

UNIVERSE

Jet Propulsion Laboratory

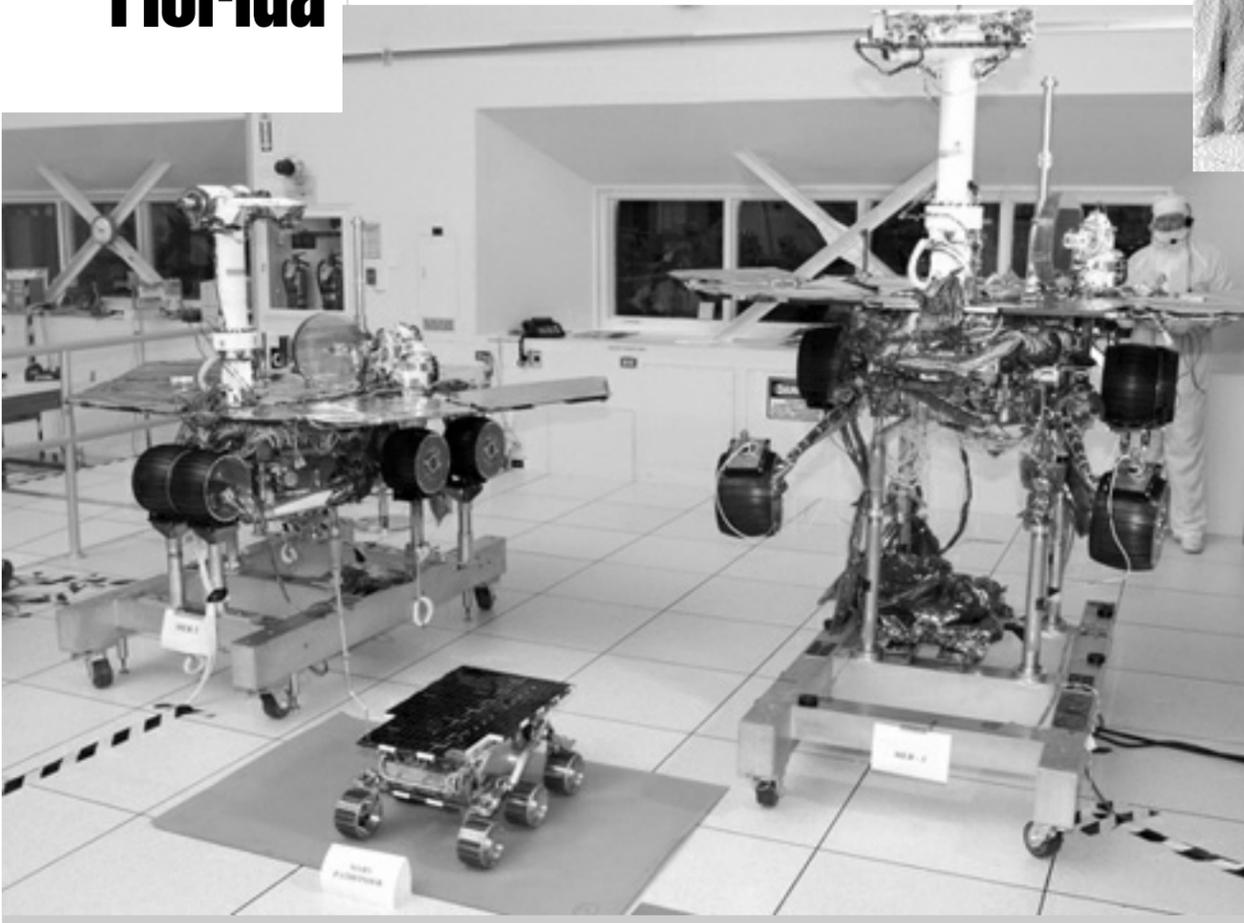
February 14, 2003
Volume 33 Number 4

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Next stop, Florida

Mars Exploration Rovers spend final days in Spacecraft Assembly Facility



Photos by Bob Brown / JPL Photolab

Engineers for JPL's Mars Exploration Rover mission complete assembly and testing for the twin robotic geologists. This week the twin rovers shared floor space in JPL's Spacecraft Assembly Facility for the last time before they are shipped to the Kennedy Space Center in Florida. Note the size difference from the Sojourner rover on 1997's Pathfinder mission, in foreground. The cruise stage, aeroshell and lander for one of the rovers arrived at the Kennedy Space Center on Jan. 27, and the identical flight hardware for the second rover will arrive in mid-February. The first of the two rovers will arrive at Kennedy in late February or early March. The rovers will be launched separately in May and June.

In memory of Columbia

JPL Director Dr. Charles Elachi shared his thoughts on the loss of Space Shuttle Columbia with JPL staff on Feb. 3. Following are his remarks.



Photo by Bob Brown / JPL Photolab

Memorial flowers at JPL's main gate honor the fallen astronauts of Space Shuttle Columbia.

Two days ago we all woke up to the tragic event of the loss of Columbia and its crew. There are no words that can properly express our grief and sadness for the loss of these seven heroes. Our hearts and prayers go out to their families and friends, both in our country and in the state of Israel.

The crew of Columbia knew that space flight is risky. But still, they went on with happy hearts and a lot of enthusiasm because they knew that their mission would expand our knowledge, enrich our minds, and make a better life for all of us here on Earth.

I knew and worked with many astronauts during my career. In fact, my first experiment in 1992 flew on the Columbia. Many of our JPL missions and experiments have flown on the shuttle — on the Columbia or the rest of the shuttle fleet — manned by the astronaut corps. These astronauts exemplify the best in humankind: courage, dedication and drive to explore, and drive to serve. On the Columbia mission, the crew worked 24 hours a day for 16 days, conducting 80 scientific experiments.

We express our deepest sympathy for their loss to their colleagues in the astronaut corps. As President Kennedy said, "We do these things because they are hard, not because they are easy." In all the history of exploration, many men and women have had the courage to face the unknown, to live at the edge, and to push the frontier to benefit

all of us here. In many cases, lives were lost — but not in vain. The world is a better place because of these heroes and explorers.

Space exploration will go on — the Columbia crew would expect that from us. As you go back to your work, I urge you to think that the best tribute to give to the Columbia crew is to continue to nurture the flame of exploration, and to carry it high for all to follow. We at NASA will find out what happened. We will fix it, and we will continue our quest. We will continue to explore our world, we will establish a permanent presence on Mars, we will probe the depths of Europa's ocean for life, we will search for other blue dots in our galaxy, and will bring samples back from celestial bodies so we can understand where we came from, how life started, and whether are we alone.

We will continue to enrich the life and mind of humankind, and inspire the next generation of explorers. The flame of exploration will never be extinguished. So let us honor the Columbia crew by going on with our work of scientific discovery, by rededicating ourselves to the work we are so privileged to undertake on behalf of our nation.



ASC 02p01-1973

THE STS-107 CREW poses in front of the entry into Space Shuttle Columbia. Kneeling in front are (left to right) Payload Specialist Ilan Ramon (the first Israeli astronaut), Pilot William "Willie" McCool and Mission Specialist David Brown. Standing in back are (left to right) Payload Commander Michael Anderson, Mission Specialist Kalpana Chawla, Commander Rick Husband and Mission Specialist Laurel Clark.

News Briefs



Dr. Homayoun Seraji



Dr. Lee-Leung Fu

Seraji honored by robotics journal

DR. HOMAYOUN SERAJI, a senior research scientist and supervisor of the Telerobotics Group in the Mobility Systems Concept Development Section 348, has received recognition as the most-published author in the history of the Journal of Robotic Systems, a leading international publication.

Seraji has published 14 articles in the journal during its 20-year history, with a 15th planned for the near future.

His research area is control of robotic systems. He has written extensively on robotic arm control and robotic vehicle control.

Seraji joined JPL in 1985 and was appointed a senior research scientist in 1996. He is a 1972 graduate of University of Cambridge, England, where he earned a doctorate in Multivariable Control.

Fu elected Fellow of AGU, AMS

In recognition of his outstanding science contributions and leadership, DR. LEE-LUENG FU, lead scientist for JPL's Ocean Sciences Research Element, was recently elected a Fellow of both the American Geophysical Union and the American Meteorological Society.

Fu, who joined JPL in 1980, is the U.S. project scientist for Topex/Poseidon and is project scientist for Jason 1, Topex/Poseidon's follow-on mission.

Student honored for AGU paper

KRISTOPHER LARSEN, a graduate student and consultant with the Planetary Radar Group in the Communications Systems and Research Section 331, received the Outstanding Student

Paper Award at the fall 2002 meeting of the American Geophysical Union.

Larsen's paper, "Radar Scattering Properties of Terra Meridiani, Mars," was co-authored by JPLers ALBERT HALDEMANN, RAYMOND JURGENS, MARTIN SLADE and RAYMOND ARVIDSON.

Larsen, a student at Washington University in St. Louis, works on radar characterization of Mars Exploration Rover landing sites using Goldstone Solar System Radar four-station interferometry.

EWV, tuition reimbursement enhanced

Human Resources has announced enhancements to Extended Work Week and tuition reimbursement practices.

The salary cap for Extended Work Week has been increased from \$1,600 to \$1,900 a week. Changes have also been made to the minimum number of hours necessary to receive Extended Work Week pay and to timekeeping practices for factoring in certain types of personal leave.

For tuition reimbursement, job-related courses that apply toward professional certification are now reimbursable to up to \$3,000 per calendar year, while the maximum reimbursable amount for undergraduate programs has been increased from \$3,000 to \$5,250 per calendar year. The maximum reimbursable amount for "non-job related" courses in graduate program courses has been reduced from \$10,000 to \$5,250 in eligible expenses per calendar year.

The revised requirement documents can be found online at <http://jplrules>.

Caltech women tour Lab

Twenty-five Caltech undergraduate students paid a visit to JPL Jan. 16 as part of the Lab's JPL Undergraduate Mentoring Program (JUMP).

The aim of the program is to bring together Caltech women undergraduates and JPL researchers and scientists in order to build a foundation for future collaboration, mentoring, networking, and research opportunities.

Students toured JPL facilities such as the Microdevices Lab, Field Integrated Design and Operations Lab and Biotechnology and Planetary Protection Lab, and also viewed the Mars Exploration Rovers in the Spacecraft Assembly Facility.

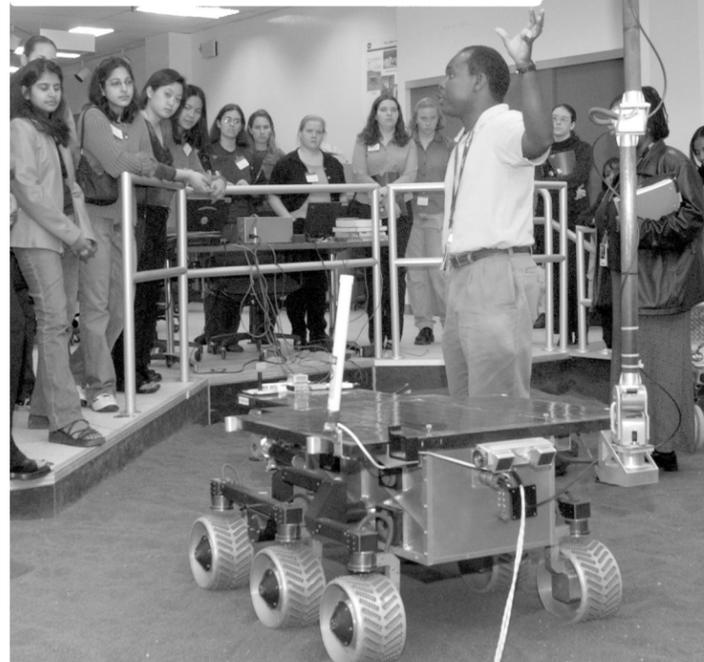
The program, in its second year, began as a collaborative effort between JPL's Advisory Council for Women and the Caltech Women's Center. The committee members consist of a diverse group of women throughout the Lab that includes Mary Bothwell, manager of the Observational Systems Division; Eva Graham, manager of the Minority Education Initiative (185); Ayan-na Howard, robotic research engineer, Division 34; Susie Pocino, secretary, Space Science and Data

Systems Section 382; and Donna Wu, Information Systems, Systems Management Office 520. Candace Rypsi and Jennifer Cichocki of the Caltech Women's Center also participated.

