Jet Propulsion Laboratory

Universe

Pasadena, California Vol. 29, No. 18 September 3, 1999

Cassini's Moon shots

New images and brief movies of the Moon, taken by the camera system on JPL's Saturn-bound Cassini spacecraft when it flew through the Earth-Moon system two weeks ago, are now available online at http://photojournal.jpl.nasa.gov.

The black-and-white lunar images were among a sequence taken of the Moon by Cassini's sophisticated camera during the Aug. 17 flyby of Earth. Cassini flew past Earth to gain enough energy to reach distant Saturn in 2004, where the spacecraft will make detailed studies for four years.

"These are the first images taken by Cassini for both photogenic and scientific purposes, and they illustrate that the cameras are functioning beautifully," said Dr. Carolyn Porco, leader of the 14-member Cassini imaging team and an associate professor of planetary sciences at the University of Arizona in Tucson.

The images released Sept. 1 are a wide-angle movie, a narrow-angle video clip, the Moon in ultraviolet and a "triptych" (a three-paneled composite image) of the Moon. The face of the Moon seen in these images is nearly identical to that seen from Earth.

They were taken from a distance of about 377,000 kilometers (234,000 miles) approximately 80 minutes prior to Cassini's closest approach to Earth. The lunar images were taken to calibrate the camera system using a familiar and well-studied target. No images of Earth were planned or taken during Cassini's flyby. ❑

CASSINI IMAGING TEAM / UNIVERSITY OF ARIZONA / JPL / NASA

Cassini's imaging science subsystem photographed Earth's moon on its Aug. 17 flyby.

Mars Polar Lander to arrive on smooth, layered terrain

By JANE PLATT

A strip of gentle, rolling plains near the Martian south pole will serve as a welcome mat when JPL's Mars Polar Lander touches down on the red planet on Dec. 3.

NASA unveiled the landing site, a swath of terrain measuring about 4,000 square kilometers (1,500 square miles), at an Aug. 25 briefing at NASA Headquarters.

"We looked for a site with slopes no steeper than 10 degrees," said Project Scientist Dr. Richard Zurek of JPL. "We chose a location with some surface features but no cliffs or jagged peaks, because the spacecraft will be able to land safely, yet we'll still accomplish our science goals."

The landing site is located at 76 degrees south latitude and 195 degrees west longitude, near the northern edge of the layered terrain in the vicinity of the Martian south pole.

"We believe this layered terrain is a record of climate changes on Mars and, in a sense, digging into its surface will be like reading tree rings or layers in an ice core," Zurek said. "The presence of fine layers of dust and ice with varying thickness will indicate changes in weather patterns and layer formation that have been repeated in recent history. In addition, we may find evidence of soil particles that formed in ancient seas on Mars and were later blown into the polar regions."

The landing will be targeted to the center of the site, a rectangular area 200 kilometers (125 miles) long and 20 kilometers (12½ miles) wide. The site was selected after the project team studied pictures and altimeter information gathered by JPL's Mars Global Surveyor, which is currently orbiting the planet. The search was

See Lander, page 4

News Briefs

Ipek Basdogan of Section 352 is organizing a fundraising effort to help victims of last month's devastating earthquake in western Turkey.

The American-Turkish Association of Southern California (ATA-SC) is currently raising funds and requesting donations of vitally needed supplies to assist the victims of the Aug. 17 quake.

"Support is needed to help heal victims and rebuild the cities," she said. Donations will be given to the Turkish Red Crescent Society (equivalent of Red Cross in the U.S.), which is coordinating aid for earthquake victims.

Checks should be made payable to ATA-SC, with "Earthquake Relief" in the memo area of the check. All donations are tax deductible. ATA-SC is a tax-exempt, non-profit charitable organization. The federal tax ID number is 33-0190399.

Donations can be mailed to American-Turkish Association of Southern California, P.O. Box 53024, Irvine, CA 92619-3024. The phone number is (714) 806-7720. ❑

JPL's Lessons Learned Committee reminds employees that current NASA and JPL initiatives encourage and/or require all flight projects to review "lessons learned" at appropriate life-cycle stages. The intent is to avoid the repetition of past failures and mishaps, and to capture valuable practices.

Recent examples cited by the committee are NASA Procedures and Guidelines 7120.5A, "NASA Program and Project Management Processes and Requirements," and "Design, Verification/Validation and Operations Principles For Flight Systems."

The user-friendly Lessons Learned Information System (LLIS) includes more than 600 lessons from all NASA centers, including approximately 170 lessons contributed by JPL. All are one to two pages and are fully word searchable. In addition, links to lessons from other agencies are available. New lessons are entered into the system as they are approved.

