadlo, L.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ammonia dehydrate (ADH) is very likely to be the most significant mineral after water ice in the mantles of ice rich moons orbiting Saturn, Uranus and Neptune. It allows for low temperature melting, and is invoked to explain a wide variety of geological processes observed on these bodies. The physical properties and phase relations of ADH are poorly constrained. There were two previously known phases (I and II) at low pressures. ADH I (stable at ambient pressure) has a cubic unit cell but the structure of ADH II (stable above approx. 4.5 kbar) is unknown. The wider context of this study in our programme of using neutron diffraction to study planetary ices is given in a companion abstract.
Author
*High Pressure; Ammonia; Dehydration; Minerals*

**20040061996** University of Northern Arizona, Flagstaff, AZ, USA
**Layered Ejecta Craters on Ganymede: Comparisons with Martian Analogs**
Neal, J. E.; Barlow, N. G.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Voyager and Galileo imagery reveal that layered ejecta morphologies occur around some impact craters on Ganymede. Similar morphologies surrounding martian impact craters are commonly attributed to the role of subsurface ice. This study compares the characteristics of layered ejecta morphologies on Ganymede and Mars to investigate how impact into increasing amounts of target ice affect these ejecta morphologies.
Derived from text
*Ejecta; Ganymede; Mars Craters; Analogs; Planetary Geology; Geomorphology*

**20040061997** Colorado Univ., Boulder, CO, USA
**Combined Effects of Diurnal and Nonsynchronous Surface Stresses on Europa**
Stempel, M. M.; Pappalardo, R. T.; Wahr, J.; Barr, A. C.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations
Contract(s)/Grant(s): NAG5-11616; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

To date, modeling of the surface stresses on Europa has considered tidal, nonsynchronous, and polar wander sources of stress. The results of such models can be used to match lineament orientations with candidate stress patterns. We present a rigorous surface stress model for Europa that will facilitate comparison of principal stresses to lineament orientation, and which will be available in the public domain. Nonsynchronous rotation and diurnal motion contribute to a stress pattern that deforms the surface of Europa. Over the 85-hour orbital period, the diurnal stress pattern acts on the surface, with a maximum magnitude of approximately 0.1 MPa. The nonsynchronous stress pattern sweeps over the surface due to differential rotation of the icy shell relative to the tidally locked interior of the moon. Nonsynchronous stress builds cumulatively with approximately 0.1 MPa per degree of shell rotation.
Derived from text
*Diurnal Variations; Europa; Nonsynchronization; Structural Properties (Geology); Stress Analysis; Mathematical Models; Planetary Surfaces*

**20040061998** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

**Band Position Variations in Reflectance Spectra of the Jovian Satellite Ganymede**

Stephan, K.; Jaumann, R.; Hibbitts, C. A.; Hansen, G. B.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; 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 strong fundamental O-H stretching vibration near 3 micron active in water-ice as well as in hydrated and hydroxylated materials was identified in the reflectance spectra of the icy Galilean satellites. Being largely independent of photometry and also grain size variations, the state of the wavelength position of the 3 micron band provides unequivocal relative abundance information of water-ice and non-ice components. The influence of additional surface components other than water ice shifts the wavelength position of maximum absorbance. We performed detailed analyses of the 3-micron band to study the spatial distribution of band position variations with respect to compositional changes and grain size variations across the surface of Ganymede.

Derived from text

*Ganymede; Jupiter Satellites; Spectral Reflectance; Planetary Geology*

**20040061999** Desert Research Inst., Reno, NV, USA

**Gas Hydrate Stability at Low Temperatures and High Pressures with Applications to Mars and Europa**

Marion, G. M.; Kargel, J. S.; Catling, D. C.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Gas hydrates are implicated in the geochemical evolution of both Mars and Europa [1- 3]. Most models developed for gas hydrate chemistry are based on the statistical thermodynamic model of van der Waals and Platteeuw [4] with subsequent modifications [5-8]. None of these models are, however, state-of-the-art with respect to gas hydrate/electrolyte interactions, which is particularly important for planetary applications where solution chemistry may be very different from terrestrial seawater. The objectives of this work were to add gas (carbon dioxide and methane) hydrate chemistries into an electrolyte model parameterized for low temperatures and high pressures (the FREZCHEM model) and use the model to examine controls on gas hydrate chemistries for Mars and Europa.

Derived from text

*Gas Temperature; Stability; Hydrates; Mathematical Models; Thermodynamics*

**20040062000** California Univ., Berkeley, CA, USA

**Geosciences at Jupiter's Icy Moons: The Midas Touch**

Lipps, J. H.; Delory, G. T.; Manga, M.; DePater, I.; Graham, J.; Reiboldt, S.; Pitman, J.; Duncan, A.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Galileo mission revealed that the Jovian Icy Moons (JIM) and Io are dynamic worlds possessing possible subsurface oceans, magnetism, spectacular volcanic activity, and potentially life. While Galileo's images and spectroscopic measurements have greatly increased our understanding of these bodies, higher spectral and spatial resolution measurements are clearly needed in order to begin to address the myriad of new questions and uncertainties regarding these moons. Here we describe the potential science objectives on the Jupiter Icy Moons Orbiter (JIMO) mission enabled by the Multiple Instrument Distributed Aperture System (MIDAS), a low-volume, 1.5m aperture imaging spectrometer capable of ~nm spectral resolution at spatial resolutions of approximately 2cm-1m/pixel from orbit.

Derived from text

*Galileo Spacecraft; Geophysics; Imaging Spectrometers; Jupiter (Planet); Icy Satellites; Planetary Geology*

**20040062001** Texas Univ., Austin, TX, USA

**Monte Carlo Modeling of [O I] 630 nm Auroral Emission on Io**

Moore, C.; Miki, K.; Goldstein, D. B.; Varghese, P. L.; Trafton, L.; Zhang, J.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The interaction of Jupiter's plasma torus with Io's atmosphere produces an aurora with many distinct features. Unlike Earth s aurora which occurs mainly near the poles, Io's aurora is concentrated around the equator. Observations of Io s [O I] 630 nm aurora by Trauger et al. [1] and Retherford et al. [2] showed several distinct features including a limb glow, a bright

spot in the wake, and the absence of appreciable emission on the upstream side of Io. Retherford et al. [2] offered an explanation for the brightness ratio observed for the north and south limb glows based on Io's position in the plasma torus which affected the electron column density above and below Io. Figure 1 shows Trauger's 1997 WFPC2 [O I] emission observation. In the present work a three-dimensional Monte Carlo model for the motion of electrons and excited oxygen atoms is used to simulate the electron flow around Io, electron-neutral collisions, and the resulting [O I] 630 nm emission. Electrons enter the domain across the polar boundaries with a thermal velocity parallel to the perturbed Jovian magnetic field; the bulk B E r r drift velocity is neglected because the thermal velocity is almost two orders of magnitude greater. The simulation yielded a wake bright spot and no upstream spot.
Derived from text
*Auroras; Io; Monte Carlo Method; Toroidal Plasmas; Brightness; Planetary Magnetic Fields; Electron Scattering*

**20040062002** Science Applications International Corp., Chantilly, VA, USA
**The Detection of Iron Sulfide on Io**
Granahan, J. C.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; 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 NASA Galileo Near Infrared Mapping Spectrometer (NIMS) collected reflectance spectra of the surface of the mountains of the Jovian moon Io during 2000 and 2001. These spectra exhibit an absorption feature near 3.0 microns consistent with absorption features of iron sulfide minerals. The detection of iron sulfide minerals offers evidence of minerals capable of supporting the high elevations of Io's mountains.
Derived from text
*Iron; Sulfides; Io; Infrared Imagery; Near Infrared Radiation; Infrared Spectrometers*

**20040062003** Texas Univ., Austin, TX, USA
**Comparison of Porosity and Radar Models for Europa's Near Surface**
Danque, H. A.; Blankenship, D. D.; Peters, M. E.; Jackson, John A.; Jackson, Katherine G.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Our intent is to compare models of Europa's near-surface porosity development with models that explain Europa's radar anomalies to determine the most probable structure of Europa's shallow subsurface. Some of the radar models suggest that the near surface may have properties that would produce the observed echoes.
Author
*Europa; Porosity; Planetary Surfaces; Planetary Geology; Radar Measurement*

**20040062004** Alabama Univ., Birmingham, AL, USA
**Laboratory UV Photolysis of Planetary Ice Analogs Containing H2O + CO2 (1:1)**
Richey, C. R.; Underwood, R. A.; Gerakines, P. A.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 1 pp.; In English; See also 20040061990
Contract(s)/Grant(s): NSF DMR-02-43640; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

H2O and CO2 are important constituents of ices the Solar System [1]. They are two of the most abundant molecules found in the interstellar medium, out of which the Solar System formed [2,3]. H2O and CO2 are also found on many different satellites in the form of ices. By studying the IR spectra of these ices and the effects of UV photolysis we can obtain important information about their evolution. While there is an abundance of literature pertaining to the mid-IR spectra of photolyzed ices ( = 2.5-25 m) [4], research in the near-IR ( = 1-2.5 m) is slowly increasing. Part of this work is meant to complement previous studies of UV photolyzed H2O+CO2 ices [5,6].
Derived from text
*Carbon Dioxide; Water; Near Infrared Radiation; Ice; Photolysis; Interstellar Matter*

**20040062005** Virginia Univ., Charlottesville, VA, USA
**The OH Stretch Infrared Band of Water Ice and Its Temperature and Radiation Dependence**
Raut, U.; Loeffler, M. J.; Vidal, R. A.; Baragiola, R. A.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Knowledge of the infrared spectra of water ice and its dependence on conditions and history is important for obtaining information about icy objects from remote sensing. The infrared absorption band corresponding to the OH stretch vibration at near 3.1 ?m is the most prominent water band. Thus, it can be used to most sensitively detect the presence of water and is the first one to saturate with increasing optical path length. The literature of infrared spectra of low temperature water ice has been reviewed recently [1-2]. Recently, we have measured infrared reflectance spectra of transparent thin films of water ice under different conditions relevant to environments in the outer solar system and interstellar grains. Some preliminary results are given here.
Derived from text
*Ice; Water; Temperature Dependence; Interstellar Matter; Cosmic Dust*

**20040062006** Wheaton Coll., Norton, MA, USA
**Comparison of Methods to Determine Furrow System Centers on Ganymede and Callisto**
Collins, G. C.; Prockter, L. M.; Fontaine, R.; Farrar, K. S.; Murchie, S. L.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Furrows are arcuate troughs, often with raised rims or asymmetric scarps, which are generally accepted to be the remnants of ancient multiringed impact basins on Ganymede. Similar multiringed impact basins are well preserved on the surface of Callisto, but on Ganymede the process of groove formation has broken the basins into fragments found in the remnants of ancient dark terrain. If a reliable method can be found to calculate the centers of fragments of ancient impact basins, then furrow systems on Ganymede can be used as large-scale strain markers to constrain the tectonics of grooved terrain.
Derived from text
*Callisto; Escarpments; Ganymede; Grooves; Markers; Structural Basins*

**20040062007** NASA Ames Research Center, Moffett Field, CA, USA
**Resurfacing of Ganymede by Liquid-Water Volcanism**
Showman, A. P.; Mosqueira, I.; Head, J. W., III; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A long-popular model for producing Ganymede s bright terrain involves flooding of low-lying graben with liquid water, slush, or warm, soft ice. The model suffers from major problems, however, including the absence of obvious near-surface heat sources, the negative buoyancy of liquid water, and the lack of a mechanism for confining the flows to graben floors. We show that topography - such as a global set of graben - causes subsurface (a hydrostatic) pressure gradients that can 'suck' subsurface liquid water upward onto the floors of topographic lows (graben). As the low areas become full, the pressure gradients disappear and the resurfacing ceases. This provides an explanation for the observed straight dark-bright terrain boundaries: water cannot overflow the graben, so surfacing rarely embays craters and other rough topography. Subsurface liquid water must exist for the scenario to exist, of course, and is plausibly provided by tidal heating during an ancient orbital resonance. This abstract is a summary of Showman et al. recently submitted to Icarus.
Author
*Water; Volcanology; Heat Sources; Craters; Ganymede*

**20040062008** Lowell Observatory, Flagstaff, AZ, USA
**Mapping the Surface of Pluto with the Hubble Space Telescope**
Buie, M. W.; Grundy, W.; Young, E. F.; Young, L. A.; Stern, S. A.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 1 pp.; In English; See also 20040061990; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Imaging the surface of Pluto remains a challenge even with the best of current technology. Owing to Pluto s orbital eccentricity and obliquity, the surface insolation changes dramatically over its 240 year orbital period. The presence of active volatiles on the surface has led to widespread predictions that at least some areas of the surface would change. To date there have been two distinct epochs of global albedo maps. The first, in the mid-to-late1980's, used mutual events and rotational lightcurve data to extract a variable resolution map. The second epoch, in 1994, used the Faint Object Camera (FOC) of HST. While the resolution is not sufficient to show any geologic detail, the data are useful for constraining large-scale albedo provinces that give rise to the long-known rotational lightcurve. Unfortunately, the previous works are quite dissimilar and direct comparisons between maps are hard to make. With the passing of time, and recent reported changes in Pluto s

photometric lightcurve, it became time once again to generate a map to look for change.
Derived from text
*Pluto (Planet); Hubble Space Telescope; Imaging Techniques; Mapping; Surfactants*

**20040062009** Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain
**Evaluation of the Possible Presence of CO2-Clathrates in Europa's Icy Shell or Seafloor**
Prieto-Ballesteros, O.; Kargel, J. S.; Fernandez-Sampedro, M.; Hogenboom, D. L.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The mineralogy of Europa's crust has been partly revealed by reflectance spectroscopy and geochemical modeling using available sources of data from space missions and earth-based remote sensing. The exact chemical composition of the non-ice components is still under discussion because the infrared spectra can be interpreted as three different candidates: a) salt hydrates, b) hydrates of sulfuric acid, c) H3O(+). Infrared data from the noisy mid-IR region obtained by Galileo has detect additional substances on the surfaces of Europa, Ganymede and Callisto. A peak at 4.25 microns, for example has been interpreted as CO2. However, CO2 ice is unstable at the surface (ultravacuum and low temperatures) of Europa or Callisto. Thus, they have proposed the possibility that this signal comes from clathrates, so we have study the stability of CO2 clathrates along the crust and the ocean.
Derived from text
*Carbon Dioxide; Clathrates; Europa; Mineralogy; Ocean Bottom; Planetary Crusts; Icy Satellites*

**20040062010** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**In Situ Surveying of Saturn's Rings**
Clark, P. E.; Curtis, S. A.; Rilee, M. L.; Cheung, C.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; Original contains color illustrations
Contract(s)/Grant(s): NAS5-99189; ITMI0-0299189EER; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Saturn Autonomous Ring Array (SARA) mission concept is a new application for the Autonomous Nano-Technology Swarm (ANTS) architecture, a paradigm being developed for exploration of high surface area and/or multibody targets to minimize costs and maximize effectiveness of survey operations. Systems designed with ANTS architecture are built from potentially very large numbers of highly autonomous, yet socially interactive, specialists, in approximately ten specialist classes. Here, we analyze requirements for such a mission as well as specialized autonomous operations which would support this application.
Derived from text
*Saturn Rings; Surveys; In Situ Measurement*

**20040062011** Johns Hopkins Univ., Laurel, MD, USA
**Europa at the Highest Resolution: Implications for Surface Processes and Landing Sites**
Prockter, L. M.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; 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 twelfth orbit around Jupiter, Galileo acquired some of the highest resolution images of Europa obtained throughout its mission. Nine such images comprise a mosaic in which one frame was obtained at a resolution of 6 m/pixel, while the rest were acquired at 12 m/pixel. The 6-m/pixel frame represents the highest resolution image obtained of any icy satellite surface. The image mosaic is centered at 13 deg. S, 235 deg. W, and trends in a broadly west-east direction. This region of the surface appears typical by Europa standards, and contains examples of many surface features studied in detail at lower resolution elsewhere. These features include background ridged plains, bands, double ridges, scarps, dark plains, and a variety of troughs. Part of the region has been broken up into chaos, while other areas appear to be 'proto-chaos', that is, they show evidence of fracturing and uplift into regional-scale blocks, within which some terrain is further broken up into chaos at local scales. A mapping study of this area is underway in order to understand better the processes and morphologies that occur at small scales on Europa s surface, and to enable a more thorough interpretation of lower resolution (e.g., regional-scale) images. Mapping of the high-resolution area is challenging, since there is significant foreshortening of the

images due to spacecraft viewing geometry. For context, the E12 high-resolution mosaic is overlain on a regional (approx. 220 m/pixel) mosaic obtained during the E11 orbit.
Derived from text
*Europa; High Resolution; Landing Sites; Surface Geometry*

**20040062012** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Europa's Northern Trailing Hemisphere: Lineament Stratigraphic Framework**
Figueredo, P. H.; Hare, T.; Ricq, E.; Strom, K.; Greeley, R.; Tanaka, K.; Senske, D.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; 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

Knowledge of the global distribution of Europan geologic units in time and space is a necessary step for the synthesis of the results of the Galileo mission and in preparation for future exploration (namely, by JIMO) of the satellite. We have initiated the production of the first Global Geological Map of Europa. As a base map, we use the recently published global photomosaic of Europa (U.S.G.S. Map I-2757) and additional Galileo SSI images at their original resolution. The map is being produced entirely on GIS format for analysis and combination with other datasets [1]. One of the main objectives of this project is to establish a global stratigraphic framework for Europa. In the absence of a well-developed cratering record, this goal will be achieved using the satellite s global network of lineaments (ridges, ridge complexes and bands; cf. [2]). Here we present the preliminary stratigraphic framework synthesized from the sequence of lineaments derived for the northern trailing hemisphere of Europa (Figure 1, below), and we discuss its significance and some emerging implications.
Derived from text
*Europa; Cratering; Galileo Spacecraft; Geochronology; Structural Properties (Geology)*

**20040062013** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Planetary Remote Sensing Science Enabled by MIDAS (Multiple Instrument Distributed Aperture Sensor)**
Pitman, Joe; Duncan, Alan; Stubbs, David; Sigler, Robert; Kendrick, Rick; Chilese, John; Lipps, Jere; Manga, Mike; Graham, James; dePater, Imke, et al.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040061990; 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 science capabilities and features of an innovative and revolutionary approach to remote sensing imaging systems, aimed at increasing the return on future space science missions many fold, are described. Our concept, called Multiple Instrument Distributed Aperture Sensor (MIDAS), provides a large-aperture, wide-field, diffraction-limited telescope at a fraction of the cost, mass and volume of conventional telescopes, by integrating optical interferometry technologies into a mature multiple aperture array concept that addresses one of the highest needs for advancing future planetary science remote sensing.
Derived from text
*Apertures; Imaging Techniques; Remote Sensing; Space Missions; Spectroscopic Telescopes; Measuring Instruments*

**20040062015** Japan Aerospace Exploration Agency, Tsukuba, Japan
**Study of the Apollo 16 Landing Site: As a Standard Site for the SELENE Multiband Imager**
Ohtake, M.; Arai, T.; Takeda, H.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is our ultimate goal in our future lunar exploration mission to obtain data of modal abundances of minerals and chemical compositions of the lunar surface. Global multi-spectral data of Multiband Imager (MI) for the SELENE mission is going to deriver that information by combined with hyper-spectral data of Spectral Profiler (SP). To understand mineral abundance and mineral compositional distribution of the lunar surface from the remote sensing data using MI and SP data we need precise correction and calibration procedure. One of the most important procedures for the precise correction and calibration of remote sensing data is a selection and understanding of a suitable optical standard site.
Derived from text
*Lunar Exploration; Emission Spectra; Remote Sensing; Apollo 16 Flight*

**20040062018** Rutherford Appleton Lab., Chilton, UK

**Lunar Elemental Composition and Investigations with D-CIXS X-Ray Mapping Spectrometer on SMART-1**

Grande, M.; Dunkin, S.; Howe, C.; Browning, R.; Kellett, B.; Perry, C. H.; Swinyard, B.; Waltham, N.; Kent, B.; Huovenin, J., et al.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ESA SMART-1 mission to the Moon was successfully launched on 27 Sept 2003. A major payload element is D-CIXS, a Compact X-ray Spectrometer which will provide high quality spectroscopic mapping of the Lunar surface. At the same time it will demonstrate a radically novel approach to building a type of instrument essential for the Mercury cornerstone mission. It will achieve ground breaking science within a resource envelope far smaller than previously thought possible for this type of instrument, using new technology which does not require cold running, with its associated overheads to the spacecraft. It consists of a high throughput spectrometer, which will perform spatially localised X-ray fluorescence spectroscopy, and a solar monitor to provide the calibration of the illumination necessary to produce global map of absolute Lunar elemental abundances.

Derived from text

*Lunar Maps; X Ray Fluorescence; Moon; Mapping; Lunar Composition*

**20040062019** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Lunar Seismic Network: Mission Update**

Neal, C. R.; Banerdt, W. B.; Chenet, H.; Gagnepain-Beyneix, J.; Hood, L.; Jolliff, B.; Khan, A.; Lawrence, D. J.; Lognonne, P.; Mackwell, S., et al.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; 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

At LPSC 34, the concept of a new mission to the Moon to deploy a seismic network was presented. Since that time, a group has been formed to further develop this idea with the goal of putting together a Discovery-type mission, which would build upon the Japanese LUNAR-A mission by deploying 8-10 seismometers around the Moon. This would give a much greater coverage, including the lunar farside, than was the case during Apollo.

Author

*Moon; Seismographs*

**20040062020** Japan Aerospace Exploration Agency, Tsukuba, Japan

**Detectability of Degradation of Lunar Impact Craters by SELENE Terrain Camera**

Haruyama, J.; Ohtake, M.; Matunaga, T., et al.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The degradation states of lunar impact craters provide information about the ages of eruption of lunar maria. In 2006, a Moon explorer named SELENE (SELenological and ENgineering Explorer) will be launched by an H-2A rocket of the Japan Aerospace Exploration Agency (JAXA) that was recently established with combining Japanese three space agencies: National Space Development Agency of Japan (NASDA), the Institute of Space and Astronautical Science (ISAS), and the National Aerospace Laboratory (NAL). The photometric data taken by the Terrain Camera (TC) installed on SELENE will be useful for the investigation of degradation of lunar impact craters. the investigation of degradation of lunar impact craters. The identification of eruption age of each geological unit of the Moon is necessary to understand the lunar thermal history. The most reliable ages of the lunar surface formation has been described on the basis of the age identification of lunar samples. The detectability of degradation of lunar craters by the SELENE Terrain Camera is summarized.

Derived from text

*Cameras; Degradation; Detection; Lunar Craters; Selenology; Terrain; Lunar Geology; Photometry*

**20040062021** Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, Germany

**Selection of Targets for the SMART-1 Infrared Spectrometer (SIR)**

Keller, H. U.; Basilevsky, A. T.; Nathues, A.; Mall, U.; Rosiek, M.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper describes the results of selection of targets for the IR spectrometer SIR. It is a part of the payload of ESA s

SMART-1 mission to the Moon launched on September 27, 2003 and expected to arrive to its destination in spring 2005. The circum-lunar orbit of SMART-1 is planned to be a polar, elliptical, with a varying 300 to 2,000 km altitude of the pericenter and 8,000 to10,000 km altitude of the apocenter, which might be lowered depending on the remaining fuel.
Derived from text
*Targets; Infrared Spectrometers; Lunar Orbits*

**20040062025** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Integrated Solar System Exploration Education and Public Outreach: Theme, Products and Activities**
Lowes, Leslie; Lindstrom, Marilyn; Stockman, Stephanie; Scalice, Daniela; Allen, Jaclyn; Tobola, Kay; Klug, Sheri; Harmon, Art; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration; 2004; 1 pp.; In English; See also 20040062024; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NASA's Solar System Exploration Program is entering an unprecedented period of exploration and discovery. Its goal is to understand the origin and evolution of the solar system and life within it. SSE missions are operating or in development to study the far reaches of our solar system and beyond. These missions proceed in sequence for each body from reconnaissance flybys through orbiters and landers or rovers to sample returns. SSE research programs develop new instruments, analyze mission data or returned samples, and provide experimental or theoretical models to aid in interpretation.
Derived from text
*Solar System; Space Exploration; Reconnaissance*

**20040062026** Northwestern Univ., Evanston, IL, USA
**Online Access to the NEAR Image Collection: A Resource for Educators and Scientists**
Speyerer, E. J.; Robinson, M. S.; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students, and the General Public in Space Science Exploration; 2004; 2 pp.; In English; See also 20040062024; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In 1996 the Near Earth Asteroid Rendezvous (NEAR) Shoemaker spacecraft was launched on a five-year voyage to encounter and study 433 Eros. From February 14th 2000 to February 12th 2001 the NEAR spacecraft orbited the 33 x 11 x 11 km asteroid 433 Eros. During the year-long orbital phase of the mission, the NEAR Multi-Spectral Imager (MSI) acquired over 140,000 images of Eros with resolutions ranging from 20 m to about 1 cm per pixel. To facilitate easy access to this resource we have developed several tools to serve the needs of scientists, educators, and the general public. The NEAR website http://cps.earth.northwestern.edu/near.html is aimed at assisting a wide audience ranging from middle school students to research scientists. We have made available four resources: a Geology Field Guide, a large collection of hand laid mosaics, orbital movies, and a multilevel searchable database.
Author
*Eros Asteroid; Near Earth Asteroid Rendezvous Mission; Geology; Data Bases*

**20040062045** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Impacts: Observations and Experiments**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062046 - 20040062058
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The title in this section include: 1) Impactites of the Haughton Impact Structure, Devon Island, Nunavut, Canada; 2) Geochemical Characteristics of Impactites from the Yaxcopoil-1 ICDP Drill Core, Chicxulub Impact Structure, Mexico; 3) Investigation of the Ries Impact Crater Based upon Old and New Geophysical Data and Numerical Modeling; 4) Potential of Radar Imaging and Sounding Methods in Mapping Heavily Eroded Impact Craters: Mapping Some Structural Elements of the Hico Crater, TX; 5) From Simple to Complex Craters: The Mechanics of Late-time Crater Adjustments; 6) Impact Structures: What Does Crater Diameter Mean? 7) Early-Time Temperature Evolution of the Impact Flash and Beyond; 8) Probing Impact-Generated Vapor Plumes; 9) Non-Ballistic Vapor-Driven Ejecta; 10) Depth and Diameter of Transient Craters; 11) A Plausibility of Z-Model; 12) Experiments with Explosives and Ordnance Disposal Devices for the Simulation of Specific Processes During Shallow-Marine Impacts; 13) Collisional Fragmentation of Rotating Bodies.
CASI
*Meteorite Craters; Meteorite Collisions*

**20040062046** Arizona Univ., Tucson, AZ, USA

**Impact Structures: What Does Crater Diameter Mean?**

Turtle, E. P.; Pierazzo, E.; Collins, G. S.; Osinski, G. R.; Melosh, H. J.; Morgan, J. V.; Reimold, W. U.; Spray, J. G.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The study of impact craters is still a relatively young field, and our understanding of the processes involved in crater formation remains far from complete. The current extent of our knowledge is derived from investigations spanning many disciplines, including: geologic mapping and geophysical exploration (both in situ and based on remote-sensing for Earth, whereas almost exclusively the latter for other planets); numerical simulations; and small-scale laboratory and larger-scale nuclear explosion experiments. An unfortunate side effect of the cross-disciplinary nature of such investigations is that inconsistencies in terminology commonly arise because the data sets are so disparate.

Derived from text

*Craters; Mapping; Remote Sensing; Geophysics; Cratering*

**20040062049** Brown Univ., Providence, RI, USA

**Early-Time Temperature Evolution of the Impact Flash and Beyond**

Ernst, C. M.; Schultz, P. H.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

When a hypervelocity projectile impacts a target, a light flash is produced at the moment of first contact. Time-resolved light intensity curves can be used to determine the starting conditions of the observed impacts [1,2]. For impacts into metal targets, the peak intensity of the flash occurs during the initial projectile penetration, with the signal quickly decaying [3,4]. Impacts into particulate targets produce a source of blackbody radiators in addition to the initial flash. This source extends the resulting light intensity profile well beyond the time of initial contact. A time-resolved temperature profile is an additional useful tool for analyzing the early-time evolution of an impact based solely on its emitted light. Observed thermal signatures indicate that the increase in light intensity to a peak value is dependent on an expanding radiating source area, not on an increasing temperature. Impact temperature profiles evolve differently for various angles and projectile diameters.

Derived from text

*Hypervelocity Projectiles; Time Temperature Parameter; Luminous Intensity; Particulates*

**20040062050** Tokyo Univ., Japan

**Depth and Diameter of Transient Craters**

Yamamoto, S.; Okabe, N.; Wada, K.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Transient crater in gravity regime collapses even during excavation stage owing to gravity, and the crater shape (diameter and depth) may change. In the previous experiments, crater shapes after the collapse have been assumed to be the same as those of transient craters, because the degree of the collapse has been considered to be negligible in laboratory scales. However, even in laboratory scales, the degree of the collapse may depend on target material properties (e.g., cohesion among grains). Therefore, we tried to observe formation process of transient craters directly. A schematic diagram of an experimental apparatus to measure the depth and diameter of transient craters is presented.

Derived from text

*Lunar Craters; Diameters; Depth; Measuring Instruments*

**20040062057** Tokyo Univ., Japan

**A Plausibility of Z-Model**

Wada, K.; Senshu, H.; Matsu, T.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Maxwell's Z-model has been used as a first-order approximation model of excavation flow for vertical impact. It can be derived analytically from a few simple assumptions: (1) Flow is steady and (2) incompressible. (3) Origin of flow (hereafter we call it effective origin of flow (EOF)) is a point source. (4) The radial component of particle velocity, u(sub r), decreases exponentially with increasing the radial distance r, as u(sub r) proportional to r (sup -Z). Z is a parameter that determines the

rate of attenuation of u(sub r) with distance. These assumptions give the steady streamlines in polar coordinates (its origin is given by EOF) as r = r (sub 0)(1-cos theta) (sup 1/z-2), where r (sub 0) is a constant given for each streamline and theta is measured from the vertical downward line. A plausibility of the Z-model has not been studied so far, because the motion of target materials is not visible directly in laboratory experiments. downward line. A plausibility of the Z-model has not been studied so far, because the motion of target materials is not visible directly in laboratory experiments. In numerical simulations of impact cratering, the velocity field can be calculated at each time step of cratering. According to these numerical studies, the value of Z is estimated to be about 3, though varying a little bit with time, and the depth of EOF is located at about one projectile diameter below the target surface. These simulations were carried out using a hydrocode with finite difference scheme. Thus, the actual motions of target particles were not able to be traced. We have conducted numerical simulations of impacts onto granular materials using the Distinct Element Method (DEM) and demonstrated that this simulation method can simulate well the cratering process for the vertical impact. Based on the DEM, the trajectories of target particles can be traced directly, because the motions of distinct particles are computed by this method. It is thus possible to compare the actual motions of target particles with the streamlines predicted by the Z-model.
Derived from text
*Mathematical Models; Maxwell Equation; Approximation; Numerical Analysis; Lunar Craters*

**20040062058** Brown Univ., Providence, RI, USA
**Probing Impact-Generated Vapor Plumes**
Eberhardy, C. A.; Schultz, P. H.; Lunar and Planetary Science XXXV: Impacts: Observations and Experiments; 2004; 2 pp.; In English; See also 20040062045; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Laboratory-produced impact vapor plumes cannot be completely characterized without understanding their temperature and pressure conditions, and their composition. Spectroscopy can define these parameters but it lacks the spatial resolution of high-speed imaging. High-speed imaging captures the source region but the composition cannot be characterized. Spectroscopy allows the detection of tenuous vapor plumes and enables the measurement of composition and temperature. Targeting several small and discrete regions simultaneously can then be used instead of imaging. By looking inside and around the growing crater using quarterspace experiments, we are able to characterize vapor plume evolution. High-speed spectroscopy reveals the evolving composition of impact vapor. Previous studies have used high-speed spectroscopy to study the jetting phase. Atmospheric interactions with the vapor plume also have been analyzed with spectroscopy, resulting in the identification of new molecules synthesized in the vapor plume. The study here improves the understanding of where the impact vapor is forming and how it evolves.
Author
*Impact Melts; Vapors; Plumes; Imaging Techniques*

**20040062060** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062061 - 20040062073
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI -Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session ‘chondrites: An Awesome Assortment’ included the following reports:Nucleation of the Widmanstatten Pattern in Iron Meteorites; Compositions of the Group IVB Iron Meteorites; Sm-Nd Age and Initial 87Sr/86Sr for Yamato 980318: An Old Cumulate Eucrite; Petrology of New Stannern-trend Eucrites and Eucrite Genesis; The Dichotomous HED Meteorite Suite; Early Thermal Evolution of HED Parent Body; Thermal History of the Lodranite Yamato 74357: Constraints from Compositional Zoning and Fe-Mg Ordering; Late Thermal Evolution of Acapulcoites-Lodranites Parent Body: Evidence from Sm-Nd Isotopes and Trace Elements of the LEW 86220 Acapulcoite; Partial Melting Under Reducing Conditions: How are Primitive Achondrites Formed?; Evolution of the Ureilite Parent Body; Complex, Contrasting Behavior of Chromium During Late-Stage Processes in Ureilites; Sahara 99555 and D Orbigny: Possible Pristine Parent Magma of Quenched Angrites; and Devolatilized-Allende Partial Melts as an Analog for Primitive Angrite Magmas.
Derived from text
*Achondrites; Meteoritic Composition*

**20040062063** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Devolatilized-Allende Partial Melts as an Analog for Primitive Angrite Magmas**

Jurewicz, A. J. G.; Jones, J. H.; Mittlefehldt, D. W.; Longhit, J.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have shown that partial melts of devolatilized Allende chondrite (CV3) have bulk compositions generally similar to those of angrites. Here we show that the recently described D'Orbigny and Sahara 99555 angrites are virtually identical in major-element composition to specific Allende experimental melts from. This observation has petrogenetic significance for the origins of the angrite clan.