Students also had an opportunity to meet with Caltech alumni and Ph.D.s, with a special guest appearance from JPL Director Dr. Charles Elachi, who once was a Caltech student and an academic part-time employee here at the Lab.

One student said she enjoyed the program because it gave her a good introduction to student employment opportunities on Lab, such as the Caltech's Summer Undergraduate Research Fellowships program (SURF), which introduces students to research under the guidance of seasoned research mentors at Caltech and JPL.

This year's event was hosted by the Engineering and Science Directorate, the Education and Public Outreach Office and the Advisory Council for Women.



Dr. Asbity Trebi-Ollennu shows Caltech students the Field Integrated Design and Operations (FIDO) rover during their Jan. 16 visit.

Special Events Calendar

Ongoing Support Groups

Alcoholics Anonymous—Meetings are available. Call the Employee Assistance Program at ext. 4-3680 for time and location.

Caregivers Support Group—Meets the first Thursday of the month at noon in Building 167-111 (The Wellness Place). For more information, call the Employee Assistance Program at ext. 4-3680.

Codependents Anonymous—Meeting at noon every Wednesday. Call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Group—Meets the first Friday and third Thursday of the month at noon in Building 111-117. Call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parents Group for Children With Special Needs—Meets the second Thursday of the month at noon in the Wellness Place, Building 167-111.

Working Parents Support Group—Meets the third Thursday of the month at noon in Building 167-111 (The Wellness Place). For more information, call the Employee Assistance Program at ext. 4-3680.

Wednesday, February 19

Prostate Cancer Screening—For men age 40 and over. A limited number of screenings is scheduled from 8:15 a.m. to 3 p.m. in Building 310-202 by appointment only. The screenings, conducted by the Cancer Detection Center, are available to all JPL employees and affiliates. Cost is \$45, payable at the time of the screening. Human Resources will contribute \$20 for each JPL employee's screening expense. Call ext. 4-3319 for an appointment.

Thursday, February 20

TIAA/CREF Enrollment Meeting—Held at noon in T1720-137, this workshop is designed to assist employees newly eligible for the Caltech/JPL retirement plan with selection of investment options and completion of forms.

Thu.-Fri., Feb. 20-21

Von Kármán Lecture Series—Dr. Mustafa Chahine, JPL senior research scientist and science team leader for the Aqua spacecraft sounding system, will present "New Weather and Climate Tools for the 21st Century" at 7 p.m. Thursday in von Kármán Auditorium and Friday in Pasadena City College's Vosloh Forum, 1570 E. Colorado Blvd. Thursday's lecture will be webcast at <http://www.jpl.nasa.gov/events/lectures/feb03.html>. For more information, call Public Services at ext. 4-0112.

Friday, February 21

Folk Music—Robin and Linda Williams will appear at 8 p.m. in Caltech's Dabney Lounge. Admission is \$18 for adults and \$5 for Caltech students and children under 12. For more information, call (626) 395-4652 or visit www.events.caltech.edu.

Saturday, February 22

MatheMagic!—Magician Bradley Fields, who makes math fun by incorporating magic, storytelling and comedy to engage children, will appear at 2 p.m. in Caltech's Beckman Auditorium. Tickets are \$10 for adults, \$5 for children. Call (626) 395-4652.

Sunday, February 23

Chamber Music—The Amelia Piano Trio will perform at 3:30 p.m. in Caltech's Beckman Auditorium. Tickets are \$29, \$25, \$21 and \$17. For more information, call (626) 395-4652.

Monday, February 24

JPL Softball—An organizational meeting will be held at 11:30 a.m. in the 167 conference room. All team managers and interested individual players

not currently affiliated with a team should attend. Call Scott Morgan at 4-4972 or Rich Benesh at 4-3748 for information or visit <http://jplreclubs.caltech.edu/softball>.

Tuesday, February 25

AVIRIS & Hyperion Earth Science and Applications Research Workshop—Held at Pasadena's Westin Hotel, 191 N. Los Robles Ave., from 8 a.m. to 5 p.m., continuing through Feb. 28. JPLers considering attending are asked to register online at <http://aviris.jpl.nasa.gov>. For more information, call Sharis Dilanchian at ext. 4-2605.

State of the Union—This film, held at 7:30 p.m. in Caltech's Beckman Auditorium, concludes the Frank Capra Film Festival. A panel discussion will follow the screening. Free admission. For more information, call (626) 395-4652.

Wednesday, February 26

JPL Toastmasters Club—Meeting at 5 p.m. in conference room 167. Call Roger Carlson at ext. 4-2295.

"The Physics of Star Trek"—Lawrence Krauss, professor of physics and astronomy at Case Western Reserve University, takes the audience on a warp-speed journey through the Star Trek universe, offering a glimpse of the world of modern physics, at 8 p.m. in Caltech's Beckman Auditorium. Free admission. Call (626) 395-4652 or visit www.events.caltech.edu.

Volunteer Professionals for Medical Advancement—Meeting at 10:30 a.m. at the Caltech Credit Union, 528 Foothill Blvd., La Cañada.

Thursday, February 27

Caltech Architectural Tour—The Caltech Women's Club presents this free service, which is open to the public. The tour begins at 11 a.m. and lasts about 1 1/2 hours. Meet at the Athenaeum front hall, 551 S. Hill St. For reservations, call Susan Lee at (626) 395-6327.

JPL Golf Club—Meeting at noon in Building 306-302.

JPL Stories—Dr. Dusan Petrac, cryogenics specialist for the Infrared Astronomy Satellite, will present "About IRAS, cryogenic challenges and testing of the IR focal plane" at 4 p.m. in the Library, Building 111-104. The 300-day IRAS mission in 1983 had the first satellite to utilize super fluid helium to cool infrared detectors. For questions about the story series, call Teresa Bailey at ext. 4-9233.

Social Security—A representative will be available for one-on-one counseling. This is a change from the usual third Thursday of the month. For an appointment, call the Benefits Office, ext. 4-3760.

Saturday, March 1

Boys of the Lough—This Grammy Award-winning ensemble will perform a program of Celtic music at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$29, \$25 and \$21, youth high school age and younger, \$10. For more information, call (626) 395-4652.

Saturday, March 8

"Planning for Your Child's Educational Future"—David Levy, assistant dean and director of financial aid at Caltech, and Catherine Thomas, associate dean of admissions and financial aid at USC, will discuss simple yet effective ways for parents to develop a financial plan for their child's college education. Hosted by the Child Educational Center and the Verdugo Hills Hospital Foundation for parents, grandparents and expectant parents. It will be held from 10 a.m. to noon at Verdugo Hills Hospital, 182 Verdugo Blvd., Glendale, 4th floor council room. A complimentary continental breakfast will be served starting at 9:45 a.m. For more information or reservations, call the Child Educational Center at ext. 4-3418.

A N D C O U N T I N G



Elachi outlines Lab's suite of upcoming missions in his State of the Lab address

By Mark Whalen

Even as JPL is in the busiest period in its history — with 14 spacecraft and three major instruments operating throughout the solar system — the Lab is working toward a number of additional launches over the next few months. JPL Director Dr. Charles Elachi, in his annual State of the Laboratory address on Feb. 10, outlined these near-term challenges as well as the Lab's outlook in the coming years.

Between now and the beginning of the summer, JPL is preparing to launch the Galaxy Evolution Explorer (March 28), Space Infrared Telescope Facility (April 15), and two Mars Exploration Rovers (May 30 and June 25). "We are facing a very hectic period," Elachi said, but "we have some very exciting scientific and technical challenges."

In 2004, Space Technology 6, CloudSat and Deep Impact are due for launch. Also next year, the Lab will set to achieve Stardust encountering comet Wild 2; the two Mars rover landings; the Earth Observing System (Microwave Limb Sounder/Tropospheric Emission Spectrometer) mission; and Cassini encountering and going into orbit around Saturn.

The work will continue apace in the years to come. In January 2005, the Huygens probe will be dropped into Titan's atmosphere. Elachi also noted the 2005 launches of Mars Reconnaissance Orbiter and Jason 2 and scheduled 2006 launches of the Actuated Hybrid Mirror/X-Sat, Space Technology 7 and Dawn.

Elachi said the NASA budget for 2004 includes several initiatives to tackle the "roadblocks" that need to be overcome for future exploration: propulsion, power and communication.

A new NASA program called Project Prometheus will develop safe nuclear power reactors that will be used for spacecraft power as well as for electric propulsion. Within that program are research activities to develop more efficient Radioisotope Thermoelectric Generators (RTGs), which could be used in the Mars Program.

A new major flight project that JPL would manage called the Jovian Icy Moons Orbiter is proposed for launch in 2011. The orbiter would circle the three icy satellites of Jupiter — Callisto, Ganymede and Europa — utilizing a nuclear reactor the size of a trash can. "This mission addresses the highest flagship mission priority provided by the National Academy Decadal Study, which laid out a vision for planetary exploration in the next decade," Elachi said.

"Our interest is not only because this is a Jovian icy satellites mission. This is also a steppingstone to the kind of missions that we envision doing in the following decade — Titan orbiters, rendezvous with a variety of comets, an orbit of Neptune," he said.

The reactor would be developed by the Department of Energy. Retired project manager John Casani will manage the formulation phase, and Dr. Torrence Johnson will be the project scientist. A "Phase A" study will be done over the next year and a half.

A second initiative to eliminate the "roadblocks" is the proposed 2009 Mars optical telecom demonstration. This would be developed as part of the Mars Telesat mission — a radio satellite that will be used to communicate with the 2009 Mars Science Laboratory. For ground detection, Goddard Space Flight Center would develop a balloon telescope to go above the clouds, while JPL would develop optical receivers deployed at a number of telescopes around the world. The system would later become a major element in the Interplanetary Network and will enable data rates of 10 to

100 megabits between Mars and Earth.

A third initiative, Beyond Einstein, consists of two strategic missions defined in the new Structure and Evolution of the Universe Program: Laser Interferometer Space Antenna (LISA), which would detect gravitational waves from space; and Constellation X, a Goddard mission.

Another element of Beyond Einstein is a program called Cosmic Probes, which will solicit proposals for three missions to understand dark energy, understand what forces powered the Big Bang, and provide a complete census of black holes.

For the most part, NASA's fiscal year 2004 budget request represents a significant increase in a tight budget environment. The total budget request for FY '04 is almost \$15.5 billion, a 3% increase over 2003. "I think NASA got a respectable increase when you compare it to other agencies," Elachi said. Space science received an increase of 16% in the request, to just more than \$4 billion. Within that discipline, solar system exploration received a 30% hike, to about \$1.36 billion.

Each NASA center, Elachi said, has an implementation plan — the role the centers play in NASA's overall strategic plan. JPL's plan has three elements: "Who We Are" (organizational character and value system), "What We Do" (our mission and focus) and "Future Focus," which comprises six specific areas, all of equal importance: Scientific and Technical Excellence, Business and Management Excellence, Strong

Partnerships, Contributing to National Security, Our Employees and Public Engagement.

In addition, the future focus theme also includes about 30 initiatives (to be achieved over the next three or four years) and 80 action items to be achieved in the next two years. Elachi provided examples of the action items:

THE RESEARCH AND TECHNOLOGY PROGRAM, established last year with \$10 million in funding, will continue to have an increase in funding to reach \$50 million in 2006.

HUMAN RESOURCES INITIATIVE. "This will take 1% of our budget to attract people to JPL and provide them with funds early in their career. It's somewhat of a training program, and will apply mostly to science and technology research."

STRENGTHENING JPL'S TECHNICAL INFRASTRUCTURE. "We need to provide you with the best tools so you can be successful. Over the next six months there will be a number of initiatives put forward so we can do this without increasing our burden rate."

PHYSICAL INFRASTRUCTURE. "We are looking at adding three or four buildings over the next decade, hopefully one of them starting this coming October if we can fund them within our programs. The master plan for JPL for the next decade could include a new parking structure, if we can get the funds."

