

MGS antenna deployment may be delayed

Extension of high-gain antenna could be postponed for up to nine months

Concern over the deployment mechanism for the high-gain communication antenna on the Mars Global Surveyor spacecraft has caused NASA managers to consider postponing the antenna's deployment in order to maximize the probability of mission success.

The project team is studying a postponement of up to nine months in the antenna deployment, which currently is scheduled to take place in March 1999. The spacecraft uses the undeployed high-gain antenna to communicate with Earth, but the entire spacecraft must be turned to point the antenna toward Earth dur-

ing each communication session.

"We have not made any decisions yet, but we want to take a conservative approach in order to protect the mission as fully as possible," said Project Manager Glenn E. Cunningham. "A delay in the antenna deployment would reduce the flow of imagery and science data somewhat, but we have some ideas about how to compensate for that."

Launched in November 1996 and in Mars orbit since September 1997, Mars Global Surveyor carries a dish-shaped high-gain antenna that is to be deployed on a two-meter-long

(6.6-foot) boom for the global mapping portion of the mission. The antenna is stowed during launch and the early orbital phase at Mars so that it is not contaminated by the exhaust plume from the spacecraft's main engine. The mission plan calls for the antenna boom to be deployed following the final use of the main engine next spring, at the completion of the spacecraft's orbit-shaping aerobraking activity.

During deployment, the boom is pushed outward by a powerful spring. A damper mechanism cushions the force of the spring and limits

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Deep Space 1 arrives at KSC to prepare for October launch

JPL's Deep Space 1 spacecraft, designed to validate 12 new technologies for scientific space missions of the next century, has arrived at Kennedy Space Center to begin prelaunch processing. Deep Space 1 will be launched aboard Boeing's Delta 7326 rocket and is currently targeted to lift off Oct. 15. This is the first flight in NASA's New Millennium Program.

Among the experiments aboard Deep Space 1 is an ion propulsion engine strikingly similar to those described in futuristic science fiction works, and software that tracks celestial bodies so that the spacecraft can make its own navigation decisions without the intervention of ground controllers.

At launch, the diminutive Deep Space 1 weighs only 490 kilograms (1,080 pounds) fully fueled and is just 2.5 meters (8.2 feet) high, 2 meters (6.9 feet) deep and 1.7 meters (5.6 feet) wide, including such attached items as twin stowed solar arrays. However, when those arrays are deployed, the width will grow to 11.8 meters (38.6 feet) across. Deep Space 1 should complete most of its mission objectives during the first two months after launch. However, it will continue validating these

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KENNEDY SPACE CENTER PHOTO

Wearing protective suits, workers maneuver the Deep Space 1 spacecraft into place for prelaunch processing in the Payload Hazardous Servicing Facility at Kennedy Space Center. The mission is targeted for launch on a Boeing Delta 7326 rocket on Oct. 15.

Lab, local company agree to commercialize technologies

By JOHN G. WATSON

JPL and Jacobs Engineering Group Inc. of Pasadena have signed a memorandum of understanding to commercialize JPL technologies.

Under terms of the agreement, JPL will work with Jacobs to review and discuss available JPL technologies that are of specific interest to Jacobs, including:

- Hyperspectral imaging for land cover classification in agriculture and pollutant detection;
- Advanced mapping for new facility siting, land use planning and resource management;
- Ground-penetrating radar for detecting such buried objects as pipelines and ordnance;
- Radar remote sensing for detection and measurement of ground movement over a wide area;

• Regenerative fuel cell systems for high-efficiency, environmentally friendly energy generation and storage;

• Miniature sensors and instrumentation for in-situ analytical chemistry;

• "Electronic noses" for rapidly detecting and monitoring complex gas mixtures; and

• Precision robotics for a multitude of engineering and industrial applications.

"This represents an innovative step in JPL's continuing efforts to bring the best of its cutting edge technologies to the attention and benefit of American business," said JPL Director Dr. Edward Stone.

"We are pleased to forge this new relationship as yet another cornerstone of JPL's commitment to technology transfer," added Dr.

David Tralli, manager of JPL's Targeted Commercialization Office.

"Our office is fundamentally about market-driven technology commercialization," Tralli said. "Development and demonstrations of our technologies in applications for which they were not initially intended provides an enormous opportunity for new business growth."

The agreement represents a formal acknowledgement of an ongoing business relationship between Jacobs and JPL. "I am not aware of any other such commitment between two significant entities, with complementary resources, to work toward bringing advanced technology to non-traditional markets," said Terrance Mason of the Targeted Commercialization Office.

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Special Events Calendar

Ongoing

Alcoholics Anonymous—Meeting at 11:30 a.m. Mondays, Tuesdays, Thursdays (women only) and Fridays. For more information, call Occupational Health Services at ext. 4-3319.

Codependents Anonymous—Meeting at noon every Wednesday. For more information, call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Support Group—Meets the first and third Fridays of the month at noon in Building 111-117. For more information, call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parent Support Group—Meets the fourth Tuesday of the month at noon. For location, call Jayne Dutra at ext. 4-6400.

Senior Caregivers Support Group—Meets the second and fourth Wednesdays of the month at 6:30 p.m. at the Senior Care Network, 837 S. Fair Oaks Ave., Pasadena, conference room #1. For more information, call (626) 397-3110.

Friday, August 21

JPL Dance Club—Meeting at noon in Building 300-217.

Von Kármán Lecture Series—Deep Space 1 chief engineer Dr. Marc Rayman will discuss the mission at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Tuesday, August 25

Eudora Training for Technical Staff—This session features an introduction to using Eudora and its various features, and offers more detail than the sessions for business users. At noon in the Building 167 conference room.

Wednesday, August 26

JPL Drama Club—Meeting at noon in Building 301-127.

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room.

Preparing Graphics for the Web—Web developer Sugi Sorensen of Section 389 will provide information to web developers and graphic designers who prove content for publication on the web. It will include discussion of 2D graphics file formats (e.g., JPEG, GIF, PNG), tools to create and process graphics, and techniques for creating, optimizing and deploying graphics. Also included will be a showcase of web graphics resources available both on Lab and the World Wide Web. At noon in von Kármán Auditorium.

Thursday, August 27

JPL Atari Club—Meeting at noon in Building 238-544.

JPL Dance Club—Clogging class will be held at noon in Building 300-217.

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

Concepts In Fracture Mechanics Applied To Reliability and Quality Assurance—Engineering mechanics professor Michael Wnuk of the University of Wisconsin-Milwaukee will deliver this lecture at 10:30 a.m. in Building 157-210.

Friday, August 28

FolkMusic—Singer/songwriter Michael Smith will appear in Caltech's Dabney Lounge at 8 p.m. Tickets are \$12. Call (626) 395-4652.

JPL Dance Club—Meeting at noon in Building 300-217.

Monday, August 31

Space Flight Awareness Award—Nominations for the award are due today to Reward and Recognition Program Administrator Monica Garcia. For information, including how to download the nomination form, go to the SFA home page at <http://eis/sec614/reward/sfa.htm> or call Garcia at ext. 4-3825 or Laurie Lincoln at ext. 4-8515.