Author

*Allende Meteorite; Melting; Meteoritic Composition*

**20040062064** NASA Johnson Space Center, Houston, TX, USA

**The Dichotomous HED Meteorite Suite**

Mittlefehldt, D. W.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The howardite, eucrite and diogenite (HED) clan is the largest suite of crustal rocks available from a differentiated asteroid. Attempts to unravel the petrogenetic history of the HED parent body have tacitly assumed that the suite is representative of the crust, and thus can be used to understand the differentiation history of the entire parent body. This assumption is a holdover from a time when we knew little about the HED parent body. Much has changed. Is this assumption still valid? HED Geochemistry: The HED suite is composed

Author

*Meteoritic Composition; Rocks; Achondrites*

**20040062065** Massachusetts Univ., Amherst, MA, USA

**Nucleation of the Widmanstatten Pattern in Iron Meteorites**

Yang, J.; Goldstein, J. I.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060

Contract(s)/Grant(s): NAG5-11778; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Widmanstatten pattern develops at low temperatures during the evolution of the asteroids. We have studied the origin of the Widmanstatten pattern in order to obtain metallographic cooling rates in the temperature range (approx. 700 to 300 deg C). This paper summarizes our recent evaluation of the various mechanisms for the formation of the Widmanstatten pattern. All chemical groups of the iron meteorites are considered. We also propose a new mechanism for the formation of the Widmanstatten pattern in the low P metal phase of iron, stony-iron and stony meteorites. The results of this evaluation enables us to more accurately determine metallographic cooling rates particularly when incorporated with other recent advances in Fe-Ni and Fe-Ni (P saturated) phase diagrams and interdiffusion coefficients.

Author

*Nucleation; Widmanstatten Structure; Patterns; Iron Meteorites; Metallography; Cooling*

**20040062071** NASA Johnson Space Center, Houston, TX, USA

**Petrology of New Stannern-trend Eucrites and Eucrite Genesis**

Gardner, K. G.; Mittlefehldt, D. W.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Eucrites are basaltic meteorites of the howardite-eucrite-diogenite (HED) suite that originated on a differentiated asteroid, possibly 4 Vesta. Basaltic eucrites are divided into three subgroups based on composition: main group, Stannern-trend, and Nuevo Laredo-trend. The main group and Nuevo Laredo-trend define a sequence formed by fractional crystallization of pigeonite and plagioclase from primitive parent melts [2, 3]. The Stannern-trend cannot be explained this way, but may rather represent a partial-melt sequence of their parent body. However, this model seems inadequate to explain eucrite siderophile element contents, and it is difficult to develop a single unifying model for petrogenesis of all eucrites. Until recently, there were only four Stannern- trend eucrites. One is an anomalous partial cumulate. There is little geochemical variation among these

meteorites, so the Stannern-trend was poorly defined. Geochemical studies have identified four additional eucrites as members of the Stannern-trend; one extends the Stannern-trend closer to the main group [5]. No detailed descriptions of these rocks have been published. In order to better integrate these eucrites into the suite, we have done petrologic study of them. They are: LEW 88010, PCA 82501, PCA 91006 and PCA 91179.
Derived from text
*Petrology; Basalt; Meteorites; Rocks; Pyroxenes*

**20040062072** NASA Johnson Space Center, Houston, TX, USA
**Sm-Nd Age and Initial Sr-87/Sr-86 for Yamato 980318: An Old Cumulate Eucrite**
Nyquist, L. E.; Takeda, H.; Shih, C.-Y.; Wiesmann, H.; Lunar and Planetary Science XXXV: Achondrites: An Awesome Assortment; 2004; 2 pp.; In English; See also 20040062060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The complex pyroxene exsolution texture of the Moore County cumulate eucrite was interpreted by Miyamoto and Takeda as indicating initial cooling at 160 C/Ma followed by a sudden temperature rise and final cooling at 0.35 C/yr. They suggested initial cooling at a depth of approx. 8 km near the base of Vesta s crust, followed by impact excavation to its surface. Young Sm-Nd ages of approx. 4456, 4460, and 4410 Ma, respectively, for the Moore County, Moama, and Serra de Mag cumulate eucrites are puzzling because closure to Nd isotopic exchange would occur in only a few Ma at the above initial cooling rate. The exception to young ages among the cumulate eucrites is EET87520, with a 147Sm-147 - Nd-143 age of 4547-4598 Ma. We report here initial results of a combined mineralogical/chronological study of the Yamato 980318 feldspar-cumulate eucrite.
Author
*Samarium; Samarium Isotopes; Mineralogy; Cooling*

**20040062078** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062079 - 20040062091
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Lunar Crust as Samples by Basins and Craters' included:Radar Properties of Lunar Basin Deposits; Numerical Modeling of the South Pole-Aitkin Impact; Lunar South Pole-Aitken Impact Basin: Topography and Mineralogy; Comparison of the Geologic Setting of the South Pole-Aitken Basin Interior with Apollo 16: Implications for Regolith Components; Identifying Impact Events Within the Lunar Cataclysm from 40Ar-39Ar Ages of Apollo 16 Impact Melt Rocks; Apollo 16 Mafic Glass: Geochemistry, Provenance, and Implications; Lunar Meteorite PCA 02 007: A Feldspathic Regolith Breccia with Mixed Mare/Highland Components; Compositional Constraints on the Launch Pairing of LAP 02205 and PCA 02007 with Other Lunar Meteorites; An In-Situ Study of REE Abundances in Three Anorthositic Impact Melt Lunar Highland Meteorites; A Crustal Rock Clast in Magnesian Anorthositic Breccia, Dhofar 489 and Its Excavation from a Large Basin; The Origin and Impact History of Lunar Meteorite Yamato 86032; Evolved Lithologies and Their Inferred Sources in the Northwestern Procellarum Region of the Moon; and Revisiting the Interpretation of Thorium Abundances at Hansteen Alpha.
Derived from text
*Lunar Crust; Lunar Rocks*

**20040062079** Brown Univ., Providence, RI, USA
**Comparison of the Geologic Setting of the South Pole-Aitken Basin Interior with Apollo 16: Implications for Regolith Components**
Petro, N. E.; Pieters, C. M.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078
Contract(s)/Grant(s): NAG5-10401; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The interior of the South Pole-Aitken Basin (SPA) contains ancient cratered terrain that is possibly remnant of the original interior of the basin. This terrain has been modified by the addition of and mixing with foreign material introduced by later basins and craters of all sizes (lateral and vertical mixing). Since much of our thinking about ancient regolith is based on detailed analysis of samples from one nearside ancient heavily cratered highland site, Apollo 16 (Ap16), it is instructive to

compare the interior of SPA with the Ap16 landing site. For this comparison we use a central location within SPA (SPA-1 at 60 deg. S, 160 deg. W). Two models have recently been presented that allow estimation of the amount of original SPA interior material likely to remain in the regolith of SPA. Although the details of each model are different, results consistently range from 50-82% original material in the regolith. The models also allow the contribution from individual basins to be predicted.
Derived from text
*Geology; Regolith; Craters; Structural Basins*

**20040062080** Oregon State Univ., Corvallis, OR, USA
**Identifying Impact Events Within the Lunar Cataclysm from Ar-40 -- Ar-39 Ages of Apollo 16 Impact Melt Rocks**
Duncan, R. A.; Norman, M. D.; Ryder, G.; Dalrymple, G. B.; Huard, J. J.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Apollo 16 samples from the lunar highlands include numerous fragments of impact-produced melt rocks, both as discrete fragments and as clasts in breccias. They have a wide range of compositions and petrographic characteristics, and are fundamental in understanding the geological history of the Apollo 16 landing site and the impact history of the Moon. Most of the Apollo 16 crystalline melt rocks for which geochronological data exist have ages between 3.80 and 3.92 Ga; a few older ages have been claimed. One group of aluminous melt rocks, including samples 68415 and 68416 chipped from a homogenous boulder, are clearly younger at close to 3.75 Ga than most other samples. Some glassy melts are rather younger still, reflecting continuing small scale bombardment of the Moon following heavy bombardment.
Derived from text
*Impact Melts; Lunar Rocks; Rocks; Geochronology; Crystallinity*

**20040062081** Washington Univ., Saint Louis, MO, USA
**Apollo 16 Mafic Glass: Geochemistry, Provenance, and Implications**
Zeigler, R. A.; Korotev, R. L.; Jolliff, B. L.; Haskin, L. A.; Floss, C.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although the Apollo 16 mission landed in the feldspathic lunar highlands, mass-balance models suggest that there is a 5-6% mare component in the mature soils collected at the site. Only one mare basalt greater than 1 cm was found and two surveys of 2-4 mm particles found that less than 1% of this size fraction is mare basalt. Similar surveys of the less than 1 mm size fraction of A16 soils found very little lithic mare basalt, but several percent of basaltic green, yellow, and orange glass. The green glass beads were identified as VLT picritic glass and the orange/yellow glass shards were a mix of high and low Ti mare-like glass, high-Al basaltic glass, and KREEPy glasses. Most previous studies of glasses in the A16 regolith were surveys that identified a high proportion of feldspathic glass because most of the glass is produced by local impacts. Because the number of mafic glasses found was low, few compositional groupings were identified. As part of our ongoing study of the mafic components of the Apollo 16 site, we specifically targeted mafic glasses from Apollo 16, selecting against the more feldspathic glasses. In this way we were able to identify over 300 mafic glasses (greater than 10 wt % FeO). We present here the major- and trace-element chemistry of the main glass groups and discuss the likely provenance of each group.
Derived from text
*Geochemistry; Glass; Mineralogy; Apollo 16 Flight; Trace Elements*

**20040062082** NASA Johnson Space Center, Houston, TX, USA
**A Crustal Rock Clast in Magnesian Anorthositic Breccia, Dhofar 489 and Its Excavation from a Large Basin**
Takeda, Hiroshi; Bogard, D. D.; Yamaguchi, Akira; Ohtake, Makiko; Saiki, Kazuto; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report the mineralogy and Ar-Ar age of a spinel troctolite clast with a granulitic texture found in the Dofar 489 lunar meteorite. This anothositic breccia contained magnesian mafic silicates not common in ferroan anorthosites (FAN) from the Feldspathic Highlands Terrane (FHT) of Joliff et al. The Ar-Ar ages of most FANs in the Apollo sample collection from the Procellarum KREEP Terrane (PKT) and FHT of the near-side of the Moon were reset at around 3.9 Gyr. by the basin forming event of Imbrium. From the older Ar-Ar age of Dho 489, we propose that a large basin formation other than the Imbrium basin may have mixed deep crustal rocks such as spinel troctolites with ‘pure’ anrthosites to produce a magnesian anorthosite brecca.

This model is in line with a proposal by Bussey and Spudis, who reported that inner rings of large basins display massifs of nearly pure anorthosites.
Author
*Crusts; Rocks; Magnesium; Breccia; Mineralogy; Argon*

**20040062083** Tennessee Univ., Knoxville, TN, USA
**Lunar Meteorite PCA 02 007: A Feldspathic Regolith Breccia with Mixed Mare/Highland Components**
Taylor, L. A.; Anand, M.; Neal, C.; Patchen, A.; Kramer, G.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar meteorite PCA 02 007 was recently discovered in the Pecora Escarpment in Antarctica. We were allocated one thin section (PCA 02 007,27), one polished thick section (PCA 02 007,24), and 0.535 g powdered rock sample (PCA 02 007,13) by the Meteorite Working Group (MWG) for carrying out mineral and geochemical investigations. This sample was originally described as a basaltic lunar breccia. However, the polished thick- and thin sections that we have examined are of a regolith breccia consisting of many highland clasts and a few basalt clasts of VLT affinity and a multitude of monomineralic basaltic clasts, all set within a fine-grained, brownish glassy matrix, made almost opaque by myriads of native Fe grains. Several regolith clasts are also present containing partially devitrified glass spheres and a network of fine-grained native Fe grains from the accompanying agglutinates.
Derived from text
*Breccia; Highlands; Meteorites; Regolith; Lunar Surface; Mineralogy; Lithology; Lunar Maria*

**20040062084** Washington Univ., Saint Louis, MO, USA
**Compositional Constraints on the Launch Pairing of LAP 02205 and PCA 02007 with Other Lunar Meteorites**
Korotev, R. L.; Zeigler, R. A.; Jolliff, B. L.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078
Contract(s)/Grant(s): NAG5-10485; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report compositional data for two new lunar meteorites collected during the 2002 03 ANSMET (Antarctic Search for Meteorites) field season, LAP 02205 and PCA 02007.
Author
*Composition (Property); Meteorites; Lunar Surface; Meteoritic Composition*

**20040062085** Smithsonian Institution, Washington, DC, USA
**Radar Properties of Lunar Basin Deposits**
Campbell, B. A.; Campbell, D. B.; Hawke, B. R.; Lucey, P. G.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Basin-forming impacts have sculpted much of the lunar highland terrain, and their overlapping distal ejecta deposits form the 'megaregolith'. Variations in surface morphology have been used to identify likely contacts between ejecta from various basins, but there has been little opportunity to study differences in physical properties due to age, distance from basin rim, and perhaps target composition. We address this issue through new high-resolution 70-cm radar images, which penetrate to depths of 5 m or more in the highland regolith, thermal infrared eclipse maps, and multi-spectral data.
Author
*Deposits; Morphology; Radar Imagery; Regolith*

**20040062086** Brown Univ., Providence, RI, USA
**Lunar South Pole-Aitken Impact Basin: Topography and Mineralogy**
Hiesinger, H.; Head, J. W., III; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar impact basins show a variety of internal and external structure [e.g., Wilhelms, 1987; Head et al., 1993, Spudis, 1993] and states of degradation and preservation. Orientale, one of the youngest and best-preserved large basins, shows a configuration of internal topography, ring structure, and deposit morphology ( Orientale-type ) that is generally similar to other

relatively undegraded lunar basins. This basin type formed by impact into a target that has sufficient target rigidity to form a small number of multiple rings and to preserve them over geologic time Other, more heavily degraded basins on the Moon ( Tranquillitatis- type ) have apparently undergone significant viscous relaxation subsequent to their formation, reducing basin topography [Solomon et al., 1982]. They formed in a manner likely similar to the Orientale type but in a target thermal structure that subsequently allowed for long-term crustal flow and viscous relaxation of the major topographic elements to produce a very shallow basin. These older basins have also been subject to significant impact degradation. Both of these morphologies are in contrast to some impact basins on icy satellites characterized by many more rings and little topographic expression ( Valhalla-type ) (e.g., Passey and Shoemaker, 1982; Greeley et al., 2000), a morphology thought to have been formed as part of the very early modification stage of the impact event, due primarily to sublithospheric flow into the cavity area and attendant formation of many multiple rings but little basin topography [McKinnon and Melosh, 1980].
Derived from text
*Structural Basins; Ring Structures; Mineralogy; Topography; Morphology; Crusts; Degradation; Geochronology*

**20040062087** Arizona Univ., Tucson, AZ, USA
**Numerical Modeling of the South Pole-Aitkin Impact**
Collins, G. S.; Melosh, H. J.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078
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

The South Pole-Aitkin (SPA) basin, on the far side of the Moon, is the largest and oldest impact structure still preserved in the solar system. The crater is about 2500 km in diameter and formed in the Pre-Nectarian era of lunar history, over 4 Gyr ago. At this time, the thermal state of the Moon was much hotter than it is today. Accretional energy from the rapidly forming Moon melted the outermost few hundred kilometers of the Moon. As this magma ocean differentiated and cooled a 60 100-km thick low-density crust formed at the surface; below this the residual melt, with a higher density, cooled to form the lunar mantle. The giant SPA impact event punctured the Moon some time during the cooling of the magma ocean and thus provides a unique window for studying the lunar interior and the early formative processes of the Moon. The impact excavated otherwise inaccessible samples of the deep crust and (possibly) upper mantle, which has inspired proposed sample return missions. Furthermore, the thermal and rheologic state of the early Moon played a role in shaping the final structure of the basin. To aid in site selection for future sample return missions to the SPA basin, and to investigate the effect of thermal state on final crater structure, we performed some numerical simulations of the SPA impact event.
Derived from text
*Mathematical Models; Structural Basins; Polar Regions; Lunar Craters; Lunar Topography*

**20040062088** Washington Univ., Saint Louis, MO, USA
**Evolved Lithologies and Their Inferred Sources in the Northwestern Procellarum Region of the Moon**
Jolliff, Bradley L.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078
Contract(s)/Grant(s): NAG5-8905; NAG5-10227; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Compositional remote sensing from the Lunar Prospector mission reveals the Procellarum- Imbrium region of the Moon, also referred to as the Procellarum KREEP Terrane, to be an area of significant enrichment of heat-producing residua (i.e., Thrich) of the early lunar differentiation. Previous estimates place as much as 60-70% of the whole-Moon content of Th into the crust and as much as 35-40% of the crustal Th content into the Procellarum KREEP Terrane [5], which occupies only approx. 10-15% of the volume of the crust. Although these estimates have significant uncertainty, the correspondence of the enrichment of Th (and other heat producers U and K) in this region is consistent with extended igneous activity, manifested at the surface by extensive basaltic volcanism and subdued topography. Such activity may have extended also to a significant depth, probably including the upper mantle. In this abstract, we present evidence based on Apollo samples for some of the most extensively fractionated lunar rocks types, including a Th-rich mare basalt from Apollo 12, and monzogabbro (also known as monzodiorite), granite, and alkali anorthosite from Apollo 12 and 14 samples. We relate these to likely exposures and sources indicated by compositional remote sensing.
Author
*Lithology; Volcanology; Topography; Remote Sensing; Kreep; Lunar Rocks*

**20040062089** NASA Johnson Space Center, Houston, TX, USA

**The Origin and Impact History of Lunar Meteorite Yamato 86032**

Yamaguchi, A.; Takeda, H.; Nyquist, L. E.; Bogard, D. D.; Ebihara, M.; Karouji, Y.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078

Contract(s)/Grant(s): MOE-14740308; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Yamato (Y) 86032 is a feldspathic lunar highland breccia having some characteristics of regolith breccia. The absence of KREEP components in the matrix in Y86032 indicates that these meteorites came from a long distance from Mare Imbrium, perhaps from the far-side of the moon. One ferroan anorthosite (FAN) clast in Y86032 has a very old Ar-Ar age of approximately 4.35-4.4 Ga. The negative Nd of this clast may suggest a direct link with the primordial magma ocean. The facts indicate that Y86032 contains components derived from a protolith of the original lunar crust. Detailed petrologic characterization of each component in this breccia is essential to understand the early impact history and origin of the lunar highland crust. We made a large slab (5.2 x 3.6 cm x 3-5 mm) of Y86032 to better understand the relationship of various lithologies and their petrologic origin.

Derived from text

*Lunar Crust; Meteorites; Geochronology; Lunar Evolution; Lithology; Meteoritic Composition*

**20040062090** Los Alamos National Lab., NM, USA

**Revisiting the Interpretation of Thorium Abundances at Hansteen Alpha**

Lawrence, D. J.; Hawke, B. R.; Elphic, R. C.; Feldman, W. C.; Prettyman, T. H.; Vaniman, D. T.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078

Contract(s)/Grant(s): NASA Order W-19949; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hansteen Alpha is one of the few remaining locations on the Moon thought to be formed by highlands volcanism. Hansteen Alpha is a triangular shaped feature located in the southern portion of Oceanus Procellarum (12 degrees W, 50 degrees S) and its size is approximately 25 km on each side. As described by Hawke et al., there is clear evidence that: 1) Hansteen Alpha was emplaced by extrusive volcanic processes; and 2) it was formed by a viscous lava that should be enriched in Th. However, in the study of Hawke et al. using available Lunar Prospector (LP) Th data, it was concluded that the Hansteen Alpha region was not greatly enriched in Th as would be expected for a highly evolved, viscous lava. It was further concluded based on other compositional data that the magma that formed Hansteen Alpha did not correspond to any known rock type. Here we revisit the interpretation of Th abundances at Hansteen Alpha for a couple of reasons. First, the size of Hansteen Alpha is smaller than the spatial resolution of the LP Gamma-ray Spectrometer (LP-GRS) from which the Th abundances were derived. Therefore, the LP-GRS pixels covering Hansteen Alpha may not truly represent the Th abundance of the Hansteen Alpha feature. Second, recent work has led to a much greater understanding of the Th spatial distribution for small-area features on the lunar surface. In particular, using forward modeling techniques, we have developed the ability to obtain information about Th abundances for features that are at or smaller than the FWHM spatial resolution (approximately [80 square kilometers]) of the LP-GRS data.

Derived from text

*Abundance; Highlands; Thorium; Volcanology; Planetary Geology; Mathematical Models*

**20040062091** Specola Vaticana, Vatican City State (Holy See)

**An In-Situ Study of REE Abundances in Three Anorthositic Impact Melt Lunar Highland Meteorites**

Consolmagno, G. J.; Russell, S. S.; Jeffries, T. E.; Lunar and Planetary Science XXXV: Lunar Crust as Sampled by Basins and Craters; 2004; 2 pp.; In English; See also 20040062078; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar meteorites may have sampled material more representative of the bulk lunar surface than the nearside regions sampled by Apollo and Luna missions. Lunar highland meteorites tend to be more anorthosite-rich, and poorer in the melt residue component (KREEP), than their Apollo analogues. For example, the Ni/Ir of most lunar meteorites is lower than for Apollo samples. Here we report the REE composition of clasts from three lunar meteorites; model the original melt composition from which the clasts and relict crystals formed; and compare these results with previous work on the Apollo ferroan anorthosite (FAN) suite.

Author

*In Situ Measurement; Anorthosite; Impact Melts; Kreep; Lunar Surface; Melts (Crystal Growth); Meteorites*

**20040062092** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062093 - 20040062122

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

Reports included:Long Term Stability of Mars Trojans; Horseshoe Asteroids and Quasi-satellites in Earth-like Orbits; Effect of Roughness on Visible Reflectance Spectra of Planetary Surface; SUBARU Spectroscopy of Asteroid (832) Karin; Determining Time Scale of Space Weathering; Change of Asteroid Reflectance Spectra by Space Weathering: Pulse Laser Irradiation on Meteorite Samples; Reflectance Spectra of CM2 Chondrite Mighei Irradiated with Pulsed Laser and Implications for Low-Albedo Asteroids and Martian Moons; Meteorite Porosities and Densities: A Review of Trends in the Data; Small Craters in the Inner Solar System: Primaries or Secondaries or Both?; Generation of an Ordinary-Chondrite Regolith by Repetitive Impact; Asteroid Modal Mineralogy Using Hapke Mixing Models: Validation with HED Meteorites; Particle Size Effect in X-Ray Fluorescence at a Large Phase Angle: Importance on Elemental Analysis of Asteroid Eros (433); An Investigation into Solar Wind Depletion of Sulfur in Troilite; Photometric Behaviour Dependent on Solar Phase Angle and Physical Characteristics of Binary Near-Earth-Asteroid (65803) 1996 GT; Spectroscopic Observations of Asteroid 4 Vesta from 1.9 to 3.5 micron: Evidence of Hydrated and/or Hydroxylated Minerals; Multi-Wavelength Observations of Asteroid 2100 Ra-Shalom: Visible, Infrared, and Thermal Spectroscopy Results; New Peculiarities of Cometary Outburst Activity; Preliminary Shape Modeling for the Asteroid (25143) Itokawa, AMICA of Hayabusa Mission; Scientific Capability of MINERVA Rover in Hayabusa Asteroid Mission; Characteristics and Current Status of Near Infrared Spectrometer for Hayabusa Mission; Sampling Strategy and Curation Plan of Hayabusa Asteroid Sample Return Mission; Visible/Near-Infrared Spectral Properties of MUSES C Target Asteroid 25143 Itokawa; Calibration of the NEAR XRS Solar Monitor; Modeling Mosaic Degradation of X-Ray Measurements of 433 Eros by NEAR-Shoemaker; Scattered Light Remediation and Recalibration of near Sheomaker s NIS Global Dataaset at 433 Eros; Evaluation of Preparation and Measuring Techniques for Interplanetary Dust Particles for the MIDAS Experiment on Rosetta; Chiron: a Proposed Remote Sensing Prompt Gamma Ray Activation Analysis Instrument for a Nuclear Powered Prometheus Mission;From Present Surveying to Future Prospecting of the Asteroid Belt; Asteroid Physical Properties Probe Microgravity Testing of a Surface Sampling System for Sample Return from Small Solar System Bodies;and Penetrator Coring Apparatus for Cometary Surfaces.

Derived from text

*Asteroids; Comets; Meteoroids*

**20040062096** NASA Johnson Space Center, Houston, TX, USA

**Sampling Strategy and Curation Plan of 'Hayabusa' Asteroid Sample Return Mission**

Yano, H.; Fujiwara, A.; Abe, M.; Hasegawa, S.; Kushiro, I.; Zolensky, M. E.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On the 9th May 2003 JST, Japanese spacecraft MUSES-C was successfully launched from Uchinoura. The spacecraft was directly inserted to interplanetary trajectory and renamed as Hayabusa , or 'Falcon' to be the world s first sample return spacecraft to a near Earth asteroid (NEA). The NEA (25143)Itokawa (formerly known as '1998SF36') is its mission target. Its orbital and physical characteristics were well observed; the size is (490 +/- 100)x (250 +/- 55)x(180 +/- 50) m with about 12-hour rotation period. It has a red-sloped S(IV)-type spectrum with strong 1- and 2-micron absorption bands, analogous to ordinary LL chondrites with space weathering effect. Assuming its bulk density, the surface gravity level of Itokawa is in the order of 10 micro-G with its escape velocity = approx. 20 cm/s.

Author

*Absorption Spectra; Asteroids; Chondrites; Gravitation; Sampling; Space Weathering*

**20040062097** Aizu Univ., Aizu, Japan

**Preliminary Shape Modeling for the Asteroid (25143) Itokawa, AMICA of Hayabusa Mission**

Demura, H.; Kobayashi, S.; Murai, Y.; Nishiyama, K.; Hashimoto, T.; Saito, J.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 1 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hayabusa mission is a sample return program of ISAS/JAXA. The spacecraft was renamed from MUSES-C, which was launched to the target asteroid (25143) Itokawa at May 9, 2003. Scheduled arrival is summer of 2005. We are a group of shape modeling for selecting landing sites, for characterizing geologic context on the basis of a telescope (AMICA: Asteroid

Multiband Imaging Camera) and a laser range finder (LIDAR: Light Detection And Ranging). We show preliminary results of a type of image-based one by means of ground experiments with proto-model of AMICA.
Author
*Image Analysis; Shapes; Models; Asteroids*

**20040062098** Tokyo Univ., Japan
**Change of Asteroid Reflectance Spectra by Space Weathering: Pulse Laser Irradiation on Meteorite Samples**
Sasaki, S.; Ueda, Y.; Kurahashi, E.; Loeffler, M.; Hiroi, T.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are spectral mismatches between S-type asteroids and ordinary chondrites. S-type asteroids exhibit more overall depletion and reddening of spectra, and more weakening of absorption bands relative to ordinary chondrites. These spectral mismatches are explained by the so-called 'space weathering'. Hapke et al. proposed that the spectral change should be caused by formation of nanophase metallic iron particles. High-velocity dust particle impacts as well as sputtering by solar wind would be responsible for vapor formation. Nanophase iron particles are confirmed in the rim of lunar soil grains. Recent ground-based and spacecraft observations confirmed the strong link between S-type asteroids and ordinary chondrites.
Author
*Asteroids; Absorption Spectra; Weathering; Space; Pulsed Lasers; Irradiation; Meteorites; Samples*

**20040062099** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**'Chiron': A Proposed Remote Sensing Prompt Gamma Ray Activation Analysis Instrument for a Nuclear Powered Prometheus Mission**
Floyd, Samuel R.; Keller, John W.; Dworkin, Jason P.; Mildner, David F. R.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Prompt Gamma Ray Activation Analysis (PGAA) from neutron capture is an important experimental method that yields information on the elemental abundance of target materials. Gamma ray analysis has been used in planetary exploration missions by taking advantage of the production of neutrons as a result of Galactic Cosmic Ray interaction within the planetary surfaces. The .gamma ray signal that can be obtained from the GCR production of neutrons is very low, so we seek a superior neutron source. NASA s Project Prometheus and the Dept. of Energy aim to develop a nuclear power system for planetary exploration. This provides us with a tremendous opportunity to harness the reactor as a source of neutrons that can be used for PGAA. We envision a narrow stream of neutrons from the reactor directed toward the surface of an asteroid or comet producing the prompt gamma ray signal for analysis. Under ideal conditions of neutron flux and spacecraft orbit, both the signal strength and the spatial resolution will improved by several orders of magnitude over previously missions.
Derived from text
*Gamma Rays; Activation Analysis; Asteroids; Chiron; Galactic Cosmic Rays; Remote Sensing*

**20040062100** Johns Hopkins Univ., Laurel, MD, USA
**Scattered Light Remediation and Recalibration of near Shoemaker's NIS Global Data set at 433 Eros**
Izenberg, N. R.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The original calibration of NEAR Shoemaker s Near Infrared Spectrometer (NIS), while complete, omitted a critical correction for internal scattered light of the spectrometer grating. This kind of scatter is a natural feature of grating spectrometers, but it was initially discounted as a significant factor in NIS calibration. After a re-analysis of the ground calibrations, determined the scattered light contribution to be significant enough to warrant correction, and generated a correction factor for the instrument s raw data-to-radiance conversion coefficients. The NIS+MSI used calibrated and photometrically corrected Eros spectra, and a postprocessing scattered light correction applied to those spectra directly. Ideally the scattered light, and other post-mission calibration corrections should be applied as part of the calibration pipeline, before any postprocessing (including photometric correction). Future analysis using calibrated NIS data is better served by propagating corrections through the complete (over 200,000 spectrum) dataset from the raw original.
Author
*Scattering; Calibrating; Spectra; Radiance*

**20040062102** Institute of Space and Astronautical Science, Sagamihara, Japan

**Spectroscopic Observations of Asteroid 4 Vesta from 1.9 to 3.5 micron: Evidence of Hydrated and/or Hydroxylated Minerals**

Hasegawa, S.; Hiroi, T.; Ishiguro, M.; Nonaka, H.; Takato, N.; Davis, C. J.; Ueno, M.; Murakawa, K.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Asteroid 4 Vesta has been done various observations. McCord et al. obtained the first modern extended-visible spectrum of 4 Vesta in the range from 0.3 to 1.1 m, and showed that the surface of Vesta has a composition similar to that of certain basaltic achondrites. It was noted that visible and near infrared reflectance spectrum of Vesta is unique among the main-belt asteroids larger than 50 km and is closely matched with three subclasses of basaltic achondries: howardites, eucrites, and diogenites (HED). In order to confirm whether Vesta has any 3- m feature or not, simultaneous and continuous spectroscopic observation of Vesta from 2.5 m to 3.0 m are required. Therefore, we have conducted such new 3- m observations of Vesta.
Derived from text

*Vesta Asteroid; Spectroscopy*

**20040062103** Arkansas-Oklahoma Center for Space and Planetary Sciences, USA

**Microgravity Testing of a Surface Sampling System for Sample Return from Small Solar System Bodies**

Franzen, M. A.; Preble, J.; Schoenoff, M.; Halona, K.; Long, T. E.; Park, T.; Sears, D. W. G.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The return of samples from solar system bodies is becoming an essential element of solar system exploration. The recent National Research Council Solar System Exploration Decadal Survey identified six sample return missions as high priority missions: South-Aitken Basin Sample Return, Comet Surface Sample Return, Comet Surface Sample Return-sample from selected surface sites, Asteroid Lander/Rover/Sample Return, Comet Nucleus Sample Return-cold samples from depth, and Mars Sample Return [1] and the NASA Roadmap also includes sample return missions [2] . Sample collection methods that have been flown on robotic spacecraft to date return subgram quantities, but many scientific issues (like bulk composition, particle size distributions, petrology, chronology) require tens to hundreds of grams of sample. Many complex sample collection devices have been proposed, however, small robotic missions require simplicity. We present here the results of experiments done with a simple but innovative collection system for sample return from small solar system bodies.
Derived from text

*Sample Return Missions; Space Exploration; Microgravity; Mars Sample Return Missions; Petrology; Chronology*

**20040062104** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Penetrator Coring Apparatus for Cometary Surfaces**

Braun, David F.; Heinrich, Michael; Ai, Huirong Anita; Ahrens, Thomas J.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Touch and go impact coring is an attractive technique for sampling cometary nuclei and asteroidal surface on account of the uncertain strength properties and low surface gravities of these objects. Initial coring experiments in low temperature (approx. 153K polycrystalline ice) and porous rock demonstrate that simultaneous with impact coring, measurements of both the penetration strength and constraints on the frictional properties of surface materials can be obtained upon core penetration and core sample extraction. The method of sampling an asteroid, to be deployed, on the now launched MUSES-C mission, employs a small gun device that fires into the asteroid and the resulted impact ejecta is collected for return to Earth. This technique is well suited for initial sampling in a very low gravity environment and deployment depends little on asteroid surface mechanical properties. Since both asteroids and comets are believed to have altered surface properties a simple sampling apparatus that preserves stratigraphic information, such as impact coring is an attractive alternate to impact ejecta collection.
Derived from text

*Asteroids; Comet Nuclei; Cores*

**20040062105** Tokyo Univ., Hongo, Japan

**Photometric Behaviour Dependent on Solar Phase Angle and Physical Characteristics of Binary Near-Earth-Asteroid (65803) 1996 GT**

Kitazato, K.; Abe, M.; Mito, H.; Tarusawa, K.; Soyano, T.; Nishihara, S.; Sarugaku, Y.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Photometric behavior of an asteroid is generally considered to derive from mainly changing distances from Earth and Sun, rotation causing a periodic variation of the area and/or average albedo of the visible surface, and changing solar phase angle. The goal of this study is to map out the relationships between photometric behavior and solar phase angle as accurately as possible. Furthermore we have taken near-Earth-asteroids survey of the target of the next asteroid exploratory mission (post-HAYABUSA mission) in Japan. The object observed in this study is also one of them and to reveal its physical characteristics is important purpose, too. Asteroid of (65803) 1996 GT is an near-Earth-asteroid designed as belonging to the PHA (Potentially Hazardous Asteroid) group (q = 1.013 AU, a = 1.644 AU, i = 3.4 deg (MPO 53573)) and one of the most accessible asteroids by spacecraft. The object was predicted from ephemeris to make a close pass by the Earth on November 2003, which represented the enhancement of the apparent brightness. We had observed the object using with Kiso 30-cm Telescope (K.3T) for long periods. During these observational periods the solar phase angle of 1996 GT had varied 40.0 to 2.0. In the past, there is little observation to obtain the photometry of asteroids such as solar phase angle varied remarkably by a same telescope and in a continued term, and thus these data sets are very informative. In addition, we had observed the object using with 1.05-m Kiso Schmidt Telescope at UBVRI band filters and determined the color index and the taxonomic type of this asteroid.