ENGINEERING AND SCIENCE DIRECTORATE REORGANIZATION. ESD Director John Beckman

has chartered a group of section managers to assess options, present them to the division managers, then to the Executive Council in June, and hopefully a final decision in July or August.

EMPLOYER OF CHOICE. Family Day was successful last year, and will be held again this year; the Lab has increased undergraduate tuition reimbursement from \$3,000 to \$5,250; the limitation on employees' children working at JPL during the summer has been lifted.

BUDGET RESERVES. "I appreciate the hard work many people are doing. I'm urging all projects to have the appropriate reserves in their budgets so people don't have to work extensive hours for a long period of time."

Elachi pointed out that the recently renewed contract for Caltech to operate JPL for NASA includes the importance of the "One NASA" vision. "It's important to remember we're part of the NASA family," he said. "At the same time, we have to uphold the standards of Caltech and the importance we put on excellence. Both NASA and Caltech are part of a broader endeavor we're doing on behalf of the nation."

The contract also highlighted the importance of good cost management. Starting Oct. 1, Elachi said, all flight projects will apply the "earned value" management approach — a way of estimating progress relative to cost. Associate Director and Chief Financial Officer Fred McNutt and his team are developing train-

ing for both financial and technical staff to use this system.

The new contract is for five years, and will be automatically extended or reduced in length based on JPL's performance. For example, an "excellent" grade will mean a nine-month extension, "very good" means a three-month extension, "good" means no extension, "average" means a reduction of three months, and "poor" means a reduction of nine months. "I have no doubt," Elachi said, "that with your help we'll perform 'excellent.'" He acknowledged Steve Proia and his team in the Contracts Management Office. Historically, Elachi said, the contract is negotiated in late September, but this time it was prepared nine months ahead of schedule.

Elachi also acknowledged some other outstanding work by JPLers:

THE OFFICE OF COMMUNICATIONS AND EDUCATION'S OUTREACH TEAM, which received a rating of 97 out of a possible 100 in its 2002 performance evaluation from NASA, the highest score JPL has ever received.

DIVISION 34, particularly the **PEOPLE WHO WORK IN BUILDING 198**. "When wind damage caused the evacuation of part of the building in late November, many people offered to share an office. Everybody pulled together, and this reflects the spirit of JPL."

THE NETWORK SIMPLIFICATION PROJECT TEAM, which developed hardware and

2.3 million lines of code for the Deep Space Network, spending weekends and vacation to help implementation of that capability.

THE SHUTTLE RADAR TOPOGRAPHY MISSION TEAM, which developed a topographical map of the world—the equivalent of the previous 40 years of work—in a year and a half.

THE GLOBAL POSITIONING SYSTEM TEAM, which achieved radial orbital accuracy on Jason down to one centimeter, and with 30 days of measurements from the GRACE mission were able to achieve at least as good a gravitational field of Earth as existed prior to the mission.

MARC MONTGOMERY AND HIS TEAM, which delivered the upgrade of the Oracle system. "They treated this like a launch, worked over vacation, weekends, 24 hours a day to preserve our operations."

THE GALILEO TEAM was complimented by the Washington Post for "bringing the spacecraft back to life and got its tape recorder working to record its final treasure," and complimented the ingenuity of the JPL flight control team.

JEANNE HOLM (Knowledge Management manager) and **TOM RENFROW** (chief information officer), **AND THEIR TEAM**, which developed the NASA portal in record time. The portal came on line Feb. 1, and was expecting 100,000 hits. Unfortunately, a few hours later the Columbia accident happened, and the portal took 220 million hits that weekend. They were able to accommodate it.

SIRENA ALVAREZ for her outstanding customer service and dedication to the Flight Hardware Logistics Program. Elachi thanked program manager Kevin Clark for acknowledging her good work. "It's important to say 'thank you.' Just a simple statement like this means a lot to people who work hard. That's the kind of spirit I see across the Lab."

Elachi concluded by laying out a vision of the legacy that will be left from 2015 to 2020 to the next generation. He predicted that we would be able to say that this generation:

- Established a permanent presence around and on the surface of Mars
- Explored the Saturnian system, especially Titan, the only satellite with an organic atmosphere
- Explored Jovian satellites in detail and probed their interiors for possible life-favorable environments
- Returned the first samples from other solar system bodies beyond the moon
- Began exploring neighboring solar systems
- Enabled efficient access to all the bodies of the solar system
- Explored the boundaries of physics to understand the forces that powered the Big Bang
- Established an operational capability to monitor the dynamics of solid Earth and its oceans and atmosphere
- Established the Interplanetary Network, which is being commonly used by students.



Dutch Sliger / JPL Photolab

Flight hardware facility opens

From left: Kevin Clark, Flight Hardware Logistics Program; Bob DeVille and Bruce Fisher, Facilities; Jeff Leising, Project Planning Office; Tom Gavin, Associate Director, Flight Projects & Mission Success; Ken Van Amringe, FHLP; Joe Solomon, Facilities project manager.



Dutch Slager / JPL PhotoLab

The new Flight Hardware Logistics Program Bonded Stores (Building 325) officially opened for business on Jan. 17.

The Bonded Stores provides a centralized facility to more efficiently transfer residual flight hardware from past to future projects. Due to the increase in projects, the amount of residual flight hardware is increasing and, there is

a greater possibility of the need for reutilization. In the past 24 months, FHLP has captured more than 6,000 items—valued at over \$200 million—and has delivered more than 500 items, valued at over \$5 million. The first major use of the facility was a capture of Atmospheric Infrared Sounder residual hardware, valued at more than \$2.5 million, and delivered from BAE in Massachusetts, some of which is already destined for JPL customers.

The new Bonded Stores has over 4,000 square feet to receive post-launch residual hardware for staging, review, disposition, storage, and inventory management. The facility includes a 320-square-foot clean room for hardware review required by projects.

To help JPL achieve its goal to provide critical hardware to projects faster and more efficiently, the program also brokers common flight procurements, develops anticipatory buys and supplier agreements, and provides information to projects and proposers about flight hardware availability. The program's online website and catalog at <http://fhlp> provide Labwide access to the FHLP inventory and other inventories on Lab.

Ad deadline extended

Due to the Presidents Day holiday on Feb. 17, the Universe ad deadline has been extended to Tuesday, Feb. 18 at 2 p.m.

JPL'S ONLINE NEWS SOURCE

Classified ads will be available the day before Universe is published at <http://dailyplanet>

View this and previous issues of Universe at <http://universe.jpl.nasa.gov>

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Notice to Advertisers

Advertising is available for JPL and Caltech employees, contractors and retirees and their families. No more than two ads of up to 60 words each will be published for each advertiser. Items may be combined within one submission. Ads must be submitted on ad cards, available at the JPL Store and the Universe office, Bldg. 111-B29C, or via e-mail to universe@jpl.nasa.gov.

Ads are due at 2 p.m. on the Monday after publication for the following issue.

All housing and vehicle advertisements require that the qualifying person(s) placing the ad be listed as an owner on the ownership documents.

Letters

My husband and I would like to thank my friends and colleagues for all of your support and expressions of sympathy upon the passing of my father-in-law. Your kind thoughts and words were appreciated at this time of sorrow. I also wish to thank the JPL Store for the beautiful plant sent to my home.

Gayane and Ardashes Kazarians

Passings

Retired employee **THOMAS WOOD** passed away Feb 5. He began his career at JPL in 1952. In 1962, he continued his work at the Edwards Air Force Base test site as a supervisor of solid propellant for Explorer 1 and Voyager projects until his retirement in 1987.

Wood is survived by his wife Faye, son Thomas Jr., daughter Linda, and grandchildren Kristy, Kim, Brandon and Aubry.

Classifieds

For Sale

BABY ITEMS: Graco wind-up swing, \$20; bicycle carrier seats; Rhode Gear, \$20; Gerry, \$15; Peg Perego Prima Pappa highchair, needs new cushion, \$45; all items in vg cond. 626/794-1319.

BANJO, 5 string, \$150. 248-7331.

BATHTUB DOOR, glass, nice pattern, 1 gold and 1 silver frame, installation instructions, brand new in box. \$85/ea. 731-0470.

BED, flotation, Somma queen, pine headboard, \$150/obo; PICNIC TABLE, redwood, round, 60" across w/4 benches, needs work. \$15. 626/914-7853.

BOOTS, Lowe mountaineering, leather, insulated, size 12, plus over-boot insulator, \$10. 626/794-2431.

CAR SEATS, infant, 1 Graco (navy blue & teal green plaid; 1 one Evenflo (navy blue w/ gold stars); with base, carrying handle, and canopy, good cond., \$20/each. 626/256-6606.

CAT TREE, custom for 2 cats, ctr unit is enclosed box, 18" x 18" x 12", w/3 side entry holes and 1 hole ea top & bottom; top unit is 18" x 18" + 5.5" surround wall and 1 entry hole; adjustable secure height for any ceiling, covered in orange carpet w/white trim, in La Verne, \$100/as is. 909/593-4046. viddaves@earthlink.net.

CLOTHES for boys, incl. 2 suits, slacks & shirts, most about sz. 12, exc. cond. 359-3644.

CLOTHING, men's career bus. suits and separates; all in new/exc. cond.; fine qual. fabric/ tailoring; designer & sizes vary, more items not listed; navy wool flannel suit, sz. 40, 32 1/2 x 31+, \$90; gray-brown wool flannel 3-pc. suit, sz. 40, 32 x 31+, \$90; wool flannel trousers, sz. 36 x 31+, \$40; 2 pairs; 1 char-coal gray, 1 soft brown. 626/289-2795.

COFFEE MAKERS, Krups 10-cups, white/gray, like new, \$40/obo; Braun 10-cups, white/black, like new, \$30/obo. 626/791-6101.

COMPUTER, Sun Ultra 5, w/17" monitor, 270 MHz CPU, 128 MB RAM, 14 GB IDE drive, CD-ROM drive, 10/100 NIC, VGA adapter, keyboard, mouse, cables, and Solaris 2.6/8/9 media, \$300. 310/208-3249, Roy.

COMPUTER DESK, on wheels, vertical design, med. brown wood w/room for tower, monitor, printer, keyboard/pencil tray, fold down side shelf for scanner, etc., exc. cond., not a writing desk, w/computer chair, \$50. 626/836-4960.

COUCH, shades of gray/blues, with oak trim, very versatile and comfortable, \$200/obo; DESK, white, with glass fitted top piece, 3 drawers, \$50/obo. 626/294-1927.

DESK AND CHAIR, antique mahogany, \$500; TABLES (2), rod iron, glass top tables indoor/outdoor \$1,500; BED, child's full size, new mattress, book shelf, drawers, night stand, \$500. 248-8853.

DIET TAPES, Jenny Craig, set of 14, \$50; COMPUTER POWER CONTR. CTR., 5 pwr. switches + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, \$20; ORGAN, Yamaha 415 electronic console w/13 pedals, 3 keyboards, 144 rhythm patterns, pd. \$7,500, sacrifice for \$2,000. 790-3899.

DINING ROOM SET, lg. table w/3 extension leaves, 6 chairs, table pads, large china

cabinet, beautiful older set, see to appreciate, \$3,200. 626/447-6423.

DINNER JACKET, men's formal, for cruises, weddings, etc., sz. 40 long, burgundy, vg cond., \$100 value at \$25. 626/793-1985.

EXERCISE EQUIPMENT, abs sculptor, equipment and video, \$10. 626/850-4378.

EXERCISER, Total Gym 1000, slant board, like new, \$90/obo. 661/295-6681.

GUITAR, Takamine, 6-string acoustic, F360 with silk/steel strings, case, tuning fork, battery operated tuner included, \$300/ reasonable offers considered. 626/294-1927.

HOME BREWING KIT, 5-gal. glass carboy, complete package, including approx. (50) 22-oz. bottles, \$50/obo. 626/794-1319.

KITCHEN TABLE AND CHAIRS, 2 sets, 1 w/6 padded chairs, oak finish lg. table w/1 leaf, \$150; smaller set w/4 chairs, \$75. CANISTER VACUUM, originally \$400, now \$75; ROCKING CHAIRS, pair of mauve swivel, \$75. LAMPS, pair, ceramic, \$40. 626/447-6423.