Tuesday, September 1

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

JPL Genealogy Club—Meeting at noon in Building 301-169.

Wednesday, September 2

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

JPL Drama Club—Meeting at noon in Building 301-127.

Thursday, September 3

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

Friday, September 4

JPL Dance Club—Meeting at noon in Building 300-217.

NOVA Vouchers Expire—ERC vouchers that were received as part of a NOVA award expire today. For questions, call the Reward & Recognition Program office at 4-3706.

2 NEAT asteroid discoveries noted

By DIANE AINSWORTH

A NASA-sponsored asteroid tracking system has found two new large objects that cross Earth's orbital path, but show no signs of coming dangerously close to Earth within at least the next several decades, astronomers say.

The asteroids were found in observations made with the Near-Earth Asteroid Tracking (NEAT) system, managed by JPL.

"These discoveries come on the heels of last month's installation of new state-of-the-art computing and data analysis hardware that speeds our search for near-Earth objects," said NEAT Project Manager Dr. Steven Pravdo of JPL. "This shows that our efforts to find near-Earth objects are paying off."

The newly discovered asteroids 1998 OH and 1998 OR2 are both large enough to cause global effects if one impacted Earth, and both are classified as "potentially hazardous objects" because they pass periodically near Earth's orbit (like at least 125 other objects discovered so far). Both asteroids are 1 to 3 kilometers (about 1 mile) in diameter.

Crucial follow-up observations of both asteroids made by co-investigator Dr. David Rabinowitz of JPL were used to calculate projected orbits that show that neither of the objects pose an immediate threat to Earth. Rabinowitz made the observations with the 61-centimeter (24-inch) telescope at JPL's Table Mountain facility in Wrightwood, which is used to make immediate follow-up observations of recently discovered near-Earth objects in an effort to better determine their orbits, compositions and rotational state.

"Our goal is to discover and track all the potentially dangerous asteroids and comets long before

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Mars Program Manager Shirley retires

By DIANE AINSWORTH

Donna Shirley, manager of NASA's Mars Exploration Program at JPL and original leader of the team that built the highly acclaimed Mars Pathfinder rover, retired Aug. 21.

An aerospace engineer and author who joined the Laboratory 32 years ago, Shirley is best known for her work on the first rover to explore the surface of Mars. Her recent book, "Managing Martians," includes a chronicle of the adventures of the Mars Pathfinder rover team that built the six-wheeled robotic explorer named Sojourner, as well as the story of the Mars Global Surveyor team.

She was named manager of the Mars Exploration Program Office when it was established in August 1994.

An aerodynamicist by training, Shirley joined JPL's former Engineering Mechanics Division in 1966. She served in a variety of positions in engineering systems analysis for space missions, worked on new space technologies with terrestrial applications, was the mission analyst for the Mariner Venus-Mercury mission in the early 1970s, and played an instrumental role in the 1980s and 1990s in the development of automation, robotics and mobile surface vehicles.

Shirley headed a 1979 study of a Saturn orbiter and probe that eventually led to Cassini, an international mission to the ringed planet, mounted by NASA with the European Space Agency and Italian Space Agency, which was launched in October 1997. In 1990-91, she acted as project engineer for the Cassini flight project.

She led work at JPL in the 1980s supporting an early version of NASA's space station and developed concepts for automated mobile vehicles to be used on planetary surfaces, with an emphasis on the moon and Mars. She

also led NASA-wide teams that developed systems engineering and management processes for the agency in the early 1990s.

Born in Wynnewood, Okla., Shirley received a bachelor's degree in technical writing in 1963 and a bachelor's degree in aerospace engineering from the University of Oklahoma. She earned a master's degree in aerospace engineering in 1968 from USC. She is currently working on a doctorate in human and organizational development at the Fielding Institute in Santa Barbara.

Shirley is a recipient of several NASA group achievement awards, including those for her work on the 1973 Mariner 10 mission to Venus and Mercury and the 1985 Space Station Task Force, and has been awarded the NASA Outstanding Leadership Medal. In addition to her book on her experiences in the Mars program, she is the author of another book, "Managing Creativity," which is published on the Internet.

A past president of the Caltech Management Association, Shirley resides in La Cañada-Flintridge and has one adult daughter, Laura. □



Donna Shirley

Report says Lab's water presents no health hazard

By MARY BETH MURRILL

A federally mandated public health assessment of JPL has found that groundwater at the Laboratory does not present a past, present or future public health hazard.

The public health assessment was prepared by the Agency for Toxic Substances and Disease Registry (ATSDR), a public health agency of the U.S. Department of Health and Human Services, and will be available for public review and comment by Aug. 21 at the Pasadena Central Library, La Cañada-Flintridge Library, Altadena Library and the JPL Library.

ATSDR is responsible for evaluating possible human health effects that can occur when people are exposed to certain hazardous chemical or hazardous wastes. The agency reviewed environmental and health-related information about JPL's site.

The site is known to have been contaminated in the past due to past chemical waste disposal practices and is now listed on the National

Priorities List, which includes facilities throughout the United States known to have environmental contamination. ATSDR is responsible for evaluating all such sites for possible human health effects that may occur if people are exposed to environmental contamination.

The ATSDR reported that groundwater at JPL does not represent a public health hazard because groundwater has never been used for drinking and there are no plans to use this groundwater in the future.

In addition, the ATSDR report includes findings that:

- Perchlorate contamination (a by-product from burned rocket fuel) in off-site groundwater presents no apparent present or future public health hazard. Current sampling and blending procedures by the drinking water suppliers are expected to prevent any potential present or future public health hazards posed by perchlorate in groundwater.
- Past exposures to perchlorate contamination

present an indeterminate public health hazard because there are no data on perchlorate levels before 1997.

- No public health hazards are associated with exposure to contaminated soils at JPL.

The ATSDR report is available for public review and comment through Sept. 9. Comments will become part of the public record and will be addressed and included in the assessment, although the names of those commenting will not be included.

For information about the JPL site, the public health assessment or to receive a copy of the assessment, contact the ATSDR's toll-free number at (800) 447-1544, refer to the JPL site, and leave the name, address and telephone number of the person to whom the report should be mailed, or ask for health assessor W. Mark Weber or community involvement representative Linda West. Callers may also contact ATSDR's regional representative, Dan Strausbaug, in San Francisco at (415) 744-1774. □

Lab to provide new technology visions for TV

New science-fiction show 'Crusade' to benefit from JPL Tech Affiliates deal

BY JOHN G. WATSON

Through a unique technology transfer program, space scientists and engineers have begun sharing their brain power with producers and writers at Babylonian Productions, producers of "Babylon 5" and the new science-fiction television series "Crusade."

JPL will provide "Crusade" producers with new visions of technology and will assist them in portraying science and astronomy as accurately as possible, forecasting science and technology issues circa the year 2250.

The producers, whose "Crusade" debuts on Turner Network Television (TNT) in January, were able to tap JPL's expertise by participating

in the Lab's Technology Affiliates Program, through which businesses form strategic alliances with JPL either to license intellectual property or to gain access to JPL's engineers and scientists to help solve technological problems.

To date, more than 120 companies, large and small, have utilized the program to solve upwards of 200 specific technology challenges.