New JPL Lessons Learned developed during FY '99 to date include:

- Commercial Electronic Parts Supplier Evaluation
- DC-DC Converter Applications
- Handling and Storage of Flight Spares
- Develop and Test the Launch Procedure Early
- Consider Language Differences When Conveying Requirements to Foreign Partners
- Evaluate Launch Vehicle and Services Requirements

See Briefs, page 6

Special Events Calendar

Ongoing

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

Codependents Anonymous—Meeting at noon Wednesdays. 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. 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. 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. Call (626) 397-3110.

Friday, September 3

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

JPL Perl Users Group—Meeting at noon in Building 301-127.

NOVA Vouchers Expire—ERC vouchers that were received as part of a NOVA award will expire today. For questions, call the Reward & Recognition Program Office at ext. 4-1612.

Tuesday, September 7

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

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

Wednesday, September 8

"A Tribute to Pete Conrad: His Vision for the Future"—Tom Ingersoll, president and CEO, Universal Space Network, will provide an insider's view of astronaut Charles "Pete" Conrad's history and his more recent, less well-known achievements, including the founding of Universal Space Network, Universal Space Lines, and the Rocket Development Company, all of which are working toward the ultimate goal of making space far more accessible, profitable, and inspirational. At 4:45 p.m. in von Kármán Auditorium. Presented by the Caltech Management Association and open to the public. For questions, send e-mail to CMA.Announce @jpl.nasa.gov or call Michael Eastwood, ext. 4-9273.

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

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. Guests welcome. Contact Mary Sue O'Brien at ext. 4-5090.

SESPD Lecture Series—Dr. Joel Sercel, manager of the X2000 Future Deliveries Project, and Dr. John Brophy, manager of the NASA Solar Electric Propulsion Technology Applications Readiness (NSTAR) Project, will deliver a lecture titled "The Origin and Evolution of Ion Propulsion" at 11 a.m. in von Kármán Auditorium.

Friday, September 10

Folk Music—Tom Lewis will perform at 8 p.m. in Caltech's Dabney Lounge. Tickets are $12. For information, call (626) 395-4652.

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

Tuesday, September 14

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

Wednesday, September 15

Future Trends In Web Design—Best-selling author Lynda Weinman will discuss trends, Web graphics and color. This talk will run two hours and will allow time for questions from the audience. At noon in von Kármán Auditorium.

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

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

Thursday, September 16

JPL Astronomy Club—Meeting at noon in Building 198-102.

Von Kármán Lecture Series—"Twenty Years of Discovering Jupiter: Voyager and Galileo Celebrate Significant Anniversaries" will be moderated by Dr. Al Hibbs with JPL Director Dr. Edward Stone, Dr. Andy Ingersoll, Dr. Torrence Johnson, William O'Neil and James Erickson on the panel. To be held at 7 p.m. in von Kármán Auditorium. Seating is limited. Open to the public.

Friday, September 17

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

JPL Perl Users Group—Meeting at noon in Building 301-127.

Von Kármán Lecture Series—"Twenty Years of Discovering Jupiter: Voyager and Galileo Celebrate Significant anniversaries" will be moderated by Dr. Al Hibbs with JPL Director Dr. Edward Stone, Dr. Andy Ingersoll, Dr. Torrence Johnson, William O'Neil and James Erickson on the panel. To be held at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Seating is limited. Open to the public.

Big near-Earth asteroid detected by radar

Observed at 8.5 million kilometers away; Earth encounter not a concern

By DIANE AINSWORTH

Astronomers have used the world's two most powerful radar telescopes to make the most detailed images ever obtained of an asteroid in a near-Earth trajectory.

With an average diameter of about 3.5 kilometers (2 miles), 1999 JM8 is the largest near-Earth asteroid ever studied in detail. Although this object can pass fairly close to Earth in celestial terms, astronomers concur that an actual encounter with Earth is not of concern in the next few centuries.

The new images, obtained with JPL's Goldstone Solar System Radar in California and the Arecibo Observatory in Puerto Rico, reveal that 1999 JM8 is a several-kilometer-wide object with a peculiar shape and an unusually slow and possibly complex spin state, said Dr. Lance Benner of JPL, who led the team of astronomers. The images are available online at http://photojournal.jpl.nasa.gov or http://echo.jpl.nasa.gov/~lance/1999JM8.html.

"It will take much more data analysis to determine the object's shape and exact rotation state," Benner said. "But just from looking at the images we can see that this nearby world is extremely peculiar. At this point we do not understand what some of the features in the images are, much less how they originated."