MOVING SALE: Pottery Barn/Z Gallery/Ethan Allen/designer, Bakers rack, \$125; pine buffet, \$175, maple dbl. head/footboard, \$100, dressers/chests, \$100-250; 3 matching LR tables, \$150-175; custom overstuffed chair, \$200; pine bookcase, \$250, glass/metal patio set, \$250; mtn. bike, \$50, prints/paintings \$25-\$250; Lenox china, Oneida stainless flatware, iMac, desks, lamps, bookcases, mattresses \$15-75. bbon@earthlink.net, 952-2581.

MOVING SALE: all prices are obo; TV, \$100; stereo/VCR/speakers, \$500; wood end tables/lamp tables, \$10-\$100; 9-foot beige sofa, \$100; 7 x 8-foot wood breakfast, \$700; gold flatware, \$50; Persian-style rugs, \$100/each; espresso maker, \$20; vacuum cleaner \$50; desk and chair, \$100; power hand saw, \$50; sewing machine, \$20. 626/797-5768.

ORGAN, Wurlitzer, with bench, two 44-key manuals, 1 octave bass pedal, electronic beats, Mahogany, \$150. 248-9418.

PLAYGROUND EQUIPMENT, for 1-3 yrs. old, Little Tikes swing, climber, slide, and steering wheel, like new, \$60. 626/850-4378.

PUPPY, 4-mo.-old poodle, toy size, white, cute, loving, lively, pedigree, vaccinated, \$450. 626/794-0073.

REFRIGERATOR, Westinghouse, 28" x 28" x 64", top freezer, \$140/obo. 310/478-3454.

REFRIGERATOR, Whirlpool, 18.2 cu. ft., freezer on top, white, automatic ice maker, EZ-vue crispers, adjustable glass shelves, two years old, like new, sacrifice \$350. 790-4028.

ROAD BIKE, 2000 GT ZR, 1.0 Team Lotto, Easton alum., size 56cm, Fork-Reynolds 11/8 full carbon headset, Chris King black stem I.T.M 130cm bar-3T 46 seat post, carbon Campy record w/flight gel L shifters, Campy 10 record drive train, Campy 10 chorus brakes, Campy chorus wheels, 2000 Mavic Ksyrium all black, built 6 mo. ago, has 300 miles, all new parts, must sell, \$1,700/obo. 548-5082.

SOFTWARE, PrintShop CD Label Creator, brand new in orig. box, Windows XP compatible, incl. device for applying CD labels, \$10; POKKET ELEPHANT, Aurora, featuring digital voice alarm and memo recorder, all-in-one calculator, clock/ alarm, and voice recorder, brand new in sealed package, \$10. 790-3899.

STEAM BATH, fiberglass, very nice, portable, \$225. 626/437-6214.

TABLE TOP, butcher block, hardwood, 60 x 28 x 1 inch, with legs, \$100. 248-9418.

TELEVISION, Toshiba, color, 32", w/stand, 4 years old, exc. cond., \$250. 661/297-5234.

TENT, heavy duty, lifetime quality canvas, rainproof, sleeps 3, no centerpole, ideal for fishermen or hunters, have photo, very good cond., \$45. 626/793-1895.

TREES, red banana plant, 5' tall, \$60/obo; fish tail, 6' tall, \$80/obo; Ficus, braided, in 30" plastic pot >10' tall, \$250/obo; CERAMIC BOWL, gray, 2' diameter with planted geraniums, \$40/obo. 626/791-6101.

VANITY DRESSING TABLE, antique, mirror + 4 small drawers, Art Deco circa 1930s, great cond., \$300; DRESSING TABLE, unique honey oak, pedestal type, dual circular mirrors w/solid brass appointments, circa 1940s, great cond., must see, \$275. 368-9520.

WHEEL HUB, for big wagon, not used as such, hand made, solid oak, w/separate wired base, light emits thru (no-spokes) slats, 12" x 7", \$45/ obo. 909/593-4046. viddaves@earthlink.net.

Vehicles / Accessories

ALLOY RIMS, for '99 Acura Integra, mint cond., new tires, fits all Integras, Civics, CRXs, or 4-lug pattern, \$450/obo. 525-0912.

CABLE CHAINS, 2 sets, new, 1 set never used: 1 used <2 mi., fits variety of 15" or 16" tires, \$20/each/obo. 353-6369, eves.

'98 CHEVY Corvette coupe, 6 spd., pewter/black, 43K mi., active suspension, dual zone air, power steering, anti-lock power brakes, power seats, leather, cruise control, traction control, \$25,900. 626/794-2772.

'96 CHRYSLER Concorde, green w/beige leath-

er, 3.5L eng., 1 owner, 80K mi., power everything, CD, tape etc, \$6,400. 768-3465, Harold or Torrie.

'94 DODGE Grand Caravan SE, 6 cyl., a/c, a/t, roof rack, gd cond, 124K mi., \$3,600. 248-4601.

'00 FORD Taurus, V6, 3.0, 24 valve, exc. cond., \$6,450. 626/379-3503.

'98 FORD Taurus, V6, 3.0, 24 valve, exc. cond., \$4,450. 626/379-3503.

'96 FORD T-Bird LX, V6, 112K mi., 2 dr, exc. cond., new tires/battery, am/fm/ stereo/cass., a/c, cruise control, electric windows, central locking, alloys, very well maint., \$3,600/obo. 626/796-3701, Stephen.

'00 HONDA Civic DX, 2-door sedan, automatic, am/fm radio, a/c, clean, good cond., red, 15,000 original miles, 1 owner, \$10,000/obo. 626/568-2806 or 626/473-4445.

'97 HONDA Valkyrie motorcycle, exc. cond., extra chrome, garage kept, purple/white, studded seats (2 seats and backrest), leather bags, many access., 23K mi., see to appreciate, \$7,990. 957-2852.

'92 HONDA Accord EX, very clean, good cond., black w/tan leather interior, auto, moon roof, 108K mi., \$5,000/obo. 549-1516.

'91 HONDA Accord LX, maroon/red, 4 dr., auto full power, leather seats, a/c, am/fm/cass., new tires, well-maint., 233K, \$2,800/obo. 525-0912.

'90 HONDA Accord LX, 4 dr. sedan, auto, brown, 146K mi., \$2,200/obo. 626/798-1990.

'90 HONDA Accord DX, white, 2 dr., a/c, black windows, exc. cond. 626/665-3571.

'89 HONDA LXi sedan, see to appreciate, white, 4 dr., 5-sp, 189K, p/v, p/l, am/fm/ cass., clean interior/exterior, vg running cond., no accidents, 1 owner, \$2,300. 626/780-2427.

'88 HONDA Accord LX, charcoal gray, am/fm/ cass., a/c, low miles, runs gd, \$2,500/obo. 626/443-9774.

'84 HONDA Sabre, VF 7005, 700cc, 18,000 mi., black, rear rack, windshield, helmet, good cond., \$1,600. 626/794-2431.

'91 HYUNDAI Scoupe, 100+K mi., good cond., needs clutch work, \$900/obo. 626/303-7255.

'90 PLYMOUTH Laser RS, white w/black trim, alloy wheels, 5-sp, sporty and quick, runs well, looks great, 130K mi., orig. owner, \$1,000/obo. 249-1749.

'98 PORSCHE Boxster, loaded, red/black, hardtop, 37,000 miles, exc. cond., \$29,000. robinson.wj@gte.net or 310/318-6372.

'86 SUZUKI GSX-R 750 motorcycle, 22K mi., Keihin CVK carbs, KN filters, Kerker K2 pipe, Progressive front springs, degreed cams, great shape, lots of extras including parts microfiche and complete service manual, digital pictures available, \$2,500. 640-7479, Greg.

'02 TOYOTA Camry XLE, 10K mi., 4 cyl, auto frnt. seats, 6 CD chgr., sunroof, climate ctrl, side & curtin airbags, ABS, \$19,700/obo. 626/794-0073.

'96 VOLVO 960 wagon, top of the line, white w/gray leather int., 6 disc/cassette, moon roof, all power, auto, a/c, 3rd seat, exc. cond., maintained perfectly, \$10,300. 626/296-3441.

'95 VOLVO, 850 GLT wagon, 92,000 miles, excellent condition, \$9,500. 248-8853

'90 VOLVO 740 wagon, 140K, leather, turbo, 3rd seat, the works, \$2,800. 626/358-2151, Mike.

Wanted

HOUSING: NASA employee, new to area, seeks 2/2+ house near JPL; married couple, no kids, pets or smoking, exc. credit and ref., range \$1,800-\$2,200. 913-5550.

MATH TUTOR, jr. & sr. high school level classes; geometry, pre-algebra, algebra I & II, SAT math, etc., eves and/or weekends, 888/784-1639, David.

NANNY, full or half time, for 6-mo.-old, Hollywood Hills area starting in March. 323/428-1123, Tim.

PARKING SPACE, for a 30-ft. motor home, in Montrose/La Crescenta/La Canada area. 249-5337.

SPACE INFO/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.

T-BIRD OWNERS, with a valid CA drivers license and insurance, join our club, meet owners of classic '55-56-57 T-Birds; monthly meeting, events, parades; \$25 membership/year per couple. 626/797-1310, leave msg.

VANPOOL RIDERS for Lancaster/Palmdale/Littlerock/Acton area; van leaves Angeles Forest Park & Ride @5:30 a.m., returns from JPL @4 p.m.; cost: \$140. Call Frank Shanklin, 3-0505 or Shirlee Kurtz, 4-9737.

Lost & Found

Found: single gold hoop rope style earring in conf. rm. 301-367A (Planning Center), week of Jan. 27. Call Linda Kopatz, 4-0116 or pick up at 301-370E.

Free

CATS, 1 male, 6-yr.-old tabby; 1 female, 3-yr.-old black; very people-oriented/affectionate, great with dogs/other cats, together or separate; they just require love, I regret giving up my babies

due to pregnancy-induced allergies. 209-5001. COMPUTER, IBM PC w/Pentium 166 MHz, Windows 95, 15 GB disk, Epson Color Stylus 500 printer, IBM 20" monitor, all works. bbon@earthlink.net or 952-2581.

POOL FILTER, DE, 72 sq. ft. (lg.); CLOTHES DRYER, Miele electric, broken, but Miele says they'll fix it for \$300, you would then have a much better machine than the \$800 one we got to replace it; KID VIDEOS, Disney etc., on VHS. 768-3465, Harold or Torrie.

PUPPIES, Weimaraner/Dalmatian, born 12/22/02. 626/791-2909, vastadub@hotmail.com.

REFRIGERATOR, G.E., side-by-side, 17 years old. 626/357-8210.

For Rent

ALTADENA, guest house, 1 mi./JPL, 2 bd., 1 ba., hardwood floors, lg. windows, patio w/ garden, refrigerator, pets considered, util. and prem. cable included, \$1,200. 626/798-5044.

PASADENA, spacious and clean, 2 bd., 1 ba., den with fireplace and window seat, large formal dining room, office/study, carport and enclosed yard, \$1,795. 952-5568.

PASADENA, apt. to share with Caltech postdoc, fully furnished townhome-style apt., 3 bd., 3 ba., patio, laundry, close to Caltech & JPL, \$625 including util. 626/351-9641.

PASADENA, back house, 3 mi. from JPL, excellent for one person, no pets, available after March 10. 626/390-2474.

SIERRA MADRE, charming home, quiet street, 3 bd., 2 ba., ctrl. a/c & heat, w/d hook-ups, lg. fenced yard with patio & fruit trees, garage parking, non-smoker, \$1,900. 626/355-9670.

SIERRA MADRE apt., 2 bd., 1 ba., 6-unit bldg., short walk to village, new carpet and paint, carport, \$920. 626/355-7318.

SIERRA MADRE, townhome-style apt. to share, 1,000 sq. ft., lg. patio, 2 bd., 1.5 ba., quiet st., garage prking, washer/dryer for this unit, \$605 + 1/2 util. 626/355-4838, Heather.

SOUTH PASADENA, custom home, 5 bd., 3 ba., double garage, C/A, 15 min. to JPL, good school, \$2,600. 800/205-5009, x222.