"It's exciting for us to be able to share knowledge from the space program in order to help ensure the realism and accuracy of popular science-fiction programming," said Joan Horvath, a business alliance manager with the Technology Affiliates Program.

"We have a very challenging task before us on the production side, visualizing and creating

different planets and planetary bodies complete with civilizations, flora and fauna," said "Crusade" producer John Copeland. "The scientists and engineers at JPL will be advising us on how to depict the future."

Copeland became aware of JPL's capabilities in large part through his acceptance of an invitation by the Caltech Management Association (CMA) to speak about "Babylon 5" to JPL employees last spring. JPL engineer Michael Eastwood, a CMA events co-chair, explained, "As a thank you, we gave the 'Babylon 5' team a Lab tour. John Copeland was excited and impressed with what he saw and called me two days later asking how we might all work together more closely. The Technology Affiliates Program was a perfect fit." □

JPL instruments part of high-altitude hurricane study

With an aim to better understand and improve ground-based predictions of hurricanes, two specially equipped NASA aircraft soon will take to the skies to collect high-altitude information about Atlantic hurricanes and tropical storms.

The Convection and Moisture Experiment (CAMEX) mission is scheduled for August and September. Results from the mission may increase warning time—saving lives and property—and decrease the size of evacuation areas—saving money—while giving scientists a better understanding of these dramatic weather phenomena.

CAMEX will yield high-resolution information on hurricane structure, dynamics and motion, leading to improved hurricane prediction. Results also will be used to validate existing measurements from the Tropical Rainfall Measuring Mission (TRMM) of hurricanes and tropical storms and to develop mathematical models for future Earth science missions.

The experiment unites eight NASA centers, other government weather researchers and universities.

JPL's contributions to the study include:

- Airborne Rain Mapping Radar (ARMAR), measuring the strength of the signal reflected by the rain, with each scan providing a vertical slice through the storm. By putting many slices together, scientists can produce a three-dimensional view of the storm's structure. ARMAR also measures the speed of the raindrops and other particles like hail as they fall.

- The surface acoustic wave (SAW) dew-point microhygrometer. Local humidity is measured by cooling a small quartz sensor and measuring the temperature at which microscopic quantities of water vapor condense on the surface. The device is about 100 times more sensitive to condensation than conventional chilled-mirror devices.

- A tunable diode laser hygrometer, which measures water vapor, in situ, through absorption of laser light in an open path outside of the aircraft.

When a hurricane or tropical storm erupts in the Atlantic, a NASA Dryden Flight Research Center DC-8—equipped with instruments to measure the storm's structure, environment and changes in intensity and tracking—will fly into the storm at about 10,700 to 12,200 meters (35,000 to 40,000 feet).

At the same time, a specially equipped Dryden ER-2 research plane will soar above the storm at 19,800 meters (65,000 feet). The modified U-2 will measure the storm's structure and the surrounding atmosphere.

On the ground, the storm research team will launch weather balloons and monitor land-based sensors to validate the high-altitude measurements taken by instruments aboard the planes. □

MGS

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the speed of the deployment, somewhat like an automobile shock absorber or the piston-like automatic closer on a screen door. In recent months, however, engineers have become aware of problems with similar damper devices on deployable structures such as solar panels on other spacecraft.

New data suggest that, in the vacuum of space, air bubbles may develop in the viscous fluid inside the damper. This may allow the boom to move through a considerable range of motion at a high speed before any cushioning effect begins to occur.

"To the best of our knowledge, we could deploy the antenna boom without any adverse effect," said Cunningham. "However, the forces that the damper and boom would be subjected to as a result of the bubble formation are close enough to the maximum force that they are designed to withstand that we want to take

a cautious approach in evaluating the deployment." In a worst-case scenario, damage resulting from damper failure could render the spacecraft unable to communicate with Earth.

"The advantage of deploying the high-gain antenna is that we can then use its gimbals to point the antenna at Earth to send data at the same time science instruments are pointed at Mars acquiring science data," said Cunningham. "Until we deploy the antenna, we must store data on the spacecraft's onboard recorder and then turn the entire spacecraft periodically to transmit data to Earth." A similar approach was used on JPL's Magellan spacecraft, which orbited Venus from 1990 to 1994.

The project team is considering postponing the antenna deployment until after the landing of the Mars Polar Lander, which will reach Mars in December 1999. Mars Polar Lander carries an experiment called the Deep Space 2 microprobes, which will penetrate the soil of Mars in search of subsurface water. Deep Space 2 relies on Global Surveyor as its only possible communication link with Earth.

If the high-gain antenna remains undeployed when Mars Global Surveyor begins its prime mapping mission next March, Cunningham said that small gaps would exist in coverage of the Martian surface by the spacecraft's camera and other instruments, due to the periods when the spacecraft is turned to communicate with Earth. Those gaps could be filled in later in the orbital mission.

The project team is not yet certain how a postponed deployment would affect the total amount of data returned by the spacecraft. An initial estimate for the first 30 days of the global mapping mission found that it could return approximately 40 percent of the data that could be sent with a fully articulated antenna. However, the data return rate could be improved by strategies such as using larger ground antennas on Earth so that the spacecraft could transmit data more quickly, Cunningham noted.

A final decision on the antenna deployment will not be made until a review is held on Feb. 3, 1999, before the spacecraft's prime mapping mission begins the following month. □



In a Microdevices Laboratory clean room, Dr. Rich Muller of Section 346 prepares electron beam equipment for inscription of names on a wafer that holds a microchip similar to the one shown in inset, which will be engraved with more than 1 million names before it is placed onboard the Stardust spacecraft. For size comparison, the tiny spot in the center of the chip holds about 7,000 names.

BOB BROWN / JPL PHOTO LAB

More than 1 million names to fly on Stardust microchip

By MARY BETH MURRILL

More than 1 million people signed up to have their names electronically engraved on the second of two microchips that will fly aboard JPL's Stardust spacecraft. Stardust is scheduled for launch on a round-trip journey to a comet next February.

The one-millionth signature was received

Wednesday, Aug. 6, at 5:49 p.m. Pacific Daylight Time and more than 100,000 additional submissions were received by the project by the Aug. 15 deadline. The first microchip, which contained 136,000 names collected last fall, has already been installed on the spacecraft, which is being assembled at Lockheed Martin Astronautics in Denver. The "Send Your Name to a Comet" effort is

being coordinated by JPL and the National Space Society.

Names were submitted only electronically, either on the Stardust web site at <http://stardust.jpl.nasa.gov> or the National Space Society web site at <http://www.nss.org/impact>. Those submitting their names have granted permission for the Stardust project and its partners to use the names in possible future exhibits and/or publications.

Stardust will fly within about 160 kilometers (100 miles) of the nucleus of the comet Wild 2 (pronounced vilt-2). It will capture a sample of comet dust for return to Earth in 2006, and collect nearly 100 high-resolution pictures of the comet's surface. □

DS2 completes key thermal vacuum tests

By MARK WHALEN

The Deep Space 2 microprobe mission has successfully reached a critical milestone in its development with the completion of thermal vacuum testing.