Author

*Photometry; Near Earth Objects; Asteroids*

**20040062106** NASA Johnson Space Center, Houston, TX, USA

**Multi-Wavelength Observations of Asteroid 2100 Ra-Shalom: Visible, Infrared, and Thermal Spectroscopy Results**

Clark, Beth Ellen; Shepard, M.; Bus, S. J.; Vilas, F.; Rivkin, A. S.; Lim, L.; Lederer, S.; Jarvis, K.; Shah, S.; McConnochie, T.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 1 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The August 2003 apparition of asteroid 2100 Ra-Shalom brought together a collaboration of observers with the goal of obtaining rotationally resolved multiwavelength spectra at each of 5 facilities: infrared spectra at the NASA Infrared Telescope Facility (Clark and Shepard), radar images at Arecibo (Shepard and Clark), thermal infrared spectra at Palomar (Lim, McConnochie and Bell), visible spectra at McDonald Observatory (Vilas, Lederer and Jarvis), and visible lightcurves at Ondrojev Observatory (Pravec). The radar data was to be used to develop a high spatial resolution physical model to be used in conjunction with spectral data to investigate compositional and textural properties on the near surface of Ra Shalom as a function of rotation phase. This was the first coordinated multi-wavelength investigation of any Aten asteroid. There are many reasons to study near-Earth asteroid (NEA) 2100 Ra-Shalom: 1) It has a controversial classification (is it a C- or K-type object)? 2) There would be interesting dynamical ramifications if Ra-Shalom is a K-type because most K-types come from the Eos family and there are no known dynamical pathways from Eos to the Aten population. 3) The best available spectra obtained previously may indicate a heterogeneous surface (most asteroids appear to be fairly homogeneous). 4) Ra-Shalom thermal observations obtained previously indicated a lack of regolith, minimizing the worry of space weathering effects in the spectra. 5) Radar observations obtained previously hinted at interesting surface structures. 6) Ra-Shalom is one of the largest Aten objects. And 7) Ra-Shalom is on a short list of proposed NEAs for spacecraft encounters and possible sample returns. Preliminary results from the visible, infrared, and thermal spectroscopy measurements will be presented here.

Author (revised)

*Asteroids; Astronomical Spectroscopy*

**20040062107** Astronomical Observatory, Kiev, Ukraine

**New Peculiarities of Cometary Outburst Activity**

Filonenko, V. S.; Churyumov, K. I.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 1 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On the basis of long-time investigations of light curves, outburst activity and photometric evolution of comets the following new peculiarities of cometary outburst activity had been found: 1) For all observed comets brightness outbursts are occurring on the same heliocentric distances; 2) A quasi-periodicity of cometary outburst activity had been found. A mean

value of this period is T = 6.8d (+/-) 0.6d; 3) The moments of sudden changes of the values of potometric parameter n coincide with the brightness outbursts of comets; 4) During brightness outbursts of comets the values of O-C (the deviations of observational photometric center from the mass center of cometary nucleus) are increasing. These phenomena, found by authors, are new observational criterions for the development of a mechanism of cometary outburst activity.
Author
*Comets; Brightness; Periodic Variations*

**20040062108** NASA Johnson Space Center, Houston, TX, USA
**Visible/Near-Infrared Spectral Properties of MUSES C Target Asteroid 25143 Itokawa**
Jarvis, K. S.; Vilas, F.; Kelley, M. S.; Abell, P. A.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 1 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Japanese MUSES C mission launched the Hayabusa spacecraft last May 15, 2003, to encounter and study the near-Earth asteroid 25143 Itokawa. The spacecraft will obtain visible images through broadband filters similar to the ECAS filters, and near-infrared spectra from 0.85 - 2.1 microns. In preparation for this encounter, opportunities to study the asteroid with Earth-based telescopes have been fully leveraged. Visible and near-infrared spectral observations were made of asteroid 25143 Itokawa during several nights of March, 2001, around the last apparition. We report here on the results of extensive spectral observations made to address the questions of compositional variations across the surface of the asteroid (as determined by the rotational period and shape model); variations in phase angle (Sun-Itokawa-Earth angle) on spectral characteristics; and predictions of Itokawa observations by Hayabusa based on the spectral resolution and responsivity of the NIRS and AMICA instruments.
Derived from text
*Near Infrared Radiation; Spectral Resolution; Asteroids*

**20040062109** California Inst. of Tech., Pasadena, CA, USA
**Asteroid Physical Properties Probe**
Ai, H. Anita; Ahrens, Thomas J.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Physical properties of asteroidal and cometary nuclei are important to measure because they are critical to understanding the origin and evolution of these objects. Since direct measurement of the physical properties of asteroid surfaces is impractical to conduct, a set of experiments to measure in-situ physical properties, including density, strength, and seismic compressional velocity, of the ground of asteroidal and cometary nuclei were conducted. Such a package of instruments may be included on an asteroid or cometary lander/sampler to measure in-situ physical properties of asteroids in the solar system. Three unconsolidated materials: Portland cement, All purpose sand, and Bedford chips, with the average grain size increasing in order (Fig. 1), are chosen to simulate the asteroid ground surfaces.
Derived from text
*Asteroids; Probes; Physical Properties; Comet Nuclei; Grain Size; Samplers*

**20040062110** Observatoire du Mont-Gros, Nice, France
**Long Term Stability of Mars Trojans**
Scholl, H.; Marzari, F.; Tricarico, P.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We study the long term stability of Mars Trojans over the solar system age. A first screening of the parameter space of Mars tadpole orbits with the Frequency Map Analysis method allows us to outline a limited number of orbits with higher stability. The subsequent N-body long-term integration with a symplectic integrator allows us to test their survival over the solar system age.
Derived from text
*Solar System; Mars (Planet); Trojan Asteroids*

**20040062111** Virginia Univ., Charlottesville, VA, USA

**An Investigation into Solar Wind Depletion of Sulfur in Troilite**

Dukes, C. A.; Chang, W. Y.; Loeffler, M. J.; Baragiola, R. A.; McFadden, L. A.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 1 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent measurements by the Near Earth Asteroid Rendezvous (NEAR) x-ray/gamma ray spectrometer system (XGRS) have shown the surface of 433 Eros to be depleted in sulfur. This is a surprising result, as data from the XRS and NEAR s Near Infrared Spectrometer describe a surface composition with elemental ratios (Mg/Si, Fe/Si, and Ca/Si) that are consistent with ratios for ordinary chondritic (OC) meteorites. Sulfur, too, is inherent in the majority of OCs in the form of troilite (FeS), at typical abundance levels of 1 3 %. XRS data describes the surface content of sulfur on Eros as less than or equal to 0.2%, the detection limit of the spectrometer. Assuming the mineralogy of Eros is chondritic in nature, what is the source of this discrepancy? Several possible mechanisms have been suggested: micrometeorite bombardment and species volatilization; solar wind bombardment; photon-stimulated desorption.

Derived from text

*Solar Wind; Depletion; Sulfur; Meteorites; Troilite*

**20040062112** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Modeling Mosaic Degradation of X-Ray Measurements of 433 Eros by NEAR-Shoemaker**

Burbine, T. H.; Bergstrom, P. M., Jr.; Trombka, J. I.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the primary accomplishments of the NEAR-Shoemaker mission to 433 Eros was the first measurement of the elemental composition of an asteroid. X- and -ray detectors measured characteristic emission lines for a variety of elements. The X-ray results are usually presented as elemental ratios, which are thought to eliminate geometric and mosaic degradation effects. One of the mission goals was to determine the best meteoritic analog for Eros. The X-ray data obtained from the surface of Eros appear consistent with an ordinary chondrite composition that has been depleted in sulfur.

Derived from text

*X Rays; Mosaics; Models; Degradation; Asteroids; Emission Spectra*

**20040062113** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Horseshoe Asteroids and Quasi-satellites in Earth-like Orbits**

Connors, M.; Veillet, C.; Brasser, R.; Wiegert, P.; Chodas, P. W.; Mikkola, S.; Innanen, K.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Newly found asteroid 2003 YN107 is the first and only known current quasi-satellite (QS) of the Earth. Asteroid 2002 AA29 is in a horseshoe orbit (HS) but has periods of QS behavior. Both asteroids closely follow Earth s orbit. 2002 AA29 has inclination i is approximately 11 degrees while for 2003 YN107 i<5 degrees, making the most Earth-like orbit known. 2003 YN107, 2002 AA29, and other Earth-resonant objects in less Earthlike orbits, form an important new class of co-orbital bodies with interesting dynamics and are the best targets for sample return missions to asteroids.

Author

*Asteroids; Earth Orbits; Near Earth Objects*

**20040062114** NASA Johnson Space Center, Houston, TX, USA

**Generation of an Ordinary-Chondrite 'Regolith' by Repetitive Impact**

Cintala, M. J.; Hoerz, F.; See, T. H.; Morris, R. V.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Analyses of meteorites and remote sensing studies for years have suggested the presence of regolith on asteroids, yet detailed observations of asteroid regoliths have been possible only recently with the flybys of 951 Gaspra, 243 Ida, and 253 Mathilde, and with the orbiting of and landing on 433 Eros by the NEAR Shoemaker spacecraft. Virtually all investigations into the generation and evolution of asteroid regoliths to date have been theoretical in nature. These have been guided mainly by observations of the lunar regolith, using what meager experimental data exist for terrestrial materials as substitutes for their asteroidal counterparts. As part of a program to evaluate the behavior of an ordinary chondrite under impact conditions, about

460 g of the L6 chondrite ALH85017 were subjected to 50 consecutive impacts, sufficient to reduce the target from a mean grain size of 11 mm to 0.5 mm. Some of the details of these experiments are presented here.
Author
*Regolith; Impact Tests; Chondrites*

**20040062115** Institute of Space and Astronautical Science, Sagamihara, Japan
**Particle Size Effect in X-Ray Fluorescence at a Large Phase Angle: Importance on Elemental Analysis of Asteroid Eros(433)**
Okada, T.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Laboratory experiments have been performed to show that microscopic roughness in the uppermost layer of planetary surface results in remarkable alteration of intensities and spectral profiles of X-ray fluorescence, especially at large phase angles. Key objective of NEAR-Shoemaker mission was to evidence a linkage between an S(IV)-class asteroid and the corresponding meteorite. During one-year long observation around 433 Eros, the NEAR has conducted visible to near-infrared spectroscopy as well as X-ray and gamma-ray spectroscopy for surface mineralogy and elemental composition, respectively.
Derived from text
*Particle Size Distribution; X Ray Fluorescence; Asteroids; Chemical Analysis*

**20040062116** Institute of Space and Astronautical Science, Sagamihara, Japan
**Scientific Capability of MINERVA Rover in Hayabusa Asteroid Mission**
Yoshimitsu, T.; Sasaki, S.; Yanagisawa, M.; Kubota, T.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Institute of Space and Astronautical Science (ISAS) of Japan has launched the engineering test spacecraft 'HAYABUSA' (formerly called 'MUSES-C') to the near Earth asteroid 'ITOKAWA (1998SF36)' on May 9, 2003. HAYABUSA will go to the target asteroid after two years' interplanetary cruise and will descend onto the asteroid surface in 2005 to acquire some fragments, which will be brought back to the Earth in 2007.
Derived from text
*Asteroids; Fragments; Targets*

**20040062117** Kobe Univ. of Mercantile Marine, Japan
**Effect of Roughness on Visible Reflectance Spectra of Planetary Surface**
Sakai, T.; Nakamura, A. M.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is necessary to illuminate the effects of surface structures on reflectance spectra for a detailed study of planetary surfaces and the relevant works, e.g. asteroid-meteorite connection. It was shown in previous laboratory investigations that a surface prepared by 'sifting' the sample powders has lower visible reflectance spectra than a 'packed' surface, 'porous' powdery surfaces are darker than compact surfaces, and macroscopic roughness of a surface due to a crater-shape depression reduces the reflectance.
Derived from text
*Asteroids; Planetary Surfaces; Reflectance; Shapes; Surface Roughness*

**20040062118** Tokyo Univ., Hongo, Japan
**Subaru Spectroscopy of Asteroid (832)Karin; Determining Time Scale of Space Weathering**
Sasaki, T.; Sasaki, S.; Watanabe, J.; Kawakita, H.; Fuse, T.; Takato, N.; Sekiguchi, T.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; 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 the darkening and reddening of the surface in the planetary materials with time. The reflection spectra of asteroids show unknown mismatches to those of meteorites due to the weathering, though asteroids are believed to be parents of meteorites. The detailed mechanism of this space weathering has been remained to be unsolved until 2001, when Sasaki et al. confirmed Hapke's old hypothesis that the spectral darkening and reddening are caused by formation of nano iron particles on the basis of pulse-laser irradiation experiments simulating micrometeorite impacts. The

reflection spectra of the altered olivine in which high-energy laser experiments match with typical spectra of two S-type asteroids produced the iron nano-particles.
Derived from text
*Spectroscopy; Asteroids; Space Weathering; Time Lag; Meteorite Collisions*

**20040062119** Muenster Univ., Germany
**Evaluation of Preparation and Measuring Techniques for Interplanetary Dust Particles for the MIDAS Experiment on Rosetta**
Weber, I.; Stephan, T.; Jessberger, E. K.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092
Contract(s)/Grant(s): DLR-RD-RX-50OO010-ZA; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In spring of 2004 the Rosetta mission, Europe s comet chaser, will be launched. Comets are accepted as one type of parent body of interplanetary dust particles (IDPs). IDPs are collected in the stratosphere by NASA using high-flying aircraft. After hitting the collector the IDPs are encased in a layer of silicone oil, which acts as a glue on the collection surfaces. The original focus of our study was to assemble a complete dataset on morphology, microstructure, mineralogy, and chemistry of individual IDPs in order to generate a database for the upcoming AFM (atomic force microscopy) investigation with the MIDAS (Micro Imaging Dust Analysis System) experiment on Rosetta.
Derived from text
*Atomic Force Microscopy; Comets; Data Bases; Interplanetary Dust; Microstructure; Rosetta Mission*

**20040062121** Lockheed Martin Corp., USA
**Small Craters in the Inner Solar System: Primaries or Secondaries or Both?**
Bierhaus, E. B.; Chapman, C. R.; Merline, W. J.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Until the relative abundances of primaries and secondaries are resolved, inferring the small near Earth asteroid (NEA) population from lunar craters will be suspect. Indeed, the important parameters regarding the formation of secondary craters are still not all known, let alone well-quantified. Some research suggests the production of secondaries depends upon the near-surface properties of the target body; i.e. the presence or absence of regolith will affect how many secondaries form from a given primary. For example, a regolith layer may suppress the formation of secondaries until the primary reaches a certain size. The relative abundances of primaries and secondaries could fluctuate over an object as a function of terrain type. Using small craters may set limits on the impactors (i.e. assume all craters are primaries, which would set an upper-limit), but one should not use small craters for robust estimation of the small impactor objects.
Author
*Asteroids; Craters; Cratering; Near Earth Objects*

**20040062122** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
**Reflectance Spectra of CM2 Chondrite Mighei Irradiated with Pulsed Laser and Implications for Low-Albedo Asteroids and Martian Moons**
Moroz, L. V.; Hiroi, T.; Shingareva, T. V.; Basilevsky, A. T.; Fisenko, A. V.; Semjonova, L. F.; Pieters, C. M.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040062092
Contract(s)/Grant(s): NAG5-13609; RFBR-02-05-65156; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Micrometeoritic bombardment is an important space weathering process modifying surface optical properties of airless solar system bodies. We have used irradiation with a microsecond pulsed laser as an experimental method to simulate such a process on various targets. The experiment discussed here was performed on a powdered sample of CM2 carbonaceous chondrite Mighei. Shingareva et al. report the details of experimental procedure as well as the results of mineralogical and chemical studies of the irradiated material. Here we present reflectance spectra of irradiated Mighei samples and discuss their spectral properties compared to those of non-irradiated meteorite and low-albedo small solar system bodies.
Author
*Spectral Reflectance; Chondrites; Visible Spectrum; Infrared Spectra*

**20040062123** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glasses**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062124 - 20040062136

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session'Viewing the Lunar Interior Through Titanium-Colored Glasses' included the following reports:Consequences of High Crystallinity for the Evolution of the Lunar Magma Ocean: Trapped Plagioclase; Low Abundances of Highly Siderophile Elements in the Lunar Mantle: Evidence for Prolonged Late Accretion; Fast Anorthite Dissolution Rates in Lunar Picritic Melts: Petrologic Implications; Searching the Moon for Aluminous Mare Basalts Using Compositional Remote-Sensing Constraints II: Detailed analysis of ROIs; Origin of Lunar High Titanium Ultramafic Glasses: A Hybridized Source?; Ilmenite Solubility in Lunar Basalts as a Function of Temperature and Pressure: Implications for Petrogenesis; Garnet in the Lunar Mantle: Further Evidence from Volcanic Glasses; Preliminary High Pressure Phase Relations of Apollo 15 Green C Glass: Assessment of the Role of Garnet; Oxygen Fugacity of Mare Basalts and the Lunar Mantle. Application of a New Microscale Oxybarometer Based on the Valence State of Vanadium; A Model for the Origin of the Dark Ring at Orientale Basin; Petrology and Geochemistry of LAP 02 205: A New Low-Ti Mare-Basalt Meteorite; Thorium and Samarium in Lunar Pyroclastic Glasses: Insights into the Composition of the Lunar Mantle and Basaltic Magmatism on the Moon; and Eu2+ and REE3+ Diffusion in Enstatite, Diopside, Anorthite, and a Silicate Melt: A Database for Understanding Kinetic Fractionation of REE in the Lunar Mantle and Crust.

Derived from text

*Lunar Surface; Lunar Geology*

**20040062124** Notre Dame Univ., IN, USA

**Searching the Moon for Aluminous Mare Basalts Using Compositional Remote-Sensing Constraints II: Detailed analysis of ROIs**

Kramer, Georgiana Y.; Jolliff, Bradley L.; Neal, Clive R.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In a companion abstract we use global Lunar Prospector (LP) and Clementine data to identify potentially high-Al mare basalt exposures or regolith dominated by such basalts on the surface of the Moon. Several of the selected regions are the result of mixing between high-Fe mare basalt and low-Fe (aluminous) highlands. These include basin rims around Mare Humorum, Crisium, and Tranquillitatis, and parts of the western border of Oceanus Procellarum. However, other areas show promise as potential high-Al basalt exposures. Areas selected for further study include Mare Nectaris, Mare Smythii, Mare Marginis, two areas in northern Imbrium, an area near Sinus Roris, and a portion of western Procellarum basalts near the crater Struve, as well as Mare Fecunditatis, where aluminous basalts are expected on the basis of Luna 16 samples.

Derived from text

*Lunar Maria; Basalt; Remote Sensing*

**20040062125** Maryland Univ., College Park, MD, USA

**Low Abundances of Highly Siderophile Elements in the Lunar Mantle: Evidence for Prolonged Late Accretion**

Walker, R. J.; Horan, M. F.; Shearer, C. K.; Papike, J. J.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123

Contract(s)/Grant(s): NAG5-10425; NAG5-12796; NSF EAR-02-07183; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The highly siderophile elements (HSE: including Re, Au, Ir, Os, Ru, Pt, Pd, Rh) are strongly partitioned into metal relative to silicates. In the terrestrial planets these elements are concentrated in metallic cores. Earth s mantle has sufficiently high abundances of the HSE (~0.008 times CI abundances) that it has been hypothesized approximately 0.1-0.5% of the mass of the Earth was added following the last major interaction between the core and mantle [e.g. 1]. The additional material added to the Earth and Moon has been termed a late veneer , and the process has often been termed late accretion [2]. The timing of the dominant late accretionary period of the Earth and Moon is still poorly known. The abundances of HSE in the lunar mantle could provide important constraints on when the late veneer was added. The material that ultimately became the silicate portion of the Moon was likely stripped of most of its HSE prior to and during coalescence of the Moon. Consequently the initial lunar mantle likely had very low concentrations of the HSE. Unlike Earth, the generation of permanent lunar crust by ~4.4 Ga prevented subsequent additions of HSE to the lunar mantle via continued accretion. Thus, if a substantial portion of

the late veneer was added after 4.4 Ga, the lunar mantle should have retained very low HSE concentrations. Conversely, if the late veneer was mostly added prior to 4.4 Ga, HSE abundances in the lunar mantle may be roughly similar to abundances in the terrestrial mantle.
Derived from text
*Lunar Mantle; Low Concentrations; Lunar Crust; Terrestrial Planets; Silicates; Abundance; Coalescing*

**20040062126** Notre Dame Univ., IN, USA
**Garnet in the Lunar Mantle: Further Evidence from Volcanic Glasses**
Neal, C. R.; Shearer, C. K.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The returned lunar samples contained no direct samples of the lunar mantle (i.e., mantle xenoliths). Coupled with the ambiguity of the Apollo Seismic Experiment results, detailed investigations of the lunar interior can only be achieved through analysis of volcanic products. Neal suggested that the ion microprobe data reported by Shearer and co-workers contained evidence of garnet being retained in the source. This evidence came from ratioing garnet-compatible elements to garnet-incompatible elements. Samples that contain, for example, Zr/Y ratios greater than mare basalts and KREEP are best modeled by retaining garnet in the residue after melting. This required these glasses to be derived from a source less than 500 km deep, where garnet is stable. However, the number of garnet-loving elements in the original dataset was limited. The purpose of this study was to collect a comprehensive dataset on low- and high-Ti glasses of trace elements that are sensitive indicators of garnet in their source regions. The elements quantified were Sc, Y, Zr, Nb, Ce, Sm, and Yb. Sc, Y, and Yb are highly compatible in garnet and if garnet is retained in the residue, Sc/Sm will decrease and ratios such as Zr/Y and Sm/Yb will increase.
Author
*Garnets; Lunar Mantle; Volcanoes; Trace Elements; Lunar Rocks; Glass*

**20040062127** Massachusetts Inst. of Tech., Cambridge, MA, USA
**Origin of Lunar High Titanium Ultramafic Glasses: A Hybridized Source?**
Singletary, S. J.; Grove, T. L.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Two new hypotheses for the origin of the lunar high-Ti ultramafic glasses are considered in this study. These new models are motivated by the results of experiments on a model hybridized lunar magma ocean cumulate composition. These models are also motivated by the failure of current models to adequately account for the processes that lead to the origin of these unique lunar ultramafic magmas.
Author
*Titanium; Glass; Lunar Evolution; Lunar Geology*

**20040062128** New Mexico Univ., Albuquerque, NM, USA
**Preliminary High Pressure Phase Relations of Apollo 15 Green C Glass: Assessment of the Role of Garnet**
Draper, D. S.; DuFrane, S. A.; Shearer, C. K.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Pristine lunar glasses constitute unique probes of the interior of the Moon, because they were delivered to the lunar surface directly from their source regions. In conjunction with inferences drawn from compositions of selected mare basalts, their origins can help shed light on the mineralogy of the deep lunar mantle and thus on interpretations of the internal structure of the Moon. Recently, Neal argued that trace element and
Derived from text
*High Pressure; Lunar Mantle; Lunar Surface; Mineralogy; Basalt*

**20040062129** Proxemy Research, Inc., Bowie, MD, USA
**A Model for the Origin of the Dark Ring at Orientale Basin**
Baloga, S. M.; Glaze, L. S.; Spudis, P. D.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have investigated some plausible formation mechanisms for the dark ring at Orientale on the Moon. The diameter of this deposit is approximately 175 km. One possible formative mechanism based on Lunar Orbiter imaging is that this feature was produced by an annular set of volcanic vents associated with a pre-Orientale structure. Subsequent analysis of Galileo images supported the notion of multiple local pyroclastic events by the reactivation of zones of weakness. An alternative possibility is that the dark ring is a pyroclastic deposit from a single, central vent eruption. The potential source is an elongate feature roughly near the center of the ring. The appearance of the dark annular deposit does in fact resemble Promethean style Io deposits (with colors reversed) and comparable physics is indeed suggested.
Author
*Lunar Maria; Moon; Volcanoes; Selenology; Lunar Geology; Lunar Surface; Lunar Topography*

**20040062130** Tennessee Univ., Knoxville, TN, USA
**Petrology and Geochemistry of LAP 02 205: A New Low-Ti Mare-Basalt Meteorite**
Anand, M.; Taylor, L. A.; Neal, C.; Patchen, A.; Kramer, G.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

LAP 02 205 is a low-Ti mare-basalt meteorite which was discovered in LaPaz Ice Field in Antarctica. This is the first crystalline lunar basalt in US Antarctic collection and only the 8th mare-basaltic meteorite to be discovered on the Earth to date. We were allocated one thin section (LAP 02 205,36), one polished thick section (LAP 02 205,31), and 1.572 g powdered rock sample (LAP 02 205,19) by the Meteorite Working Group (MWG) for carrying out mineral and geochemical investigations.
Author
*Petrology; Geochemistry; Meteorites*

**20040062131** Brown Univ., Providence, RI, USA
**Consequences of High Crystallinity for the Evolution of the Lunar Magma Ocean: Trapped Plagioclase**
Elkins-Tanton, L. T.; Parmentier, E. M.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Moon has the best evidence of all the terrestrial bodies for existence of a large magma ocean early in planetary evolution. The anorthite-rich highlands are thought to be a flotation crust of late-stage magma ocean differentiates, a proposal that is supported by the complementary europium anomalies in the highlands and in the mare basalts. Estimates for the end of magma ocean differentiation vary from 4.3 to 4.5 Ga. Norman, Borg, and colleagues find Sm-Nd crystallization ages of specific ferroan anorthosites to be 4.29 +/- 0.06 and 4.40 +/- 0.11 Ga, indicating that some ferroan anorthosites probably formed after magma ocean crystallization was complete (others date to 4.53 Ga). Norman and colleagues also find that the trace element and Nd contents of some of the ferroan anorthosites are not consistent with formation from a highly differentiated source, as implied by the traditional models.
Derived from text
*Crusts; Crystallinity; Highlands; Magma; Moon; Oceans; Planetary Evolution*

**20040062132** Brown Univ., Providence, RI, USA
**Eu(2+) and REE(3+) Diffusion in Enstatite, Diopside, Anorthite, and a Silicate Melt: A Database for Understanding Kinetic Fractionation of REE in the Lunar Mantle and Crust**
Liang, Y.; Cherniak, D. J.; Morgan, Z. T.; Hess, P. C.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The abundance and distribution of REE in various lunar samples have played a crucial role in understanding the origin and evolution of the Moon. Due to the relatively reducing environment a large fraction of Eu is in 2+ state during lunar magmatic and metamorphic processes [1]. Due to their differences in size and charge (hence differences in partition and diffusion coefficients), Eu2+ can be fractionationed from REE3+ during lunar magmatic processes. The extent of fractionation depends on crystal-melt partition coefficients and REE diffusion coefficients in the crystals and the melt. REE partition coefficients for a number of minerals important to lunar magma genesis have been reported in the literature (e.g., anorthite and pyroxene [2]), whilst REE3+ diffusion coefficients in anorthite and diopside have recently been measured at conditions relevant to terrestrial magmatic and metamorphic processes [3-5]. In an effort to compile a set of REE diffusion data relevant

to our on-going studies of magma transport and melt-rock reaction in the lunar mantle and crust, we have measured the rate of Eu2+ and REE3+ diffusion in enstatite and silicate melts. Based on published Sr2+, Pb2+, and REE3+ diffusion data and ionic size considerations we also estimated the Eu2+ diffusion coefficients in diopside and anorthite.
Derived from text
*Lunar Mantle; Crusts; Fractionation; Data Bases; Enstatite; Silicates; Melts (Crystal Growth)*

**20040062133** New Mexico Univ., Los Alamos, NM, USA
**Thorium and Samarium in Lunar Pyroclastic Glasses: Insights into the Composition of the Lunar Mantle and Basaltic Magmatism on the Moon**
Hagerty, J. J.; Shearer, C. K.; Vaniman, D. T.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar pyroclastic glasses are thought to represent quenched products of near-primary melts from the deep lunar mantle, thus the composition of the glasses serves as a window into the lunar interior. High-pressure experiments on lunar pyroclastic glasses indicate that their temperature and pressure of multiple saturation is 1410-1500 C and 1.7-2.5 GPa. If it is assumed that the points of multiple saturation represent the minimum depth of melting, then the basaltic magmas were generated at a depth of >400 km within the lunar mantle. These high-pressure experiments in conjunction with trace element data have been interpreted as indicating that the basalts that the glasses represent were in equilibrium with olivine + orthopyroxene residua. Such a mineral assemblage is incapable of fractionating Sm from Th during melting, which means that the Th/Sm of the glasses approximates the Th/Sm of the mantle sources for these magmas. This abstract reports the Th and Sm concentrations of individual pyroclastic glasses from the Apollo 11, 12, 14, 15, and 17 landing sites and uses these data as a means to evaluate the distribution and abundances of Th and Sm in the lunar mantle.
Author
*Lunar Composition; Lunar Mantle; Basalt; Magma*

**20040062134** Brown Univ., Providence, RI, USA
**Ilmenite Solubility in Lunar Basalts as a Function of Temperature and Pressure: Implications for Petrogenesis**
Beck, A. R.; Hess, P. C.; Lunar and Planetary Science XXXV: Viewing the Lunar Interior Through Titanium-Colored Glassed; 2004; 2 pp.; In English; See also 20040062123; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The picritic glasses are among the most primitive lunar basaltic liquids, and thus most useful in constraining the depth and composition of their source region despite having undergone a certain degree of shallow level olivine crystallization. The bulk of the lunar volcanic glass suite can be modeled as the partial melting products of an olivine + orthopyroxene source region deep within the lunar mantle. TiO2 contents vary from 0.2 wt % - 17.01wt%. Values that extreme would seem to require a Ti-bearing phase such as ilmenite in the source of the high-Ti (but not in the VLT source). A source region of primitive LMO olivine and orthopyroxene, even when melted in small degrees cannot account for these compositions. The picritic glasses are undersaturated with respect to ilmenite at all pressures investigated therefore ilmenite must have been consumed during melting, leaving an ilmenite free residue and an undersaturated melt.
Derived from text
*Lunar Mantle; Temperature Dependence; Pressure Dependence; Pyroxenes; Glass*

**20040062137** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062138 - 20040062150
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Mars: Gullies, Fluids, and Rocks' included the following reports:Gullies on Mars and Constraints Imposed by Mars Global Surveyor Data; Gullies on Mars: Origin by Snow and Ice Melting and Potential for Life Based on Possible Analogs from Devon Island, High Arctic; Formation of Recent Martian Gullies by Avalanches of CO2 Frost; Martian Slope Streaks and Gullies: Origins as Dry Granular Flows; Depths and Geologic Setting of Northern Hemisphere Gullies (and Comparison to Their Southern Counterparts); Mars as a Salt-, Acid-, and Gas-Hydrate World; Composition of Simulated Martian Brines and Implications for the Origin of Martian Salts; Evaporation Rates of Brine on Mars; Hydrogeology of the

Valles Marineris-Chaotic Terrain Transition Zone, Mars; Measured Fluid Flow in an Active H2O-CO2 Geothermal Well as an Analog to Fluid Flow in Fractures on Mars: Preliminary Report; Understanding Rock Breakdown on Earth and Mars: Geomorphological Concepts and Facet Mapping Methods; Classification and Distribution of Mars Pathfinder Rocks Using Quantitative Morphologic Indices; and Systematic Rock Classification in a Data-poor Environment: Application to Mars.
Derived from text
*Mars Surface; Hydrogeology; Fluid Flow*

**20040062138** NASA Ames Research Center, Moffett Field, CA, USA
**Gullies on Mars and Constraints Imposed by Mars Global Surveyor Data**
Heldmann, J. L.; Mellon, M. T.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The discovery of geologically recent gully features on Mars has spawned a wide variety of proposed theories of their origin including water versus carbon dioxide based erosion and shallow versus deep fluid sources. To test the validity of such gully formation mechanisms, data from the Mars Global Surveyor spacecraft has been analyzed to uncover trends in the dimensional and physical properties of the gullies and their surrounding terrain. Over 100 Mars Orbiter Camera (MOC) images containing clear evidence of gully landforms, distributed in the southern mid and high latitudes, have been analyzed in combination with Mars Orbiter Laser Altimeter (MOLA) and Thermal Emission Spectrometer (TES) data to provide quantitative measurements of numerous gully characteristics. Parameters measured include apparent source depth and distribution, vertical and horizontal dimensions, slopes, compass orientations, and factors controlling present-day climatic conditions.
Author
*Carbon Dioxide; Erosion; Mars Surface; Planetary Geology*

**20040062139** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Evaporation Rates of Brine on Mars**
Sears, D. W. G.; Chittenden, J.; Moore, S. R.; Meier, A.; Kareev, M.; Farmer, C. B.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

While Mars is now largely a dry and barren place, recent data have indicated that water has flowed at specific locations within the last approx. 10(exp 6) y. This had led to a resurgence of interest in theoretical and experimental work aimed at understanding the behavior of water on Mars. There are several means whereby the stability of liquid water on Mars could be increased, one being the presence solutes that would depress the freezing point. Salt water on Earth is about 0.5M NaCl, but laboratory experiments suggest that martian salt water is quite different. We recently began a program of laboratory measurements of the stability of liquid water, ice and ice-dust mixtures under martian conditions and here report measurements of the evaporation rate of 0.25M brine.
Author
*Brines; Evaporation Rate; Mars Surface; Melting Points*

**20040062141** Wesleyan Univ., Middletown, CT, USA
**Depths and Geologic Setting of Northern Hemisphere Gullies (and Comparison to Their Southern Counterparts)**
Gilmore, Martha S.; Goldenson, Naomi; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Gullies are recognized as having an incised (often sinuous) channel, alcove, and apron morphology as defined. Previous detailed work has focused on the characteristics of southern hemisphere gullies; here we examine the distribution, morphology and depth of northern hemisphere gullies. Gully locations (both hemispheres) were compiled from the literature, not a global search, and thus the gullies studied here are the subset of the whole for which corresponding MOLA tracks are available. We find that the heads of the majority of N. hemisphere gullies commence in a specific cliff-forming layer, and average 250 m below the local surface. This observation suggests that the rock layer has a genetic relationship to gullies and is difficult at present to reconcile with gully formation from snowmelt, which predicts no correlation to rock layers. Gully locations and

depths correspond to specific geologic units. We propose that in addition to ground ice and a melting mechanism, gully formation requires groundwater flow along or within specific rock units.
Author
*Depth; Geological Surveys; Northern Hemisphere; Southern Hemisphere; Morphology; Erosion*