SUNLAND, fully furn. rm. in condo, share kitch./bath/laundry; gar. prking, a/c, fireplace, pool, spa, tennis court; 10 miles/JPL, prefer male, non-smoking, no pets; \$450 + 1/2 util., security deposit, references. 352-3112.

VENICE, nr. Rose/Vaingrove, charming guest house, hi ceiling, newly renovated, quiet neighborh'd, landscaped yd., parking, refrigerator, 1-year lease, \$1,100 incl. uti. 310/392-9073.

Real Estate

LA CANADA, 3 bd., 2 ba., fr dining area, La Canada schools, 2 blks from JPL, updated kitchen, 2 tp, h/w floors, landscaped yds. w/auto water and lighting, workshop off garage, \$660,000. 626/798-4134.

MT. WASHINGTON house, next to Glendale/Pasadena/Eagle Rock/Occidental College; 2,000 sq. ft., lg. custom 3 bd., 2 1/2 ba., 2-car gar., lots of storage, exc. Mt. Wash. elem. school, 12 min./JPL, cyn. view, quiet neighborhood, avail. summer '03. \$479,000. 626/403-0446.

Vacation Rentals

BALBOA ISLAND, fully furnished 2 bd., 1 ba., patio, washer/dryer, parking, steps to bay. \$150/night or \$875/week. 626/351-9641.

BIG BEAR LAKEFRONT, luxury townhome, 2 decks, tennis, pool/spa, beautiful master bd. suite, sleeps 6. 949/786-6548.

COPACABANA BEACH, Rio de Janeiro, Brazil, 1 bd. furnished apt. overlooking beach, superb view and location, sleeps 2-3, \$80/day. 626/303-1616 or 626/304-0688.

HAWAII, Kona, ocean front on Keauhou Bay, house/guest house comfortably slp 6, 3 bd., 2 ba., rustic/rich/relaxing/beautiful, swimming/snorkeling/fishing, spectacular vw., nr restaurants, golf and other attractions. 626/584-9632.

HAWAII, Maui condo, NW coast, ocean front view, 25 ft. fr. surf, 1 bd. w/loft, compl. frnt. phone, color TV, VCR, microwave, d/w, pool, priv. lanai, slps 4, laundry fac., 4/15-12/14 \$105/nite/2, 12/15-4/14 \$120/nite/2, \$15/nite/ add'l person. 949/348-8047, jackandrandy@cox.net.

LAKE TAHOE, Incline Village, luxury time-share, 2 bd.

universe

Jet Propulsion Laboratory

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Odyssey: melting snow caused gullies

By Mary Hardin

This visible-light image (left), taken by the thermal emission imaging system on JPL's 2001 Mars Odyssey spacecraft, shows the gullies in the top right-center as they appear to emerge from beneath and within a gradually disappearing blanket of snow. The image on the right, taken by the Mars orbiter camera on JPL's Mars Global Surveyor spacecraft, shows numerous gullies, with a remnant of the snow pack (arrow) proposed to be the source of water that eroded the gullies.

IMAGES FROM THE VISIBLE LIGHT CAMERA ON JPL'S MARS ODYSSEY spacecraft, combined with images from the Lab's Mars Global Surveyor, suggest melting snow is the likely cause of the numerous eroded gullies first documented on Mars in 2000 by Global Surveyor.

The now-famous Martian gullies were created by trickling water from melting snow packs, not underground springs or pressurized flows, as had been previously suggested, argues Dr. Philip Christensen, the principal investigator for Odyssey's camera system and a professor from Arizona State University. He proposes gullies are carved by water melting and flowing beneath snow packs, where it is sheltered from rapid evaporation in the planet's thin atmosphere. His paper is in the electronic Feb. 19 issue of Nature.

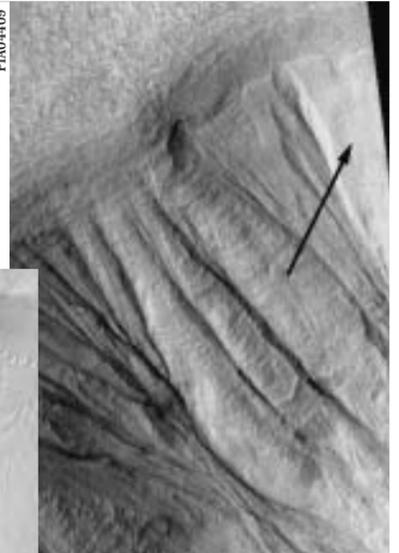
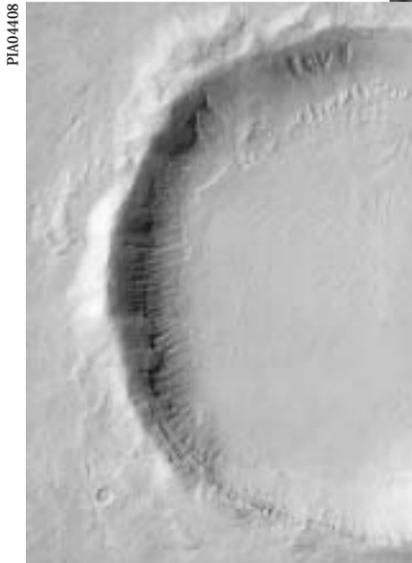
Looking at an image of an impact crater in the southern mid-latitudes of Mars, Christensen noted eroded gullies on the crater's cold, pole-facing northern wall and immediately next to them a section of what he calls "pasted-on terrain." Such unique terrain represents a smooth deposit of material that Mars researchers have concluded is "volatile" (composed of materials that evaporate in the thin Mars atmosphere), because it characteristically occurs only in the coldest, most sheltered areas. The most likely composition of this slowly evaporating material is snow. Christensen suspected a special relationship between the gullies and the snow.

"The Odyssey image shows a crater on the pole-facing side has this 'pasted-on' terrain, and as you come around to the west there are all these gullies," said Christensen. "I saw it and said 'Ah-ha!' It looks for all the world like these gullies are being exposed as this terrain is being removed through melting and evaporation."

Eroded gullies on Martian crater walls and cliff sides were first observed in images taken by Mars Global Surveyor in 2000. There have been other scientific theories offered to explain gully formation on Mars, including seeps of ground water, pressurized flows of ground water (or carbon dioxide), and mudflows caused by collapsing permafrost deposits, but no explanation to date has been universally accepted. The scientific community has remained puzzled, yet has been eagerly pursuing various possibilities.

"The gullies are very young," Christensen said. "That's always bothered me, because how is it that Mars has groundwater close enough to the surface to form these gullies, and yet the water has stuck around for billions of years? Second, you have craters with rims that are raised, and the gullies go almost to the crest of the rim. If it's a leaking subsurface aquifer, there's not much subsurface up there. And, finally, why do they occur pre-

entially on the cold face of the slope at mid-latitudes? If it's melting groundwater causing the flow, that's the coldest place, and the least likely place for that to happen."



Christensen points out that finding water erosion under melting snow deposits answers many of these problems. "Snow on Mars is most likely to accumulate on the pole-facing slopes, the coldest areas. It accumulates and drapes the landscape in these

areas during one climate period, and then it melts during a warmer one. Melting begins first in the most exposed area right at the crest of the ridge. This explains why gullies start so high up." Once he started to think about snow, Christensen began finding a large number of other images showing a similar relationship between "pasted on" snow deposits and gullies in the high-resolution images taken by the camera on Global Surveyor. Yet it was the unique mid-range resolution of the visible light camera in Mars Odyssey's thermal emission imaging system that was critical for the insight, because of its wide field of view.

"It was almost like finding a Rosetta Stone. The basic idea comes out of having a regional view, which Odyssey's camera system gives. It's a kind of you-can't-see-the-forest-for-the-trees problem," he said. "An Odyssey image made it all suddenly click, because the resolution was high enough to identify these features and yet low enough to show their relationship to each other in the landscape."

50 years later, photo study shows asteroid hit moon

By D.C. Agle

IN THE EARLY MORNING HOURS OF Nov. 15, 1953, an amateur astronomer in Oklahoma photographed what he believed to be a massive, white-hot fireball of vaporized rock rising from the center of the Moon's face. If his theory was right, Dr. Leon Stuart would be the first and only human in history to witness and document the impact of an asteroid-sized body impacting the Moon's scarred exterior.

Almost a half-century, numerous space probes and six manned lunar landings later, what had become known in astronomy circles as "Stuart's Event" was still an unproven, controversial theory. Skeptics dismissed Stuart's data as inconclusive and claimed the flash was a result of a meteorite entering Earth's atmosphere. That is, until Dr. Bonnie Buratti, lead scientist for asteroids, comets and satellites in Section 3224, and Lane Johnson of Pomona College, took a fresh look at the 50-year-old lunar mystery.

"Stuart's remarkable photograph of the colli-

sion gave us an excellent starting point in our search," said Buratti. "We were able to estimate the energy produced by the collision. But we calculated that any crater resulting from the collision would have been too small to be seen by even the best Earth-based telescopes, so we looked elsewhere for proof."

Buratti and Johnson's reconnaissance of the 35-kilometer-wide (21.75-mile) region where the impact likely occurred led them to observations made by spacecraft orbiting the Moon. First, they dusted off photographs taken from the Lunar Orbiter spacecraft back in 1967, but none of the craters appeared a likely candidate. Then they consulted the more detailed imagery taken from the Clementine spacecraft in 1994.

"Using Stuart's photograph of the lunar flash, we estimated the object that hit the Moon was approximately 20 meters (65.6 feet) across, and the resulting crater would be in the range of one to two kilometers (.62 to 1.24 miles) across. We were looking for fresh craters with a non-eroded appearance," Buratti said.

Part of what makes a Moon crater look "fresh" is the appearance of a bluish tinge to the surface. This bluish tinge indicates lunar soil that is relatively untouched by a process called "space weathering," which reddens the soil. Another indicator of a fresh crater is that it reflects distinctly more light than the surrounding area.

Buratti and Johnson's search of images from the Clementine mission revealed a 1.5-kilometer (0.93 mile) wide crater. It had a bright blue, fresh-appearing layer of material surrounding the impact site, and it was located in the middle of Stuart's photograph of the 1953 flash. The crater's size is consistent with the energy produced by the observed flash; it has the right color and reflectance, and it is the right shape.

Having the vital statistics of Stuart's crater, Buratti and Johnson calculated the energy released at impact was about .5 megatons (35 times more powerful than the Hiroshima atomic bomb). They estimate such events occur on the lunar surface once every half-century.

"To me this is the celestial equivalent of observing a once-in-a-century hurricane," said Buratti. "We're taught the Moon is geologically dead, but this proves that it is not. Here we can actually see weather on the Moon," she said.

While Dr. Stuart passed on in 1969, his son Jerry Stuart offered some thoughts about Buratti and Lane's findings. "Astronomy is all about investigation and discovery. It was my father's passion, and I know he would be quite pleased," he said.

Buratti and Johnson's study appears in the latest issue of the space journal *Icarus*.

The NASA Planetary Geology and Planetary Astronomy Programs and the National Science Foundation funded Buratti's work.



Near the center-right of this image by Dr. Leon Stuart is a lunar flare he observed in 1953.

News Briefs

Lab receives energy-efficient vehicles

JPL has received from NASA the delivery of nine energy-efficient Global Electric Motor Cars (GEMs). The cars were donated to NASA by Chrysler Corp., and the agency also gave a number of the same vehicles to NASA's Dryden Flight Research Center and Ames Research Center.

Currently in use by JPL's Safety Office and Environmental Affairs Office, the electric cars use no fossil fuels. The four-passenger vehicles feature front-wheel drive and four-wheel hydraulic brakes, a safety glass windshield, and

There are optional for protection sun. The cars van, making them

are battery-charger plugs into d can be fully 10 hours.

ervisor of the ons Group in Sec- he vehicles are

available for use by JPL organizations.

Black said before the donation JPL was considering purchasing some of the vehicles to comply with the federal Greening The Government Through Federal Fleet Transportation Act as well as the Energy Policy Act of 1992, which addresses the reduction of petroleum consumption through improvements in fleet fuel efficiency and the use of alternative-fuel vehicles and alternative fuels.

For more information about the cars, call MARCOS FALCON, ext. 4-4140.

Software award nominations accepted

NASA is accepting nominations for the annual Software of the Year Award, part of an effort to recognize exceptional software developed and owned by the agency.