Deep Space 2 is a New Millennium Program technology validation mission that will piggyback aboard the Mars Polar Lander, which is scheduled to launch Jan. 3, 1999 and land 11 months later. Just minutes before the lander touches down, Deep Space 2 will deploy two small, 2-kilogram (4.5-pound) microprobes beneath the Martian surface to study subsurface materials.

The end-to-end system verification sequences, the last of a series of major environmental tests, were conducted on Lab Aug. 1 to 4. "We had very positive results," said Project Manager Sarah Gavit. "This is a huge milestone in terms of verifying and proving our design end-to-end, because the tests simulated the entire mission in a Mars-like environment."

To simulate Mars' frigid climate, testing

was conducted at temperatures as low as minus 110 degrees C (minus 166 F) for the probe's forebody and minus 80 degrees C (minus 112 F) for the aftbody. In addition, pressure testing was performed to prepare the mission for operation in a Martian atmosphere that is less than 1 percent that of Earth, she added.

The 10-centimeter-long (4-inch) forebody contains a drill for collecting a soil sample, a water detection instrument, a soil conductivity experiment and an impact accelerometer, and is designed to burrow up to 0.9 meters (3 feet) into the Martian soil. The circular aftbody, 13 centimeters (5 inches) in diameter, contains the batteries, telecommunications electronics, antenna, atmospheric descent accelerometer and sun sensor, and remains atop the surface. The two modules are connected via a flexible cable that unravels as the forebody dives into the soil after a freefall impact.

"In addition to verifying the probe's performance in a simulated Martian environment, the assembly of the qualification unit also provided

invaluable lessons for the assembly of the flight probes," Gavit said. "This is especially important since the requirement for impact survival necessitates that many of the probe's assembly steps be irreversible.

"The skill level of the technicians involved in putting the probe's miniaturized assemblies together is phenomenal," she added. "The JPL Hybrid Laboratory has done an excellent job."

Work is still under way on the design of the microprobe's telecommunications system, which was not part of the qualification tests. The aftbody electronics assembly will be retested with the completed telecommunications system in September. The telecommunications system, together with miniaturized electronics in the forebody, will relay the probe's findings to Mars Global Surveyor for transmission to Earth via the Deep Space Network.

The project will continue with the assembly and test of the flight probes in the next several months. To date, the Mars Polar Lander inter-

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ISO assessments focus on process improvements

By KERRY LYN CASSIDY
ISO 9001 Implementation Team

Round 3 of internal assessments in preparation for JPL's November ISO 9001 audit took place the week of Aug. 10. While the first two rounds were mainly aimed at familiarizing employees with the nature of assessments, learning about processes and where to find documentation that supports the jobs they do, round 3 is the first assessment to emphasize findings and introduce the concept of "corrective action," the key aspect of which provides employees with an opportunity to improve the process.

A web-based internal assessment corrective action tool was beta-tested by the assessors during round 3. A version of this tool will eventually be made accessible to the Lab for use in reporting and correcting ISO noncompliances; for example, the identification of an error in a process that does not comply with ISO's slogan of "do what you say, say what you do and prove it."

In this round, about 250 people were interviewed from across the Lab from the Executive Council on down. As in prior interviews, people were asked to describe the work they do; however, this time they were also asked about the JPL Quality Policy and how it impacts their work. In addition, they were asked to show how the work they do complies with ISO 9001 requirements.

The Quality Policy and Quality Objectives are key guiding principles determined by the EC to be integral to the way JPL conducts business. The Quality Policy states that JPL will deliver products that meet or exceed customer expectations, while reducing cycle time and cost.

The official Quality Objectives are the change goals of the new Strategic Implementation Plan and state that JPL will:

- Rapidly develop and infuse cutting edge technology into flight missions and instruments;
- Seek substantive collaboration with high-caliber organizations whose strengths complement those of the Laboratory;
- As a collective responsibility of all at the Laboratory, create a work environment based on mutual trust and respect that enables high-quality work and promotes personal development;
- Base its administrative processes on best business practices;
- Implement challenging fast-track missions and systems in a process-oriented, interdependent, multi-mission environment.

The new ISO/process-based management web

site at <http://iso> has made its debut. Containing an ISO guide and training manual, the site is actively working toward becoming an invaluable resource for understanding ISO 9001 and what JPL must do to achieve registration in March of 1999.

The excellent feedback thus far includes detailed questions probing the nature of the relationship between ISO, process-based management and the Define and Maintain the Institutional Environment (DMIE) process, which defines, generates, maintains and continuously improves the structures and operations of the Laboratory.

The process-based management section of the site is presently under construction but should be available in the very near future. □

DS1

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instruments while doing a flyby of a near-Earth asteroid named 1992 KD in July 1999.

The spacecraft is being processed in NASA's Payload Hazardous Servicing Facility. Among the processing activities to be performed are the attachment to the spacecraft bus of the Plasma Experiment for Planetary Exploration instrument and the attachment of the solar arrays, each of which is among the dozen new technologies being tested on Deep Space 1.

There is to be a functional test of the advanced technology science instruments as well as of the basic spacecraft subsystems. Checks of Deep Space 1's communications system will be performed, including a verification of the spacecraft's ability to send data to JPL via the tracking stations of the Deep Space Network. Also, the last of the thermal blankets will be installed.

Finally, before the spacecraft leaves the Payload Hazardous Servicing Facility, it will be fueled with its hydrazine attitude-control propellant. Then, on Sept. 22, it is to be transported to a spin test facility at Cape Canaveral Air Station. There it will be mated to a Star 37 solid propellant upper stage, and the combined elements will undergo a series of spin balance tests.

Meanwhile, at Complex 17, the Delta II rocket will be undergoing prelaunch checkout by Boeing. The first stage is scheduled to be installed into the launcher on Sept. 10. Three solid rocket boosters will be attached around the base of the first stage the next day. The second stage will be mated atop the first stage on Sept. 15, and the dual-sector spacecraft fairing will be hoisted into the clean room of the pad's mobile service tower the following day.

Deep Space 1 will be transported to Complex 17 on Oct. 5 for hoisting aboard the Delta rocket on Pad A and mating to the second stage. After the spacecraft undergoes state-of-health checks, the fairing can be placed around it three days later. The launch period ends Nov. 10.

If the spacecraft is healthy when the primary mission is completed on Sept. 18, 1999, NASA could choose to continue the spacecraft's voyage. Deep Space 1 may then be on a trajectory resulting in the flyby in January 2001 of the dormant comet Wilson-Harrington that is in the process of changing from a comet to an asteroid. Finally, in September 2001, as the spacecraft continues on this trajectory, it may also do a flyby of an active comet, Borrelly. □

—Kennedy Space Center

Jacobs

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Specifically, Jacobs engineers will work together with those from JPL's Radar Science and Engineering Section 334; Imaging and Spectrometry Systems Technology Section 385; Device Research and Applications Section 346; Measurement, Test and Engineering Section 351; and Network Engineering and Distributed Systems Technology Section 394.

Jacobs Engineering Group Inc. is one of the nation's largest global engineering and construction firms, specializing in a variety of project delivery services, including engineering, procurement, construction and maintenance.