The asteroid was discovered on May 13, 1999, at a U.S. Air Force telescope in New Mexico that is part of the Lincoln Near Earth Asteroid Research Project, managed by the Lincoln Laboratories of the Massachusetts Institute of Technology. The discovery provided adequate notice for radar observations to be scheduled at Goldstone from July 18 to Aug. 8 and at Arecibo from Aug. 1-9 during the asteroid's close approach to 8.5 million kilometers (5.3 million miles), the equivalent of 22 Earth-Moon distances.

"Although Arecibo is the more sensitive telescope, Goldstone is more fully steerable, and we took advantage of the complementary capabilities of the two antennas," noted Benner. "The discovery of this object weeks before its closest approach was a stroke of luck," he said. "The asteroid won't come this close again for more than a thousand years."

Asteroid 1999 JM8 bears a striking resemblance to Toutatis, a similar-sized, slowly rotating object also studied in detail with radar, said Dr. Scott Hudson of Washington State University, who is an expert in using radar images to determine the shapes of asteroids.

"The fact that both these several-kilometer-wide asteroids are in extremely slow spin states suggests that slow rotators are fairly common among near-Earth asteroids," he said. "However, although collisions are thought to be the primary process that determines asteroid spin states, we don't know how the slow, complex states come about."

"Our finest resolution is 15 meters (49 feet) per pixel, which is finer than that obtained for any other asteroid, even for spacecraft," said Dr. Jean-Luc Margot, one of the team members from Arecibo Observatory. "To get that kind of resolution with an optical telescope, you'd need a mirror several hundred meters across. Radar certainly is the least expensive way of imaging Earth-approaching objects."

The images show impact craters with diameters as small as 100 meters (330 feet)—about the length of a football field—and a few as large as 1 kilometer (0.6 miles). "The density of craters suggest that the surface is geologically old, and is not simply a chip off of a parent asteroid," said Dr. Michael Nolan, a staff scientist at the Arecibo Observatory.

This is hardly the first time that radar has revealed a near-Earth asteroid with peculiar characteristics, said Dr. Steven Ostro of JPL, who has led dozens of asteroid radar experiments. Radar studies have revealed a stunning array of exotically shaped worlds with compositions ranging from solid metal to low-density carbonaceous rock and rotation periods ranging from 11 minutes to more than a week. "These are very, very strange places," he said. "I really envy the coming generations of space explorers who will visit them."

In addition to Benner, Hudson, Margot, Nolan and Ostro, the radar team included Drs. Jon Giorgini, Raymond Jurgens, Donald Yeomans and Martin Slade from JPL. ❑

SOHO rescuers receive special thanks

JPLers who last year contributed to the recovery of NASA's SOHO spacecraft received special honors last month.

JPL personnel who last year helped recover NASA's sun-observing Solar and Heliospheric Observatory (SOHO) spacecraft were honored for their efforts in a special ceremony last month.

Bill Worrall, the SOHO project manager at NASA's Goddard Spaceflight Center in Maryland, was on hand at JPL Aug. 3 to present NASA Group Achievement Award certificates to about 60 JPL employees and contractors who contributed to the European Space Agency/NASA recovery team that was critical in helping to restore communications to the disabled spacecraft.

Receiving the honors were JPLers from the Telecommunications and Mission Operations Directorate's Resource Allocation Planning and Scheduling Office and the Goldstone Solar System Radar Group. Also recognized were members of the Goldstone operations staff, as well as contractors from AlliedSignal in Pasadena.

SOHO, launched in 1995, carries both American and European instruments. It revolutionized solar science

See SOHO, page 7

Internship program hosts summer students

Twenty-two university students have completed a successful summer of work at JPL as part of the Laboratory's Minority Initiative Intern Program.

Managed by the Minority Science and Engineering Initiatives Office within the Educational Affairs Office, the program supports JPL minority initiatives for students attending Historically Black Colleges and Universities, as well as Native American and Hispanic students.

Program coordinator Lisa Campbell said this year's effort was "an outstanding success. The students had valuable work experiences, which matched one of the goals of NASA's implementation plan for education. The objective was to provide support to the science and technology workforce pipeline by including greater participation of individuals who are underrepresented in science, mathematics, engineering and technology in NASA student programs."

In addition, she said, feedback from the students was "extremely positive. Some commented that the program made them aware of how their practical school experience could be used in the workforce. Others learned how to network and gained insight into areas of scientific advancement."

BOB BROWN / JPL PHOTO LAB

Intern Tanecia Simmons developed a web site for the Atomic and Molecular Collisions Research Element during her work at JPL this summer.

The students' mentors and supervisors "should be commended," she added, "for giving meaningful work assignments to these young people, who will be our future scientists and engineers."