The award is given to author(s) of scientific and technical software. The software must have been supported, adopted, sponsored, or used by NASA; be significant to NASA's aeronautical or space activities; and officially released by NASA within the last three years.

Entries and supporting material must be submitted electronically no later than April 18. For information about the nomination process, call RICH DOYLE, ext. 4-9894, or visit <http://icb.nasa.gov>.

Winners receive the NASA Software Medal, a certificate signed by the administrator, and a monetary award. NASA's Invention and Contributions Board may recommend an award up to \$100,000, depending on the value of the software to government and industry.

Changes noted for U.S. bonds

The Department of the Treasury has announced a change to the terms and conditions for U.S. Savings Bonds. Series EE and I Bonds with an issue date of February 2003 or later must be held for at least 12 months before they can be redeemed. Savings bonds issued prior to February 2003 may be cashed after six months.

For more information, visit <http://www.treasurydirect.gov>.

Chess team wins trophy

A team from JPL won the Best Industrial Team trophy over the Presidents Day weekend at the U.S. Amateur Team Chess Championship - West. The "Mars Attacks" team of JPLers RICHARD BORGEN, TIM THOMPSON and DAVID STEIN, along with San Gabriel math teacher JULIO-CESAR MARIN, won the trophy. Borgen, Thompson, Marin and LARRY STEVENS had teamed to win the same trophy in 1998.

"CALTECHnically Won," with Caltech students WHEE KY MA, EUGENE YANAYT, GRAHAM FREE and HOWARD LIU, won first place overall. They will now compete for the national title against other regional winners.

Special Events Calendar

Ongoing Support Groups

Alcoholics Anonymous—Meetings are available. Call the Employee Assistance Program at ext. 4-3680 for time and location.

Caregivers Support Group—Meets the first Thursday of the month at noon in Building 167-111 (The Wellness Place). For more information, call the Employee Assistance Program at ext. 4-3680.

Codependents Anonymous—Meeting at noon every Wednesday. Call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Group—Meets the first Friday and third Thursday of the month at noon in Building 111-117. Call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parents Group for Children With Special Needs—Meets the second Thursday of the month at noon in the Wellness Place, Building 167-111.

Working Parents Support Group—Meets the third Thursday of the month at noon in Building 167-111. For more information, call the Employee Assistance Program at ext. 4-3680.

Observatory at 8 p.m. in Caltech's Beckman Auditorium. For more information, call (626) 395-4652.

Thursday, March 6

Investment Advice—A Fidelity representative will be available for one-on-one counseling. For an appointment, call (800) 642-7131.

JPL Gun Club—Meeting at noon in Building 183-328.

Saturday, March 8

"Planning for Your Child's Educational Future"—David Levy, assistant dean and director of financial aid at Caltech, and Catherine Thomas, associate dean of admissions and financial aid at USC, will discuss simple ways for parents to develop a financial plan for their child's college education. Hosted by the Child Educational Center and the Verdugo Hills Hospital Foundation for parents, grandparents and expectant parents. It will be held from 10 a.m. to noon at Verdugo Hills Hospital, 182 Verdugo Blvd., Glendale, 4th floor council room. A complimentary continental breakfast will be served starting at 9:45 a.m. For more information or reservations, call the CEC at ext. 4-3418.

Saturday, March 1

Boys of the Lough—This Grammy Award-winning ensemble will perform a program of Celtic music at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$29, \$25 and \$21, youth high school age and younger, \$10. For more information, call (626) 395-4652.

Tuesday, March 11

"E Pluribus Unum: Future World of Mutable, Cellular Spacecraft"—Dr. Tom Yunck of the Exploration Systems Autonomy Section will speak at noon in Building 180-101, describing an approach to Earth sensing with large arrays of tiny, free-flying cells, each of which is an autonomous sensor collecting data that may itself be of direct interest.

JPL Stamp Club—Meeting at noon in Building 183-328.

Wednesday, March 12

JPL Amateur Radio Club—Meeting at noon in Building 238-543.

JPL Toastmasters Club—Meeting at 5 p.m. in the 167 conference room. Call Roger Carlson at ext. 4-2295 for information.

Friday, March 14

Caltech Women's Club—A "Welcoming Coffee" will be held from 9 to 10:30 a.m. in von Kármán Auditorium. For more information, call Carol Anderson at (818) 790-8175.

Fri.-Sat., March 14-15

Aquila Theatre Company—This award-winning company will present *The Importance of Being Earnest* on Friday and *A Midsummer Night's Dream* on Saturday in Caltech's Beckman Auditorium. Both shows begin at 8 p.m. Tickets are \$15 for adults, \$10 for youth high school age and under. For more information, call (626) 395-4652.

Ongoing

The Social Security representative will no longer take one-on-one counseling appointments on Lab. Call the Benefits Office, ext. 4-3760, to arrange for a telephone counseling appointment.

Sunday, March 2

Chamber Music—The Debussy Trio, whose repertoire includes styles from French Impressionism to American jazz-fusion and works by film composers, will offer a free concert at 3:30 p.m. in Caltech's Dabney Lounge. For more information, call (626) 395-4652.

"Rational Mysticism: the Border Between Science and Spirituality"—Author John Horgan will present this Skeptics Society-sponsored talk at 2 p.m. in Caltech's Baxter Lecture Hall. Free for the JPL/Caltech community. For more information, call (626) 395-4652.

Tuesday, March 4

JPL Gamers Club—Meeting at noon in Building 301-227.

JPL Genealogy Club—Meeting at noon in Building 301-271.

Tues.-Wed., March 4-5

Investment Advice—TIAA/CREF representatives will be available for one-on-one counseling. For an appointment, call (877) 209-3140, ext. 2614, or visit <http://www.tiaacref.com>.

Wednesday, March 5

Associated Retirees of JPL/Caltech—Meeting at 10 a.m. at the Caltech Credit Union, 528 Foothill Blvd., La Cañada.

"Catching Waves with LIGO"—Caltech physics professor Dr. Barry Barish will deliver this free lecture on the Laser Interferometer Gravitational-Wave

This month in Aeronautics and astronautics history

- 55 years ago 2.16.48 • Gerard Kuiper discovered Uranus' moon Miranda.
- 35 years ago 2.24.68 • Discovery of the first pulsar.
- 26 years ago 2.12.77 • The Viking Lander began its deep-digging operations on Mars following the reception of commands from JPL.
- 13 years ago 2.10.90 • JPL's Galileo spacecraft completed the first major milestone in its gravity-assisted flight to Jupiter when it flew a carefully designed course close to the planet Venus.
- 5 years ago 2.10.98 • Galileo completed the Europa 13 flyby.
- 2.17.98 • JPL's Voyager 1 passed Pioneer 10 to become the most distant human-created object in space at 10.4 billion kilometers.



Seated in one of JPL's new Global Electric Motorcars are, left to right,

Bruce Troutman, Section 272

manager; Gerald Kalish, safety

coordinator; James Black,

Administrative Operations Group

supervisor; and Marcos Falcon,

Fleet Management. Standing,

from left, are Fleet Management

staff Terry Durham, Jim Parrish

and Dominick Martinez.

Bob Brown / JPL Photolab



Marshall program on the right track

This article is the second in a monthly series that describes how NASA centers are realizing the One NASA goal.

There's a picture of "Wisdom" on Thom Holden's office wall.

The picture is of an elderly bespectacled man in deep thought and it serves as a salve for any frustration that creeps into Holden's soul.

"Every time I look at it I realize there is more knowledge to be gained—more I can do to benefit all of NASA," Holden said.

He uses the same analogy when talking about the agency's "One NASA" concept—something that Holden readily agrees with and supports.

"I think it's a great idea—long overdue," Holden said. "For NASA to fulfill its missions, all of the centers really do need to operate as one entity. We need to pull together on projects and goals that reach across the agency, and I believe we are on the right track toward achieving that."

Holden, 45, leads the Implementation Support Team at the Marshall Center. He's responsible for providing change management support to the Integrated Financial Management

module projects at the center. These module projects are all part of the Integrated Financial Management Program (IFMP), which is a NASA-wide

effort to modernize its financial and administrative systems and processes. The IFMP project exemplifies the "One NASA" approach to business. The program is implementing a series of new enterprise software systems and business processes through module projects.

"We've got 10 IFMP module projects," Holden said. "NASA has implemented three of those module projects to date: Resume Management, Posi-

tion Description and Travel Manager."

Resume Management, also known as "NASA Stars," is enabling the agency to have one staffing and recruiting process. Position Description Management allows supervisors to use a common database for writing job descriptions. Travel Manager provides NASA one standard system for processing travel requests.

The Core Financial Project is the fourth in the series of IFMP modules and is considered the "backbone" of the entire IFM program. It's being rolled out in waves, and implementation at all NASA centers for the Core Financial Project is scheduled to be completed later this fiscal year.

"The Core Financial module is the foundation for the whole IFM program," Holden said.

The reason it is considered the foundation is that it will allow NASA staff to provide timely, consistent and reliable information for management decisions and provide an accounting and budgeting structure to enable full-cost management.

"IFMP is ushering in entirely new and different tools for NASA employees to use and enabling the agency to conduct its financial and business affairs in a much more efficient manner," Holden said. "The IFM program will enable 'One NASA' with 10 interdependent centers. And it's doing that."

"As a part of One NASA, integrated financial management is a change of culture, a change of thought, a change in the way we do business," Holden continued. "There will be rough spots, but if people will stay the course and give One NASA and the IFM program a chance, the American people will benefit as well as the NASA community."



Thom Holden of NASA's Marshall Space Flight Center.



A Friend From the Beltway

BY MARK WHALEN



JPL's new congressman, Rep. David Dreier (R-Glendora), addressed JPL staff Feb. 19 to show his continued support for the Laboratory and for NASA. Dreier's 26th district seat now includes JPL and La Cañada, due to redistricting following last November's congressional elections.

LAB DIRECTOR DR. CHARLES ELACHI THANKED Dreier for the latter's longtime interest in JPL's work. Elachi noted that the congressman dropped by JPL in 1999 following the loss of Mars Polar Lander.

"I was impressed," Elachi said. "He also came a couple more times to support the morale of the people working here. When we lost contact with the spacecraft, he called me, Richard Cook and a number of other people, to tell us how much Congress is behind us and how much he personally is behind us. This was even before JPL was in his district (laughter), and that shows his commitment to the space program."

Elachi also appreciated Dreier's "(playing) a key role in reversing the language in the Senate [in the attempt to] farm out the telecommunications and mission operations activities here," Elachi said. "We should all be thankful. That would have impacted 800 jobs at JPL."

In the fiscal year 2003 budget that was just approved in mid-February, Elachi added, "Dreier played a key role in making sure that the Mars Program is fully supported, and the (new) Jovian Icy Moons Orbiter mission is fully supported."

Dreier, the first Californian and the youngest-ever member of the House Rules Committee, wished the Lab good luck on the May 30 and June 25 launches of the Mars Exploration Rovers. He considered it "an honor and a privilege just to be able to visit you. It's a thrill because there's still a little kid in every single one of us, and I believe that the work you're doing here is so important," he said.

Regarding the Feb. 1 loss of Space Shuttle Columbia, "It's obviously a real challenge and a difficult time for everyone," Dreier said. But, he pointed out, "What you do here is very tough work. Three Saturdays ago, I was reminded of the (loss of Mars Polar Lander). And while there was no loss of life in December 1999, ... it was a similar feeling to those nights when I came up here. (Then-JPL Director) Ed Stone was here, and he told me, 'If you don't take risks, you're never going to learn anything.'

"Failure is a very important part of this process, because it says you're taking those important risks. While blood, sweat and tears are given in the ... work that takes place here, it's obvious that the fact that you were pushing the envelope clearly means that you're not going to succeed every time."

Dreier recalled the "resolve and commitment" of the Columbia astronauts as noted in an emotional statement by NASA Administrator Sean O'Keefe at the memorial service in Houston. Astronaut Kalpana Chawla called over all her crewmates one day and asked them to look into the retina of her eye. They could see the reflection of the planet Earth.