More information about JPL's technology



JPL Director Dr. Edward Stone signs memorandum of understanding as Jacobs Engineering chairman and founder Dr. Joseph Jacobs looks on.

transfer programs is available at the Commercial Technology Program's web site at <http://techtrans.jpl.nasa.gov/tu.html>. □

NEAT

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they are likely to approach Earth," said NEAT Principal Investigator Eleanor Helin. "The discovery of these two asteroids illustrates how NEAT is doing precisely what it is supposed to do."

Additional follow-up observations are required to more precisely determine the orbits of these asteroids, but preliminary projections show that 1998 OH can get no closer than about 5 million kilometers (about 3 million miles)—about 12 times the distance between Earth and the moon.

NEAT uses a large, sensitive and fully automated charge-coupled device camera mounted on a 1-meter-diameter (39-inch) telescope operated by the U.S. Air Force at the 3,000-meter (10,000-foot) summit of Haleakela on the island of Maui in Hawaii. "Our upgraded equipment has speeded up the data processing, allowing us to analyze up to 40 gigabytes of data each night, equivalent to 1,200 images of areas of the sky," said Pravdo.

Images and other information about the new asteroids and the NEAT project can be found on the Internet at <http://huey.jpl.nasa.gov/~spravdo/neat.html>. □

July NOVA winners announced

The winners of JPL's Notable Organizational Value-Added (NOVA) awards for July have been announced:

Section 195: Sheri Kazz.

Section 211: Thomas Davall.

Section 212: Scott Yeats.

Section 302: Deborah Fambro.

Section 312: Vijayarag Alwar, Paul Chodas, Scott Fullner, Eric Graat, Yungsun Hahn, Earl Higa, George Lewis, Martin Lo, Robert Mase, Duane Roth, John Smith Jr., Raymond Solomon.

Section 313: Donald Langford.

Section 314: William Eggemeyer, Stephen Peters.

Section 321: Stacy Klinger, Darlene Padgett, Cheryl Walker.

Element 3231: James Bock, Maria Klein, Michael Ressler, Thangasamy Velusamy, Michael Werner.

Element 3232: Richard Cageao, Timothy Crawford.

Element 3233: Mark Allen, Stephanie Granger, Candice Hansen, Terry Martin, Edward Olsen, John Schofield.

Element 3237: Frank Carsey, John Crawford.

Element 3238: Diana Blaney.

Element 3239: Daniel Winterhalter, Joyce Wolf.

Element 3273: Barbara Gaitley, William Ledebor, Duncan McDonald, Brian Rheingans.

Element 3274: Mingzhao Luo, Helen Worden.

Section 333: Martha Berg, Michael Ciminera, Cynthia Copeland, Larry Epp, Abdur Khan, Patricia Lux, Miguel Marina, Michael Tope, Gerald Walsh.

Section 334: Alona Benson, Thomas Bicknell, Glenn Cunningham, Stephen Durden, James Huddleston, Yong Liu, Leslie Nguyen, Paul Siqueira.

Section 335: George Lutes Jr.

Section 336: Jon Adams, William Berkley, Shehenaz Bhanji, Cosme Chavez, Wayne Harvey, Hamilton Hill, John Huang, Selahattin Kayalar, Richard Lovick, Frank Ott, Mark Schaefer, Robert Thomas.

Section 340: Adrienne Lovejoy.

Section 341: Randall Bartos.

Section 344: Eric Cassell, Michael Dickerson, Nancy Livermore, Carlos Salazar-Lazaro, Christopher Stell, Mark Underwood.

Section 345: Paul Backes, J. Balaram, Robert Bonitz, Tracy Carrillo-Coccaro, Daniel Chang,

Jeffrey Chung, Kenneth Clark, Edwin Dennison, Allan Eisenman, Mehran Gangianpour, Ali Ghavimi, Peter Gluck, Kim Gostelow, Fred Hadaegh, Ricardo Hassan, Samad Hayati, David Hecox, Robert Hogg, Robert Ivlev, Burton Jaffe, John Lai, Larry Matthies, Allen Nikora, Clark Olson, Hiroshi Otake, Richard Petras, Christine Preheim, Alfred Schoepke, Boris Shenker, Frederick Serricchio, Gurkirpal Singh, Charles Vanelli, Richard Volpe, Edward Wong, David Zhu.

Section 354: Regina Bernardini, Talso Chui, Steven Elliott, Anthony Lai, Melora Larson, David Pearson.

Section 380: John Simmonds.

Section 383: Lawrence Azevedo, Debra Camp, Philip Irwin, Richard Johnson, Laura Needels, Edouard Schmidlin.

Section 385: James Bradley, Rose Carden, Bruce Chippindale, Thomas Cunningham, Michael Eastwood, Jessica Faust, Robert Ferraro, Paul Henry, Daniel Katz, Stanley Love, Roberto Mendoza, Pantazis Mouroulis, James Raney, Cesar Sepulveda, Guang Yang.

Section 387: Rudolf Schindler, Marc Walch.

Section 388: Maribel Castillo, Qui Chau, John Diehl, Shirley Giuggio, Maher Hanna, Thomas Huang, Elizabeth Kay-Im, Thomas Logan, Lori Ludwig, Shari Mayer, Thuy Nguyen, Marc Sarrel, Robert Toaz Jr., Felix Vanshelbaum.

Section 389: Robert Berwin, William Carr Jr., Daniel Crichton, Robin Dumas, Adrian Godoy, Jason Hyon, Michael Kolar, Jason La Pointe, Michael Martin, Susan McMahon, Jose Pena, Sugi Sorensen, Quentin Sun, Betty Sword, Jennifer Ting.

Section 391: Laura Carr, Ronald Hungerford, James McClure, Lourdes McKim.

Section 395: Steve Chien, Daniel Dvorak, Sherrill Eastman, Tara Estlin, Rosemary Estrada, Forest Fisher, Edward Gamble Jr., Erann Gat, Russell Knight, Fred Krogh, Raymond Lam, Tobias Mann, Saleem Mukhtar, Darren Mutz, Gregg Rabideau, Angela Smythe.

Section 500: Yvonne Zieger.

Section 505: Michael Gross, Richard Kuberry, Pablo Narvaez, Naomi Palmer, Betty Ruff, Albert Whittlesey.

Section 506: Richard Aragon, Julie Corpe, Kathleen Drake-Willcox, James Howard, John Kennedy, Margaret Lam, Donna Markley, Sarah Marshall, Kenneth Ogden, John Vasbinder.

Section 507: Juliet Ellis, Kenneth Evans, Linda Facto, Robert Karpen, Linda Mayo, Deanna

Rowe, Duc Vu, Joan Westgate, Donna Wu.

Section 515: Grant Faris, George Greanias, Walter Keryluk, Marc Trummel.

Section 601: Eva Bazzarre, Jeannine Harmon.

Section 620: Randall Taylor.

Section 621: Vicki Iwata, Steven Alfery, Jeffrey Cornish, Janester Short, Patricia Vitti, Jean Walker, Laura Sergott, Mitchell Shellman.