**20040062142** NASA Ames Research Center, Moffett Field, CA, USA
**Gullies on Mars: Origin by Snow and Ice Melting and Potential for Life Based on Possible Analogs from Devon Island, High Arctic**
Lee, Pascal; Cockell, Charles S.; McKay, Christopher P.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Gullies on Devon Island, High Arctic, which form by melting of transient surface ice and snow covers and offer morphologic and contextual analogs for gullies reported on Mars are reported to display enhancements in biological activity in contrast to surrounding polar desert terrain.
Author
*Ice; Snow; Melting; Mars Environment; Activity (Biology)*

**20040062144** Geological Survey, Flagstaff, AZ, USA
**Mars as a Salt-, Acid-, and Gas-Hydrate World**
Kargel, J. S.; Marion, Giles M.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The widespread occurrence, abundance, and major geologic roles of water on Mars (occurring in all three pure phases) are now accepted after more than a century of speculation and increasing observations. Imaging indicates diverse water- and ice-mediated geologic processes, especially at high and middle latitudes in geologically recent times and globally long ago. Neutron/gamma-ray spectroscopy has confirmed hydrogen in amounts that (1) at the poles can only be ice, and (2) at lower latitudes suggest hydrates as the chief hydrogen host. Here I report on the stability of hydrates and possible processes involving them.
Author
*Hydrates; Mars (Planet); Planetary Composition; Planetary Geology*

**20040062145** Illinois Univ., Urbana, IL, USA
**Measured Fluid Flow in an Active H2O-CO2 Geothermal Well as an Analog to Fluid Flow in Fractures on Mars: Preliminary Report**
Kieffer, Susan W.; Brown, K. L.; Simmons, Stuart F.; Watson, Arnold; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137
Contract(s)/Grant(s): NAG5-12747; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Water in the Earth's crust generally contains dissolved gases such as CO2. Models for both 'Blue Mars' (H2O-driven processes) and 'White Mars' (CO2-driven processes) predict liquid H2O with dissolved CO2 at depth. The fate of dissolved CO2 as this mixture rises toward the surface has not been quantitatively explored. Our approach is a variation on NASA's 'Follow the Water' as we 'Follow the Fluid' from depth to the surface in hydrothermal areas on Earth and extrapolate our results to Mars. This is a preliminary report on a field study of fluid flow in a producing geothermal well. For proprietary reasons, the name and location of this well cannot be revealed, so we have named it 'Earth1' for this study.
Author
*Fluid Flow; Water; Carbon Dioxide; Mars Environment*

**20040062146** Lunar and Planetary Inst., Houston, TX, USA
**Martian Slope Streaks and Gullies: Origins as Dry Granular Flows**
Treiman, A. H.; Louge, M. Y.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137
Contract(s)/Grant(s): NAG3-2705; NCC3-797; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Streaks and gullies are common on Martian slopes, and are geologically young; slope streaks have formed during the last few years of Mars Global Surveyor imaging. Both slope streaks and gullies involve flow of granular material, but it is not clear whether liquid water (or another suspending agent) was involved. The possibility that liquid water was involved makes gullies and slope streaks important for understanding Mars recent climate and for the hope of extant life near its surface. Here, we show that significant features of slope streaks and gullies are consistent with dry flows of granular material. Liquid water may not be required.
Author
*Drying; Granular Materials; Mars Surface*

**20040062147** NASA Ames Research Center, Moffett Field, CA, USA
**Composition of Simulated Martian Brines and Implications for the Origin of Martian Salts**
Bullock, M. A.; Moore, J. M.; Mellon, M. T.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report on laboratory experiments that have produced dilute brines under controlled conditions meant to simulate past and present Mars. We allowed an SNC-derived mineral mix to react with pure water under a simulated present-Mars atmosphere for seven months. We then subjected the same mineral mix to a similar aqueous environment for one year, but with a simulated Mars atmosphere that contained the added gases SO2, HCl and NO2. The addition of acidic gases was designed to mimic the effects of volcanic gases that may have been present in the martian atmosphere during periods of increased volcanic activity. The experiments were performed at one bar and at two different temperatures in order to simulate subsurface conditions where liquid water and rock are likely to interact on Mars. The dominant cations dissolved in the solutions we produced were Ca(2+), Mg(2+), Al(3+) and Na(+), while the major anions are dissolved C, F(-), SO4(2-) and Cl(-). Typical solution pH was 4.2 to 6.0 for experiments run with a Mars analog atmosphere, and 3.6-5.0 for experiments with acidic gases added. Abundance patterns of elements in the synthetic sulfate-chloride brines produced under acidic conditions were distinctly unlike those of terrestrial ocean water, terrestrial continental waters, and those measured in the martian fines at the Mars Pathfinder and Viking 1 and 2 landing sites. In particular, the S/Cl ratio in these experiments was about 200, compared with an average value of approx. 5 in martian fines. In contrast, abundance patterns of elements in the brines produced under a present day Mars analog atmosphere were quite similar to those measured in the martian fines at the Mars Pathfinder and Viking 1 and 2 landing sites. This suggests that salts present in the martian regolith may have formed over time as a result of the interaction of surface or subsurface liquid water with basalts in the presence of a martian atmosphere similar in composition to that of today, rather than in an atmosphere higher in acidic volatiles.
Author
*Planetary Composition; Mars Atmosphere; Brines; Salts; Environment Simulation; Water*

**20040062148** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Classification and Distribution of Mars Pathfinder Rocks Using Quantitative Morphologic Indices**
Yingst, R. A.; Biederman, K. L.; Monhead, A. M.; Haldemann, A. F. C.; Kowalczyk, M. R.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Pathfinder (MPF) landing site was predicted to contain a broad sampling of rock types varying in mineralogical, physical, mechanical and geochemical characteristics. Although rocks have been divided into several spectral categories based on Imager for Mars Pathfinder visible/near-infrared spectra, it has not been fully determined which of these stem from intrinsic mineralogical differences between rocks or rock surfaces, and which result from factors such as physical or chemical weathering. This has made isolation of unique mineralogy's difficult. Efforts in isolating and classifying spectral units among MPF rocks and soils have met with varying degrees of success, and the current understanding is such that many factors influencing spectral signatures cannot be quantified to a sufficient level so they may be removed. The result is that fundamental questions regarding information needed to reveal the present and past interactions between the rocks and rock surfaces and the Martian environment remain unanswered. But it is possible to approach the issue of identifying distinct rock and rock surface types from a different angle.
Author
*Mars Pathfinder; Mars Environment; Rocks; Quantitative Analysis; Morphology; Geochemistry*

**20040062149** Geological Survey, Flagstaff, AZ, USA

**Systematic Rock Classification in a Data-poor Environment: Application to Mars**

Keszthelyi, L.; Burr, D. M.; Herkenhoff, K.; Gaddis, L.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The process that a terrestrial geologist usually uses to classify a rock is analogous to a flow-chart. The top-level classification (igneous, sedimentary, or metamorphic) is made first. Then further subdivisions are made until the proper rock name is determined. Further observations may lead to additional descriptors being added to the front of the rock name. Thus, a rock may be successively determined to be: (1) sedimentary, (2) clastic sedimentary, and (3) sandstone. While sandstone is a proper classification of the rock, further observations lead to the addition of descriptors so the final classification could be 'tan, immature, massive arkosic sandstone.'

Derived from text

*Classifications; Sedimentary Rocks; Geological Surveys*

**20040062150** International Research School of Planetary Sciences, Pescara, Italy

**Hydrogeology of the Valles Marineris-Chaotic Terrain Transition Zone, Mars**

Komatsu, G.; Rossi, A. P.; DiLorenzo, S.; Lunar and Planetary Science XXXV: Mars: Gullies, Fluids, and Rocks; March 19, 2004; 2 pp.; In English; See also 20040062137; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Valles Marineris-chaotic terrain transition zone on Mars is rich in landforms indicative of past water and volcanic activities. Our preliminary results from the GIS mapping of Gangis Chasma and its surroundings indicate that the region represents one of the best examples of liquid water and ice-related processes as represented by ancient crater lakes, chaotic terrain, an outflow channel system, canyon wasting, moist or wet landslides, ice-related small debris aprons, and a subice volcano. We mapped the Gangis Chasma region over Viking imagery, MOLA (Mars Orbiter Laser Altimeter) topography, THEMIS (Thermal Emission Imaging System) and wide and narrow angle MOC (Mars Orbiter Camera) images.

Author

*Craters; Hydrogeology; Mars Surface; Planetary Geology; Planetary Surfaces; Topography*

**20040062151** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Mars Geophysics**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062152 - 20040062164

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) An Extraordinary Magnetic Field Map of Mars; 2) Mapping Weak Crustal Magnetic Fields on Mars with Electron Reflectometry; 3) Analytic Signal in the Interpretation of Mars Southern Highlands Magnetic Field; 4) Modeling of Major Martian Magnetic Anomalies: Further Evidence for Polar Reorientations During the Noachian; 5) An Improved Model of the Crustal Structure of Mars; 6) Geologic Evolution of the Martian Dichotomy and Plains Magnetization in the Ismenius Area of Mars; 7) Relaxation of the Martian Crustal Dichotomy Boundary in the Ismenius Region; 8) Localized Tharsis Loading on Mars: Testing the Membrane Surface Hypothesis; 9) Thermal Stresses and Tharsis Loading: Implications for Wrinkle Ridge Formation on Mars; 10) What Can be Learned about the Martian Lithosphere from Gravity and Topography Data? 11) A Gravity Analysis of the Subsurface Structure of the Utopia Impact Basin; 12) Mechanics of Utopia Basin on Mars; 13) Burying the 'Buried Channels' on Mars: An Alternative Explanation.

CASI

*Mars (Planet); Geophysics; Planetary Geology*

**20040062153** Washington Univ., Saint Louis, MO, USA

**Mechanics of Utopia Basin on Mars**

Searls, M. L.; Phillips, R. J.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Utopia was first recognized as an impact basin based on the lack of evidence of buried topography and on the existence of a gravity high associated with the basin. Utopia is located in the northern lowlands of Mars and is marked by a 1-3 km

surface depression with a diameter of approximately 3200 km. With a free-air gravity high of 350 mGal, Utopia basin shows the classical signs of mascon loading. Here we use gravity and topography data to analyze the mechanical configuration of the basin, focusing particularly on the amount of basin fill material.
Derived from text
*Structural Basins; Mars Surface; Topography; Gravitation; Planetary Geology*

**20040062154** Arizona Univ., Tucson, AZ, USA
**Modeling of Major Martian Magnetic Anomalies: Further Evidence for Polar Reorientations During the Noachian**
Hood, L. L.; Young, C. N.; Richmond, N. C.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this paper, we report further quantitative modeling of major, relatively isolated Martian magnetic anomalies for the primary purpose of estimating bulk directions of magnetization and corresponding paleomagnetic pole locations. Modeling of these anomalies is considered to be most reliable because of larger signal-to-noise ratios on the field maps.
Derived from text
*Magnetic Anomalies; Mars Surface; Mathematical Models; Geophysics; Polar Regions*

**20040062155** Institut de Physique du Globe, Paris, France
**What Can be Learned About the Martian Lithosphere from Gravity and Topography Data?**
Belleguic, V.; Wieczorek, M.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the absence of in situ geophysical measurements, modeling the relationship between a planet's gravity and topography is one of the few methods that can be used to elucidate a planet's interior structure. In this study, we use gravity and topography data collected by Mars Global Surveyor mission in order to model the localized spectral admittance of the large Martian volcanoes by assuming that surface and subsurface loads are elastically supported by the lithosphere. The goal is to determine what inversion parameters can be uniquely determined (e.g., crustal thickness, elastic thickness, crustal density, load density, as the ratio of surface to subsurface loading), and to similarly determine any correlations that might exist between these parameters. If useful bounds can be determined for the Martian volcanoes, then these can help to constrain their composition. Similarly, bounds on the elastic thickness can be used to constrain the thermal evolution of the planet.
Derived from text
*Gravitation; Lithosphere; Mars Surface; Planetary Geology; Topography*

**20040062156** Washington Univ., Saint Louis, MO, USA
**Burying the 'Buried Channels' on Mars: An Alternative Explanation**
Dombard, A. J.; Searls, M. L.; Phillips, R. J.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A surprising feature found in martian gravity models is a suite of negative, linear, troughs in Chryse/Acidalia Planitiae that flank the northeastern edge of Tharsis (Tempe Terra) in the west and the Arabia highlands in the east. In particular, the largest, best-developed trough hugs the edge of Tempe Terra [1], running thousands of kilometers with maximum amplitudes exceeding 150 mGal. It has been proposed that these gravity troughs represent buried fluvial channels, transporting water and sediment from the outflow channels in the south to the northern lowlands [1,2]. Assuming densities appropriate to sediments, the size of this largest gravity trough suggests a canyon 1.5-4.5 km deep [1], putting it in the same league as Valles Marineris, yet these channels do not appear to show any topographic expression, indicating complete burial. Here, we consider the gravity trough flanking Tempe Terra; this analysis is chronicled more thoroughly in [3].
Derived from text
*Mars Surface; Topography; Troughs*

**20040062157** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**A Gravity Analysis of the Subsurface Structure of the Utopia Impact Basin**
Barnerdt, W. B.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The large, shallow, circular depression in Utopia Planitia has been identified as a huge impact basin, based on both geological evidence and detailed analysis of MOLA topography. Its diameter (approximately 3000 km) is equivalent to that of the Hellas basin, as is its inferred age (early Noachian). However, there the similarity ends. Their appearance, both surficially and geophysically, are virtually polar opposites. Whereas Hellas is extremely deep with rough terrain and large slopes, high-precision MOLA measurements were required to unambiguously define the smooth, shallow, almost imperceptible bowl of the Utopia basin. Conversely, Utopia displays one of the largest (non-Tharsis-related) positive geoid anomalies on Mars, in contrast to a more subdued negative anomaly over Hellas. As these two features presumably formed roughly contemporaneously by similar mechanisms, it is reasonable to assume that they were originally quite similar, and that their differences are due largely to different paths of subsequent modification. The obvious source for these differences is in their elevations: Hellas is located in the southern highlands at a rim elevation of about 3km, whereas Utopia is in the lowlying northern plains, at an average elevation of 4 km. Thus Utopia has been in an especially gravitationally favorable position to be subjected to infilling, for example, by lava flows, sedimentation, or water. In fact, its floor was almost certainly the lowest point on the planet at one time, and it would have been the termination point for down-slope drainage from over two-thirds of Mars. Thus the nature of the material filling this basin has strong connections to the sedimentary and/or volcanic processes acting on Mars in the Noachian and Early Hesperian periods. In particular, it may be able to shed some light on amount and persistence of water on early Mars in general and in the Utopia basin in particular. In this study I will use the inferred early correspondence between Hellas and Utopia to investigate Utopia's subsurface structure.
Derived from text
*Gravitation; Mars Surface; Planetary Geology; Structural Basins; Structural Properties (Geology); Topography*

**20040062158** University of Southern Illinois, Carbondale, IL, USA
**Analytic Signal in the Interpretation of Mars Southern Highlands Magnetic Field**
Ravat, D.; Miller, J.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Linearity and high-low-high-low pattern of some of the large amplitude magnetic anomalies in the southern highlands of Mars was initially interpreted as the result of ancient seafloor spreading. We investigated possibilities of the magnetic field reflecting Earth-like tectonics by reconstructing magnetic field at 150 km altitude over North America and North Atlantic Ocean from nearsurface and satellite-altitude data and found that narrow Earth-scale tectonic features (such as continental rifts, sutures, and seafloor spreading patterns) would be difficult to interpret correctly from magnetic data at 100-200 km and higher altitude. Magnetic pattern at 150 km elevation over Mars southern highlands has similar characteristics as the pattern on Earth. However, on Earth, at these altitudes, what one observes is the coalescence of strong local magnetic anomalies into ovals and patterns associated with very large geologic provinces (1000s of km length and width), large oceanic quiet zones, and regional-scale large heat flow variations. Many linear appearing magnetic features on Earth, at 150 km elevation, result from false tectonic continuity and are artifacts of anomaly coalescence; such a possibility for the linear magnetic features on Mars cannot be discounted. In terms of interpreting tectonics, we are limited by the 100-200 km altitude data (the highest resolution data we currently have). With these data, we can still model bulk characteristics of magnetic sources (average magnetization, width, thickness, etc.) and attempt to understand them. In this paper, we model bulk magnetizations associated with the prominent linear magnetic anomalies and one positive-negative anomaly pair in the southern highlands of Mars using Z-component variation (negative of Br-component) as well as its analytic signal field. The analytic signal field has certain desirable characteristics in terms of interpretation of sources and its modeling leads to important constraints on positioning of magnetic sources.
Derived from text
*Highlands; Magnetic Fields; Mars Surface; Planetary Geology; Tectonics*

**20040062159** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**An Improved Model of the Crustal Structure of Mars**
Zuber, M. T.; Neumann, G. A.; McGovern, P. J.; Wieczorek, M. A.; Lemoine, F. G.; Smith, D. E.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The first reliable model of the structure of the crust and upper mantle of Mars from remote observations was produced using data from the Mars Orbiter Laser Altimeter (MOLA) and the Radio Science investigation of Mars Global Surveyor (MGS). That model assumed a uniform crustal density and solved for the global variations in crustal thickness using a gravity field derived from preliminary MGS tracking. In that study, spherical harmonic potential coefficients were derived to degree and order 80, but crustal structure was interpreted cautiously to degree 60, or 360 km wavelength, owing to the presence of

noise. Tracking normal equations have since been generated to degree 75, to degree 80 (supplemented by altimetric crossovers), and recently to degree 90, using new constants for the orientation of the spin pole and the rotation rate of Mars provided by the IAU2000 rotation model. Gravity models now incorporate tracking data coverage from the Primary and Extended MGS missions and the early phases of the Mars Odyssey mission. In the present study we exploit these advances in gravity modeling to present a refined crustal inversion, which we also interpret in the context of Mars' internal structure and thermal evolution.
Derived from text
*Mathematical Models; Structural Properties (Geology); Planetary Geology; Planetary Crusts*

**20040062160** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**An Extraordinary Magnetic Field Map of Mars**
Connerney, J. E. P.; Acuna, M. H.; Ness, N. F.; Mitchell, D. L.; Lin, R. P.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 1 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Global Surveyor spacecraft has completed two Mars years in nearly circular polar orbit at a nominal altitude of 400 km. The Mars crust is at least an order of magnitude more intensely magnetized than that of the Earth [1], and intriguing in both its global distribution and geometric properties [2,3]. Measurements of the vector magnetic field have been used to map the magnetic field of crustal origin to high accuracy [4]. We present here a new map of the magnetic field with an order of magnitude increased sensitivity to crustal magnetization. The map is assembled from > 2 full years of MGS night-side observations, and uses along-track filtering to greatly reduce noise due to external field variations.
Derived from text
*Planetary Magnetic Fields; Polar Orbits; Mars Surface; Crusts*

**20040062161** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**Mapping Weak Crustal Magnetic Fields on Mars with Electron Reflectometry**
Mitchell, D. L.; Lillis, R.; Lin, R. P.; Connerney, J. E. P.; Acuna, M. H.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; 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 (MGS) mission was the discovery of intensely magnetized crust. These magnetic sources are at least ten times stronger than their terrestrial counterparts, probably requiring large volumes of coherently magnetized material, very strong remanence, or both. Perhaps the most intriguing aspect of these fields is their large scale coherence and organization into east-west stripes thousands of kilometers long. The anomalies were almost certainly created by thermoremanent magnetization (TRM) in the presence of a strong Martian dynamo. With few exceptions, the crustal fields are associated with the oldest terrain on Mars. Much of the northern lowlands appears to be non-magnetic, except for the relatively weak north polar anomalies and a few sources adja-cent to the dichotomy boundary, which appear to be associated with strongly magnetized crust south of the boundary. There is clear evidence for impact demagnetization of the Hellas, Argyre, and Isidis basins. Thus, Mars' crustal magnetic fields are among the oldest preserved geologic features on the planet.
Derived from text
*Magnetic Fields; Mars Surface; Optical Measurement; Planetary Geology; Planetary Crusts; Reflectometers*

**20040062163** Washington Univ., Saint Louis, MO, USA
**Localized Tharsis Loading on Mars: Testing the Membrane Surface Hypothesis**
Phillips, R. J.; Dombard, A. J.; Johnson, C. L.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040062151; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Restricting the topographic load on Mars to the Tharsis region alone results in a warping of the planetary surface outside of Tharsis as a thin spherical lithospheric membrane. This is a spherical analogy to flexural deformation in response to an isolated volcanic load on a flat lithospheric plate. Using MGS topography and gravity data, and localizing the Tharsis load by its zero elevation contour, we showed that the long wavelength shape of Mars can be explained by the pole-to-pole slope, regional Tharsis topography, and the deformation of the rest of the planet in response to the Tharsis load. Here we revisit the

hypothesis that the long-wavelength surface outside of Tharsis is, essentially, a deformed membrane.
Derived from text
*Loads (Forces); Mars Surface; Topography; Mathematical Models; Membrane Structures; Structural Properties (Geology)*

**20040062165** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062166 - 20040062178
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'From Ancient Mists: Presolar and Nebular Processes' included the following reports: Interpretation of the Meteoritic Extinct Radioactivity - Mean Life Relation; On the Issue of Molybdenum Isotopic Anomalies in Meteorites: Is It Still 'FUN'?; (26Al/27Al)o of the Solar Nebula Inferred from Al-Mg Systematic in Bulk CAIs from CV3 Chondrites; Magnesium Isotopic Compositions of Igneous CAIs in the CR Carbonaceous Chondrites: Evidence for an Early and Late-stage Melting of CAIs; The 26Al-26Mg Chronology of a Type C CAI and POIs in Ningqiang Carbonaceous Chondrite; Bulk Compositions of CAIs and Al-rich Chondrules: Implications of the Reversal of the Anorthite / Forsterite Condensation Sequence at Low Nebular Pressures; Synthesis of Refractory Minerals by High-Temperature Condensation of a Gas of Solar Composition; Elemental and Isotopic Fractionation by Diffusion-limited Evaporation; 'Nonideal' Isotopic Fractionation Behavior of Magnesium in Evaporation Residues; Determination of Primordial Refractory Inclusion Compositions; Zoning Patterns in Spinel from Type B Ca-Al-rich Inclusions: Constraints on Sub-Solidus Thermal History; Radial Migration of Materials from Inner to Outer Solar Nebula: Evidence from Meteorite Matrix; and Refractory Forsterites in Chondritic Meteorites, a Link Between CAIs and Chondrules.
Derived from text
*Meteoritic Composition; Chondrites; Chondrule*

**20040062168** California Inst. of Tech., Pasadena, CA, USA
**Zoning Patterns in Spinel from Type B Ca-Al-rich Inclusions: Constraints on Sub-Solidus Thermal History**
Burnett, D. S.; Paque, J. M.; Beckett, J. R.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; 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) has revealed a complex series of events subsequent to initial crystallization, including pervasive alteration. The alteration in Allende type B1 CAIs has produced obvious FeO enrichment in rim spinels, but also in interior spinels. Allende TS 34 has atypically large Fe-zoned spinel [1], opening the possibility of time-temperature constraints, as diffusion coefficients are known. With our new extensive database, we have discovered systematic zoning patterns for Fe, V and Ti from in TS 34 spinels.
Author
*Crystallization; Spinel; Meteoritic Composition; Enrichment; Calcium; Aluminum*

**20040062172** California Univ., Davis, CA, USA
**On the Issue of Molybdenum Isotopic Anomalies in Meteorites: Is It Still FUN?**
Yin, Q.-Z.; Jacobsen, S. B.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Since B2FH (1957) and AGWC (1957), heavy elements beyond the Fe group are known to be produced via two major nucleosynthetic paths; one is through the rapid neutron addition (rprocess), usually associated with extremely neutron rich environments in supernova explosions. The second is through slow neutron addition (s-process), normally associated with AGB stars, where neutron density is not as high and the rate of neutron addition is slower than the rate of beta decay. By definition, the isotopic abundance pattern in the r-process is expected to be enriched for un-shielded nuclides, while nuclides shielded from free beta decay are deficient in r-process and enriched in s-process components. Thus in a reservoir representing mixtures of these nucleosynthetic processes such as the solar nebula, the isolated components are expected to be complimentary to each other in their isotopic abundance patterns. Recent Mo isotope measurements in meteorites beautifully illustrate this theory. Similar observations have been made for other elements (e.g. Nd, Sm, Ba, and Xe; see [4] for review) primarily in the so called FUN inclusions (Fractionated and Unknown Nuclear effects), while the new measurements were

made in the not so FUN bulk carbonaceous chondrites as well as in CAIs. The extension of such observations to Mo and Zr represent advancement of new analytical capabilities. More stunning observations are expected in the near future. There are already indications of endemic Ru isotopic anomalies in iron meteorites and in Allende as well as planet wide Cr-54 anomalies in the HED parent body, distinct from the Earth-Moon system and the bulk chondrites. However, the Mo isotopic anomalies have also generated confusion, highlighted by a recent publication. The issue centered around the terminology (definition of bulk rock vs. leachate) and whether the choice of isotope pair used to correct instrumental mass fractionation could generate artificial isotopic anomalies or not. The doubt cast by authors about our Mo isotope work, as well as the recent works of several others, hinders the use of valid data and proper interpretation by cosmochemists and astrophysicists. This contribution is intended to clarify these issues through open discussions.
Derived from text
*Anomalies; Fractionation; Molybdenum Isotopes; Planetary Geology; Meteorites*

**20040062176** Cologne Univ., Germany
**Refractory Forsterites in Chondritic Meteorites, a Link Between CAIs and Chondrules**
Palme, H.; Pack, A.; Shelley, J. M. G.; Burkhardt, C.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Unequilibrated chondritic meteorites contain a population of FeO poor olivines (0.2 - 1 mol% fa) that are rich in refractory lithophile elements, such as Ca, Al, Ti, Sc, V, and REE [1,2,3]. These forsterites are termed 'refractory forsterites' RF) and occur as isolated grains within the matrices of carbonaceous chondrites (CC) and within chondrules, therein mostly as relicts. RFs were also found in ordinary chondrites (OC) and even in the strongly oxidized Rumurutiites (RC). RFs can be identified by their cathodoluminescence, which distinguishes them from more ferrous olivines. Improvements in the accuracy and spatial resolution of microchemical methods and results of partition experiments have led to a better understanding of these objects.
Derived from text
*Refractories; Forsterite; Chondrites; Meteorites; Chondrule; Meteoritic Composition*

**20040062177** Lawrence Livermore National Lab., Livermore, CA, USA
**Magnesium Isotopic Compositions of Igneous CAIs in the CR Carbonaceous Chondrites: Evidence for an Early and Late-stage Melting of CAIs**
Hutcheon, I. D.; Krot, A. N.; Marhas, K.; Goswami, J.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It has been recently shown that AOAs, non-igneous CAIs, and several igneous (compact Type A and Type B) CAIs in CR chondrites are uniformly enriched in O-16, suggesting that formation and melting of the CAIs occurred in an O-16 rich gaseous reservoir. In contrast, three igneous Type C CAIs in CR chondrites and a Type C in the CO3.0 chondrite Y-81020 are O-16-depleted and have heterogeneous O-isotopic compositions with spinel enriched in O-16 relative to anorthite, melilite and diopside. These observations have been interpreted as indicative of incomplete oxygen isotope exchange during CAI melting in an O-16-poor gaseous reservoir. Based on mineralogy, petrology and Oisotopic compositions of Al-rich chondrules in CR chondrites, Krot et al. concluded that these chondrules formed by melting of O-16-rich Ca,Al-rich and O-16-poor ferromagnesian precursors. The melting occurred in an O-16-poor gaseous reservoir and resulted in varying degrees of oxygen isotope exchange in the Al-rich chondrules. Krot et al. suggested that the O-16 poor igneous CAIs in CR chondrites could have experienced oxygen isotope exchange during chondrule melting. If this is the case, Al-Mg isotope study of O-16 poor igneous CAIs may provide key information on the possible time difference between the CAI and chondrule formation.
Derived from text
*Chondrites; Isotopic Labeling; Magnesium Isotopes; Igneous Rocks; Mineralogy; Melting; Calcium; Aluminum; Inclusions*

**20040062178** Field Museum of Natural History, Chicago, IL, USA
**'Nonideal' Isotopic Fractionation Behavior of Magnesium in Evaporation Residues**
Janney, P. E.; Mendybaev, R. A.; Dauphas, N.; Davis, A. M.; Richter, F. M.; Wadhwa, M.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ca-Al-rich inclusions (CAIs) in CV3 chondrites are often enriched in the heavy isotopes of their more volatile species in a way that suggests kinetic isotope fractionation during evaporation. This has led to numerous laboratory studies in which

the isotopic compositions of evaporation residues have been measured. A somewhat troubling feature of the laboratory-produced evaporation residues is that they are less fractionated in their magnesium isotopes than the usual expectation that the ratio of the flux of two isotopes is fractionated by an amount corresponding to the inverse square root of mass of the gas species containing those isotopes.
Derived from text
*Magnesium Isotopes; Residues; Evaporation; Calcium; Aluminum; Meteoritic Composition*

**20040062179** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062180 - 20040062192
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Mars Mineralogy: Weathered and Dry' presented the following reports:Hyperspectral and Field Mapping of an Archaean Komatiite Unit in the Pilbara Craton, Western Australia: Applications for CRISM Mission; Emission Spectroscopy of Smectites: Implications for the TES Andesite-weathered Basalt Debate; Volcanism and/or Aqueous Alteration on Mars: Constraints on Distinguishing Glass and Phyllosilicate in the Thermal Infrared; Olivine Weathering on Mars: Getting Back to Basics; Sulfate-cemented Soils Detected in TES Data Through the Application of an Automated Band Detection Algorithm; Thermal Emission Spectroscopy of Sulfates: Possible Hydrous Iron-Sulfate in the Soil at the MER-A Gusev Crater Landing Site ; Barite and Celestine Detection in the Thermal Infrared: Possible Application to Determination of Aqueous Environments on Mars; Search for Evaporite Minerals in Flaugergues Basin, Mars; Contributions from Hydrated States of MgSO4 to the Reservoir of Hydrogen at Equatorial Latitudes on Mars; Identification of a Quartz and Na-Feldspar Surface Mineralogy in Syrtis Major; Pigeonite Masquerading as Olivine at Mars: First Results from Mars Spectroscopy Consortium; Green Mars: Geologic Characteristics of Olivine-bearing Terrains as Observed by THEMIS, MOC, and MOLA; and Global Chemical Abundances and Distributions on Mars from MGS-TES Spectra.
Derived from text
*Mars Surface; Mineralogy; Planetary Geology*

**20040062189**
**Identification of a Quartz and Na-Feldspar Surface Mineralogy in Syrtis Major**
Bandfield, J. L.; Christensen, P. R.; Hamilton, V. E.; McSween, H. Y., Jr.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Visible through thermal infrared spectroscopy has been used to identify a number of mineralogically unique surfaces on Mars. Crystalline and nanocrystalline iron oxides, pyroxene, olivine, plagioclase, water bearing phases such as zeolites, carbonate, and high silica glass are amongst the identified phases. Unique vibrational and electronic absorptions in a wide variety of materials throughout these wavelengths allow for remote identification of these materials. The Thermal Emission Imaging System (THEMIS) on the Mars Odyssey spacecraft provides measurements of the Martian surface at 100 m/pixel in 9 spectral channels from approx. 6 to 15 mm. THEMIS images are highly complimentary to data returned from the Thermal Emission Spectrometer (TES) that has high spectral resolution (10 cm(exp -1) but relatively low spatial sampling (3 km).
Author
*Mineralogy; Mars Surface; Planetary Geology; Thermal Mapping; Infrared Spectra*

**20040062190** Brown Univ., Providence, RI, USA
**Pigeonite Masquerading as Olivine at Mars: First Results from Mars Spectroscopy Consortium**
Pieters, C. M.; Dyar, M. D.; Hiroi, T.; Bishop, J.; Sunshine, J.; Klima, R.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A consortium has recently been established to analyze whole rock and mineral separates from Mars meteorites with a variety of spectroscopic techniques (currently visible to far infrared reflectance and Mossbauer). We report here results for pyroxene and olivine separates from ALH84001, Zagami, LEW88516, Nakhla, ALHA77005 and Chassigny. All data are consistent with known compositions of these meteorites. The principal surprise is that a pure pyroxene separate from

LEW88516 (largely pigeonite) exhibits almost identical features to Mg-olivine from 20-50 microns.
Author
*Olivine; Pyroxenes; Mars (Planet); Mineralogy; Meteoritic Composition*

**20040062191** Hawaii Inst. of Marine Biology, Honolulu, HI, USA
**Green Mars: Geologic Characteristics of Olivine-bearing Terrains as Observed by THEMIS, MOC, and MOLA**
Hamilton, V. E.; Christensen, P. R.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The presence of localized concentrations of olivine on Mars is important to understanding the igneous history of Mars, the possible origins of the Martian meteorites, and local weathering regimes. Globally distributed sites identified by now have nearly complete diurnal coverage by the Thermal Emission Imaging System (THEMIS) IR subsystem, and greater than 50% coverage in the visible. We are examining these data and integrating them with Mars Orbital Camera (MOC) images and Mars Orbital Laser Altimeter (MOLA) topography to understand the regional and global trends between olivine-bearing terrains and their geologic environs. We find that there are some common, as well as variable, correlations between thermophysical, visible, topographic, and infrared characteristics of these materials on Mars.
Derived from text
*Olivine; Mars (Planet); Mars Surface; Planetary Geology*

**20040062192** Arizona State Univ., Tempe, AZ, USA
**Global Chemical Abundances and Distributions on Mars from MGS-TES Spectra**
Wyatt, M. B.; McSween, H. Y, Jr.; Bandfield, J. L.; Christensen, P. R.; Lunar and Planetary Science XXXV: Mars Mineralogy: Weathered and Dry; 2004; 2 pp.; In English; See also 20040062179; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report initial Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES) derived major oxide abundance maps (4 pixels/degree or 15 km/pixel) of low-albedo surface materials and examine chemical variation diagrams to better understand the relative roles of igneous and sedimentary processes on Mars. Petrologic interpretations of TES mineral-phase and major oxide abundances constrain the bulk composition of the martian surface and provide insight to the degree of differentiation of the crust and mantle and nature of surface-atmosphere interactions. TES oxide abundance maps will also serve for comparison to 2001 Mars Odyssey (MO) Gamma Ray Spectrometer (GRS) derived element abundance maps (.1 pixels/degree or 600 km/pixel).
Derived from text
*Mars Surface; Minerals; Oxides; Planetary Geology; Mars (Planet); Mars Environment; Geochemistry; Abundance*

**20040062193** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062194 - 20040062206
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Mars: Surface Coatings, Mineralogy, and Surface Properties' contained the following reports:High-Silica Rock Coatings: TES Surface-Type 2 and Chemical Weathering on Mars; Old Desert Varnish-like Coatings and Young Breccias at the Mars Pathfinder Landing Site; Analyses of IR-Stealthy and Coated Surface Materials: A Comparison of LIBS and Reflectance Spectra and Their Application to Mars Surface Exploration; Contrasting Interpretations of TES Spectra of the 2003 Rover:Opportunity-Landing Site: Hematite Coatings and Gray Hematite; A New Hematite Formation Mechanism for Mars; Geomorphic and Diagenetic Analogs to Hematite Regions on Mars: Examples from Jurassic Sandstones of Southern Utah, USA; The Geologic Record of Early Mars: A Layered, Cratered, and 'Valley-'ed: Volume; A Simple Approach to Estimating Surface Emissivity with THEMIS; A Large Scale Topographic Correction for THEMIS Data; Thermophysical Properties of Meridiani Planum, Mars; Thermophysical and Spectral Properties of Gusev, the MER-Spirit Landing Site on Mars; Determining Water Content of Geologic Materials Using Reflectance Spectroscopy; and Global Mapping of Martian Bound Water at 6.1 Microns Based on TES Data: Seasonal Hydration.
Derived from text
*Mars Surface; Mineralogy; Moisture Content*

**20040062194** Lunar and Planetary Inst., Houston, TX, USA

**Contrasting Interpretations of TES Spectra of the 2003 Rover 'Opportunity' Landing Site: Hematite Coatings and Gray Hematite**

Kirkland, L. E.; Herr, K. C.; Adams, P. M.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Since 2001, there have been two, parallel interpretations of Mars Global Surveyor Thermal Emission Spectrometer (TES) observations of Sinus Meridiani. The TES team has consistently and dominantly argued that a deposit of coarse hematite is the only spectral match, and refers to the site as a 'gray hematite' deposit. On the other hand, the Aerospace remote sensing team has argued that a hematite coating better matches the TES spectra, although coarse hematite is also a viable option. Coatings do not necessarily imply abundant water, while coarse hema-tite does. The debate illustrates two points: (1) the attention that an option receives could be perceived as proportional to the amount of water that it implies; and (2) coatings appreciably increase ambiguities in the interpretations.