Following the Columbia tragedy, "In Washington, we have in many ways redoubled our commitment to the space program," Dreier said. O'Keefe and President Bush are "very committed" to NASA's

circling this planet (with the space shuttle), getting beyond the hurdle of the pulls that exist here and moving to Mars and Jupiter and other planets is a very important step and action for us."

Dreier also expressed appreciation for JPLers' dedication. "I know you all make sacrifices," he said. "I don't know that people will look back on the last few years of the technology boom as the 'California Gold Rush,' but ... there are a lot of people in this room who could have had the potential to be very involved in that successful endeavor. Yet you all have made a conscious choice to pursue scientific truths, which I think is an extraordinarily admirable thing."

The congressman also lauded JPL's efforts in inspiring the next generation of explorers. "I was so pleased when Dr. Elachi told us how committed



work, he added. Dreier and Congressman Adam Schiff (D-Pasadena), whose district formerly included JPL, "stand together, very committed to our goal of ensuring that JPL's work continues. While there are serious problems NASA has faced, you all are the brightest spot on the horizon. I think you all should congratulate yourselves for being that very bright spot."

Dreier noted current concerns about NASA's manned vs. unmanned missions. He said Elachi mentioned there would always be a need for human involvement. "Finding water on Mars is one of our priorities, but when it comes to the process of drilling, there is going to be a need for a human component," Dreier said.

JPL's role among NASA's priorities is secure, Dreier said. "The work you are doing ... should be our highest priority. Rather than spending so much time

JPL is to education, and that 70,000 students will be coming through here every single year. I thank you for that, because we know that education is so critically important. And up until Sept. 11, 2001, it was the No. 1 priority we were focused on in Washington."

Dreier, who said he considers himself "very anti-war," addressed the possible effect of a war with Iraq on the NASA budget. "We are going to expend what it takes to win the war. We know it will be costly. (But) I'm going to do everything I can to ensure that it doesn't have a negative effect on the NASA budget. I'm going to argue again that because of the national security assistance that you and other NASA programs have provided us that we should increase the NASA budget and have even greater spending as we pursue these scientific truths."

Passings

DR. ALBERT HIBBS, 78, a retired JPL scientist and manager known as the "Voice of JPL" for his work as a broadcast spokesman for myriad Lab missions, died Feb. 24 following complications of heart surgery at Huntington Hospital in Pasadena.

Hibbs earned a bachelor's degree in physics from Caltech in 1945 and a master's in mathematics from the University of Chicago in 1947. He joined JPL in 1950 as a research engineer, and during his time at the Lab earned a doctorate in physics from Caltech. He then held a number of increasingly responsible research and management positions, including chief of the Research and Analysis Section, chief of the Space Sciences Division, and manager of the Transportation Technology Office. He was also the system designer of the first U.S. satellite, Explorer I.

He may best be remembered for his service as the Lab's spokesman on the Surveyor missions to the moon; the Mariner missions to Mars, Venus and Mars; the Viking mission to Mars; and the



Dr. Al Hibbs

Voyager mission to the outer planets.

Hibbs received numerous awards for his broadcasting and radio work, including the George Foster Peabody Award for the NBC weekly television show Exploring (1963), cited as an outstanding children's program. He was also honored for his work on World of Science (1965) and About Science (1966), both broadcast on radio.

Hibbs retired from the Lab in 1986. He is survived by his wife, Marka; daughter Victoria; son Bart; sister Agnes Jones; stepdaughter Alicia Cortrite; stepson Lawrence Wilson; and three grandchildren.

Private services will be held in March. The family requests that donations in Hibbs' name be made to the Caltech Y, 415 S. Holliston Ave., Pasadena, 91125.

WILLIAM SHIPLEY, 71, former assistant laboratory director for JPL's Office of Engineering and Review, died Feb. 8 at his retirement home in Melbourne, Fla.

Shipley, a native of Washington, D.C., earned a bachelor's degree in physics from George Washington University in 1953. He joined JPL in 1955, as a research engineer, and later fulfilled



William Shipley

other supervisory and management duties before serving as manager of the Thermoelectric Outer Planet Spacecraft Advanced System Technology Project from 1968-71.

He was spacecraft development manager from 1971-77 for JPL's Voyager mission to the outer planets. He then served four years as manager of the orbiter spacecraft for the Galileo mission to Jupiter before assuming duties in quality assurance, safety and reliability.

In 1988, Shipley was appointed assistant laboratory director for JPL's Office of Engineering and Review. He retired from JPL in 1997.

Shipley is survived by his brother John; sons Stan, Craig, and Torbert; and grandsons Jacob, Nate, Eli and Augie.

In lieu of flowers, the family requests donations in Shipley's name to the Vision Rehabilitation Program at the Braille Institute, 741 N. Vermont Ave., Los Angeles, 90029.

Letters

I want to thank everyone in the JPL community for the lovely plant and warm card. My father was a wonderful man. He is missed. The thoughtfulness is appreciated. Sincerely,

Larry Divine

I would like to extend my sincerest thanks to all of my friends and colleagues in the Mission Assurance Division (51), the Office of Safety and Mission Success (5X), and those from other organizations for the cards, the beautiful JPL Store plant, and the kind words of sympathy and much-needed support during the untimely death of my sister. Your thoughtfulness and caring is greatly appreciated by our whole family.

Yolanda Walton

Retirees

The following JPL employees retired in February: John Meysenburg, 36 years, Section 336; Richard Nonaka, 36 years, Section 319; James Stultz, 35 years, Section 353; Ho-Sen Lin, 34 years, Section 341; John Zoutendyk, 29 years; David Boatman, 26 years, Section 352; Blair Lewis, 26 years, Section 345; Paul Richter, 24 years, Section 331; Reginald Cormier, 23 years, Section 333; Omer Divers, 23 years, Section 3234; Margaret Johnson, 20 years, Section 311; Enselmo Garcia, 19 years, Section 352; James Clawson, 17 years, Section 515; Jeanne Wu, 17 years, Section 212; Melville Roberts, 15 years, Section 344.

JPL'S ONLINE NEWS SOURCE

Classified ads will be available the day before Universe is published at <http://dailyplanet>

View this and previous issues of Universe at <http://universe.jpl.nasa.gov>

E-mail us at universe@jpl.nasa.gov

Classifieds

For Sale

BED, Select Comfort airbed, queen sz., ultra pillow top, dual controls, with frame, \$800/obo; STEREO SYSTEM, Technics, CD changer, receiver, dual cass., floor speakers & cabinet, \$175/ obo; PET CARRIER, 18" x 18" x 24", w/food & water dish, airline rated, used once, \$40. 395-0310 or donandellen1@earthlink.net.

BED, king, Waveless Flotation Waterbed, pine platform with 6-drawer under-bed storage, book shelf headboard, \$300/obo. 249-4096.

CAMERA, Hasselblad, 500 cm, 80 mm f2.8 planar, T* lens, two A12 backs, Kiev prism, filters & accessories, exc. cond., in orig. box, \$1,500/firm. 626/285-3810.

CAMERAS: Polaroid land Sun 600; Vivitar Instamatic 845 Telomotr. \$20; FILM SPLICER, 8 mm, \$5. 626/449-3699.

CEMETERY PLOT, Rose Hills Memorial Park & Mortuary, plot (Lot 277, grave 3) located on Alpine Terrace next to the new chapel (gate 1), valued at \$3,200, sell \$1,800. 626/442-9940, Chris.

CHAIRS (4), folding card-table type, by Cosco, vg cond., tan colored, \$32/all. 626/793-1895.

CHAISE, white, exc. cond., was \$600, now \$175. 626/850-4378.

CLOTHING: 2 career woman's suits, finely tailored: 1 red camo hair, sz. 12, \$75; 1 ivory wool, sz. 10, \$90; sueded shirt, indigo/violet color w/ matching multi-design scarf, both from Chico's, \$50; pumps, Bandolino, 2 pairs, sz. 7 1/2, one pair black leather, one pair khaki/gold fabric over leather, \$25/pair; all items exc./new cond., see to appreciate. 626/289-2795.

COFFEE MAKERS, Krups 10-cups, white/gray, like new, \$40/obo; Braun 10-cups, white/black, like new, \$30/obo. 626/791-6101.

DIET TAPES, Jenny Craig, set of 14, \$50; COMPUTER POWER CONTR. CENTER, 5 pwr. switches + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, \$20; ORGAN, Yamaha 415 electronic console, 13 pedals, 3 keyboards, 144 rhythm patterns, pd. \$7,500, sacrfc. for \$2,000. 790-3899.

DODGER TICKETS, selected games from season ticket pkg., Loge level (orange), aisle 140 (nr. 1st base), 2 tickets/game at face value of \$23/ticket. www.delunac.net/tickets or 626/296-1253.

EXERCISE BIKE, \$25; COMPUTER TABLE, \$5; COMPUTER, P2 Dell, monitor, printer, \$50; SOFA, hide-a-bed, \$15; REFRIGERATOR, \$100; MICROWAVE, \$20; BED, double, \$35; SHELVES, metal, 1 x 8 x 8, \$30; DESK, wood, large, \$80; FILE CABINET, 4 drawer, \$20; offers considered. 626/744-0576, eves.

EXERCISE CYCLE, Ergometer made by Tunturi, adjust. seat height, handlebars and pedal resistance, workout timer, calorie meter, mpg meter, heavy duty unit in exc. cond. manual. \$75. 626/963-5727.

FOOT MASSAGER, multi-speed, works great; orig. \$200+ (purchased at Brookstone) sell for \$50; BACK BELT MASSAGER, Dr. Scholls, new-in-box; \$10; CROQUET SET (Brookstone, retails \$100+), still in box, used once, \$40; ROCKING CHAIR, metal "vintage" outdoor, circa 1940s, \$5; exercise equip. for arms and legs isometric exercises, beautiful, \$10. 626/398-4960.

FURNITURE: dining room table, 6 high-back chairs & 2 extra leaves, \$250; couches, two, 6 ft., 200/pair; multimedia / stereo cabinet, \$200; coffee table, rectangular, \$30. 323/257-7668. FURNITURE: desk & chair, antique mahogany, \$500; glass top tables, indoor/outdoor, 2, rod iron, \$1,500; full sz. bed, child's, new matr., bookshelf, drawers, nightstand, \$500. 248-1102.

FURNITURE: recliner, teal, \$49; peacock chair, wicker, \$29; microwave cart solid oak, \$39; matching oak side table, \$19; bookcase, blue metal, sliding glass doors, 4'w x 3't, \$89; water dispenser for hot & cold water, no bottles needed, \$29; doctor's scale, tall w/ balancing lever, \$49; kneel-on computer chair, \$10; antique full-size bedsprings, \$10; European freezer, needs work, \$19. 626/798-4510.

GOURMET MAGAZINES, back issues, most new, still in plastic covers, \$.50/each; MARBLE

ROLLING PIN with wooden stand, new, never used, \$15; BREAD MAKER, Welbilt, exc. cond., \$15; FRANCISCANWARE, Desert Apple pattern, assorted misc. pieces: \$3-15/ea. 626/398-4960.

JACKET, sportsman's down insulated wider-ness, with padded collar, men's, size 40 long, good cond., \$25. 626/793-1895.

MINI-DISC PLAYER, Sony, w/record capability, remote, anti-skip, 10 blank discs, great sound, tiny, mint cond., \$99/obo. 687-8627, Alberto.

MISC.: a/c, Kenmore, fits sliding window, only 14" w x 22" t, \$149; quilting frame, \$29; spare tire/wheel, donut, T105 80D-13, used once, \$39; massage machine, fits in chair \$29; extra large mini-blinds 72" w x 50" t, 2 for \$29; golf ball retriever, telescoping alum. 12", \$19; kids rolling duffle bag, multicolor, never used \$19; Pierre Cardin 3-pc. luggage set, \$19; TV, b/w 13" \$19; stroller, pink & gray, \$15. 626/798-4510.

MOVIE ITEMS: camera, Bell & Howell, 8 mm, \$25; movie projector, Bell & Howell, 8 mm, \$35; light bar, Bell & Howell, \$10; light meter, Polaroid pr23, \$10; movie editor, Fairchild, 8 mm, \$20; filters & lens, \$5/ea. 626/449-3699. MOVING SALE, Sat. March 1, from 9 a.m., 120 S. Mentor Ave. apt. 103, Pasadena, TV/VCR, stereo (multi CD deck), sofa, queen-size bed, Ikea table, kitchen equipment, fridge/freezer, microwave, irons and board, patio furniture, and more. 626/796-3701, Stephen and Susan.