Section 622: Jan Ahn, John Brackin III, Alicia Dangerfield, Conrad Sherman, Christopher Carson, Javier Ramos, William Stewart.

Section 624: Martin Ramirez.

Section 700: Elizabeth Herrera.

Section 706: Anita Sohus.

Section 710: John Beckman, Samuel Gulkis, Eve Zimmerle.

Section 722: Gary Parks.

Section 738: David Cuddy.

Section 742: Linda Lievensen.

Section 750: Donna Avila, William Itrace, Johnny Kwok, Merle Ruiz, Charles Simon, Aurelio Tolivar.

Section 761: Elaine Corl, Karen Piggee.

Section 788: Jewel Beckert.

Section 790: Ulf Israelsson, Karla Miller.

Section 794: Thomas Luchik.

Section 893: Joan Horvath.

Section 920: Judith Hoepfner. □

DS2

Continued from page 5

face structure, aeroshells, science blocks and most of the aftbody structural assembly are already complete. "Over the coming weeks," Gavit said, "we will be focusing on the integration and test of the forebody prism electronics, including the microcontroller, power electronics and instrument electronics."

Deep Space 2 is scheduled for a mid-October shipment to Kennedy Space Center for its integration onto the Mars Polar Lander cruise ring. □

Retirees

The following employees retired in August:

Gerald Meisenholder, 41 years, Section 886; **Paul Vickers**, 39 years, Section 622; **Robert Conover**, 36 years, Section 313; **R. Rhoads Stephenson**, 34 years, Section 800; **Ralph Johansen**, 31 years, Section 314; **Otto Rotach**, 30 years, Section 333; **Philip Eckman**, 27 years, Section 800; **Charles Lifer**, 19 years, Section 354; **Gordon Mon**, 19 years, Section 353; **Faye Elman**, 11 years, Section 644. □

LETTERS

My husband, Don Fuhrman, my mother-in-law, Marge Fuhrman, and all our family wish to thank everyone at JPL for their kind thoughts, letters and flowers after the death of my father-in-law, John Fuhrman. We are especially grateful to the PDMS group and to the ERC for the magnificent flowers and plants. Your caring and sincerity during this difficult time has been a tremendous source of comfort. Wishing you all peace,

Linda Robeck and Don Fuhrman
□□□

I would like to thank the library group for the nice going-away party. You have been a great group to work with the past 11 years. I will miss you all.

□□□

Kimberly Orr

I'd like to thank Georgene Peralta, Anita LaCroix, Connie Gennaro

and Donna Avila for organizing my going-away parties. They were very great times for me. A very special thanks to Amy Walton. Over the many years of our working together, Amy never failed to recognize the accomplishments of others and tried to make their accomplishments known to others. She is indeed a unique person. I'll miss my many friends at JPL and wish you all well.

□□□

Thank you to my friends and colleagues who participated in my going-away events. It's been a pleasure working with everyone, representing JPL as a Senior Contract Negotiator in Division 62, a Business Analyst on NBS and as Chair of the Director's Advisory Council for Women. The associations made during my 12 years of employment at JPL will truly be memorable for many, many years. I will miss all of you and close this note with best wishes and continued personal success for all in your future endeavors.

Jeanette K. Mills

FOR SALE

AMATEUR RADIO EQUIPMENT: mobile antenna, Larsen-KG 2/70 PL, on glass ant. for 2 meters and 440 MHz, slightly used, \$45; mobile ant., Diamond NR-73BNMO, NMO-type mount, for 2 meters and 440 MHz, never used, \$48; magnetic ant. mount, Larsen NMO-MM round magnetic for NMO-type, \$10. 626/281-8195, Hugo. BABY ITEMS: crib and mattress, \$100; chest of drawers & changer, \$150; car seat/carrier, \$50; other items at reasonable price; all in vg cond. 248-8853. BASEBALL COINS. 88 major league, 36 unopened packs players include Ryan, McGwire, Ripken etc., \$20/ box; Proline DC-3, unopened box of 24 packs, football major stars, rookies, \$30. 626/914-6083. BED, 7-mo.-old Sealy Posturpedic qn size, \$250. 626/796-1593.

Continued on page 8

BEDROOM SET, woodgrain laminated corner group (corner desk, chair, cabinet w/drawer, 3-drawer dresser), perf. for spare bdrm. or teenager's rm., vg cond., \$150/obo. 626/337-7522.
 BEDSPREAD (king), never taken out of pkg., Strouds, \$200/obo; other king-sz. bedding (used) available. 626/577-6638, Suzanne.
 CANISTERS, ceramic; for tea, sugar, coffee; two 5" diam. and two 6" diam.; white w/blue flower designs; all 4 for \$10/obo. 626/568-8298.
 COMPUTER adapter card PCI SCSI, Initio Miles Ultra-SCSI 3 w/narrow internal, wide internal and external connectors; for PCI Power Mac only; max. transfer rate 20 MB/sec on narrow connector, 40MB/sec on wide connector; \$150. 626/795-6530, eves.
 COMPUTER CD software for Mac, all \$25 and under. 790-3899.
 COMPUTER internal hard drive, Quantum Stratus 2.1 GB ultra-SCSI 3 narrow, max. transfer rate 20 MB/sec., manufac. warr., for Mac or PC, \$125. 626/795-6530, eves.
 COMPUTER power control center, 5 power switches + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, \$20. 790-3899.
 COUCH/dual-recliner love seat, Lazy Boy, country blue, gd. cond., \$50. 352-2036.
 DINING ROOM SET, whitewashed oak table w/6 chairs, 57" L x 37" W w/20" L, extra leaf, 99. 248-2807.
 DINING SET, antique, \$375; REFRIGERATOR, 18 cu. ft., \$225; COUCH, solid, \$250; BED, child's loft, \$220 (almost new). 626/445-6100.
 DOG, German shep. mix, full shots, 1.5 yrs. old, happy attitude, must relocate where no pets allowed, to gd. home, \$20. 626/401-2571.
 FANZINE, sci-fi, w/superb Space:1999, Prisoner, and space art, stories and filmography; published '80; collector's items; \$9/2 issues. 626/577-8587.
 FUTON couch bd., solid wd. & hvy. matr., grt. cond., \$250/obo. 626/445-6100.
 GARAGE SALE, 8/22-23, 8-5, 7521 Kyle St., Tujunga; clothing, household items, tools, furn., more. 352-7321.
 MOTOR for model airplane, K&B .45 RC Sportster engine, recond., like new, \$45. 626/281-8195, Hugo.
 MOVING SALE, full-sz. bed, \$100; couch, \$100; TV, \$80; TV furn., \$20; lamps, \$10/ea. 626/256-9233.
 ORGAN, Yamaha 415 electr. console w/13 pedals, 3 keyboards, 144 rhythm patterns, pd. \$7,500, sacrifice for \$3,000. 790-3899.
 PAINTER, Wagner power, 2 wks. old, needed for just 1 job, exc. cond., pd \$90, sell \$60/obo. 626/683-7018.
 PAINTING, orig. oil on canvas, impressionistic landscape, 42" x 52", w/invisible frame, \$250. 626/797-3156.
 PERSONAL INFORMATION MANAGER, Seiko "Phone-Pal", \$25. 790-3899.
 PRINTER, Panasonic KXP 4450 laser, 300 dpi, 512K RAM, 11 ppm, parallel and serial interface; 66 lbs.; runs well, manual included; \$90/obo. 677-8895, Justin.
 RECEIVER, Yamaha RV-502 ster. nat'l sound, only 6 mo. old, Dolby surround prologic, cinema DSP, 65W/chan. (2 front + center) + 2 x 25W rear, home theater ready; new \$299, sell \$190. 626/796-3442.
 SECURITY SYSTEM (home), DSC PC 1500, 8-chan. controller, central unit, motion detector, siren, Yuasa batt., transformer, wiring, \$50. 790-7062.