Author

*Mars Landing Sites; Hematite; Planetary Geology; Spectral Signatures*

**20040062195** Arizona State Univ., Tempe, AZ, USA

**A New Hematite Formation Mechanism for Mars**

Minitti, Michelle E.; Lane, Melissa D.; Bishop, Janice L.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hematite is an important component of Martian surface mineralogy. The visible and near-infrared spectral character of Martian bright regions is explained by the presence of nanophase hematite and subordinate amounts of red, crystalline hematite [e.g., 1]. In the thermal infrared, gray, coarse and crystalline hematite was detected by MGS-TES in three separate regions on Mars, always as a component of layered (sedimentary) terranes [e.g., 2]. The presence and nature of hematite on Mars has been used to assess conditions on the Martian surface responsible for hematite formation. Palagonitization is capable of producing nanophase and red, crystalline hematite [3] and palagonitization implies basalt glass weathering in the presence relatively small amounts of water. The preferred formation mechanism for gray hematite, precipitation from Fe-rich water, implies large bodies of water at multiple sites on Mars [2]. A recent study of Martian basalt spectral properties [4] yielded samples which reveal a new hematite formation mechanism: glass oxidation during extrusion of basaltic flows. This new mechanism, which requires neither chemical weathering nor water, has different implications for the presence of hematite in Martian surface materials.

Derived from text

*Hematite; Mars Surface; Mineralogy; Surface Properties; Infrared Radiation; Basalt*

**20040062196** Brown Univ., Providence, RI, USA

**A Simple Approach to Estimating Surface Emissivity with THEMIS**

Mustard, J. F.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The THEMIS instrument provides unprecedented spatial resolution for investigating the surface composition of Mars. However, there are significant challenges for deriving surface emissivity from the observed radiance observations because of atmospheric influences. An approach to local atmospheric correction is presented here. The validity of this approach is demonstrated in a region with two overlapping THEMIS observations separated in time by 30 days or 15 deg of Ls. The results show that a consistent estimate of surface emissivity is derived that is sufficient to identify differences in emissivity in small outcrops near to the spatial resolution of THEMIS. This approach will be applied to other THEMIS data to explore compositional variations.

Author (revised)

*Mars Surface; Planetary Composition; Emissivity; Mars Atmosphere; Atmospheric Correction*

**20040062197** Hawaii Univ., Honolulu, HI, USA

**A Large Scale Topographic Correction for THEMIS Data**

Anderson, F. S.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The objective of this work is to test the hypothesis that the atmospheric influence of large-scale topography observed in 2001 Mars Odyssey Thermal Emission Imaging System (THEMIS) images can be removed by decorrelation of topography and emissivity. This correction is important for features such as the Valles Marineris and Olympus Mons, which are associated with large topographic variations that result in emissivity and radiance offsets. The resulting data is effectively normalized to a constant atmospheric thickness, and can be analyzed using a standard deconvolution approach in order to identify changes in mineralogy.
Author
*2001 Mars Odyssey; Planetary Mapping; Topography; Atmospheric Correction; Mars (Planet)*

**20040062198** Colorado Univ., Boulder, CO, USA
**Thermophysical Properties of Meridiani Planum, Mars**
Hynek, B. M.; Jakosky, B. M.; Martinez-Alonzo, S.; Putzig, N. E.; Murphy, N.; Mellon, M. T.; Pelkey, S.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The layered materials in Meridiani Planum, the landing site of the MER Opportunity rover, exhibit a wide range of thermal properties. In many cases, there is a strong correlation with geomorphology indicative of local control of composition and physical properties. We used data from the Thermal Emission Imaging System (THEMIS) and Thermal Emission Spectrometer (TES) in conjunction with other remotely sensed data to examine the thermophysical properties of the landing site and associated stratigraphy, allowing a better understanding of the geologic history of this region of Mars. In situ results from Opportunity will provide ground truth for our analysis, and help us to extrapolate properties globally.
Author
*Mars Surface; Mars Landing Sites; Thermophysical Properties; Geophysics; Planetary Geology*

**20040062199** Arizona State Univ., Tempe, AZ, USA
**High-Silica Rock Coatings: TES Surface-Type 2 and Chemical Weathering on Mars**
Kraft, M. D.; Michalski, J. R.; Sharp, T. G.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Knowledge of chemical weathering processes on Mars is important for understanding the geologic history of Martian soils and dust and the global history of water. We are investigating high-silica rock coatings as a potential product of aqueous weathering on Mars [1]. Silica coatings may be responsible for certain global-scale observations made by the Thermal Emission Spectrometer (TES). Using terrestrial silica coatings as an analog, we suggest that the essential conditions required for silica coating formation may exist on Mars. Here, we discuss a basic mechanism of silica-coating formation on Martian rocks how these coating might impact spacecraft observations of Mars.
Derived from text
*Chemical Reactions; Weathering; Rocks; Planetary Geology; Coating*

**20040062200** NASA Ames Research Center, Moffett Field, CA, USA
**Old Desert Varnish-like Coatings and Young Breccias at the Mars Pathfinder Landing Site**
Murchie, S.; Barnouin-Jha, O.; Barnouin-Jha, K.; Bishop, J.; Johnson, J.; McSween, H.; Morris, R.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Many rocks at the Mars Pathfinder landing site exhibit evidence for desert varnish-like coatings that formed during an early, moist climate. Later eolian erosion partly stripped the coatings. Rocks excavated subsequently have shapes consistent with breccias or conglomerates.
Derived from text
*Mars Landing Sites; Varnishes; Breccia; Rocks; Erosion*

**20040062201** NASA Ames Research Center, Moffett Field, CA, USA
**Analyses of IR-Stealthy and Coated Surface Materials: A Comparison of LIBS and Reflectance Spectra and Their Application to Mars Surface Exploration**
Wiens, R. C.; Kirkland, L. E.; McKay, C. P.; Cremers, D. A.; Thompson, J.; Maurice, S.; Pinet, P. C.; Lunar and Planetary

Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Identification of non-silicate samples on Mars, such as carbonates, sulfates, nitrates, or evaporites in general, is important because of their association with aqueous processes and their potential as exobiology sites. Infrared (IR) and thermal emission (TE) spectroscopy have been considered the primary tools for remote identification of these minerals. This includes current and future orbital assets such as TES on MGS, THEMIS on Mars Odyssey, OMEGA on Mars Express, CRISM on MRO, and now the Mini-TES on the MER rovers. While reflectance and emission spectroscopy have clearly been the method of choice for these missions, the technique is not always successful in mineral identifications due to dust, surface weathering chemistry, coatings, or surface texture. Here we describe and show IR spectra of several such samples, and then report on the relative success of LIBS analyses in determining the rock type.

Derived from text

*Carbonates; Sulfates; Nitrates; Infrared Radiation; Emission Spectra; Surface Properties; Laser-Induced Breakdown Spectroscopy*

**20040062202** Brown Univ., Providence, RI, USA

**Determining Water Content of Geologic Materials Using Reflectance Spectroscopy**

Milliken, R. E.; Mustard, J. F.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

VIS-NIR spectrometers onboard current and upcoming missions (OMEGA on ESA's Mars Express and CRISM on NASA's Mars Reconnaissance Orbiter) will provide high spatial and spectral resolution data of the martian surface. The wavelength region covered by these instruments includes several fundamental and overtone absorptions attributed to water of hydration (in the form of H2O and OH-), making it possible to detect the presence of hydrated phases. Mars is known to have an absorption centered near 3000 nm that varies in strength, attributed to surface hydration. Further study is required, however, to quantitatively link observed water absorptions to the form and absolute or relative water abundance of a given mineral phase. Previously, we showed that modeling changes in reflectance spectra due to loss of H2O in dehydration time series measurements (dehydrating smectites in a purging chamber) can be used to detect changes in water content as low as 0.1 wt. %, relative to a dehydrated sample. Reflectance spectra were converted to scattering efficiency by subtracting or dividing the spectrum of each intermediate time step from the final time step (driest sample). The scattering efficiency, which represented changes in water absorptions, was then modeled for each time step using the optical properties of bulk water (n and k) and methods outlined by Hapke. Estimates of the optical path length (d) for each measurement followed a power-law relationship when plotted against measured wt. % water loss relative to the dry sample (d decreased as H2O was lost). Our latest results use thermogravimetric analysis (TGA) in conjunction with reflectance spectra of heated samples (measured in RELAB at Brown University) to quantify the absolute water content of each form of water (adsorbed, bound, and structural) in various minerals. Combined, these techniques allow us to relate changes in the strength and shape of water absorptions to changes in absolute (and relative) water content.

Author (revised)

*Mars (Planet); Planetary Composition; Water; Spectroscopic Analysis; Planetary Geology*

**20040062203** Academy of Sciences (Russia), Moscow, Russia

**Global Mapping of Martian Bound Water at 6.1 Microns Based on TES Data: Seasonal Hydration-Dehydration of Surface Minerals**

Kuzmin, R. O.; Christensen, P. R.; Zolotov, M. Y.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Several independent observations indicate the presence of chemically bound water in the Martian surface materials: ground-based spectroscopy in the near-infrared and IR spectral range, Mariner 6 and 7 IRS, Phobos 2 ISM, Mars Odyssey neutron data, Viking biological experiments, and Mars Pathfinder APXS data. These data are also consistent with the presence of hydrated minerals in the Martian meteorites. Bound water could be associated with palagonite-like silicate material and associated minerals (smectites, zeolites), as well as with salts (sulfates, chlorides, and carbonates) that could account for as much as 20 vol. % of the Martian soil. Seasonal changes of the surface temperature and atmospheric water content are responsible for the formation of seasonal polar ice caps and also affect stabilities of minerals with respect to their hydration and dehydration. The emission feature at 6.1 microns, which is attributed to bound molecular water, is observed in the ground-based thermal emission spectrum of Mars, in TES (on Mars Global Surveyor) spectra, and at the landing site of Spirit

(MER-A). The data obtained with TES can be used to observe the global distribution of this spectral feature on the Martian surface. Here we report results of global mapping of bound water distribution on Mars at various seasons based on the TES data.
Author
*Planetary Mapping; Mars Surface; Water; Annual Variations; Geographic Distribution; Planetary Geology*

**20040062204** Utah Univ., Salt Lake City, UT, USA
**Geomorphic and Diagenetic Analogs to Hematite Regions on Mars: Examples from Jurassic Sandstones of Southern Utah, USA**
Beitler, B.; Ormoe, J.; Komatsu, G.; Chan, M. A.; Parry, W. T.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Several morphologic features and patterns seen on the surface of Mars have potential analogs in Jurassic eolian sandstones in southern Utah. In this study we seek an explanation for these conspicuous features visible in high resolution Mars Orbiter Camera (MOC) images from the Sinus Meridiani and Aram Chaos hematite regions on Mars, by comparing them with similar well-studied features in southern Utah, USA. Diagenetic hematite deposits and zones of redbed bleaching in Utah are often linked to geomorphic and geologic features such as knobs, buttes, bleached layers, fractures and rings on a variety of scales. Similar landforms are seen to dominate the landscape in the hematite-rich regions on Mars. Apparent similarities between these two systems provide the basis for interpretation of the Martian hematite as a chemical precipitate from groundwater flow. Much of the past literature has focused on Earth analogs for Martian hematite that are either hydrothermal, a process of ground water leaching through soils, or layered lake or oceanic precipitates similar to banded iron formations. We propose that the Martian hematite may have formed by low temperature (<100 C) diagenetic fluid flow processes similar to those commonly observed in southern Utah. The hematite occurrences in southern Utah are not nearly as extensive as the hematite deposits on Mars. However, the process behind their formation is of interest as it provides a model for iron removal, transportation, and precipitation in a low temperature hydrologic groundwater system.
Author
*Geomorphology; Analogs; Ground Water; Hematite; Mars Surface; Planetary Geology*

**20040062205** Malin Space Science Systems, San Diego, CA, USA
**The Geologic Record of Early Mars: A Layered, Cratered, and 'Valley-ed' Volume**
Edgett, K. S.; Malin, M. C.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Analysis of images from the Mars Global Surveyor (MGS), Mars Odyssey, Phobos 2, Viking, and Mariner 9 orbiters shows that the upper crust of Mars is a layered, cratered, and 'valley-ed' volume. Buried craters do not indicate a singular, 'pre- Noachian surface.' Instead, filled and buried craters - and valley networks - are found at many scales and at multiple stratigraphic levels within the upper 10 or more kilometers of the martian crust. These layers record the depositional environments of early Mars. The craters have diameters up to 100s of kilometers. The rocks that comprise these layers, more often than not, appear to be sedimentary rather than volcanic. The rock units are both vertically and laterally heterogeneous. The martian heavily cratered terrain familiar since Mariners 4-9 is the end-product of a long period of erosion and deposition, burial and exhumation. Some very large craters (> 100 km diameter) at the surface of Mars today were once buried, yet retain little evidence of their burial; some valley networks begin or end, fully-born, in the middle of nowhere, with their end points either still buried or long since removed. The attributes of the martian geologic record suggest that early Mars was a very dynamic place. Several regions exhibit exposures of layered bedrock that provide insights to the nature of the martian geologic record. This paper describes key examples in Gale Crater, Sinus Meridiani, Arabia Terra, the chaotic terrain east of the Valles Marineris, and the troughs and uplands surrounding the Valles Marineris.
Author
*Planetary Geology; Mars (Planet); Planetary Evolution*

**20040062206** Colorado Univ., Boulder, CO, USA
**Thermophysical and Spectral Properties of Gusev, the MER-Spirit Landing Site on Mars**
Martinez-Alonso, S.; Jakosky, B. M.; Mellon, M. T.; Putzig, N. E.; Pelkey, S. M.; Hynek, B. M.; Murphy, N. W.; Lunar and Planetary Science XXXV: Mars: Surface Coatings, Mineralogy, and Surface Properties; 2004; 2 pp.; In English; See also 20040062193; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On January 3, 2004, the Mars Exploration Rover (MER) Spirit landed successfully on Gusev crater. This site was selected for one of the two MER landers because of its potential for hosting fluvio-lacustrine deposits. The Gusev surface deposits have been previously characterized in terms of their geomorphological and thermophysical properties. Fluvio-lacustrine, volcanic, aeolian processes, and combinations of all of them have been proposed to explain their origin. Here we present initial results from the analysis of newly available data for the Gusev region, compiled in support of the MER team and supported by the JPL Critical Products Data Analysis Program. These data include TES albedo and thermal inertia mosaics, and THEMIS brightness temperature and thermal inertia mosaics. The thermophysical and spectral properties of the Gusev crater region (a 3-by-3 degree region centered at 14.5 S, 184.5 W), as derived from the datasets mentioned above as well as from other remote sensing datasets (TES emissivity, MOC, MOLA), will be discussed.
Author
*Mars Craters; Mars Landing Sites; Thermophysical Properties; Spectral Signatures; Planetary Geology*

**20040062208** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062209 - 20040062221
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM
The session 'Astrobiology: Analogs and Applications to the Search for Life' included the folowing reports:The Search for Life on Mars Using Macroscopically Visible Microbial Mats (Stromatolites) in 3.5/3.3 Ga Cherts from the Pilbara in Australia and Barberton in South Africa as Analogues; Life in a Mars Analog: Microbial Activity Associated with Carbonate Cemented Lava Breccias from NW Spitsbergen; Groundwater-fed Iron-rich Microbial Mats in a Freshwater Creek: Growth Cycles and Fossilization Potential of Microbial Features; Episodic Fossilization of Microorganisms on an Annual Timescale in an Anthropogenically Modified Natural Environment: Geochemical Controls and Implications for Astrobiology; Proterozoic Microfossils and Their Implications for Recognizing Life on Mars; Microbial Alteration of Volcanic Glass in Modern and Ancient Oceanic Crust as a Proxy for Studies of Extraterrestrial Material ; Olivine Alteration on Earth and Mars; Searching for an Acidic Aquifer in the R!o Tinto Basin. First Geobiology Results of MARTE Project; In-Field Testing of Life Detection Instruments and Protocols in a Mars Analogue Arctic Environment; Habitability of the Shallow Subsurface on Mars: Clues from the Meteorites; Mars Analog Rio Tinto Experiment (MARTE): 2003 Drilling Campaign to Search for a Subsurface Biosphere at Rio Tinto Spain; Characterization of the Organic Matter in an Archean Chert (Warrawoona, Australia); and The Solfatara Crater, Italy: Characterization of Hydrothermal Deposits, Biosignatures and Their Astrobiological Implication.
Derived from text
*Extraterrestrial Life; Extraterrestrial Matter; Mars Environment*

**20040062209** Oslo Univ., Norway
**Life in a Mars Analog: Microbial Activity Associated with Carbonate Cemented Lava Breccias from NW Spitsbergen**
Amundsen, H. E. F.; Steele, A.; Fogel, M.; Kihle, J.; Schweizer, M.; Toporski, J.; Treiman, A. H.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
Low-temperature carbonate deposits in volcanic centres on NW Spitsbergen (Norway) comprise carbonate globules near identical to those in ALH84001 and represent a unique opportunity to examine water-rock interaction and possible microbial activity in a Mars analog environment. Field observations show that abundant magnesite and dolomite were deposited in lava conduits after eruption, likely in the presence of standing water. SEM-, fluorescence- and C,N isotope data indicate the presence of microbial activity within vesicular lava breccias in these conduits.
Author
*Breccia; Carbonates; Cementation; Mars Environment; Microorganisms; Water*

**20040062211** Ecole Nationale Superieure de Chimie, Paris, France
**Characterization of the Organic Matter in an Archean Chert (Warrawoona, Australia)**
Skrzypczak, A.; Derenne, S.; Robert, F.; Binet, L.; Gourier, D.; Rouzaud, J.-N.; Clinard, C.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; 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 on Earth is one of the most debated scientific questions to date. To address this important

issue, a special attention has been paid to the oldest archean rocks and especially to their carbonaceous matter. The discovery of microstructures in cherts from the Warrawoona group created a considerable interest in the organic matter contained in this deposit. Based on microscopic studies, these microstructures were considered to correspond to the oldest microfossils on Earth (3.465 billion years old) and to be derived from photosynthetic filamentous cyanobacteria. The occurrence of carbonaceous material associated with these structures, revealed by laser Raman microspectroscopy, was put forward as an additional evidence for a biogenic origin of the aforementioned microfossils. However, this biogenicity has been recently debated since it was shown that similar structures can be formed through abiotic reactions and the microstructures were even considered as secondary artifacts formed from amorphous carbon under hydrothermal conditions. Taken together, these results emphasize the necessity for reliable biomarkers for this ancient organic matter. To this end, we have undertaken a multidisciplinary study of the insoluble organic matter isolated from a chert of the Warrawoona Group using high resolution transmission electron microscopy and several spectroscopic techniques (Fourier transform infrared, solid state nuclear magnetic resonance and electron paramagnetic resonance).
Author
*Organic Materials; Infrared Spectra; Spectroscopy; Microanalysis; Nuclear Magnetic Resonance*

**20040062212** International Research School of Planetary Sciences, Pescara, Italy
**The Solfatara Crater, Italy: Characterization of Hydrothermal Deposits, Biosignatures and Their Astrobiological Implication**
Glamoclija, M.; Garrel, L.; Lopez-Garcia, P.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Solfatara is geologically young volcanic formation (approx. 4,000 yr BP), with a hot (45- 95 C) and acidic (pH 1.7) environment, exhibiting strong sulphur and iron mineralization characteristic of hydrothermal sites. We tried to demonstrate necessity of multidisciplinary investigation: paleontological biogeochemical and biological; in search for microbial remains or more precise biosignatures. Modern hydrothermal systems can provide significant information about processes and life thriving at these environments, that could help in understanding and providing better interpretations of their fossil counterparts. Furthermore, the site of Solfatara with its extreme environment, geological and chemical characteristics are very good analogues to possible hydrothermal systems on Mars. In this term here we present our preliminary work conducted in the area of Dao Vallis and Niger Vallis near the Hellas impact basin.
Derived from text
*Hydrothermal Systems; Craters; Microorganisms; Fossils; Exobiology; Mars Surface*

**20040062218** NASA Ames Research Center, Moffett Field, CA, USA
**Searching for an Acidic Aquifer in the Rio Tinto Basin: First Geobiology Results of MARTE Project**
Fernandez-Remolar, D. C.; Prieto-Ballesteros, O.; Stoker, C.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Among the conceivable modern habitats to be explored for searching life on Mars are those potentially developed underground. Subsurface habitats are currently environments that, under certain physicochemical circumstances, have high thermal and hydrochemical stability [1, 2]. In planets like Mars lacking an atmospheric shield, such systems are obviously protected against radiation, which strongly alters the structure of biological macromolecules. Low porosity but fractured aquifers currently emplaced inside ancient volcano/sedimentary and hydrothermal systems act as excellent habitats [3] due to its thermal and geochemical properties. In these aquifers the temperature is controlled by a thermal balance between conduction and advection processes, which are driven by the rock composition, geological structure, water turnover of aquifers and heat generation from geothermal processes or chemical reactions [4]. Moreover, microbial communities based on chemolithotrophy can obtain energy by the oxidation of metallic ores that are currently associated to these environments. Such a community core may sustain a trophic web composed of non-autotrophic forms like heterotrophic bacteria, fungi and protozoa.
Derived from text
*Aquifers; Chemical Reactions; Extraterrestrial Life; Hydrothermal Systems; Thermodynamic Properties; Microorganisms*

**20040062219** Carnegie Institution of Washington, Washington, DC, USA

**In-Field Testing of Life Detection Instruments and Protocols in a Mars Analogue Arctic Environment**

Steele, A.; Schweizer, M.; Amundsen, H. E. F.; Wainwright, N.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During August of 2003 an expedition including 19 scientists tested various equipment at a series of hot-springs sites on the island of Svalbard. This island is considered a Mars analogue environment due to the presence of hot springs, carbonate terraces and volcanic activity which have produced carbonate rosettes similar to those found in ALH84001. The goal was to test 4 portable instruments for their robustness as field instruments for life detection (for future human missions to Mars), to assess the Mars analogue environments for signs of life, to refine protocols for contamination reduction and to understand the effects of transport on sample integrity by assessing bioloads immediately in the field and then comparing this with laboratory measurements made after transportation.

Author

*Analogs; Carbonates; Contamination; Field Tests; Mars Environment*

**20040062221** NASA Ames Research Center, Moffett Field, CA, USA

**Mars Analog Rio Tinto Experiment (MARTE): 2003 Drilling Campaign to Search for a Subsurface Biosphere at Rio Tinto Spain**

Stoker, Carol; Dunagan, Stephen; Stevens, Todd; Amils, Ricardo; Gomez-Elvira, Javier; Fernandez, David; Hall, James; Lynch, Kennda; Cannon, Howard; Zavaleta, Jhony, et al.; Lunar and Planetary Science XXXV: Astrobiology: Analogs and Applications to the Search for Life; 2004; 2 pp.; In English; See also 20040062208; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The MARTE (Mars Astrobiology Research and Technology Experiment) project, an ASTEP field experiment, is exploring for a hypothesized subsurface anaerobic chemoautotrophic biosphere in the region of the Tinto River- or Rio Tinto- in southwestern Spain. It is also demonstrating technology needed to search for a subsurface biosphere on Mars. The project has three primary objectives: (1) search for and characterize subsurface life at Rio Tinto along with the physical and chemical properties and sustaining energy sources of its environment, (2) perform a high fidelity simulation of a robotic Mars drilling mission to search for life, and (3) demonstrate the drilling, sample handling, and instrument technologies relevant to searching for life on Mars. The simulation of the robotic drilling mission is guided by the results of the aseptic drilling campaign to search for life at Rio Tinto. This paper describes results of the first phase of the aseptic drilling campaign.

Derived from text

*Drilling; Biosphere; Chemical Properties; Extraterrestrial Life*

**20040062222** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062223 - 20040062235

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Organics and Alteration in Carbonaceous Chondrites: Goop and Crud' included the following reports:Organics on Fe-Silicate Grains: Potential Mimicry of Meteoritic Processes?; Molecular and Compound-Specific Isotopic Study of Monocarboxylic Acids in Murchison and Antarctic Meteorites; Nanoglobules, Macromolecular Materials, and Carbon Sulfides in Carbonaceous Chondrites; Evidence for Terrestrial Organic Contamination of the Tagish Lake Meteorite; Nitrogen Isotopic Imaging of Tagish Lake Carbon Globules; Microscale Distribution of Hydrogen Isotopes in Two Carbonaceous Chondrites; The Nature and Origin of Aromatic Organic Matter in the Tagish Lake Meteorite; Terrestrial Alteration of CM Chondritic Carbonate; Serpentine Nanotubes in CM Chondrites; Experimental Study of Serpentinization Reactions; Chondrule Glass Alteration in Type IIA Chondrules in the CR2 Chondrites EET 87770 and EET 92105: Insights into Elemental Exchange Between Chondrules and Matrices; Aqueous Alteration of Carbonaceous Chondrites: New Insights from Comparative Studies of Two Unbrecciated CM2 Chondrites, Y 791198 and ALH 81002 ;and A Unique Style of Alteration of Iron-Nickel Metal in WIS91600, an Unusual C2 Carbonaceous Chondrite.

Derived from text

*Chondrites; Meteoritic Composition*

**20040062223** Brown Univ., Providence, RI, USA

**Molecular and Compound-Specific Isotopic Study of Monocarboxylic Acids in Murchison and Antarctic Meteorites**

Huang, Y.; Wang, Y.; DeRosa, M.; Fuller, M.; Pizzarello, S.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Low molecular weight monocarboxylic acids are the most abundant soluble organic compounds in the Murchison (10 to 100 times more abundant than amino acids) [1,2] and other CM carbonaceous chondrites [3,4]. Carboxylic acids, albeit of longer chain length, are the essential components in the cell membranes of living organisms on Earth. Since carbonaceous meteorites may have seeded early earth with pricursor organic molecules [5], understanding the formation mechanisms of the monocarboxylic acids is central to understanding the prebiotic organic synthesis and origin of life. Compared with the extensive studies on meteoritic amino acids, monocarboxylic acids in Murchison meteorite have received considerably less attention. Characterization of molecular distributions of monocarboxylic acids in Murchison was conducted in 1970 s using gas chromatography equipped with stainless steel capillary GC columns [1,2]. Only 13 monocarboxylic acids were reported in Murchison [1,2]. The stainless steel capillary column has a limited resolution compared with modern fused silica capillary GC column, especially for the complex mixture of straight chain and branched hydrocarbons in the Murchison meteorite. Later studies of Antarctic carbonaceous meteorites using fused silica capillary GC column revealed a much larger suite of more than 35 monocarboxylic acids. Given that Murchison has been demonstrated to contain the most extensive series of extraterrestrial organic compounds [5], it is surprising that the composition of the monocarboxylic acids in Murchison would have been relatively simple.

Derived from text

*Carbonaceous Meteorites; Carbonaceous Chondrites; Murchison Meteorite; Carboxylic Acids; Low Molecular Weights*

**20040062224** NASA Johnson Space Center, Houston, TX, USA

**The Nature and Origin of Aromatic Organic Matter in the Tagish Lake Meteorite**

Clemett, S. J.; Keller, L. P.; Nakamura, K.; McKay, D. S.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222

Contract(s)/Grant(s): RTOP 344-31-72-07; RTOP 344-31-40-07; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Tagish Lake meteorite is an unusual carbonaceous chondrite that does not fit well within existing chondrite taxonomy. Bulk analyses suggest approx. 5 wt.% C of which approx. 1 wt.% is in the form of organic matter and the remainder is present as inorganic carbonate. The exact nature and form of this organic component is, as is the case with the other ordinary and carbonaceous chondrites, still poorly understood. Yet its significance has far reaching implications, from contributing to the abiotic evolution of the early Earth and Mars, to providing geothermal constraints in the evolution of the Solar nebula.

Author

*Organic Materials; Meteorites; Carbonates; Carbonaceous Chondrites*

**20040062225** NASA Johnson Space Center, Houston, TX, USA

**Nitrogen Isotopic Imaging of Tagish Lake Carbon Globules**

Messenger, S.; Nakamura, K.; Nittler, L. R.; Young, A.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222

Contract(s)/Grant(s): NAG5-10510; RTOP 344-31-72-08; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chondritic meteorites and interplanetary dust particles commonly exhibit significant enrichments in deuterium (D) and N-15 relative to terrestrial materials. These anomalies are usually ascribed to low temperature chemical processes occurring in a presolar cold molecular cloud and/or physically similar regions of the outer solar nebula. The sizes of these anomalies vary considerably among different classes of meteorites, in some cases on a microscopic scale, reflecting differing degrees of alteration and dilution of the presolar components owing to parent body processing.

Derived from text

*Nitrogen Isotopes; Imaging Techniques; Deuterium; Molecular Clouds; Interplanetary Dust*

**20040062226** Carnegie Institution of Washington, Washington, DC, USA

**Microscale Distribution of Hydrogen Isotopes in Two Carbonaceous Chondrites**

Young, A. F.; Nittler, L. R.; Alexander, C. M. O'D; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222

Contract(s)/Grant(s): NAG5-10510; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hydrogen isotopes are highly variable among primitive meteorites and interplanetary dust particles (IDPs) [1, 2]. In particular, many primitive objects exhibit D (and N-15) enrichments, relative to terrestrial values, thought to represent partial preservation of presolar material fractionated in molecular clouds. However, the diversity of D/H ratios among IDPs and chondrites indicates a complex history of processing in the solar nebula and on meteorite parent bodies. Deconvolving this record requires identification and characterization of the carriers of D enrichments in different objects. Isotopic imaging has proven to be a powerful method to quantitatively explore the distribution of D/H ratios on a one to several m scale in IDPs [2-4] and the CR chondrite Renazzo [5, 6]. In this study, we have used ion imaging to explore the microscale D/H distribution of two carbonaceous chondrites, Tagish Lake (unique) and Al Rais (CR2). Previous D/H measurements (on a ~tens of microns scale) of Tagish Lake matrix fragments by Messenger [7] and Engrand et al. [8] have found different results, most likely related to the analytical techniques used. Previous work has also shown a large range of D/H ratios in CR chondrites, including very large variations on a scale of a few microns [5, 6, 9].

Derived from text

*Carbonaceous Chondrites; Hydrogen Isotopes; Meteorites; Fragments; Nitrogen 15; Interplanetary Dust*

**20040062227** New Mexico Univ., Albuquerque, NM, USA

**A Unique Style of Alteration of Iron-Nickel Metal in WIS91600, an Unusual C2 Carbonaceous Chondrite**

Brearley, Adrian J.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222

Contract(s)/Grant(s): NAG5-13046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The collection of meteorites from Antarctica has provided an invaluable resource of new materials for study by the scientific community. In addition to exciting finds of new meteorite types (e.g. ALH85085, LEW 85332), these efforts have generated many important samples of existing meteorite groups, particularly C2 chondrites. Studies of these chondrites have broadened our understanding of aqueous alteration and provided a much more comprehensive view of the diversity of alteration in these meteorites. In this study, I report the findings of a petrographic and TEM study of WIS91600, a C2 chondrite that has experienced a highly unusual style of aqueous alteration that has not previously been recognized in C2 chondrites.

Author

*Carbonaceous Chondrites; Meteoritic Composition; Meteoritic Microstructures*

**20040062228** New Mexico Univ., Albuquerque, NM, USA

**Experimental Study of Serpentinization Reactions**

Cohen, B. A.; Brearley, A. J.; Ganguly, J.; Liermann, H.-P.; Keil, K.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222

Contract(s)/Grant(s): NAG5-11591; NAG5-13046; NAG5-11862; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Current carbonaceous chondrite parent-body thermal models [1-3] produce scenarios that are inconsistent with constraints on aqueous alteration conditions based on meteorite mineralogical evidence, such as phase stability relationships within the meteorite matrix minerals [4] and isotope equilibration arguments [5, 6]. This discrepancy arises principally because of the thermal runaway effect produced by silicate hydration reactions (here loosely called serpentinization, as the principal products are serpentine minerals), which are so exothermic as to produce more than enough heat to melt more ice and provide a self-sustaining chain reaction. One possible way to dissipate the heat of reaction is to use a very small parent body [e.g., 2] or possibly a rubble pile model. Another possibility is to release this heat more slowly, which depends on the alteration reaction path and kinetics.