ORGAN, classic Wurlitzer electric (brass reeds), 2 keyboards w/stops, 13 pedals, sideman, black, w/bench, \$625. 626/794-1050.

PATTERN MAKING SYSTEM, Lutterloh, includes tool kit with tailor's curve, instructions, and 280 models and pattern designs manual, used once, \$100/obo. 323/268-6645, Priscilla.

PING PONG TABLE, folding, heavy duty, + paddles, gd. cond., \$25. 626/432-4638.

PORT REPLICATORS (2): 1 advanced, works w/ Dell Inspiron 3700, 3800, 4000, 4100, 8000, 8100 and 8200 Notebook, like new, \$75; 2 offer for IBM Thinkpad, works with T20, T21, A20, A21 or X, R series, like new, \$75. 790-3899.

SCANNER/flatbed, Umax Astra 2400s w/Vista Scan software, 8.5 x 14 scannable area/max res 9600x9600 dpi, interface: built in SCSI II; one 25-pin connector and one 50-pin connector, will include: manual, installation software, cables, SCSI card, \$250. 626/791-8161.

STOVE, gas, Magic Chef, slide in, almond, electronic controller, good cond., 10 yrs. old, \$50. 626/794-2431.

SOFTWARE, PrintShop CD Label Creator, brand new in orig. box, Windows XP compat-ible, includes device for applying labels to the CD, \$10; POCKET ELEPHANT, Aurora, w/digital voice alarm and memo recorder, all-in-one calculator, clock/alarm & voice recorder, brand new in sealed pkg., \$10; FAX CARTRIDGE ribbon refill PC-102RF for w/Brother Intellifax models 1150-1950, brand new, \$25. 790-3899.

STROLLER, Emmaljunga, top-of-the-line, side-by-side, twin stroller in hunter green, exc. cond., was \$425, now \$175. 626/850-4378.

SWING, Fisher-Price, Smart-Response, exc. cond., barely used, navy-blue and beige, \$50. 661/298-2647, Dave.

TABLE LAMP, Peacock, copy of a vintage Tiffany, tail has several hundred pieces of stained and leaded glass, \$100/firm. 248-5282. TREES, red banana plant, 5' tall, \$60/obo; fish tail, 6' tall, \$80/obo; Ficus, braided, in 30" plastic pot >10' tall, \$250/obo; CERAMIC BOWL, gray, 2' diam., w/planted geraniums, \$40/obo. 626/791-6101.

WHEELCHAIR, electric, brand new, extended battery, red w/arm rests, \$2,000; TOOL CHEST, rrolley, w/top box, \$300; BIRD CAGES, 2, wrought iron, 4 ft. high, \$100, 9 ft. high, \$250. 952-7016.

Vehicles / Accessories

'93 BMW 325i, white w/black interior, 100K mi., very clean, exc. cond., \$7,500. 728-1633.

'96 DODGE Grand Caravan, 3.3L V6, gold, dual a/c, dual side doors, well-maintained, good cond., 115,000 miles, \$4,750/obo. 952-2971.

'98 FORD Taurus SE, 24-valve V6, 91K mi., white, tan leather, loaded, \$5,750. 661/424-9441.

'96 FORD Thunderbird LX, V6, 112K mi., 2 dr., exc. cond., new tires and battery, am/fm/stereo/

cass., a/c, cruise control, electric windows, central locking, alloys, very well maintained, \$3,600/obo. 626/796-3701, Stephen.

'93 FORD Explorer XLT, white/tan leather, auto, 4 dr, tinted glass, cassette, 12-disc CD, a/c, power everything, new tires, brakes; 136M, always garaged; all service records; never been in accident; looks and runs great (3E0B478); \$4,600. 626/794-6860, evenings.

'78 GMC Birchaven motorhome, 23 ft., rear bath, classic design with front wheel drive and tandem rear wheels, smooth running 405 V8, rear disc brakes, 79K mi, needs upholstery, \$7,800/obo. 626/447-5433.

'97 HONDA Valkyrie motorcycle, exc. cond., extra chrome, garage kept, purple/white, studded seats (2 seats and backrest), leather bags, many accessories, 23K mi., see to appreciate, \$7,990. 957-2852.

'84 HONDA Sabre VF 700S, 700 cc, 18,500 mi., black, rear rack, windshield, good cond., \$1,400. 626/794-2431.

'95 NISSAN Altima GLX, exc. cond., automatic, a/c, power windows/doors/steering, tilt whl, cruise contr., white exterior, gray int., 93K mi., \$5,000/obo. 626/445-1952 weekdays only, lv. msg., or 760/200-5499 weekends only, lv. msg. '93 NISSAN Pathfinder 4 X 4, exc. cond., 170K mi., new tires, needs transmission, loaded, power everything, CD player, sun roof, and roof rack, \$2,950/obo. 909/981-7492, Darlene.

'98 PORSCHE Boxster, loaded, red/black, hard-top, 37,000 miles, exc. cond., \$29,000. robinson.wj@gte.net or 310/318-6372.

'96 SATURN SW2, manual, exc. cond., anti-lock brakes, cruise control, a/c, power doors, power windows, am/fm/cassette, 100K miles, blue book value \$3,800, sell \$3,000. 323/462-4440.

'02 SUBARU WRX wagon, Sedona Red, 5-sp, air, cruise, allow wheels, CD changer, exc. cond., 12,500 mi., \$19,900. 661/297-3815.

'88 SUZUKI Savage motorcycle, 650 cc, very clean, runs great, maroon, new battery, saddle bags, located (garaged) in Van Nuys, \$1,500. 501-8161.

'95 VOLVO, 850 GLT wagon, 92,000 miles, exc. cond. \$9,500. 248-1102.

Wanted

ENGLISH TUTOR, for writing, middle- and high-school students. 626/796-7238, eves., lv. msg. SLIDE & JUNGLE GYM, used, to buy in gd. cond. for 2+ year old; MATCHBOX CARS, used, to buy in good cond. 626/296-0611.

SPACE INFORMATION/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.

TREADMILL, used, in exc. cond. 626/449-0997. VANPOOL RIDERS, for Lancaster/Palmdale/ Littlerock/Acton area, van leaves Angeles Forest Park & Ride at 5:30 a.m. and returns from JPL at 4 p.m., cost \$140. Frank Shanklin, 3-0505 or Shirlee Kurtz, 4-9737.

Free

CLEAN FILL DIRT, 20 cu. yds. avail., haul as much as you like, near Los Robles/Jackson, Pas. 791-3103.

For Rent

ALTADENA guesthouse, 1 bd., util. included, non-smoker, street parking, 5 min. to JPL, \$825 + \$500 sec. 626/797-1046.

ALTADENA (NW), 3 bd., 2 ba., new paint & carpet, cent. air/heat, large back yd. quiet st., less than 10 min. to JPL, \$1,950. 626/798-6588.

GLENDALE apt., Occidental alum seeks respon-sible roommate, pref. female, to share a 2 bd., 1 ba., in 8-unit complex, quiet and safe neighb'h'd, covered parking space incl., must be able to live w/2 well-behaved cats, utilities included, \$625 + \$175 security. 323/493-6972.

HACIENDA HEIGHTS, S. of Pasadena, priv. house, avail. June '03, best for academic or professional visitors, 3 bd., 3 ba., library, den, privacy, surrounded by trees, 2,400 sq. ft., high ceiling, attractive furn., all creature comforts, all rooms gd. size, convenient shopping. hacheng@usc.edu or 213/740-2105, Harrison.

LAS VEGAS, 2 houses in The Lakes, 2 bd., 2 ba., 1 has den, 1,250 sq. ft., carpet in bds, tile elsewhere, 2-car garage, gardener pd., incl. appliances, small pets considered, \$1,000 + \$1,050 + \$1,000 sec. 661/254-6134.

PASADENA, spacious and clean 2 bd., 1 ba., den w/fireplace & window seat, lg. formal din. room, office/study, carport & enclosed yard, util. and gardener incl., \$1,795. 952-5568.

PASADENA, lg. immac. condo in cent. located complex, 2 bd., +office, 2 ba., fully furn., ideal for visiting staff, 2 parking spaces, 1 mile/ Caltech, JPL owner, flexible lease, avail. May 1, \$2,500/neg. 202/544-8142, dmt00@earthlink.net.

PASADENA apt. to share, fully furn. 3 bd., 3 ba., townhome-style apt. w/patio, a/c, laundry facil., nr Caltech & JPL, \$625 incl. util. 626/351-9641.

SAN MARINO, share a large 3 bd., 2 ba. house, bright prvt bd., no smoking, no pets, 9 miles to JPL, \$525, util. included. 626/237-0754.

TUJUNGA, Seven Hills, rm in 3 bd., 2 ba., house, in mountains N. of Burbank Studios, quiet neighb'h'd w/great views/hiking trails, mo.-to-mo. lease for respectful non-smoking professional, some kitchen/laundry privileges, utilities shared, \$600. 544-2119, Amy, days.

TUJUNGA/SUNLAND, 2 bd., 1 ba., large living room with fireplace, kitchen with dining area, large fenced yard with separate garage, avail. March 25, \$1,100. 352-1825, evenings, Joe.

VENICE, nr. Rose & Walgrove, charming guest house, high ceiling, newly renovated, quiet neighb'h'd, landscaped yd., parking, refrig., 1-yr lease, \$1,100, incl. util. 310/392-9073.

Real Estate

GLENDALE condo, 2 bd., 2 ba., prime loc., gd. school dist., cent. a/c, hardwood floor, remodeled kitch., exc. vw., pool, \$225,000. 667-5569.

MT. WASHINGTON house, next to Glendale/Pasadena/Eagle Rock/Occidental College; 2,000 sq ft., lg. custom 3 bd., 2 1/2 ba., 2-car gar., lots of storage; exc. Mt. Washington elem. school, 12 min./JPL, cyn. vw., quiet neighb'h'd, avail. summer '03, \$479,000. 626/403-0446.

Vacation Rentals

BALBOA ISLAND, fully furnished 2 bd., 1 ba., patio, washer/dryer, parking, steps to bay, \$150/night or \$875/week. 626/351-9641.

BIG BEAR LAKEFRONT, luxury town home, 2 decks, tennis, pool/spa, beautiful master bd. suite, sleeps 6. 949/786-6548.

CAMBRIA, ocean front house, sleeps up to 4, excellent view. 248-1102.

CHARENTE, France; pleasant, spacious XVIIth cent. country house, in Aug. '03, sleeps 7 + sofa bed in l/r; fireplace, washing machine, 2 ba., telephone; in an orchard w/beautiful view, easy driving dist. from markets, 2 1/2 hrs. train from Paris, in a province famous for its many Romanesque churches & castles and by-passed by tourism; \$450/wk. + \$100 returnable cleaning deposit. 310/457-5975, eve.

HAWAII, Kona, ocean front on Keauhou Bay, house / guest house comfortably slp 6, 3 bd., 2 ba., rustic, relaxing, and beautiful, swim-ming, snorkeling, fishing, spectat. vw., nr. restaur., golf, other attractions. 626/584-9632.

HAWAII, Maui condo, NW coast, ocean front vw. 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwave, d/w, pool, priv. lanai, slps 4, laundry fac., 4/15-12/14 \$105/nt./2, 12/15-4/14 \$120/nt./2, \$15/nt./add'l person. 949/348-8047, jackandrandy@cox.net.

OCEANSIDE condo, fully furn., 2 bd., 2 ba., fr-plc., full kitch., quiet, relaxing, beautiful beachside setting, BBQ, pool, spa, game rm., great ocean view; easy walk to pier/restaurants, slps 8, weekly or monthly. 909/981-7492 or dhaug@yahoo.com, Darlene.

OCEANSIDE, on the sand, charming 1 bd. condo, panoramic view, walk to pier & harbor, pool/spa, game rm., sleeps 4. 949/786-6548. ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 18-hole golf course 6 mi. away, priv. secure parking. 626/794-3906.

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