SPRINKER VALVE ADAPTERS, Lawn Genie automatic, model 756LG 3/4, new, \$10/ea. 790-3899.
 SWEATER, Coogi, from Australia; small/medium, new; \$325 in Nordstrom, sell \$100. 790-3899.
 TABLE, dining rm., oval, cherry; sits 8 w/1 extension; exc. cond., \$300/obo. 626/796-7330, Ben or Connie.
 TABLE, din. rm., round, mahogany; sits 8 w/2 extensions; almost new; comes w/6 matching chairs, \$700/obo. 626/568-8298.
 TENT, Ridgeway by Kely, 3-person, new, still in box; 7' x 7' x 4'4" ht., 4 inside zippered windows, roof vents, gear loft, rain fly, fast easy assembly, light weight; \$50. 626/351-9117.
 TREE, Ficus Benjamina, 6' in 14-inch pot, \$30. 626/449-3699.
 TV, 27" Magnavox, color, exc. cond., \$250. 626/287-4249.

VEHICLES / ACCESSORIES

'92 ACURA Integra timing belt, original Honda parts, brand new in orig. packaging; retail \$70, sell for \$40. 562/420-2313.
 '97 BMW Z-3 2.8, Atlantic Blue, 5,000 mi., \$35,900. 790-0697.
 '96 CADILLAC Seville SLS, pearl red with cappuccino cream interior, mint cond., chrome wheels, gold pkg., 20,600 mi., \$33,800. 626/795-6538.
 CATAMARAN, 13' Alcourt, with trailer, \$400. 626/294-0426.
 '93 FORD Escort, 94K mi., a/c, sport pkg., exc. cond., new tm. belt, tires, batt.; tags good until Feb. '99, \$4,050/obo. 249-9093.
 '93 FORD Probe SE, red, 5 spd., 2.0L eng., 81K mi., upgraded 300W ster. syst. (AM/FM/cass./CD), air, pwr. strng/brks, alarm, tinted windows, vg cond., runs great, \$5,500 firm. pascaltech@yahoo.com.
 '94 HONDA Nighthawk, 250cc, under 2,000 mi., \$2,500. 562/693-1136.
 '92 HONDA Accord shop manual and bra, \$55/both. 626/798-1607.
 '85 HONDA Interceptor 500, red/blue on white, 23K mi., full faring, alw. garaged; pretty but needs work, doesn't run, \$1,250/obo. 626/683-7002.
 '89 JEEP, Cherokee 4x4, all power, newer tires, brakes, shocks, tow pak, \$9,450. 626/797-8776.
 '88 KAWASAKI Ninja 600, 9.7K miles; accessories: cycle and leather tank covers, Arai helmet, kryptonite lock; clean, 2nd owner, must sell, \$2,250/obo. 323/340-5850, pager.
 '96 MAZDA Protégé, 25K mi., 4 dr., 5 sp., ac, pwr. steering, exc. cond., 1st owner, \$11,500. 626/564-8986.
 '89 MAZDA RX7, GTUs, ltd. edition, red w/black interior, heavy duty suspension, AM/FM stereo, alarm, premium wheels, 5 speed, new brakes, transmission; other extras; great for sports-car enthusiast; 1.3L dual rotary eng. runs great, good cond., orig. owner, 150K mi., \$4,495. 626/967-8627.
 '80 MERCEDES BENZ 240D diesel, vg cond., dark brown, 160K mi., 50k on new block, \$2,500. 790-3957.
 '87 MERCEDES BENZ, diesel, vintage, only 2 owners, \$2,500/obo. 626/683-7002.
 '93 SAAB 900S, 1 owner, ABS, air, leather, sunroof, etc., \$8,500. 805/251-3854.
 '91 SAAB 900, 1 owner, ABS, air, CD/cassette, etc., \$4,800. 805/251-3854.
 SAILBOAT, 24' Columbia Challenger, sleeps 4, \$1,250/obo. 909/467-4248.
 SAILBOAT, 13-ft. Zuma, as new, cartoppable \$1,200. 626/294-0426.
 '95 TOYOTA Previa LE S/C van, 40,000 mi., 4-wheel ABS, alarm, a/c, cassette, tilt wheel, cruise cont.; pwr. windows, locks & mirrors; burgundy w/gray interior, \$18,500/obo. 909/980-3508.
 '95 TOYOTA Tacoma truck, Xcab, very low mileage (30k), auto, 4 cyl., am/fm Alpine ster./cass., cruise, bed liner, power strng., sliding rear window, exc. cond., like new, burgundy, \$11,500/obo. 626/795-3251.
 '89 TOYOTA Camry DX, 6 cyl., at, ac, cc, tilt whl., overdrive, 4-wheel disk br., sec. alarm syst., exc. cond., orig. owner, \$4,950. 909/981-5740.
 '87 TOYOTA Corolla, 4-door, 5 speed, 100,000 orig. miles, new belts, seals and timing chain, complete maint. record, exc. cond., \$3,500. 626/440-0609.
 '95 VW Jetta III black, 58K miles, stick, a/c, sunroof, pwr. windows/locks, AM/FM/cass., cruise, ABS, alarm, more; exc. cond., plus extd. warr.; going back to school, must sell. \$13,500. 626/683-7002.

WANTED

COMPUTER CPU, Pentium 200 or 166, regular or MMX. 993-6292, Troy.
 SPACE INFORMATION & memorabilia from U.S. & other countries, past & present. 790-8523, Marc.
 TREADMILL (Space Saver), small as poss.; nothing fancy needed; motorized perf. 626/577-6638, Suzanne.
 VANPOOL RIDER, full-time, for #20, w/stops in Northridge and Granada Hills. Ext., 4-0307, Marilyn.

FREE

DIRT, mostly gravel-like, several cu yds., take as little or as much as you like, 3 blks. ESE of NY & Hill, Altadena. 798-5152.
 DOG, 2-yr-old black Lab, all shots, lonesome, needs children, very loving, to a good home. 626/355-2564.
 PUPPY, Doberman, 9 mos. old, female, spayed, current shots, loves kids, will be a lap dog or sleep on bed w/you if you let her, to gd. home. 626/351-0097.

LOST & FOUND

Lost: GOLD TWIST BRACELET, women's, slightly mangled around clasp, sentimental value. 790-3899.