Derived from text

*Carbonaceous Chondrites; Serpentine; Reaction Kinetics; Meteorites; Mineralogy; Temperature Distribution; Exothermic Reactions*

**20040062229** Arizona State Univ., Tempe, AZ, USA

**Nanoglobules, Macromolecular Materials, and Carbon Sulfides in Carbonaceous Chondrites**

Garvie, Laurence A. J.; Buseck, Peter R.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The CI and CM meteorites contain a diverse suite of carbonaceous materials, with the majority as insoluble, macromolecular, and kerogen-like. This material has primarily been analyzed in bulk acid residues, and much information has been provided regarding functional groups and elemental and isotopic compositions. Studies of carbonaceous chondrites suggest a spatial relationship of some C-rich materials with products of aqueous alteration. Major questions remain regarding the form, composition, and location of the carbonaceous materials in primitive meteorites - issues that we address here.
Author

*Carbonaceous Chondrites; Sulfides; Meteorites; Kerogen; Chemical Composition*

**20040062230** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Organics on Fe-Silicate Grains: Potential Mimicry of Meteoritic Processes?**

Johnson, N. M.; Nuth, J. A., III; Cody, G. D.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Currently, it is unknown what exact process or combination of processes produced organics that are found in meteorites or are detected in comets and nebulas. One particular process that forms organics involves Fischer-Tropsch type (FTT) reactions. Fischer-Tropsch type reactions produce hydrocarbons by hydrogenating carbon monoxide via catalytic reactions. The overall reaction is shown. The products of these reactions have been studied using natural catalysts and calculations of the efficiency of FTT synthesis in the Solar Nebula suggest that these types of reactions could make significant contributions to the composition of material near three AU. We use FTT synthesis to coat amorphous Fesilicate grains with organic material to simulate the chemistry in the early Solar Nebula. We used lab-synthesized amorphous Fe-silicate grains for the catalyst because they might better simulate the starting materials found in protostellar nebulas. A brief description of the synthesis of these grains is given in Experiments. This work is different from previous studies because we focus here on the carbonaceous material deposited on the grains. In our experiments, we roughly simulate a model of the nebular environment where grains are successively transported from hot to cold regions of the nebula. In other words, the starting cold regions of the nebula. In other words, the starting gases and FTT products are continuously circulated through the grains at high temperature with intervals of cooling. Overall, organics generated in this manner could represent the carbonaceous material incorporated into comets and meteorites. We present the analyses of the organics produced using pyrolysis gas chromatography mass spectrometry (GCMS) and compare the results with those organics found in the Murchison meteorite.
Derived from text

*Silicates; Iron; Grains; Chemical Reactions; Meteoritic Composition*

**20040062231** Arizona State Univ., Tempe, AZ, USA

**Serpentine Nanotubes in CM Chondrites**

Zega, Thomas J.; Garvie, Laurence A. J.; Dodony, Istvan; Buseck, Peter R.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222
Contract(s)/Grant(s): NAG5-9352; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The CM chondrites are primitive meteorites that formed during the early solar system. Although they retain much of their original physical character, their matrices and fine-grained rims (FGRs) sustained aqueous alteration early in their histories [1-3]. Serpentine-group minerals are abundant products of such alteration, and information regarding their structures, compositions, and spatial relationships is important for determining the reactions that produced them and the conditions under which they formed. Our recent work on FGRs and matrices of the CM chondrites has revealed new information on the structures and compositions of serpentine-group minerals [4,5] and has provided insights into the evolution of these primitive meteorites. Here we report on serpentine nanotubes from the Mighei and Murchison CM chondrites [6].
Derived from text

*Chondrites; Meteorites; Minerals; Spatial Distribution*

**20040062232** NASA Johnson Space Center, Houston, TX, USA

**Evidence for Terrestrial Organic Contamination of the Tagish Lake Meteorite**

Wirick, S.; Flynn, G. J.; Keller, L. P.; Jacobsen, C.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Tagish Lake meteorite is a rare discovery in the meteorite world. Tentatively classified as an ungrouped type 2 carbonaceous chondrite, it is the first known CI2 meteorite [1, 2, 3]. Tagish Lake is the first meteorite to exhibit a reflectance spectrum showing the red color characteristic of the D- and P-type asteroids that populate the outer main-belt [2], although many interplanetary dust particles collected from the Earth s stratosphere exhibit a similar spectrum [4]. Several large pieces of the Tagish Lake meteorite were recovered on Jan. 18, 2000. We obtained two samples of the Tagish Lake meteorite, both collected on April 24, 2000, designated MG02 and MG03, from A. Hildebrand (Univ. of Calgary) and P. Brown (Univ. of Western Ontario). Smaller fragments collected in May 2000 were purchased from the The Meteorite Market (samples designated 'MM'). We have reported preliminary results from infrared and X-ray Absorption Near-edge Structure (XANES) spectroscopy on the MM samples [5]. We report evidence to suggest that there was terrestrial contamination of the meteorite, even in fragments in contact with the lake ice for only a few months .

Derived from text

*Meteorites; Contamination; Carbonaceous Chondrites; Asteroids; Infrared Absorption; Interplanetary Dust*

**20040062233** New Mexico Univ., Albuquerque, NM, USA

**Aqueous Alteration of Carbonaceous Chondrites: New Insights from Comparative Studies of Two Unbrecciated CM2 Chondrites, Y 791198 and ALH 81002**

Chizmadia, L. J.; Brearley, A. J.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222

Contract(s)/Grant(s): NAG5-13046; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Carbonaceous chondrites are an important resource for understanding the physical and chemical conditions in the early solar system. In particular, a long-standing question concerns the role of water in the cosmochemical evolution of carbonaceous chondrites. It is well established that extensive hydration of primary nebular phases occurred in the CM and CI chondrites, but the location where this alteration occurred remains controversial. In the CM2 chondrites, hydration formed secondary phases such as serpentine, tochilinite, pentlandite, carbonate and PCP. There are several textural observations which suggest that alteration occurred before the accretion of the final CM parent asteroid, i.e. preaccretionary alteration. Conversely, there is a significant body of evidence that supports parent-body alteration. In order to test these two competing hypotheses further, we studied two CM chondrites, Y-791198 and ALH81002, two meteorites that exhibit widely differing degrees of aqueous alteration. In addition, both meteorites have primary accretionary textures, i.e. experienced minimal asteroidal brecciation. Brecciation significantly complicates the task of unraveling alteration histories, mixing components that have been altered to different degrees from different locations on the same asteroidal parent body. Alteration in Y-791198 is mostly confined to chondrule mesostases, FeNi metal and fine-grained matrix and rims. In comparison, the primary chondrule silicates in ALH81002 have undergone extensive replacement by secondary hydrous phases. This study focuses on compositional and textural relationships between chondrule mesostasis and the associated rim materials. Our hypothesis is: both these components are highly susceptible to aqueous alteration and should be sensitive recorders of the alteration process. For parent body alteration, we expect systematic coupled mineralogical and compositional changes in rims and altered mesostasis, as elemental exchange between these components occurs. Conversely, for preaccretionary alteration, there should be no clear relationships between the rims and mesostases.

Author

*Carbonaceous Chondrites; Cosmochemistry; Water; Mineralogy; Meteoritic Composition*

**20040062234** Maryland Univ., College Park, MD, USA

**Terrestrial Alteration of CM Chondritic Carbonate**

Tyra, M. A.; Farquhar, J.; Wing, B. A.; Benedix, G. K.; Jull, A. J. T.; Thiemens, M. H.; Wing, B.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this study, carbonate was extracted from a set of paired Antarctic CM chondrites and delta (18)O, delta (17)O, delta (13)C, delta (14)C ratios measured. Oxygen isotopes were compared to Benedix et al., 2003's data collected for CM chondrite

falls to study the effects of terrestrial oxygen exchange. Carbon isotopes of the same sample set were examined at the University of Arizona's accelerated mass spectrometry (AMS) lab for insights how terrestrial carbon exchange corresponds to oxygen's trends. The meteorites we analyzed are: EET 96006, EET 96016, EET 96017, and EET 96019.
Author
*Chondrites; Meteoritic Composition; Carbonates; Isotope Ratios; Oxygen Isotopes; Carbon Isotopes*

**20040062235** New Mexico Univ., Albuquerque, NM, USA
**Chondrule Glass Alteration in Type IIA Chondrules in the CR2 Chondrites EET 87770 and EET 92105: Insights into Elemental Exchange Between Chondrules and Matrices**
Burger, Paul V.; Brearley, Adrian J.; Lunar and Planetary Science XXXV: Organics and Alteration in Carbonaceous Chondrites: Goop and Crud; 2004; 2 pp.; In English; See also 20040062222
Contract(s)/Grant(s): NAG5-11862; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

CR2 carbonaceous chondrites are a primitive group of meteorites that preserve evidence of a variety of processes that occurred in the solar nebula as well as on asteroidal parent bodies. CR2 chondrites are distinct from other carbonaceous chondrites by (among other properties) their relatively high abundance of chondrules (50-60 vol. %) and Fe,Ni metal (5-8 vol. %) [1]. Like the CM2 chondrites, the CRs have been affected by aqueous alteration and according to [2] show a range of degrees of alteration. In weakly- altered CR chondrites, fine-grained matrices and chondrule rims have been partially altered and chondrule mesostases show evidence of incipient aqueous alteration. In these meteorites, glassy mesostasis is still common. However, some CR chondrites, (e.g. Renazzo and Al Rais) show evidence of much more extensive alteration with complete replacement of chondrule mesostasis [2] by chlorite and serpentine. Although the general characteristics of alteration of the CR chondrites have been described, the details of alteration reactions in these meteorites remain unclear. In addition, the setting for aqueous alteration is poorly understood: both asteroidal and preaccretionary alteration scenarios have been proposed [2].
Derived from text
*Carbonaceous Chondrites; Asteroids; Meteorites; Meteoritic Composition; Serpentine*

**20040062236** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Special Session: Mars Climate Change**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062237 - 20040062249
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Mars Climate Change' contained the following reports:Geological Evidence for Climate Change on Mars; A New Astronomical Solution for the Long Term Evolution of the Insolation Quantities of Mars; Interpreting Martian Paleoclimate with a Mars General Circulation Model; History and Progress of GCM Simulations on Recent Mars Climate Change; Northern and Southern Permafrost Regions on Mars with High Content of Water Ice: Similarities and Differences; Periods of Active Permafrost Layer Formation in the Recent Geological History of Mars; Microclimate Zones in the Dry Valleys of Antarctica: Implications for Landscape; Evolution and Climate Change on Mars; Geomorphic Evidence for Martian Ground Ice and Climate Change; Explaining the Mid-Latitude Ice Deposits with a General Circulation Model; Tharsis Montes Cold-based Glaciers: Observations and Constraints for Modeling and Preliminary Results; Ice Sheet Modeling: Terrestrial Background and Application to Arsia Mons Lobate Deposit, Mars; Enhanced Water-Equivalent Hydrogen on the Western Flanks of the Tharsis Montes and Olympus Mons: Remnant Subsurface Ice or Hydrate Minerals?; and New Age Mars.
Derived from text
*Climate Change; Mars Atmosphere*

**20040062237** Arizona Univ., Tucson, AZ, USA
**New Age Mars**
McEwen, A. S.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Some of the most exciting results from MGS have come from images of terrains and deposits that are nearly devoid of small (10-100 m diameter) impact craters, interpreted as evidence for recent geologic activity and/or climate change. What

are the constraints on absolute ages of the deposits or timing of the modification processes? A key issue is whether impact craters smaller than a few hundred meters diameter are dominated by primary impacts or by the secondary impacts of larger primary craters. Many craters are obvious secondaries, closely associated with a primary crater and with distinctive morphologies, but there has been a longstanding controversy about the relative abundances of small primaries versus distant secondaries on the Moon [1]. McEwen et al. [2] have concluded that Martian impact craters smaller than at least ~250 m are most likely dominated by secondaries. I suggest here that the Hartmann and Neukum production functions [HNPF; ref. 3] predicts far too many small primary craters, thus changing the constraints on the ages of the youngest terrains.
Derived from text
*Climate Change; Mars Surface; Mars Craters; Terrain; Deposits*

**20040062238** Brown Univ., Providence, RI, USA
**Geological Evidence for Climate Change on Mars**
Head, J. W.; Mustard, J. F.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A wide variety of geological evidence indicates that the climate on Mars has changed during its past history. Evidence for these changes ranges in physical scale from layering in the polar caps and sediments, to meters-thick layers extending from high to mid-latitudes, to kilometers-thick polar and circumpolar deposits. The evidence is found throughout the geologic record of Mars, ranging from interpreted Amazonian tropical mountain glaciers to much longer term trends implied by the temporal distribution of geological features such as valley networks and outflow channels. Furthermore, there is strong evidence for changes in the hydrological cycle of Mars that reflects long-term climate change. For the last approx. 80% of Mars history, Mars appears to have been a very cold, hyper-arid polar desert. The hydrologic system has been horizontally layered with the hydrologic cycle consisting of a globally continuous cryosphere with liquid water occasionally emerging to the surface during magmatic events that cracked the cryosphere. Most of the surface water was tied up in the polar caps and in the regolith, and variations in orbital parameters caused significant surface redistribution of ice and dust. In the first 20% of Mars history, many believe that Mars was 'warm and wet', there was no global cryosphere, and that the hydrological cycle was vertically integrated.
Derived from text
*Climate Change; Mars Environment; Planetary Geology; Tropical Regions*

**20040062239** NASA, Washington, DC, USA
**Northern and Southern Permafrost Regions on Mars with High Content of Water Ice: Similarities and Differences**
Mitrofanov, I. G.; Litvak, M. L.; Kozyrev, A. S.; Sanin, A. B.; Tretyakov, V. I.; Kuzmin, R. O.; Boynton, W. V.; Hamara, D. K.; Shinohara, C.; Saunders, R. S.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The measurements by neutron detectors on Odyssey have revealed two large poleward regions with large depression of flux of epithermal and high energy neutrons [1-3]. The flux of neutrons from Mars is known to be produced by the bombardment of the surface layer by galactic cosmic rays. The leakage flux of epithermal and fast neutrons has regional variation by a factor of 10 over the surface of Mars (e.g. see [3- 5]). These variations are mainly produced by variations of hydrogen content in the shallow subsurface. On Mars hydrogen is associated with water. Therefore, the Northern and Southern depressions of neutron emission could be identified as permafrost regions with very high content of water ice [1-5]. These regions are much larger than the residual polar caps, and could contain the major fraction of subsurface water ice. Here we present the results of HEND neutron data deconvolution for these regions and describe the similarities and differences between them.
Derived from text
*Neutron Emission; Mars Surface; Permafrost; Ice; Fast Neutrons*

**20040062240** Brown Univ., Providence, RI, USA
**Tharsis Montes Cold-based Glaciers: Observations and Constraints for Modeling and Preliminary Results**
Shean, D. E.; Head, J. W.; Fastook, J. L.; Marchant, D. R.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Each of the Tharsis Montes volcanoes on Mars has an unusual fan-shaped deposit on the NW flank and adjacent plains. These deposits appear to be the depositional remains of massive cold-based glaciers that were present at each of the shields in relatively recent martian history . These glaciers would have formed during periods of high obliquity (>45 ), when precipitation of water ice is predicted to occur in the equatorial regions . Reconstruction of these glaciers provides estimates for ice thicknesses and volumes, which will help delineate the thermal character of the ice (cold-based vs wetbased . More importantly, these estimates can be compared to current polar cap volume, providing information about the amount of material removed from volatile reservoirs and the global distribution of volatiles during the time when the glaciers were present.
Author
*Mars Surface; Mars Volcanoes*

**20040062248** Maine Univ., Orono, ME, USA
**Ice Sheet Modeling: Terrestrial Background and Application to Arsia Mons Lobate Deposit, Mars**
Fastook, J. L.; Head, J. W.; Marchant, D.; Shean, D.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062236; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Scientific glaciology began when researchers recognized that certain landforms had been produced by large sheets of moving ice that covered wide expanses of the landscape. Obviously, these moving ice mountains could only have existed if the world were colder. Had they come and gone repeatedly in the past, and if so, how many times? Is it possible that the ice age state of the world is actually its normal state? Would the glaciers come again, and when? All of these questions are as relevant to the planet Mars as they are to the planet Earth.
Author
*Ice; Models; Topography; Mars Volcanoes; Glaciology; Deposits*

**20040062250** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Special Session: Mars Climate Change**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062251 - 20040062263
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Mars Climate Change' included the following topics:Geological Evidence for Climate Change on Mars; A New Astronomical Solution for the Long Term Evolution of the Insolation Quantities of Mars; Interpreting Martian Paleoclimate with a Mars General Circulation Model; History and Progress of GCM Simulations on Recent Mars Climate Change; Northern and Southern Permafrost Regions on Mars with High Content of Water Ice: Similarities and Differences; Periods of Active Permafrost Layer Formation in the Recent Geological History of Mars; Microclimate Zones in the Dry Valleys of Antarctica: Implications for Landscape Evolution and Climate Change on Mars; Geomorphic Evidence for Martian Ground Ice and Climate Change; Explaining the Mid-Latitude Ice Deposits with a General Circulation Model; Tharsis Montes Cold-based Glaciers: Observations and Constraints for Modeling and Preliminary Results; Ice Sheet Modeling: Terrestrial Background and Application to Arsia Mons Lobate Deposit, Mars; Enhanced Water-Equivalent Hydrogen on the Western Flanks of the Tharsis Montes and Olympus Mons: Remnant Subsurface Ice or Hydrate Minerals?; and New Age Mars.
Derived from text
*Mars Atmosphere; Mars Surface; Climate Change*

**20040062251** NASA Johnson Space Center, Houston, TX, USA
**Geomorphic Evidence for Martian Ground Ice and Climate Change**
Kanner, L. C.; Allen, C. C.; Bell, M. S.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent results from gamma-ray and neutron spectrometers on Mars Odyssey indicate the presence of a hydrogen-rich layer tens of centimeters thick in the uppermost meter in high latitudes (greater than 60) on Mars. This hydrogen-rich layer correlates to regions of ice stability. Thus, the subsurface hydrogen is thought to be water ice constituting 35 plus or minus 15% by weight near the north and south polar regions. We refine the location of subsurface ice deposits at a less than km scale by combining existing spectroscopy data with surface features indicative of subsurface ice. A positive correlation between spectroscopy data and geomorphic ice indicators has been previously suggested for high latitudes. Here we expand the

comparative study to northern mid latitudes (30 degrees N- 65 degrees N).
Derived from text
*Climate Change; Geomorphology; Ice; Mars Surface; Planetary Geology*

**20040062252** NASA Ames Research Center, Moffett Field, CA, USA
**Explaining the Mid-Latitude Ice Deposits with a General Circulation Model**
Mischna, M. A.; Richardson, M. I.; Wilson, R. J.; Zent, A.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have examined the influence of a regolith on the water cycle with a focus on high obliquity periods on Mars. Our findings show that while the regolith will almost certainly interact with the atmosphere initially, it is only a transient effect, and ice will form on the surface once the regolith is effectively isolated from the atmosphere. These low latitude deposits could conceivably be ice deposits formed at high obliquity and are certainly presently out of thermal equilibrium, but remain due to the insulating effect of a dust lag.
Derived from text
*Atmospheric General Circulation Models; Mineral Deposits; Ice; Temperate Regions; Regolith; Planetary Geology; Mars Surface*

**20040062253** Arizona Univ., Tucson, AZ, USA
**New Age Mars**
McEwen, A.S.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Some of the most exciting results from MGS have come from images of terrains and deposits that are nearly devoid of small (10-100 m diameter) impact craters, interpreted as evidence for recent geologic activity and/or climate change. What are the constraints on absolute ages of the deposits or timing of the modification processes? A key issue is whether impact craters smaller than a few hundred meters diameter are dominated by primary impacts or by the secondary impacts of larger primary craters. Many craters are obvious secondaries, closely associated with a primary crater and with distinctive morphologies, but there has been a longstanding controversy about the relative abundances of small primaries versus distant secondaries on the Moon. McEwen et al. have concluded that Martian impact craters smaller than at least approx. 250 m are most likely dominated by secondaries. I suggest here that the Hartmann and Neukum production functions (HNPF) predicts far too many small primary craters, thus changing the constraints on the ages of the youngest terrains.
Author
*Mars Craters; Meteorites; Climate Change; Morphology*

**20040062257** Centre National de la Recherche Scientifique, Paris, France
**A New Astronomical Solution for the Long Term Evolution of the Insolation Quantities of Mars**
Laskar, J.; Gastineau, M.; Joutel, F.; Levrard, B.; Robutel, P.; Correia, A.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As the obliquity of Mars is strongly chaotic, it is not possible to give a solution for its evolution overmore than a few million of years. Using the most recent data for the rotational state of Mars, and a new numerical integration of the Solar System, we provide here a precise solution for the evolution of Mars spin over 10 to 20 Myr. Over 250 Myr, we present a statistical study of its possible evolution, when considering the uncertainties in the present rotational state. Over much longer time span, reaching 5 Gyr, the chaotic diffusion prevails, and we have performed an extensive statistical analysis of the orbital and rotational evolution of Mars, relying on Laskar s secular solution of the Solar System, based on more than 600 orbital and 200 000 obliquity solutions over 5 Gyr. The density function of the eccentricity and obliquity are explicited with simple analytical formulas. We found an averaged eccentricity of Mars over 5 Gyr of e-bar = 0.0690 with standard deviation sigma(sub e) = 0.0299, while the averaged value of the obliquity is epsilon = 37.62 with a standard deviation of sigma(sub epsilon) = 13.82 deg, and a maximal value of 82.035 deg. We find that the probability for Mars obliquity to have reached more than 60 deg. in the past 1 Gyr is 63.0%, and 89.3% in 3 Gyr. Over 4 Gyr, the position of Mars axis is given by a uniform distribution on a spherical cap limited by the obliquity epsilom(sub tilde-m) = 58.62 deg, with the addition of a random noise allowing a slow diffusion beyond epselon(sub tilde-m). We can also define a standard model of Mars insolation parameters

over 4 Gyr with the most probable values for the eccentricity e(sub s) = 0.067 and epsilon(sub s) = 45.60 deg.for the obliquity. Author

*Astronomy; Evolution (Development); Statistical Analysis; Standard Deviation; Rotational States; Numerical Integration; Mars (Planet)*

**20040062259** Brown Univ., Providence, RI, USA

**Periods of Active Permafrost Layer Formation in the Recent Geological History of Mars**

Kreslavsky, M. A.; Head, J. W.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Estimation of the summer day average surface temperature on inclined surfaces on Mars has been done with a global climate model (GCM) for different obliquities. These calculations showed that starting from approximately 35 obliquity, the maximal day-average temperature reaches the ice melting point at high latitudes; for even higher obliquity, the day-average temperature exceeds 0 C at lower latitudes, up to 40 latitude at 45 obliquity, but only at 20-30 - steep pole-facing slopes. This fact was used to explain formation of the recent gullies as debris flows formed at the periods of high obliquity, when melting of snow and a permafrost layer could occur. High dayaverage temperatures suggest that summer thawing/winter freezing cycle can occur on Mars during some periods of geological history, which could lead to the existence of an active layer and formation of a number of geomorphological features characteristic of terrestrial permafrost regions. black curves, N-facing slopes, gray curves, S-facing slopes. We have found a strong latitudinal trend of occurrence of steep slopes on Mars. The frequency of steep (greater than 20) slopes drops more than 3 orders of magnitude from equatorial to high-latitude regions. The boundary between preserved and removed steep slopes occurs at higher latitudes for pole-facing slopes and at lower latitudes for equator-facing slopes. This produces a strong asymmetry of steep slopes in the midlatitude zone around 45 latitude in both hemispheres. We explained these observations with active-layer-assisted erosion at high latitudes and at polefacing slopes at midlatitudes. This relatively intensive erosion acted during geologically short repeating periods of high obliquity during the Amazonian. Here we analyze the calculated history of spin/orbital parameters of Mars to identify the most recent periods in the geologic history of Mars when active layer could occur.

Derived from text

*Mars Surface; Permafrost; Structural Properties (Geology); Planetary Geology; Geochronology; Climatology*

**20040062260** Boston Univ., Boston, MA, USA

**Microclimate Zones 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 XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; 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 Earth's polar deserts make for compelling comparisons to a dry and cold Mars. Among polar deserts on Earth, the Dry Valleys region of Antarctica has long been featured as the most Mars-like. Classified broadly as a cold and hyper-arid region, the valleys feature a diverse suite of surface landforms that provide a geomophological framework for interpreting features on Mars. New climate and geomorphological data from the Dry Valleys show that the region is best subdivided into a series of narrow climatological zones. Each microclimate zone differs from the next by slight variations in atmospheric temperature and soil-moisture. Along microclimate boundaries, subtle variations in temperature and soil-moisture are sufficient to produce remarkable variations in surface topography. As is the case for most polar deserts, the geomorphic impact of minor variations in moisture and temperature is disproportionately large when compared to similar shifts in atmospheric temperature and soil moisture in humid-temperate latitudes. Insight gained from the distribution and temporal migration of microclimate zones in the Dry Valleys may help shed light on the origin and, in particular, the evolution of periglacial features and climate change on Mars. Three microclimate zones are presented and distinguished on the basis of varying temperature and soil-moisture content.

Derived from text

*Antarctic Regions; Climate Change; Landforms; Mars Surface; Microclimatology; Valleys; Geomorphology; Planetary Evolution*

**20040062261** Brown Univ., Providence, RI, USA

**Tharsis Montes Cold-based Glaciers: Observations and Constraints for Modeling and Preliminary Results**

Shean, D. E.; Head, J. W.; Fastook, J. L.; Marchant, D. R.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Each of the Tharsis Montes volcanoes on Mars has an unusual fan-shaped deposit on the NW flank and adjacent plains. These deposits appear to be the depositional remains of massive cold-based glaciers that were present at each of the shields in relatively recent martian history. These glaciers would have formed during periods of high obliquity (greater than 45 degrees), when precipitation of water ice is predicted to occur in the equatorial regions. Reconstruction of these glaciers provides estimates for ice thicknesses and volumes, which will help delineate the thermal character of the ice (cold-based vs wetbased). More importantly, these estimates can be compared to current polar cap volume, providing information about the amount of material removed from volatile reservoirs and the global distribution of volatiles during the time when the glaciers were present.

Derived from text

*Glaciers; Mars Volcanoes; Planetary Geology; Topography; Mathematical Models; Low Temperature*

**20040062262** Maine Univ., Orono, ME, USA

**Ice Sheet Modeling: Terrestrial Background and Application to Arsia Mons Lobate Deposit, Mars**

Fastook, J. L.; Head, J. W.; Marchant, D.; Shean, D.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Scientific glaciology began when researchers recognized that certain landforms had been produced by large sheets of moving ice that covered wide expanses of the landscape. Obviously, these moving ice mountains could only have existed if the world were colder. Had they come and gone repeatedly in the past, and if so, how many times? Is it possible that the ice age state of the world is actually its normal state? Would the glaciers come again, and when? All of these questions are as relevant to the planet Mars as they are to the planet Earth. The answer to these questions are summarized in this paper.

Derived from text

*Glaciology; Ice; Mars Volcanoes; Mars Surface; Mathematical Models; Topography*

**20040062263** Los Alamos National Lab., NM, USA

**Enhanced Water-Equivalent Hydrogen on the Western Flanks of the Tharsis Montes and Olympus Mons: Remnant Subsurface Ice or Hydrate Minerals?**

Elphic, R. C.; Feldman, W. C.; Prettyman, T. H.; Tokar, R. L.; Lanza, N.; Lawrence, D. J.; Head, J. W., III; Mischna, M. A.; Richardson, M. I.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062250; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Odyssey gamma ray and neutron spectrometer (NS) observations have revealed surprisingly high water-equivalent hydrogen abundances at the equatorial and mid-latitudes of Mars. Studies indicate that at these latitudes water ice should not be stable at the depths to which the spectrometers are sensitive (less than 1 m). Consequently these water enhancements are a puzzle: do they represent stable, hydrated minerals or regions where special soil and stratigraphic conditions permit remnant shallow water ice deposits? Here we focus on the water enhancements on the west slopes of the Tharsis Montes, Olympus Mons and Alba Patera, where landforms to the west and northwest suggest the possible presence of cold-based mountain glaciers. We investigate the possibility that significant snow/ice deposits could have formed in these locations during periods of high obliquity within the last 500 kyr, and that present day remnant water may be locked up in stable hydrate minerals or (less likely) shallowly buried ice in glacial and periglacial landforms.

Derived from text

*Hydrates; Hydrogen; Mars Surface; Mars Volcanoes; Minerals; Water; Slopes*

**20040062264** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062265 - 20040062277

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Terrestrial Planets: Building Blocks and Differentiation: included the following topics:Magnesium Isotopes in the Earth, Moon, Mars, and Pallasite Parent Body: High-Precision Analysis of Olivine by Laser-Ablation Multi-Collector ICPMS; Meteoritic Constraints on Collision Rates in the Primordial Asteroid Belt and Its Origin; New Constraints on the Origin of the Highly Siderophile Elements in the Earth's Upper Mantle; Further Lu-Hf and Sm-Nd Isotopic Data on Planetary Materials and Consequences for Planetary Differentiation; A Deep Lunar Magma Ocean Based on Neodymium, Strontium and Hafnium Isotope Mass Balance Partial Resetting on Hf-W System by Giant Impacts; On the Problem of Metal-Silicate Equilibration During Planet Formation: Significance for Hf-W Chronometry ; Solid Metal-Liquid Metal Partitioning of Pt, Re, and Os: The Effect of Carbon; Siderophile Element Abundances in Fe-S-Ni-O Melts Segregated from Partially Molten Ordinary Chondrite Under Dynamic Conditions; Activity Coefficients of Silicon in Iron-Nickel Alloys: Experimental Determination and Relevance for Planetary Differentiation; Reinvestigation of the Ni and Co Metal-Silicate Partitioning; Metal/Silicate Paritioning of P, Ga, and W at High Pressures and Temperatures: Dependence on Silicate Melt Composition; and Closure of the Fe-S-Si Liquid Miscibility Gap at High Pressure and Its Implications for Planetary Core Formation.
Derived from text
*Planetary Composition; Chondrites; Planetary Evolution*

**20040062265** NASA Johnson Space Center, Houston, TX, USA
**Magnesium Isotopes in the Earth, Moon, Mars, and Pallasite Parent Body: High-Precision Analysis of Olivine by Laser-Ablation Multi-Collector ICPMS**
Norman, M.; McCulloch, M.; ONeill, H.; Brandon, A.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Magnesium isotopes potentially offer new insights into a diverse range of processes including evaporation and condensation in the solar nebula, melting and metasomatism in planetary interiors, and hydrothermal alteration [1,2,3,4]. Volatility-related Mg isotopic variations of up to 10 per mil/amu relative to a terrestrial standard have been found in early nebular phases interpreted as evaporation residues [1], and relatively large variations (up to 3 per mil/amu) in the terrestrial mantle have been reported recently [4]. In order to investigate possible differences in the nebular history of material contributing to the terrestrial planets, and to search for evidence of a high-temperature origin of the Moon, we have measured the magnesium isotopic composition of primitive olivines from the Earth, Moon, Mars, and pallasite parent body using laser-ablation multicollector ICPMS.
Derived from text
*Magnesium Isotopes; Inductively Coupled Plasma Mass Spectrometry; Olivine; Laser Ablation; Metamorphism (Geology); Stony-Iron Meteorites*

**20040062266** Arizona Univ., Tucson, AZ, USA
**Metal/Silicate Partitioning of P, Ga, and W at High Pressures and Temperatures: Dependence on Silicate Melt Composition**
Bailey, Edward; Drake, Michael J.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264
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 distinctive pattern of element concentrations in the upper mantle provides essential evidence in our attempts to understand the accretion and differentiation of the Earth (e.g., Drake and Righter, 2002; Jones and Drake, 1986; Righter et al., 1997; Wanke 1981). Core formation is best investigated through use of metal/silicate partition coefficients for siderophile elements. The variables influencing partition coefficients are temperature, pressure, the major element compositions of the silicate and metal phases, and oxygen fugacity. Examples of studies investigating the effects of these variables on partitioning behavior are: composition of the metal phase by Capobianco et al. (1999) and Righter et al. (1997); silicate melt composition by Watson (1976), Walter and Thibault (1995), Hillgren et al. (1996), Jana and Walker (1997), and Jaeger and Drake (2000); and oxygen fugacity by Capobianco et al. (1999), and Walter and Thibault (1995). Here we address the relative influences of silicate melt composition, pressure and temperature.
Derived from text
*High Pressure; Melts (Crystal Growth); Silicates; Chemical Composition; Temperature Dependence; Gallium; Tungsten; Phosphorus*

**20040062267** Hawaii Univ., Honolulu, HI, USA

**Meteoritic Constraints on Collision Rates in the Primordial Asteroid Belt and Its Origin**

Scott, Edward R. D.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Two widely held scenarios for the formation of the asteroid belt appear to be totally incompatible. 1) Limited cooling rate data for meteorites and other petrographic constraints suggest that the original parent bodies of chondrites and differentiated meteorites were approx.50-250 km in radius, no larger than current asteroids. Several are thought to have cooled peacefully after they accreted without being disrupted by impacts [e.g., 1]. Asteroid family statistics and Vesta s intact crust suggest that the mass of main-belt asteroids was no more than 5x its current mass when 'the present collisionally erosive environment was established' [2]. 2) By contrast, the standard model for planetary accretion leads naturally to a scenario in which a hundred or more Mars- and Moon-sized bodies formed in the asteroid belt and were extracted in <100 Myr through mutual gravitational perturbations, close encounters and planetary resonances [3-5]. This scenario implies that the asteroids are trivial remnants from a vast population of asteroidal and planetary bodies, which survived an early violent epoch.