FOR RENT

ALTADENA house, 2 bd., 1.75 ba., garage, deck, stv., refrig., dshwsh, wshr/dryr, H2O included, 2 mi./JPL, avail. 10/1, \$1,400. 626/797-8324.
 LA CRESCENTA, 3 bd., 2 ba., 2 frplc., lg kitchen w/brk. nook, laundry rm., garage, wooded corner lot, above Foothill, \$1,750. 236-9642, pgr.
 LAKE HOLLYWOOD, 2 bd. apt. in 7-unit bldg. (adj. to Universal, Griffith Pk. and Toluca Lake in Burbank); pleasant hillside community w/close fwy. access; outside floor entr., newly remodeled, hardwood oak flrs., sm. priv. patio, refrig., a/c, solar heated-water, laundry rm. downstairs, parking; non-smoker. 626/798-3235.
 PASADENA, 3-bd., 3-ba. townhome-style apt. nr. PCC, furn. or unfurn., Indry. facil., cent. air/heat; \$1,200 + util., will rent individ. to 3-4 students @ \$300-\$400/ea. 351-9641.
 PASADENA, 1 bd. w/lg. refrig., stove, cent. air/heat, on 2nd floor w/lg. patio, walk to Old Town, close to JPL/Caltech, \$750. 626/797-2765.
 PASADENA studio apt., nr. Caltech, JPL, bus stop; 180 S. Marengo, front bldg, upstairs, furn., incl. util., laundry on site, \$650. 626/797-3103, Lois Moulton.
 PASADENA studio apt., nr. Caltech, JPL, bus stop; 620 E. California Blvd., furn., includes water, off-street parking, \$650. 626/797-3103, Lois Moulton.
 PASADENA, townhouse-style apt., 2 bd., 1 1/2 ba., built-in range/oven, cent. a/c, carpets, drapes, laundry, disposal, \$725. 790-7062.
 SOUTH PASADENA, furn. studio apt. on 1 level, 1718 Huntington Dr. betw. Milan/Marengo; laundry facilities on premises, parking space; non-smoker; \$565, utilities pd. 626/792-9053, Marilyn.
 SOUTH PASADENA, fully furn. 1-bd. apt. + office (extra bdrm.) for 1 or 2 persons; 1718 Huntington Dr., N side betw. Milan/Marengo on 1 level, 6-unit bldg., full kitch., elec. heat & a/c, laundry facilities on premises, 2-car gar.; non-smokers; \$1,000, tenant pays for electricity. 626/792-9053, Marilyn.
 WINNETKA house, 2 bd., 1 ba., lg yard, 40 min. to JPL, \$800 + utilities. 626/791-9049.

REAL ESTATE

ARCADIA, charming 3-bd., 1 1/2-ba., newly remodeled ba., new double-paned grid windows, 1-yr-old carpet, wooden floor in living and dining rm., lg. enclosed patio, security syst., 2-car detached gar. w/bonus rm., manicured front/back yds.; move-in cond.; owner anx. to sell, \$195,000/obo. 626/575-4569.
 BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 ba., mud/laundry rm., \$129,000. 909/585-9026.
 LAKE CO., N. Calif., 2 1/2 acre lot, in beautiful Kelseyville near Clear Lake, perfect site for permanent or retirement home, 30 walnut trees, paved road, electricity, \$36,000. 626/337-7522.
 PALM DESERT, exquisite, 2 bd., 2 ba. villa, newly remodeled, w/skylight, patio & 2-car gar.; located across Living Desert; great locality; priv., secure resort w/ tennis cts., multiple pools, spas and clubhouse facilities; around 2 top resorts. 909/620-1364.

VACATION RENTALS

BIG BEAR, 7 mi./slopes, full kitch. f/p, 2 bd., 1 ba., sleeps 6; reasonable rates; 2-nt. min.; no smokers, no pets; exc. hiking, biking, fishing nearby. 909/585-9026, Pat & Mary Ann Carroll.
 BIG BEAR cabin, walk to village, 2 bd., 1 bdrm, TV/VCR, F/P, \$75/night. 249-8515.
 BIG BEAR LAKE cabin, near lake, shops, village, forest trails; 2 bd., sleeps up to 6, fireplace, TV, VCR, phone, microwave, BBQ and more; JPL disc. price from \$65/night. 909/599-5225.
 BIG BEAR LAKEFRONT luxury townhome, 2 decks, slps. 6, tennis, pool, spa. 949/786-6548.
 CAMBRIA, ocean front house, exc. view, sleeping up to 4, \$125/night for 2, \$175/night for 4. 248-8853.
 HAWAII, Kona, on 166 feet of ocean front on Keauhou Bay, priv. house and guest house comfortably sleep 6; 3 bd., 2 ba., swimming, snorkeling, fishing, spectacular views, near restaurants, golf and other attractions. 626/584-9632.
 LAKE TAHOE, N. shore, 2 bd., 2-1/2 ba. condo, sleeps 6; great location, all amenities; private sandy beach, pool, sauna; walk to golf, fishing 150 yards from the front door, 2 miles to casinos; special JPL weekly summer rates; reduced daily/weekly rates after Labor Day. 626/355-3886, Rosemary or Ed.
 MAMMOTH condo in Chamonix; 2 bd., 2 full ba., slps. 6, fully equipped elec. kitch. incl. microwave & extras; f/p & wood; color TV, VCR, FM stereo; sauna, game, & Indry. rms; pool, sun area, o/d Jacuzzi; play & BBQ areas; walk to Warming Hut and lifts; conv. for hiking, shops, summer events, daily/weekly rates. 249-8524.
 MAMMOTH condo, 2 bd. + loft, 3 ba., slps 8, spa, pool, full kitch., TV/VCR, JPL disc. rates. 249-8088.
 MAMMOTH condo, slps. 5, shuttle nearby, summer rates \$50/night, 5 nights or more \$40. 353-7839.
 MAUI condo, on beach w/ocean view, 25 ft. from surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwave, dishwasher, pool & priv. lanai, slps. 4, 4/15-12/14 rate \$95/night/2, 12/15-4/14 rate \$110/night/2 \$10/night/add'l person, less 10% JPL & Caltech disc. 949/348-8047.
 OCEANSIDE, on the sand, charming 1-bd. condo, panoramic view, walk to pier/marina, pool, spa, game rm., sleeps 4. 949/786-6548.
 PALM DESERT, exquisite, 2 bd., 2 ba. villa, newly remodeled, w/skylight, patio & 2-car gar.; located across Living Desert; great locality; priv., secure resort w/ tennis cts., multiple pools, spas and clubhouse facilities; around 2 top resorts. 909/620-1364.
 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.
 SAN FRANCISCO, Nob Hill honeymoon suite (for 2 only); kitch., maid, concierge; \$105/night. 626/797-3156.

NOTICE TO ADVERTISERS

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

Universe

Editor

Mark Whalen

Photos

JPL Photo Lab

Universe is published every other Friday by the Public Affairs Office of the Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109.

Advertising is a free service offered only to JPL, Caltech and contractor employees, retirees and immediate families.

Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 186-118, or via e-mail to universe@jpl.nasa.gov. E-mail ads are limited to six lines.

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

To change an address, contact your section's administrative assistant, who can make the change through the HRS database. For JPL retirees and others, call Xerox Business Services at (626) 844-4102.