Derived from text

*Asteroid Belts; Collision Rates; Meteorite Collisions; Meteorites; Asteroids; Petrography*

**20040062269** Ecole Normale Superieure, Lyon, France

**Further Lu-Hf and Sm-Nd Isotopic Data on Planetary Materials and Consequences for Planetary Differentiation**

Blichert-Toft, J.; Boyet, M.; Albarede, F.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The coupled Lu-Hf and Sm-Nd isotope systematics on lunar basalts (Unruh et al., 1984 ; Beard et al., 1998), SNC meteorites (Blichert-Toft et al., 1999), and eucrites (Blichert-Toft et al., 2002) provide unique constraints on mineral segregation in the early magma oceans of various planets. The respective roles of the early crystallizing minerals olivine and clinopyroxene and the pressure-, and therefore gravity-dependent minerals plagioclase and garnet together with the fingerprinting of ilmenite crystallization, which requires extreme degrees of fractionation to reach saturation, are illuminated by the isotope geochemistry of Hf and Nd in planetary magmatic rocks. Here we present new 176Lu-176Hf and 147Sm-143Nd data on KREEP basalts, SNC meteorites, including two nakhlites and an orthopyroxenite, eucrites, and angrites.

Derived from text

*Planetary Composition; Meteoritic Composition; Gravitational Effects; Meteorites; Isotopes; Mineralogy; Crystallization; Olivine*

**20040062270** Harvard Univ., Cambridge, MA, USA

**A Deep Lunar Magma Ocean Based on Neodymium, Strontium and Hafnium Isotope Mass Balance**

Ranen, M. C.; Jacobsen, S. B.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The size of the lunar magma ocean has major implications for the method and duration of lunar formation as well as for the thermal history and evolution of the lunar interior. However, the depth of the initial Lunar magma ocean has remained controversial. Estimates based on Al mass balance range from 250-500 km. A seismic discontinuity at approximately 500 km has been inferred to separate the upper and lower lunar mantles. Here we estimate the size of the magma ocean by using an improved mass balance based on the long-lived chronometers (Sm-Nd, Rb-Sr, Lu-Hf). Our results have significant implications for the interpretation of extinct nuclide data (Hf-182-W-182 and Sm-146-Nd-142) and therefore for the age of the Moon as well as the duration of magma ocean crystallization.

Derived from text

*Hafnium Isotopes; Magma; Neodymium Isotopes; Strontium Isotopes; Mass Distribution; Geochronology; Lunar Surface; Reservoirs*

**20040062272** Harvard Univ., Cambridge, MA, USA

**On the Problem of Metal-Silicate Equilibration During Planet Formation: Significance for Hf-W Chronometry**

Jacobsen, S. B.; Yin, Q.-Z.; Petaev, M. I.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The metallic cores of the terrestrial planets formed by physical separation of metal from silicate during the process of accretion. The chemical composition of the Earth s mantle provides strong evidence that the separation of the metal occurred in a magma ocean. It is also thought that the rate of core growth was limited by the rate of accretion over most of the Earth's accretion interval. The Hf-182-W-182 chronometer is uniquely suited to determine the timescale of this process. Our Hf-W results show that the main phase of core formation happened within 10 Ma of the origin of the solar system and that accretion must have been terminated by about 30 Ma. Recently it has been suggested that inconsistency with results from other systems (U-Pb, I-Pu-Xe, Rb-Sr) requires a disequilibrium process for Hf-W that does not affect U-Pb. Here we show that the constraints from other systems are entirely consistent with the new Hf-W age of the Earth and no revision of the interpretation is necessary.
Derived from text
*Chronometers; Silicates; Terrestrial Planets; Hafnium; Tungsten; Earth Mantle; Equilibrium; Geochronology; Planetary Evolution*

**20040062273** Vermont Univ., Burlington, VT, USA
**Siderophile Element Abundances in Fe-S-Ni-O Melts Segregated from Partially Molten Ordinary Chondrite Under Dynamic Conditions**
Rushmer, T.; Humayun, M.; Campbell, A. J.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Early differentiation in evolving planetesimals likely involved a variety of different physical mechanisms. Fe-rich metallic liquid segregation can occur in a solid, partially molten, or purely molten silicate body, with or without the presence of deformation. Deformation may assist the segregation of low degree metallic melts. Segregation of Fe-S-Ni liquids formed by variable degrees of partial melting of chondrites imparts distinct geochemical signatures on the composition of the resulting metal. These chemical signatures vary according to initial parent body composition, segregation mechanisms and the degree to which early S-rich, and possibly O-rich, core-forming liquids were extracted. In addition, the presence of deformation may enhance both kinetics and efficiency of the physical segregation process. To explore the relationship between core formation scenarios and geochemistry, the siderophile element compositions of metals formed during deformation experiments on the Kernouv H6 ordinary chondrite were determined by laser ablation ICP-MS. We present results on siderophile concentrations in Fe-S-Ni-O quench and associated Fe-Ni metal dynamically segregated at different degrees of partial melting, and determine partition coefficients for different solid metal/liquid metal compositions as a function of temperature, strain rate and amount of silicate melt present. Further, the IIE irons are related to H chondrites by their oxygen isotope composition, and were argued to have formed by solidification of melts on the H chondrite parent body. We apply our data to evaluate this hypothesis.
Derived from text
*Abundance; Chondrites; Melts (Crystal Growth); Siderophile Elements; Iron; Nickel; Sulfur; Oxygen*

**20040062275** Cologne Univ., Germany
**Reinvestigation of the Ni and Co Metal-Silicate Partitioning**
Holzheid, A.; Rubie, D. C.; Frost, D.; Kegler, Ph.; Palme, H.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The earth and the other terrestrial planets as well as differentiated asteroids contain an Fe-rich metallic core that segregated from mantle silicate shortly after or during accretion. One consequence of the formation of a metal core is that siderophile elements (e.g, Fe, Ni, Co, Ge, PGEs) are strongly partitioned into the core and are therefore depleted in the mantle. The extent of depletion contains information on details of the core forming process. The partitioning of an element (el) between metal and silicate can be described by exchange metalsilicate partition coefficients, K(sub D) (sup el-Fe) is defined.
Derived from text
*Silicates; Nickel; Cobalt; Metals; Planetary Geology; Siderophile Elements*

**20040062276** Carnegie Institution of Washington, Washington, DC, USA
**Closure of the Fe-S-Si Liquid Miscibility Gap at High Pressure and Its Implications for Planetary Core Formation**
Sanloup, C.; Fei, Y.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the early Earth or Mars, S was accreted mostly as iron sulfides, either from interplanetary dust, chondrites or small planetary bodies. The first melt to percolate through the surrounding silicates during planet differentiation was a Fe-S melt because of the low eutectic melting temperature of the Fe-FeS system. Si could not dissolve into the iron sulfide melt because the Fe-S-Si system presents an extensive liquid immiscibility field at ambient pressure. The simultaneous presence of S and Si in planetary cores was therefore rejected on the basis of such melting behavior in the system. The purpose of this study is to examine whether or not the miscibility gap persists in the Fe-S-Si liquid system at high pressure. We report melting experiments in the Fe-S-Si system conducted in a multi-anvil apparatus at pressures between 10 and 27 GPa and temperatures up to 2343 K. The experiments document the change of melting relations in the system with increasing pressure. The results have important implications for the differentiation processes of the planets and the composition of their cores.
Author
*Miscibility Gap; High Pressure; Planetary Cores*

**20040062277** Cologne Univ., Germany
**Activity Coefficients of Silicon in Iron-Nickel Alloys: Experimental Determination and Relevance for Planetary Differentiation**
Vogel, I. A.; Palme, H.; Lunar and Planetary Science XXXV: Terrestrial Planets: Building Blocks and Differentiation; 2004; 2 pp.; In English; See also 20040062264; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Metal segregation and subsequent formation of an FeNi core is the major differentiation process in large planets such as the earth, but metal separation and aggregation will also occur in smaller planetesimals such as asteroids. Core formation implies partial or full equilibration of core forming FeNi with liquid silicates, implying partial or complete redistribution of siderophile elements between metal and silicates. This also occurs for the major components of molten silicates such as SiO2 which will be partly reduced and partition into core forming metal. Most groups of iron meteorites are thought to be derived from metal cores or metal aggregations that formed during melting of planetesimals. The Si content of iron meteorites should thus record the conditions that prevailed during metal-silicate equilibration. The quantification of this process requires a better understanding of the partitioning of Si between metal and silicate which depends on temperature, oxygen fugacity, silicate composition and nickel content of the alloy. One additional parameter that is not well known is the activity coefficient of Si in FeNi-alloys. Literature data only exist for very high Si concentrations, much larger than expected for iron meteorites. We therefore performed experiments at lower Si concentrations and at various temperatures and alloy compositions to determine the activity coefficients of silicon in iron-nickel alloys.
Author
*Silicon; Iron Alloys; Nickel Alloys*

**20040062278** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062279 - 20040062291
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy' contained the following reports:The Dielectric Properties of Martian Soil Simulant JSC Mars-1 in the Range from 20Hz to 10kHz; Eastern Sahara Geology from Orbital Radar: Potential Analog to Mars On the Dielectric Properties of the Martian-like Surface Sediments; Radar Observations of Recent Mars Landing Sites; Sounding of Subsurface Water Through Conductive Media in Mars Analog Environments Using Transient Electromagnetics and Low Frequency Ground-penetrating Radar; Burial Depth of the Reservoirs of Hydrogen at the Equatorial Latitudes on Mars; Elemental Composition Variations for Large Dusty and Rocky Regions on Mars Using Gamma-Ray Data from the Mars Odyssey Gamma-Ray Spectrometer; The Distribution of Non-Volatile Elements on Mars: Mars Odyssey GRS Results; Using Mars Odyssey GRS Data to Assess Models for the Bulk Composition of Mars; Mars: The Terra Arabia Low Epithermal Neutron Flux Anomaly; The Isidis Basin of Mars: New Results from MOLA, MOC, and THEMIS; Remote Sensing of the Haughton Impact Structure (HIS): A Terrestrial Proof of Concept for Using the Remote Sensing of Martian Craters as a Probe of Subsurface Composition;and Thermal Emission Spectra of Impact Glass and Shocked Deccan Basalt from Lonar Crater, India and Implications for Remote Sensing of Mars.
Derived from text
*Mars Craters; Mars Surface; Mineralogy*

**20040062279** Centre d'Etude Spatiale des Rayonnements, Toulouse, France

**Burial Depth of the Reservoirs of Hydrogen at the Equatorial Latitudes on Mars**

Maurice, S.; Gasnault, O.; Feldman, W. C.; Prettyman, T. H.; Elphic, R. C.; Lawrence, D. J.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

At Mars, significant deposits of hydrogen have recently been observed by the GRS suite of instruments aboard Mars Odyssey [1,2,3]. Two energy ranges of neutron data are indeed very sensitive to hydrogen: epithermal (0.4 keV 0.7 MeV) and fast 0.7 MeV 10 MeV). This work will demonstrate that the comparison of these two energy ranges can be used to derive the burial depth of hydrogen at mid-latitudes. Assuming a simple stratigraphy of the Martian regolith, we calculate this burial depth and we show it is well correlated with topography.

Author

*Reservoirs; Mars Surface; Equatorial Regions; Stratigraphy; Regolith*

**20040062280** Hawaii Univ., Honolulu, HI, USA

**Using Mars Odyssey GRS Data to Assess Models for the Bulk Composition of Mars**

Taylor, G. Jeffrey; Boynton, W.; Waenke, H.; Dreibus, G.; Brueckner, J.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Planetary bulk compositions provide crucial evidence for testing models of planetary accretion and differentiation. Major questions can be addressed by comparing the bulk compositions of the terrestrial planets. As the outer most terrestrial planet, Mars plays a central role in answering these questions. Models of the Martian bulk composition have been made on the basis of the compositions of Martian meteorites. These have been supplemented by additional data from Mars Pathfinder. The Gamma-Ray Spectrometer (GRS) onboard Mars Odyssey has now obtained a global dataset for several elements, including elements useful for determining the bulk chemical composition of Mars. We focus on K, Th, and especially the K/Th ratio to assess the abundances of moderately volatile elements, and on the bulk FeO content. These allow us to assess models of the volatile inventory on Mars compared to Earth, Moon, and Vesta and the amount of oxidation of metallic iron.

Author

*Gamma Ray Spectrometers; 2001 Mars Odyssey; Chemical Composition; Mars Exploration; Iron Oxides; Geophysical Fluids*

**20040062281** NASA, Washington, DC, USA

**Mars: The Terra Arabia Low Epithermal Neutron Flux Anomaly**

Basilevsky, A. T.; Rodin, A. V.; Kozyrev, A. S.; Mitrofanov, I. G.; Neukum, G.; Werner, S. C.; Head, J. W.; Boynton, W.; Saunders, R. S.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The High Energy Neutron Spectrometer (HEND) and Neutron Specrometer, part of the Mars Odyssey Gamma Ray Spectrometer suite of instruments, measured anomalously low epithermal neutron flux in two low-latitude areas, Terra Arabia and SW of Olympus Mons (SWOM). The low epithermal neutron flux, an indirect measure of Hydrogen abundance, is indicative of relatively high water content (in this case up to 8 mass percent) in the upper 1-2 m of the surface layer. The epithermal flux within the 60 degree latitude zone does not correlate with bedrock geology or topography but partially correlates (for Arabia) with thermal inertia. According to theoretical estimates for the current geologic epoch, ground ice should not be stable at this depth at these low latitudes so it was concluded that the anomalies are due to the presence of chemically bound water (e.g. clays, hydroxides or hydrosalts). Fast neutron flux, which is indicative of the presence of water at 20-30 cm depth, does not correlate in this latitude zone with the epithermal neutron flux. As a further step of the analysis a geotraverse including study of 152 high resolution MOC images within the Arabia anomaly was done by to find out if the area inside the anomaly differs from the neighboring areas by the presence of fluvial channels and layered deposits (possible links to chemically bound water) or in thickness and apparent texture of the surface layer. No differences were found.

Author

*Flux (Rate); Gamma Ray Spectrometers; 2001 Mars Odyssey; Planetary Geology; Anomalies; Tropical Regions; Topography; Neutrons*

**20040062282** Arizona State Univ., Tempe, AZ, USA

**Thermal Emission Spectra of Impact Glass and Shocked Deccan Basalt from Lonar Crater, India and Implications for Remote Sensing of Mars**

Wright, S. P.; Johnson, J. R.; Christensen, P. R.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It has been shown that impact shock alters specific absorptions of the thermal infrared (TIR) spectra of plagioclase feldspars and, to a lesser extent, orthopyroxene. This is due to the depolymerization of the silica tetrahedra with increasing pressure. In those studies, igneous lithologies were experimentally shocked to various degrees and the implications for the deconvolution and interpretation of TIR data from Mars were noted. In this study, laboratory sample emission spectra of localized Deccan basalts and impact glasses are analyzed in preparation for field work, sample collection, and further analyses at their source region - Lonar Crater, India. Thermal emission spectra of Lonar samples may prove useful to the interpretation of TIR data from instruments on the surface of or orbiting Mars.

Author

*Meteorite Craters; Impact Melts; Planetary Geology; Glass; Basalt*

**20040062283** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands

**The Dielectric Properties of Martian Soil Simulant JSC Mars-1 in the Frequency Range from 20 Hz to 10 kHz**

Simoes, F.; Trautner, R.; Grard, R.; Hamelin, M.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The concentration of water in the Martian regolith is an important parameter in many scientific domains. Water possesses an electrical signature that allows the identification of its presence among other materials, even in low quantities. A laboratory facility has been setup to measure the complex permittivity of soil mixtures as a function of porosity, humidity, and temperature in the frequency range 20 Hz - 10 kHz. The influence of porosity and temperature are discussed, and a measurable gravimetric water content threshold is evaluated.

Author

*Planetary Geology; Soils; Simulation; Permittivity; Mars (Planet); Mars Surface*

**20040062284** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Eastern Sahara Geology from Orbital Radar: Potential Analog to Mars**

Farr, T. G.; Paillou, P.; Heggy, E.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Much of the surface of Mars has been intensely reworked by aeolian processes and key evidence about the history of the Martian environment seems to be hidden beneath a widespread layer of debris (paleo lakes and rivers, faults, impact craters). In the same way, the recent geological and hydrological history of the eastern Sahara is still mainly hidden under large regions of wind-blown sand which represent a possible terrestrial analog to Mars. The subsurface geology there is generally invisible to optical remote sensing techniques, but radar images obtained from the Shuttle Imaging Radar (SIR) missions were able to penetrate the superficial sand layer to reveal parts of paleohydrological networks in southern Egypt.

Author

*Mars Surface; Earth Surface; Analogs; Sahara Desert (Africa)*

**20040062285** Brown Univ., Providence, RI, USA

**The Isidis Basin of Mars: New Results from MOLA, MOC, and THEMIS**

Hiesinger, H.; Head, J. W., III; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report on results of our investigation of the Isidis basin based on topographic and imaging data obtained by orbiting spacecraft such as Mars Global Surveyor (MGS) and Mars Odyssey. The new data allow one to get a detailed view of the Isidis basin, its structure, stratigraphy, geologic history, evolution and its relationship to the Syrtis Major volcanic complex.

Author

*2001 Mars Odyssey; Gamma Ray Spectrometers; Mars Global Surveyor; Topography; Mars Exploration*

**20040062286** Computer Sciences Corp., Lanham, MD, USA

**Elemental Composition Variations for Large Dusty and Rocky Regions on Mars Using Gamma-Ray Data from the Mars Odyssey Gamma-Ray Spectrometer**

Evans, L. G.; Starr, R. D.; Reedy, R. C.; Boynton, W. V.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Gamma-Ray Spectrometer (GRS) on the Mars Odyssey spacecraft has been mapping the elemental composition of the surface materials since June 2002. To study elemental composition variations on the martian surface, seven large regions of Mars were selected: three very dusty ones and four mainly rocky ones. Large regions were used to get good counting statistics on as many gamma-ray peaks as possible from spectrum accumulated by the GRS experiment on Mars Odyssey, including elements with poor counting statistics. Data from TES were used to help select these regions. Gamma-ray peaks for several elements were analyzed. Some results and trends are reported.

Author

*Gamma Ray Spectrometers; 2001 Mars Odyssey; Surface Properties; Neutrons; Chemical Composition*

**20040062287** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Radar Observations of Recent Mars Landing Sites**

Larsen, K. W.; Haldemann, A. F. C.; Jurgens, R. F.; Slade, M. A.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Exploration Rovers Spirit and Opportunity will arrive at their respective landing sites of Gusev Crater and Terra Meridiani in January 2004. During the 2001 and 2003 Mars Oppositions both landing sites were targeted for a series of radar observations using the telescopes of the Goldstone Deep Space Communications Complex (GDSCC). This paper will present results of terrestrial delay- Doppler radar observations of the landing sites, predictions for the surface properties that will be encountered, and, after successful landings, correlation between the predicted and observed surface properties. The in-situ observations made by both missions serve as ground truth for the validation of the high resolution radar mapping results.

Author

*Mars Exploration; Landing Sites; Roving Vehicles; Radar Tracking; Doppler Radar*

**20040062288** Jernsletten (J. A.), Seabrook, TX, USA

**Sounding of Subsurface Water Through Conductive Media in Mars Analog Environments Using Transient Electromagnetics and Low Frequency Ground-penetrating Radar**

Jernslettern, J. A.; Heggy, E.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The purpose of this study is to compare the use of (diffusive) Transient Electromagnetics (TEM) for sounding of subsurface water in conductive Mars analog environments to the use of (propagative) Ground-Penetrating Radar (GPR) for the same purpose. To provide a baseline for such studies, and to show how these methods differ and complement each other, we show data from three field studies: 1) Radar sounding data (GPR) from the Nubian aquifer, Bahria Oasis, Egypt; 2) Diffusive sounding data (TEM) from Pima County, Arizona; and 3) Shallower sounding data using the Fast-Turnoff TEM method from Pe a de Hierro in the Rio Tinto area, Spain. The latter is data from work conducted under the auspices of the Mars Analog Research and Technology Experiment (MARTE). The GPR and TEM methods are discussed and compared in terms of their strengths and weaknesses in the following areas; resolution, sensitivity to highly conductive layers (clay, ore bodies, brines, metal-rich fluids, etc.), depth of investigation, sounding frequencies, logistical efficiency, and appropriate applications.

Author

*Ground Penetrating Radar; Analogs; Low Frequencies; Radar Data; Mars Environment; Brines*

**20040062289** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Distribution of Non-Volatile Elements on Mars: Mars Odyssey GRS Results**

Boynton, W.; Janes, D.; Kerry, K.; Kim, K.; Reedy, R.; Evans, L.; Starr, R.; Drake, D.; Taylor, J.; Waenke, H., et al.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The major scientific objective of the Gamma-Ray Spectrometer (GRS) on the 2001 Mars Odyssey Mission is to determine the distribution of elements in the near-surface of Mars. Mars Odyssey has been in its mapping orbit since February, 2002, and the GRS boom, which removes the instrument from the gamma-ray background of the spacecraft, was erected in June, 2002. In the 580 days since boom erection, we have accumulated 453 days of mapping data. The difference is due mostly to two times when Odyssey went into safe mode and the instrument warmed up forcing us to anneal out radiation damage that manifests itself after warming. Other data losses are due to simple transmitter data gaps and to intense solar particle events. The data from the GRS is statistical in nature. We have a very low count rate and a very low signal-to-noise ratio. With the exception of K, the most easily mapped elements have a signal/noise ratio on the order of 0.1 (0.5 for K) and the counting rates are on the order of 0.3 to 0.7 counts/min (4 cpm for K). In order to map the distribution of an element, we have to divide the total signal from Mars up into many cells that define the map s spatial resolution (unless the statistics are good enough that the intrinsic spatial resolution of the instrument, about 550 km diameter, dominates). The data for several elements have now achieved a statistical precision that permits us to make meaningful maps.
Author
*2001 Mars Odyssey; Spatial Resolution; Gamma Ray Spectrometers; Statistical Analysis; Precision; Signal to Noise Ratios*

**20040062290** NASA Johnson Space Center, Houston, TX, USA
**On the Dielectric Properties of the Martian-like Surface Sediments**
Heggy, E.; Clifford, S. M.; Morris, R. V.; Paillou, P.; Ruffie, G.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have undertaken laboratory electromagnetic characterization of the total set of minerals identified by TES on the Martian surface in order to investigate experimentally the dielectric properties of the sediments covering it in the frequency range from 1 to 30 MHz. Volcanic Rocks with a well defined mineralogy and petrology from potential terrestrial analogues sites have also been included in the study. Our primary objective is to evaluate the range of electrical and magnetic losses that may be encountered by the various Radar sounding and imaging experiments dedicated to map the Martian subsurface searching for underground water. The electromagnetic properties of these Mars-like materials will be presented as a function of various geophysical parameters, such as porosity, bulk density and temperature. The secondary objective, is to locate regions were surface dielectric conditions are suitable for subsurface sounding.
Author
*Mars Surface; Sediments; Dielectric Properties*

**20040062291** NASA Ames Research Center, Moffett Field, CA, USA
**Remote Sensing of the Haughton Impact Structure (HIS): A Terrestrial Proof of Concept for Using the Remote Sensing of Martian Craters as a Probe of Subsurface Composition**
Tornabene, L. L.; Osinski, G. R.; Moersch, J. E.; Lee, P.; Lunar and Planetary Science XXXV: Mars: Radar, Gamma Ray Spectrometer, and Cratering Mineralogy; 2004; 2 pp.; In English; See also 20040062278; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact cratering is the most widespread geological process in the Solar System. Impact craters can provide 'windows' into the subsurfaces of planetary bodies through excavation and uplift. By utilizing remote methods in the visible and near infrared (VNIR; 0.4-1.4 micron), short-wavelength infrared (SWIR; 1.4-2.5 micron) and thermal infrared (TIR 7-14 micron), subsurface mineral compositions may be identified and mapped via impact craters. Complex craters in particular, expose minerals from both the shallow and deep-seated subsurface, which may be identified spectroscopically. Complex craters have morphological features such as central peaks or peak rings, which are composed of relatively coherent lithologies tapped from deep-seated crustal components. While near-surface crustal components can be observed as coherent rocks uplifted and exposed in the rim and the crater walls, and from the ejecta deposits. Only two previously published studies using this approach have been successful on large planetary bodies. Tompkins and Pieters utilized ultraviolet and VNIR from Clementine to characterize near- and deep-subsurface materials in and around lunar craters. The work of Ramsey and Wright was the first remote spectroscopic study to successfully identify near-subsurface materials in the ejecta and crater wall of a terrestrial impact structure, namely Meteor Crater. Here we present early results of a third such study, a remote spectroscopy evaluation of the Haughton impact structure (HIS). The purpose of this study is to serve as terrestrial proof of concept that remote visible/infrared spectroscopic methods in this case, analysis of LANDSAT 7 ETM+ and ASTER data of the well-preserved HIS can be utilized in deciphering the subsurface composition of planetary crusts. This technique is particularly promising for

Mars were limited tectonic uplift and ubiquitous dust-mantling offer few opportunities to access subsurface information.
Author
*Meteorite Craters; Analogs; Earth Surface; Mars Surface; Mars Craters; Planetary Geology*

**20040062292** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Presolar Grains**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062293 - 20040062305
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

Topics discussed include: Presolar Silicate Grains; Presolar Silicates from Primitivr Chondrites; Oxygen and Magnesium Isotopic Ratios of Presolar Spinel Grains; Study of Two New Presolar Grains from Bishunpur Ordinary Chondrite; Extinct Technetium in Presolar Grains; etc.
Derived from text
*Chondrites; Magnesium Isotopes; Meteoritic Composition; Technetium; Spinel; Silicates*

**20040062293** Tokyo Inst. of Tech., Tokyo, Japan
**In-Situ Discovery of Presolar Silicates from Primitive Chondrites**
Nagashima, K.; Krot, A. N.; Yurimoto, H.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is known from ISO spectra that crystalline forsterite, enstatite, and amorphous silicates are the major silicate species in circumstellar disks around young stars and in outflows from red giants. Although recently presolar silicate grains were identified in IDPs, presolar silicates have not been identified in meteorites so far even though several research to find presolar silicates were conducted. Here we employed in-situ large-scale surveys of presolar grains in primitive chondrites using ion microscopy.
Author
*In Situ Measurement; Amorphous Materials; Chondrites; Meteorites; Forsterite; Enstatite*

**20040062294** Washington Univ., Saint Louis, MO, USA
**Oxygen and Magnesium Isotopic Ratios of Presolar Spinel Grains**
Zinner, E.; Nittler, L. R.; Hoppe, P.; Gallino, R.; Lewis, R. S.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the past, most Mg isotopic measurements of presolar grains have been made in SiC and corundum, which have high Al/Mg ratios. In such grains the Mg isotopic ratios are dominated by radiogenic Mg-26 and, because of low Mg concentrations, the Mg-25/Mg-24 ratios have large uncertainties. In contrast, analysis of Mg-rich spinel allows more precise determination of Mg ratios in presolar grains. Nittler et al. reported O and Mg isotopic data for 7 spinels from Ordinary Chondrites (OC). Here we present O and Mg measurements on 20 Al-Mg spinel grains from the CM carbonaceous chondrite Murray and on one Al-Mg and 2 Cr-rich spinels from the CI carbonaceous chondrite Orgueil.
Author
*Oxygen; Magnesium Isotopes; Radiogenic Materials; Carbonaceous Chondrites; Measurement*

**20040062295** Carnegie Institution of Washington, Washington, DC, USA
**New Presolar Silicon Carbide Grains with Nova Isotope Signatures**
Nittler, L. R.; Hoppe, P.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The vast majority of presolar silicon carbide grains found in meteorites originated in asymptotic giant branch (AGB) stars and supernova explosions. In contrast, out of several thousand analyzed SiC grains, only a very few with isotopic signatures strongly suggesting an origin in nova explosions have previously been identified. We report the identification of three new SiC

grains from the Murchison meteorite with C, Si, and N isotopic ratios indicative of nova nucleosynthesis.
Derived from text
*Silicon Carbides; Grains; Supernovae; Asymptotic Giant Branch Stars*

**20040062296** Open Univ., Milton Keynes, UK
**Presolar Diamonds in Krymka: C, N and Xe Isotope Data from Grain-size Separates and Comparison with Other Meteorites**
Verchovsky, A. B.; Fisenko, A. V.; Semjonova, F.; Wright, I. P.; Pillinger, C. T.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this study we present the first results from an investigation of C, N and Xe isotopic compositions in a new set of grain-size fractions of presolar diamonds separated from the Krymka (LL3.1) ordinary chondrite. This is the third meteorite which we have analysed in this way; Efremovka (CV3) and Boriskino (CM2) have been analysed previously, and are quite different from Krymka in terms of their parent body composition and metamorphic history. Comparison of isotopic data allow us to investigate how metamorphism on different parent bodies has affected the diamonds and gaseous component trapped within them. In addition we can asses whether there are any differences in diamond populations sampled by these bodies. In contrast to similar studies of bulk diamond fractions, grain-size separation allows a more detailed and specific investigation due to better resolution of the components present in the diamonds. Experimental technique: Presolar diamonds
Author
*Diamonds; Meteorites; Carbon Isotopes; Nitrogen Isotopes; Xenon Isotopes*

**20040062297** Washington Univ., Saint Louis, MO, USA
**Coordinated Isotopic and TEM Studies of Presolar Graphites from Murchison**
Croat, T. K.; Stadermann, F. J.; Zinner, E.; Bernatowicz, T. J.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Previous microstructural (SEM) and isotopic studies of the Murchison KFC1 separate (2.15-2.20 g/ml) found many presolar graphites with an average size of 1.5 microns. Carbon isotopic ratios ranged over 3 orders of magnitude (from 0.02 to 80 times the solar value of 89). Two morphological types of presolar graphites were found, with dense 'onion' graphites and less dense 'cauliflower' graphites, although these types are not isotopically distinct in carbon. Further transmission electron microscope (TEM) studies of the 'onion' graphites revealed numerous internal refractory carbides ((Ti,Zr,Mo,Ru)C) and also some graphites with a nanocrystalline core surrounded by a well-graphitized rim. Due to their small size, TEM analyses of graphites that had been isotopically characterized were not possible. In the present work, more graphites were examined in TEM, including the larger 'cauliflower' graphites omitted from the earlier study, and isotopic analysis was performed on the same samples examined in the TEM.
Author
*Microstructure; Isotopes; Potassium; Fluorine; Chlorine; Graphite*

**20040062298** Max-Planck-Inst. fuer Chemie, Mainz, Germany
**A NanoSIMS Study of Two New Presolar Spinel Grains from the Bishunpur Ordinary Chondrite**
Krestina, N.; Hoppe, P.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Presolar oxide grains are rare in meteorites. Only some 190 grains, approx. 1 micron to approx. 5 microns in size, were found before the St. Louis group started to search for submicrometer-sized presolar oxides in meteoritic residues using the imaging technique with the NanoSIMS ion microprobe. These studies led to the discovery of a large number of additional presolar oxide grains. Out of approx. 75,000 submicron-sized grains, 317 grains with anomalous O-isotopic compositions were identified. While 88% of these presolar oxide grains are spinel, only 4 presolar spinels grains (out of approx. 190) were found among the micron-sized grains. The vast majority of presolar spinel is apparently submicron in size and these grains make up at least 1 ppm of primitive meteorite matter, making spinel one of the most abundant presolar mineral phases in meteorites. The small size of most presolar spinels, however, limits the number of elements for which isotopic compositions can be measured. On micron- sized grains, on the other hand, much more isotopic information can be obtained, making these grains indispensable for the study of presolar matter. Here we report on the discovery of two spinel grains, one of which is several

m in size and one with very extreme O-isotopic composition, from the Bishunpur ordinary chondrite.
Author
*Chondrites; Isotopic Labeling; Meteoritic Composition; Oxides; Residues*

**20040062299** Max-Planck-Inst. fuer Chemie, Mainz, Germany
**A NanoSIMS Study of Iron-Isotopic Compositions in Presolar Silicon Carbide Grains**
Marhas, K. K.; Hoppe, P.; Besmehn, A.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Silicon carbide (SiC) is the best studied presolar mineral phase [1-3]. It is now well established that most of the presolar SiC (mainstream grains and the minor type Z and Y grains) originate from low-mass (1-3 M ) asymptotic giant branch (AGB) stars. Also type II supernovae (SN) are believed to have contributed to the population of presolar SiC (X grains). Although low in abundance (about 1% of the SiC) the study of X grains has provided important insights into SN nucleosynthesis [e.g., 4, 5].
Derived from text
*Asymptotic Giant Branch Stars; Isotopic Labeling; Silicon Carbides; Nuclear Fusion; Iron*

**20040062300** Lawrence Livermore National Lab., Livermore, CA, USA
**Nitrogen and Carbon Isotopic Composition of Silicon Carbide in the CO3.0 Meteorite ALHA 77307, a NanoSIMS Study**
Smith, J. B.; Weber, P. K.; Huss, G. R.; Hutcheon, I. D.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292
Contract(s)/Grant(s): NASA Order W-19894; W-7405-eng-48; NAG5-11543; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Presolar grains have been identified in primitive members of all chondrite classes [1, 2]. The study of the isotopic compositions of presolar grains provides information on galactic evolution and nucleosynthesis in stars [3, 4], while the abundances and characteristics of presolar grains contain a record of thermal processing in the solar system [2, 5]. Much of the detailed work on presolar silicon carbide grains has focused on Murchison [e.g., 2] and Orgueil [4], but several other carbonaceous [6, 7], ordinary, and enstatite chondrites [8-11] have also been studied. This study investigates the isotopic composition of silicon carbide from the CO3.0 carbonaceous chondrites ALHA77307 and Colony. SiC is present in ALHA77307 at a matrix normalized abundance of ~8.8 ppm [5], which is approximately twice the abundance of Colony [5], but less than in CI chondrites and the matrices of CM and primitive ordinary and enstatite chondrites [3]. The abundances of SiC and other presolar grains in ALHA77307 seem to correlate with the degree of chemical processing that produced CO3 chondrites [2, 5]. This implies that the same nebular processing that produced the bulk composition of the CO3 chondrite class also modified the assemblage of known presolar grains [5]. To test whether all chondrite classes originated from the same reservoir of presolar dust it is necessary to look for primary differences, not related to thermal processing, between SiC in CO3 chondrites and other chondritic meteorites.
Derived from text
*Silicon Carbides; Isotopes; Carbon; Nitrogen; Abundance; Chondrites; Galactic Evolution; Carbonaceous Chondrites*

**20040062301** Washington Univ., Saint Louis, MO, USA
**Comparison Study of Presolar Graphite Separates KE3 and KFA1 from the Murchison Meteorite**
Amari, S.; Zinner, E.; Lewis, R. S.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Graphite is the third type of presolar dust that was isolated from primitive meteorites [1]. Yet it has not been studied as extensively as SiC, which had been discovered three years earlier [2, 3]. This is because graphite is present only in very primitive meteorites and because the abundance of graphite is lower than that of SiC [4]. In addition, the separation procedure of graphite is far more complicated than that of SiC [5]. Up to date, essentially all data on graphite have been obtained from four graphite separates (KE3, KFA1, KFB1 and KFC1) with a range of density from 1.6 to 2.2g/cu cm, which were extracted from the Murchison meteorite [5]. One of the most interesting characteristics of graphite is that isotopic features depend on density. Of the graphite separates, KE3 (1.65-1.72g/cu cm) has been studied the most because graphite grains in this fraction (low-density graphite grains) have larger sizes and higher trace element concentrations than those in the other fractions. Many

KE3 grains are characterized by 18O excesses (18O/16O; up to 185 times solar), high 26Al/27Al ratios (up to approx. 0.1) and, to a lesser extent, by Si isotopic anomalies, mostly 28Si excesses (up to 2 times solar) [6]. These isotopic features can be, in general, explained by a supernova origin of these grains.
Derived from text
*Murchison Meteorite; Graphite; Dust; Anomalies*

**20040062302** Argonne National Lab., IL, USA
**Extinct Technetium in Presolar Grains**
Savina, M. R.; Davis, A. M.; Tripa, C. E.; Pellin, M. J.; Gallino, R.; Lewis, R. S.; Amari, S.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Presolar grains carry isotopic records of the nuclear processing in their parent stars. Their analysis, combined with appropriate stellar models, yields insights into stellar evolution and nucleosynthesis. The majority of SiC grains (mainstream) were produced in outflows from low-mass (approx. 1.5 to 3 M ) asymptotic giant branch (AGB) stars [1]. In AGB stars, elements heavier than Fe are synthesized by slow neutron capture (the s-process). The isotopic compositions of Zr, Mo, Sr, and Ba in mainstream SiC grains show the s-process signatures predicted by models of low-mass AGB stars from which SiC condenses [2]. [9].
Derived from text
*Technetium; Asymptotic Giant Branch Stars; Extinction; Stellar Evolution; Nuclear Fusion; Isotopic Labeling*

**20040062303** Max-Planck-Inst. fuer Chemie, Mainz, Germany
**Aluminum-26 in Submicrometer-sized Presolar SiC Grains**
Hoppe, P.; Marhas, K. K.; Gallino, R.; Straniero, O.; Amari, S.; Lewis, R. S.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Among the presolar minerals identified to date, silicon carbide (SiC) is best studied [1-3]. A wealth of information on isotopic compositions of the major and many trace elements was obtained on individual grains > 0.5 m in size. The new generation NanoSIMS ion microprobe makes it now possible to extend isotopic studies to smaller grains. First attempts in this respect were conducted by E. Zinner and coworkers [4, 5] who measured C-, N-, and Si-isotopic compositions of 0.25-0.65 m-sized SiC grains from the Murchison (CM2) and Indarch (EH4) meteorites. We have extended the isotopic characterization of SiC in this size range to Mg-Al. Here, we report the results obtained for 23 grains from the Murchison separate KJB [6].
Derived from text
*Aluminum Isotopes; Isotopic Labeling; Meteorites; Silicon Carbides*

**20040062304** Washington Univ., Saint Louis, MO, USA
**NanoSIMS Determination of Carbon and Oxygen Isotopic Compositions of Presolar Graphites from the Murchison Meteorite**
Stadermann, F. J.; Croat, T. K.; Bernatowicz, T.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040062292
Contract(s)/Grant(s): NAG5-10426; NAG5-11865; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Graphite from the Murchison density separate KFC1 (2.15 - 2.20 g/cu cm) has previously been studied by combined SEM/EDX and ion microprobe analysis. These studies found several distinct morphological types of graphites and C isotopic compositions that vary over more than 3 orders of magnitude, clearly establishing their presolar origin. Subsequent TEM measurements of a subset of these particles found abundant embedded crystals of metal (Zr, Mo, Ti, Ru) carbides which were incorporated during the growth of the graphites. A new TEM study of a large set of KFC1 graphites led to the discovery of another type of presolar material, Ru-Fe metal. Here we report results of the C and O isotopic measurements in the same graphite sections, which makes it possible for the first time to directly correlate isotopic and TEM data of KFC1 grains.
Author
*Murchison Meteorite; Graphite; Carbon Isotopes; Oxygen Isotopes; Meteoritic Composition; Isotope Ratios*

**20040062305** Washington Univ., Saint Louis, MO, USA

**Discovery of Presolar Silicate Grains in the Acfer 094 Carbonaceous Chondrite**

Nguyen, A. N.; Zinner, E.; Lunar and Planetary Science XXXV: Presolar Grains; March 19, 2004; 2 pp.; In English; See also 20040062292; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Though several presolar oxide phases have been identified in meteorites [1], presolar silicates remained elusive despite astronomical evidence that they are the most abundant grain species around O-rich evolved stars [2], the most likely stellar sources for other presolar oxides found in meteorites. Previous attempts to isolate presolar silicates in meteorites by ion probe analysis [3, 4] were restricted to grains >1 m due to the limiting spatial resolution of the instruments employed. Recently, the NanoSIMS, capable of isotopic measurements on submicron grains, the expected size of presolar silicates, was instrumental in the identification of six presolar silicates in interplanetary dust particles (IDPs) [5]. In addition, the NanoSIMS was used to identify two presolar O-rich grains containing Si in meteorites [6]. The mineralogy of these grains, however, could not be independently confirmed.

Derived from text

*Carbonaceous Chondrites; Interplanetary Dust; Ion Probes; Silicates; Meteorites*

**20040062306** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Mercury, Top to Bottom**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062307 - 20040062311

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The following topics were discussed in this document: Resonant Rotation of the Two-Layer Mercury Model; Chronology of Lobate Scarp Thrust Faults and the Mechanical Structure of Mercury's Lithosphere; Mercury: Determination of Internal Structure and Evolution; Searching for Terrain Softening near Mercury's North Pole; Mercury: First Spectra from 0.7 to 5.5 micron Support Low FeO and Feldspathic Composition.

CASI

*Chronology; Lithosphere; Mercury (Planet); Spectrum Analysis*

**20040062307** Smithsonian Institution, Washington, DC, USA

**Chronology of Lobate Scarp Thrust Faults and the Mechanical Structure of Mercury's Lithosphere**

Watters, T. R.; Nimmo, F.; Robinson, M. S.; Lunar and Planetary Science XXXV: Mercury, Top to Bottom; 2004; 2 pp.; In English; See also 20040062306; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The timing of the thrust faulting that formed lobate scarps on Mercury is important in constraining the mechanical and thermal structure of Mercury s lithosphere. Previous estimates suggest that thrust faulting initiated after the emplacement of the pre-Tolstojan intercrater plains and continued through the Calorian Period. Refined estimates of the timing of lobate scarp formation are reported based on mapping of the tectonic features on the hemisphere of Mercury imaged by Mariner 10. Estimates of the elastic thickness of Mercury s lithosphere from modeling constrained by depth of faulting are also presented.

Author

*Chronology; Lithosphere; Mariner 10 Space Probe; Escarpments; Thrust*

**20040062308** NASA Ames Research Center, Moffett Field, CA, USA

**Mercury: First Spectra from 0.7 to 5.5 micron Support Low FeO and Feldspathic Composition**

Sprague, A. L.; Warell, J.; Emery, J.; Long, A.; Kozlowski, R. W. H.; Lunar and Planetary Science XXXV: Mercury, Top to Bottom; 2004; 2 pp.; In English; See also 20040062306; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Spectral measurements of Mercury's surface indicate low or no FeO content as determined from the absence of absorptions centered near 0.9 and 1.2 m. These observations support previous observations. At the Moon these ab-sorption bands are ubiquitous at varying depths. We have obtained spectra from the Moon with the same instrumentation and telescope for comparison. The lunar results are shown in a companion abstract.

Author

*Spectrum Analysis; Iron Oxides; Infrared Telescopes; Thermal Emission*

**20040062309** Alicante Univ., Spain

**Resonant Rotation of the Two-Layer Mercury Model**

Barkin, V.; Ferrandiz, J. M.; Lunar and Planetary Science XXXV: Mercury, Top to Bottom; 2004; 2 pp.; In English; See also 20040062306

Contract(s)/Grant(s): SAB2000-0235; MOE-AYA2001-0787; MOE-ESP2001-4533; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Present significance of the study of rotation of Mercury considered as a core-mantle system arises from planned Mercury missions. New high accurate data on Mercury s structure and its physical fields are expected from BepiColombo mission (Anselmi et al., 2001). Investigation of resonant rotation of Mercury, begun by Colombo G. (1966), will play here main part. New approach to the study of Mercury dynamics and the construction of analytical theory of its resonant rotation is suggested. Within these approach Mercury is considered as a system of two non-spherical interacting bodies: a core and a mantle.The mantle of Mercury is considered as non-spherical, rigid (or elastic) layer. Inner shell is a liquid core, which occupies a large ellipsoidal cavity of Mercury. This Mercury system moves in the gravitational field of the Sun in resonant traslatory-rotary regime of the resonance 3:2. We take into account only the second harmonic of the force function of the Sun and Mercury. For the study of Mercury rotation we have been used specially designed canonical equations of motion in Andoyer and Poincare variables, more convenient for the application of mentioned methods. Approximate observational and some theoretical evaluations of the two main coefficients of Mercury gravitational field J2 and C22 are known. From observational data of Mariner-10 mission were obtained some first evaluations of these coefficients: J2 = (8 6) 10-5 (Esposito et al., 1977); J2 = (6 2) 10-5 and C22 = (1.0 0.5) 10-5 (Anderson et al., 1987). Some theoretical evaluation of ratio of these coefficients has been obtained on the base of study of periodic motions of the system of two non-spherical gravitating bodies (Barkin, 1976). Corresponding values of coefficients consist: J2 = 8 10-5 and C22 = 0.33 10-5 . We have no data about non-sphericity of inner core of Mercury. There are also some evaluations of moments of inertia Mercury and its core: C/(mR2) = 0.35,Cm/C = 0.5 0.07 (Peal, 1996). Here C and Cm are the moments of inertia of the full Mercury and of its core, m and R is a mass and a mean radius of Mercury. Based on two methods, we consider the rotation of Mercury in the gravitational field of the Sun. First method of perturbation has been effectively applied to the construction of a rotational theory of the Earth for its models as two or three layer celestial body moving in gravitational fields of the Moon, Sun and planets in wide set of papers ranging in 1999-2001 years of Ferrandiz J.M. and Getino J.(2001). Another method is an analytical method of construction of the resonant rotational motion of synchronous satellites and Mercury, considered as non-spherical rigid bodies. This method has been applied earlier to construction of an analytical theory of rotation of the Moon considered as rigid non-spherical body (Barkin, 1989). Here we modified these methods to apply them to the study of the resonant rotation of a two-layer Mercury. By this we use very effective for the application of perturbation methods and dynamical geometrical illustration the canonical equations in Andoyer and Poincare variables. Main resonant properties of Mercury motion were been described first as generalized Cassini s laws (Colombo, 1966). But Colombo and some another scientists considered Mercury as rigid non-spherical body sometimes taking into account tidal deformation. Here we have been obtained and formulated these laws and their generalization for a two-layer model of Mercury.

Author

*Gravitational Fields; Planetary Rotation; Equations of Motion; Celestial Bodies; Mariner 10 Space Probe*

**20040062310** Case Western Reserve Univ., Cleveland, OH, USA

**Mercury: Determination of Internal Structure and Evolution**

Hauck, Steven A., II; Solomon, Sean C.; Lunar and Planetary Science XXXV: Mercury, Top to Bottom; 2004; 2 pp.; In English; See also 20040062306; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the most enigmatic questions with regard to the formation of terrestrial planets is origin of Mercury s large bulk density (~5400 kg/m3). This high bulk density suggests a larger metal:silicate ratio than observed in the other terrestrial planets. However, the bulk density of the planet alone does not uniquely constrain the composition; additional information is required. We model the internal structure of Mercury, giving particular attention to core, in order to investigate the ability of anticipated future measurements of the planet s normalized polar moment of inertia (C/MR2) and ratio of the mantle moment of inertia to that of the planet (Cm/C) to constrain the planet s structure and composition.

Author

*Planetary Evolution; Terrestrial Planets; Mariner 10 Space Probe; Chemical Composition*

**20040062311** NASA Johnson Space Center, Houston, TX, USA

**Searching for Terrain Softening near Mercury's North Pole**

Cobian, P. S.; Vilas, F.; Lederer, S. M.; Barlow, N. G.; Lunar and Planetary Science XXXV: Mercury, Top to Bottom; 2004; 1 pp.; In English; See also 20040062306; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In 1999, following the initial discovery of radar bright craters near both poles of Mercury measured the depth-todiameter (d/D) ratios of 170 impact craters in Mariner 10 images covering four different regions on Mercury s surface. Rapid softening of crater structure, indicated by lower d/D ratios, could indicate the possibility of subsurface water ice in Mercury's terrain originating from an internal source in the planet. Their study included 3 specific radar bright craters suggested to contain ice. They concluded that no terrain softening was apparent, and a rapidly emplaced exogenic water source was the most likely source for the proposed ice in these craters. Recent radar observations of the Mercurian North pole have pinpointed many additional radar bright areas with a resolution 10x better than previous radar measurements, and which correlate with craters imaged by Mariner 10. These craters are correlated with regions that are permanently shaded from direct sunlight, and are consistent with observations of clean water ice. We have expanded the initial study by Barlow et al. to include d/D measurements of 12 craters newly identified as radar bright at latitudes poleward of +80o. The radar reflectivity resemblances to Mars south polar cap and echoes from three icy Galilean satellites suggest that these craters too may have polar ice on Mercury. The effect of subsurface H20 on impact craters is a decrease in its d/D ratio, and softening of crater rims over a period of time. The study of Barlow et al., focused on determining the d/D ratios of 170 impact craters in the Borealis (north polar), Tolstoj (equatorial), Kuiper (equatorial), and Bach (south polar) quadrangles. This work focuses on the newly discovered radar bright craters, investigating their d/D ratios as an expansion of the earlier work..We compare our results to the statistical results from Barlow et al. here. With the upcoming Messenger spacecraft mission to Mercury, this is an especially timely study whose result could potentially help the Messenger team as they develop a mission strategy.

Author

*Craters; Mariner 10 Space Probe; Radar Tracking; Terrain; Mercury Surface*

**20040062312** Lunar and Planetary Inst., Houston, TX, USA

**Lunar and Planetary Science XXXV: Terrestrial Planets**

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062313 - 20040062319

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session 'Terrestrial Planets: included:Lunar Soils May Tell Us When the Geomagnetic Field First Appeared; Metal-Silicate Segregation in Deforming Dunitic Rocks: Applications to Core Formation in Europa and Ganymede; Diamond Formation in Core Segregation Experiments; The Effect of Pressure on Potassium Partitioning Between Metallic Liquid and Silicate Melt; Reduction of W, Mn, and Fe, During High-Temperature Vaporization; Micrometeoritic Neon in the Earth s Mantle ; and New Analyses of Diverse Hadean Zircon Inclusions from Jack Hills.

Derived from text

*Terrestrial Planets; Planetary Mantles*

**20040062315** Paris VI Univ., France

**Diamond Formation in Core Segregation Experiments**

Siebert, J.; Guyot, F.; Malavergne, V.; Chaussidon, M.; Lunar and Planetary Science XXXV: Terrestrial Planets; 2004; 2 pp.; In English; See also 20040062312; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Heterogeneous accretion models imply a first accretion stage with highly reduced materials. The presence of silicon in the metal that segregates to form the core is a simple way to obtain such reducing conditions. During this stage of accretion (80-90 % of the final Earth), the terrestrial accreting material might be a mixture of reduced, volatile- free components and oxidized, volatile-rich components in minor proportions (e.g., mixture of EH and CI chondrites). Mixing carbonates with silicon-rich alloys is relevant to such Earth s primitive conditions. This could bring constraints on carbon evolution during core-mantle differentiation and permit to discuss if the combination of carbon and silicon is relevant for core composition.

Author

*Diamonds; Formation; Cores; Heterogeneity*

**20040062316** Tokyo Univ., Japan

**Lunar Soils May Tell Us When the Geomagnetic Field First Appeared**

Ozima, M.; Miura, Y. N.; Podosek, F. A.; Seki, K.; Lunar and Planetary Science XXXV: Terrestrial Planets; 2004; 2 pp.; In English; See also 20040062312; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

When did the Earth's magnetic field first appear? This fundamental problem is still not resolved. It has been taken for granted that the development of the geomagnetic field was concomitant with the formation of the Earth's core, but the time of core formation is not well known, nor is the role of the inner core in the generation of the geodynamo. Paleomagnetic studies trace the geomagnetic field back only to about 3.5 Ga ago that showed much weaker intensity than the present field. Since there is practically no crustal rock older than 4 Ga, we need an alternative approach to pursuit the record of the geomagnetic field in older time. We propose that lunar soils may be used to resolve this fundamental and urgent issue. We show that the isotopic compositions of N (and possibly lighter noble gases) implanted in ancient lunar soils may reflect admixture of solar wind and terrestrial atmospheric components, suggesting transport of atmospheric components to the Moon. The geomagnetic field would prevent any effective ion loss from the atmosphere, but if the geomagnetic field was absent or much weaker in the early Earth as suggest, the escape of ions from the ionosphere would be enhanced considerably, and a substantial amount of terrestrial atmospheric ions may have been transported to lunar soils. Therefore, the close examination of N (and possibly lighter noble gases) in ancient lunar soils may provide clues to resolve the time of the appearance of the geomagnetic field.

Derived from text

*Atmospheric Circulation; Dynamo Theory; Geomagnetism; Isotopic Labeling; Paleomagnetism*

**20040062317** Minnesota Univ., Minneapolis, MN, USA

**Metal-Silicate Segregation in Deforming Dunitic Rocks: Applications to Core Formation in Europa and Ganymede**

Hustoft, J. W.; Kohlstedt, D. L.; Lunar and Planetary Science XXXV: Terrestrial Planets; 2004; 2 pp.; In English; See also 20040062312

Contract(s)/Grant(s): NAG5-10509; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Core formation is an important event in the evolution of a planetary body, affecting both the geochemical and geophysical properties of the body. Metal-silicate segregation could have proceeded either by settling of liquid metal through a magma ocean or by percolation of liquid metal through a solid silicate mantle. Percolation of metallic melt had previously been excluded as a viable segregation mechanism because metallic melts do not form an interconnected network under hydrostatic conditions, except at high melt fraction (>5 vol%), due to the high dihedral angle between metals and silicates (>60 ). Without an interconnected network, porous flow of metallic melt is impossible, leaving the magma ocean scenario as the only mechanism to form the core. Moment-of-inertia measurements of Europa and Ganymede from the Galileo probe indicate that they are differentiated. This evidence suggests that a method for segregating metals and silicates at temperatures low enough to retain volatile compounds must exist. We have investigated the effect of deformation on the distribution of metallic melts in silicates. We have deformed samples of olivine + 5-9 vol% Fe-S to strains of 2.5 in simple shear and find that the metallic melt segregates into melt-rich planes oriented at 20 to the shear plane. These metallic melt-rich bands are similar in structure to the silicate melt-rich bands reported by Holtzman, indicating that deformation can interconnect isolated metallic melt pockets and allow porous flow of non-wetting melts. Such a core formation process could have occurred in the jovian satellites.

Author

*Deformation; Galileo Probe; Melts (Crystal Growth); Moments of Inertia*

**20040062318** Carnegie Institution of Washington, Washington, DC, USA

**The Effect of Pressure on Potassium Partitioning Between Metallic Liquid and Silicate Melt**

Corgne, A.; Fei, Y.; Lunar and Planetary Science XXXV: Terrestrial Planets; 2004; 2 pp.; In English; See also 20040062312; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The presence of potassium in the core as a significant heat source was suggested over three decades ago. Experimental studies on the partitioning of potassium between metal and silicate have provided ambiguous results, because of experimental and analytical artifacts. It has been recognized that polishing of a run product for chemical analysis using oil lubricants results in substantial potassium loss from the Fe-S phase [10]. Murthy et al developed a dry polishing technique using boron nitride powder as lubricant in the lapping operations to address the potassium-loss problem during polishing. They showed conclusively that potassium enters ironsulfide melts with a strong dependence on temperature. In the pressure range of their

study (1 3 GPa), they observed no significant pressure effect on metal-silicate partition coefficients. There are very limited high-pressure partitioning experiments conducted in the multi-anvil apparatus that can be used to evaluate the effect of pressure on potassium partitioning. Furthermore, these studies were carried out without taking account of the experimental and analytical difficulties addressed by Murthy et al.
Author
*Potassium Silicates; Melts (Crystal Growth); Chemical Analysis; Coefficients*

## 92
## SOLAR PHYSICS

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

**20040058042** Smithsonian Astrophysical Observatory, Cambridge, MA, USA
**Microphysics of Waves and Instabilities in the Solar Wind and their Macro Manifestations in the Corona and Interplanetary Space**
Gurman, Joseph, Technical Monitor; Habbal, Shadia Rifai; April 2004; 4 pp.; In English
Contract(s)/Grant(s): NAG5-10873; No Copyright; Avail: CASI; A01, Hardcopy

Investigations of the physical processes responsible for coronal heating and the acceleration of the solar wind were pursued with the use of our recently developed 2D MHD solar wind code and our 1D multifluid code. In particular, we explored (1) the role of proton temperature anisotropy in the expansion of the solar wind, (2) the role of plasma parameters at the coronal base in the formation of high speed solar wind streams at mid-latitudes, and (3) the heating of coronal loops. Derived from text
*Interplanetary Space; Solar Wind; Stability; Coronal Loops; Magnetohydrodynamic Waves*

**20040061973** Lunar and Planetary Inst., Houston, TX, USA
**Lunar and Planetary Science XXXV: Genesis Mission**
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040061974 - 20040061979
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) The Genesis Mission Solar Wind Collection: Solar-Wind Statistics over the Period of Collection; 2) Artificial Implantation of Noble Gases on Genesis Targets; 3) Depth Sensitive Sampling of Implanted Species in Genesis Collectors Using UV Laser Ablation and SIMS; 4) A High Energy Secondary Ion Mass Spectrometer for the Analysis of Captured Solar Wind; 5) Genesis Preliminary Examination Plans; 6) Genesis Sample Material Subdividing Plans. Author
*Genesis Mission; Solar Wind; Sample Return Missions*

**20040061974** NASA Johnson Space Center, Houston, TX, USA
**Genesis Sample Material Subdividing Plans**
McNamara, K. M.; Stansbery, E. K.; Lunar and Planetary Science XXXV: Genesis Mission; 2004; 2 pp.; In English; See also 20040061973; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Subdivision of Genesis collectors is necessary to maximize the science return of the mission and retain a representative subset of the collection to archive for the future. The ability to verify important scientific results and resolve experiment anomalies through experiment replication and independent experimental techniques requires a method for subdividing individual sample collectors so that equivalent samples are made available. In addition, subdividing the Genesis collectors is required to accommodate the size limitations of many analytical systems. Samples allocated for analysis are likely to be small sections of individual collectors. Subdivision of returned Genesis solar wind samples must be performed in a manner having minimum impact on the accuracy and interpretation of analytical information obtained from these samples. It is also necessary that we ensure that consequences of any processing are well understood and documented. half of the collectors are actually thin coatings on silicon and sapphire substrates. Most of these are merely physically deposited coatings with limited adhesion and hardness, complicating the handling of these collectors. Finally, the concentrator targets, which are to be evaluated to

address the highest priority goals of the mission, represent all of these difficulties and require cutting to greater precision as a result of the extremely limited quantities available.
Derived from text
*Genesis Mission; Solar System Evolution; Solar Wind; Samplers; Experiment Design*

**20040061975** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**The Genesis Mission Solar Wind Collection: Solar-Wind Statistics over the Period of Collection**
Barraclough, B. L.; Wiens, R. C.; Steinberg, J. E.; Reisenfeld, D. B.; Neugebauer, M.; Burnett, D. S.; Gosling, J.; Bremmer, R. R.; Lunar and Planetary Science XXXV: Genesis Mission; 2004; 2 pp.; In English; See also 20040061973; 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 spacecraft was launched August 8, 2001 on a mission to collect samples of solar wind for 2 years and return them to earth September 8, 2004. Detailed analyses of the solar wind ions implanted into high-purity collection substrates will be carried out using various mass spectrometry techniques. These analyses are expected to determine key isotopic ratios and elemental abundances in the solar wind, and by extension, in the solar photosphere. 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. The collection of solar wind samples is almost complete. Collection began for most substrates in early December, 2001, and is scheduled to be complete on April 2 of this year. It is critical to understand the solar-wind conditions during the collection phase of the mission. For this reason, plasma ion and electron spectrometers are continuously monitoring the solar wind proton density, velocity, temperature, the alpha/proton ratio, and angular distribution of suprathermal electrons. Here we report on the solar-wind conditions as observed by these in-situ instruments during the first half of the collection phase of the mission, from December, 2001 to present.
Derived from text
*Genesis Mission; Solar Wind; Plasmas (Physics); Photosphere; Chemical Composition*

**20040061977** Eidgenoessische Technische Hochschule, Zurich, Switzerland
**Artificial Implantation of Noble Gases on Genesis Targets**
Grimberg, A.; Buehler, F.; Bochsler, P.; Bauer, H.; Wieler, R.; Lunar and Planetary Science XXXV: Genesis Mission; 2004; 2 pp.; In English; See also 20040061973; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NASA's Genesis mission is collecting Solar Wind (SW) samples at libration point L1 for approximately 2 years. The main objective is to determine the SW isotopic composition for various elements. SW ions are implanted into high-purity collection substrates. We are simulating the implantation of various noble gas ions under SW conditions to test for implantation efficiencies and mass-fractionation of different collector materials. We irradiate these materials with (3)He, (4)He, (20)Ne and (22)Ne with energies between 0.6 - 2.7 keV/amu at CASYMS in Bern. The irradiated samples are then analysed by noble gas mass-spectrometry at the ETH Zurich. Results are expected to provide a better understanding of the trapping behaviour of different materials and to allow to optimize analytical procedures.
Author
*Rare Gases; Solar Wind; Genesis Mission; Ion Implantation; Space Environment Simulation*

**20040061978** NASA Johnson Space Center, Houston, TX, USA
**Genesis Preliminary Examination Plans**
McNamara, K. M.; Stansbery, E. K.; Lunar and Planetary Science XXXV: Genesis Mission; 2004; 2 pp.; In English; See also 20040061973; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The purpose of preliminary examination of the Genesis sample collectors is to provide information on the condition and availability of collector materials to the science community as a basis for allocation requests. Similarly, the information will be used by the Genesis Sample Allocation sub-committee of CAPTEM to determine the optimum allocation scheme, and by the Genesis Curator to determine the processing sequence for allocation production. The plan includes a decision process and detailed examination and documentation protocol for whole arrays and individual collectors (wafers, concentrator targets, bulk metallic glass, gold foil, and polished aluminum). It also includes a plan for communicating the information obtained to the scientific community. The plan does not include a detailed plan for preliminary examination of the SRC lid foil collectors, the

process for removal of individual collectors from their frames, or for the subsequent subdivision of collector materials for allocation.
Author
*Genesis Mission; Samples; Solar Wind*

**20040061979** Open Univ., Milton Keynes, UK
**Depth Sensitive Sampling of Implanted Species in Genesis Collectors Using UV Laser Ablation and SIMS**
Franchi, I. A.; Suhaimi, N.; Chater, R. J.; McPhail, D. S.; vanCalsteren, P.; Butterworth, A. L.; Lunar and Planetary Science XXXV: Genesis Mission; 2004; 2 pp.; In English; See also 20040061973; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The energy spectrum of the solar wind ions collected by the Genesis spacecraft is such that they are implanted into the ultra-pure collector materials to a depth where there should not be any significant diffusion loss. However, this depth is of the order of only 100nm which presents two key problems when sampling the implanted solar material. First, the collector materials generally contain some level of contamination, which given the low abundance of the solar material in the collectors, even after 2 years of collection, means it is necessary to ensure that only the implanted ions in the collector material are sampled. Second, and even more demanding, the analytical techniques have to remove or resolve surface contamination on the samples. Possible sources of contamination include absorbed atmospheric gases or volatiles degassed from other parts of the spacecraft, particulate debris from micrometeorite impacts or particles introduced during cutting, distribution and analysis. Previously, we have demonstrated that UV laser ablation was well suited to sampling the implanted gases from diamond and diamond like material. The use of a pulsed 193nm homogenized excimer laser offers exceptionally uniform power densities across the beam and therefore very flat bottomed pits. We examine the practicality of using such a laser system to remove a very shallow layer of surface material to eliminate the surface contamination without significantly affecting the implanted sample. We have used Secondary Ion Mass Spectrometry (SIMS) to determine the distribution with depth (depth profiles) of various species in the sample before and after laser ablation.
Derived from text
*Laser Ablation; Genesis Mission; Solar Wind; Secondary Ion Mass Spectrometry; Ions; Accumulators*

**20040062175** Tokyo Inst. of Tech., Tokyo, Japan
**Radial Migration of Materials from Inner to Outer Solar Nebula: Evidence from Meteorite Matrix**
Yurimoto, H.; Nagashima, K.; Emori, H.; Lunar and Planetary Science XXXV: From Ancient Mists: Presolar and Nebular Processes; 2004; 2 pp.; In English; See also 20040062165; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Outward migration of material in the accreting solar nebula has been predicted by astrophysical models and is considered a plausible mechanism to explain crystalline silicates in comets. Although solar nebular processes are recorded in primitive meteorites, direct evidence indicating outward migration has not been found, partly because forming places of meteoritic constituents are still controversial. Here we report 16O-rich enstatite micro-objects coexisting with carbonaceous presolar sub-micro-grains in the matrix of a primitive meteorite using in-situ high-precision isotope imaging, indicating evidence of the migration.
Author
*Migration; Comets; Crystallinity; Enstatite; Isotopes; Solar Nebula*

## 93
## SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

**20040056439** Stanford Linear Accelerator Center, Stanford, CA, USA
**GLAST Event Analysis. An Examination of Events Recorded by the LAT Prototype Detector**
Heimann, J. R.; Aug. 2003; 28 pp.; In English
Report No.(s): DE2003-815652; SLAC-TN-03-022; No Copyright; Avail: Department of Energy Information Bridge

The GLAST mission requires an orbiting satellite that will detect and analyze gamma rays from distant cosmic sources. A prototype particle detector (called the minitower) has been built: a scaled-down model similar to that which will be used in the satellite. previous experiments using the prototype detector have provided cosmic ray data taken at different signal

thresholds. These data were processed with a track reconstruction algorithm that performed interpolations to approximate the path that each particle traveled. Using ROOT, they produced many graphs of the data to characterize the detector's response to cosmic rays and find correlations within the data. The coordinate system used in the data was verified against specifications and sensitive areas of the detector were measured.
NTIS
*Gamma Rays; Telescopes; Radiation Detectors*

**20040056517** Stanford Linear Accelerator Center, Stanford, CA, USA
**Distinguishing Photons from Muons using the Time-Over-Threshold in the Tracker from the Gamma Ray Large Area Space Telescope**
Rawlings, R. A.; Aug. 2003; 28 pp.; In English
Report No.(s): DE2003-815654; SLAC-TN-03-024; No Copyright; Avail: Department of Energy Information Bridge

The Gamma Ray Large Area Space Telescope, GLAST, is a large scientific instrument designed to study gamma ray activity in space. GLAST is designed to detect gamma rays with greater energy and angular resolution then previously done by gamma ray telescopes. A portion of GLAST is the Large Area Space Telescope (LAT), which is made up of sixteen identical towers encased in an anticoincidence detector. The source of the data for this study is a simulation of one of these towers. The LAT will detect gamma rays by using a technique known as pair-conversion. When a gamma ray slams into a layer of tungsten in the tower it creates a pair of subatomic particles (an electron and its anti-matter counterpart, a positron). Where this pair hits the detector has an effect on the photons signal distribution. When a specific series of cuts are done a difference in the gamma ray signal as compared to the background signal is seen. This shape difference will ideally be the crux of detecting gamma rays.
NTIS
*Photons; Muons*

**20040062022** Waseda Univ., Tokyo, Japan
**SELENE Gamma Ray Spectrometer Using Ge Detector Cooled by Stirling Cryocooler**
Kobayashi, M.-N.; Berezhnoy, A. A.; Fujii, M.; Hasebe, N.; Hiramoto, T.; Miyachi, T.; Murasawa, S.; Okada, H.; Okudaira, O.; Shibamura, E., et al.; Lunar and Planetary Science XXXV: Future Missions to the Moon; 2004; 2 pp.; In English; See also 20040062014; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A gamma-ray spectrometer (GRS) will be on board a Japanese lunar polar orbiter at an altitude of 100 km, SELENE, to be launched in 2006. The spectrometer will observe lunar gamma ray for one year or more (possibly extended another year in lower orbit) to obtain spectral information, covering 0.1-12 MeV, on chemical abundance on the entire lunar surface. SELENE GRS employs a Ge detector (252 cc, manufactured by Eurysis) as the main detector. This will be the first lunar mission using Ge detector of which the superior energy resolution can lead to the spectral information of more elements with higher sensitivity. Some missions utilized passive cooler for the cryostat, a two-stage passive cooler for interplanetary mission and a V-groove type radiative cooler for martian missions to cool Ge detector. In lunar orbit, however, a heat flow from sunlight and the lunar albedo to the detector system is very large, moreover it is difficult for heat radiator to have a sufficient field of view to exhaust the heat into cold space due to the expanse of lunar surface. Therefore, we have adopted a Stirling cryocooler as the cooling device from the point of life time and cooling capacity, which was developed (by Sumitomo Heavy Industry Co. Ltd.) and qualified for use in space environment. The Stirling cryocooler generates mechanical vibration, it was therefore considerably concerned that such the mechanical vibration could cause microphonic noise on the Ge detector. Now, the flight model of SELENE GRS was built and qualified by several environment test. It shows an energy resolution of 3 keV @ 1.33 MeV in the GRS system. This paper describes the detail of the detector-cryostat system and the performance.
Derived from text
*Gamma Ray Spectrometers; Cryogenic Cooling; Lunar Orbiter; Stirling Cycle; Aerospace Environments*

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