She noted a couple of examples. Master's candidate Maleata Caldwell of the University of Michigan, through her work with Section 365, served as a liaison between JPL and Children's Hospital of Los Angeles, evaluating computer software designed to detect visual disorders in pre-verbal children.

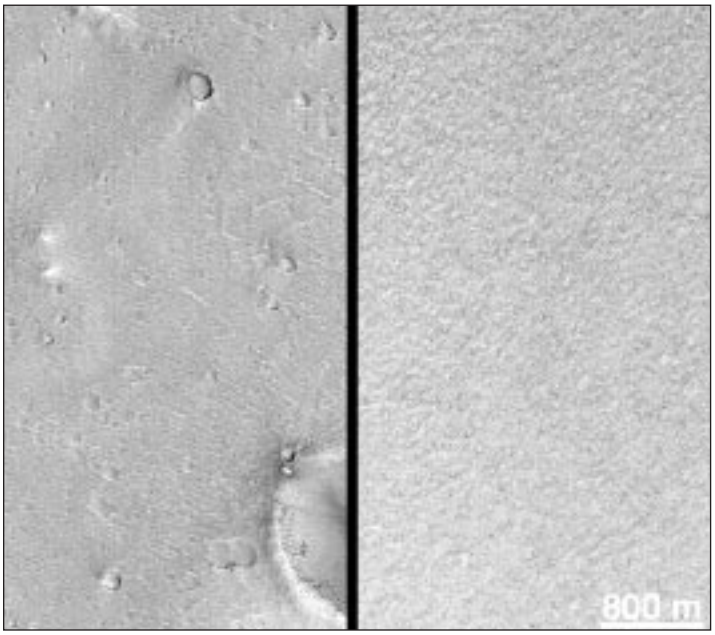
Also, three students participated in JPL's Underwater Volcanic Vent Mission in July, which sent a new aluminum deep-sea probe, the prototype of one designed to withstand crushing pressures and extreme temperatures, to depths of 9 meters (30 feet) in Monterey Bay Aquarium's giant kelp forest to hunt for clues to life's origins.

Lena Horsley, a master's candidate at North Carolina A&T State University, majors in computer science and hopes to earn a doctorate in the subject. This summer she worked on the Stellar Planet Survey (STEPS) program, assisting in writing a program to automate a system that analyzes astronomical observations. "JPL is a good place to work," she said. "The environment is friendly and the people are helpful and encouraging."

"I had a great time here," said Tanecia Simmons, a master's candidate in computer science at Auburn University in Alabama, who created a home page for the Atomic and Molecular Collisions Research Element using image-mapping software. "I enjoyed the opportunity to network with the engineers. I'd be very interested in working here or at another NASA center in the future."

To be eligible for the program, students must be in good academic standing, have at least a 3.0 grade-point average or better in their discipline, and attend a college or university with whom JPL has a memorandum of understanding and is collaborating on a current project or were recipients of a scholarship or fellowship supported by JPL or NASA. In addition, students must be U.S. citizens or have permanent resident status.

JPL offers the summer interns 10 weeks of fully paid employment, round-trip travel expenses from their institution or residence and a weekly housing allowance. ❑



Lander

Continued from page 1

narrowed to four sites before the final location was chosen. A backup landing site is located nearby, at 75 degrees south latitude and 180 degrees west longitude.

"For the next several weeks, we'll study newly transmitted Mars Global Surveyor images," said Flight Team Manager Dr. Sam Thurman at JPL. "If necessary, we can retarget for the backup landing site as late as early October, when the flight team begins preparations for landing."

The Dec. 3 landing occurs toward the end of spring in the Martian southern hemisphere. The sun will shine all day, moving higher and lower in the sky but never dipping below the horizon. This nonstop sunshine will power the lander's solar panels for 90 days, until the Martian seasons change and the lander's mission ends.

Launched on Jan. 3, 1999, Mars Polar Lander will study the soil and look for ice beneath the surface of the Martian south pole. The lander also carries two Deep Space 2 microprobes that will be deployed about five minutes before the spacecraft enters the Martian atmosphere. The microprobes will smash into the planet's surface and penetrate the soil to look for water ice.

Images of the landing site and additional information about Mars Polar Lander are available online at http://mars.jpl.nasa.gov/ msp98/ lander.

Additional information about Deep Space 2 is available on the web at http://nmp.jpl.nasa.gov/ds2. ❑

This image shows a comparison at the same scale (about 5 meters (16 feet) per pixel) of the 1997 Mars Pathfinder landing site (left) and a representative portion within the primary landing ellipse designated for the Mars Polar Lander (right). Familiar landmarks at the Mars Pathfinder site include the "Twin Peaks" (center left), "North Peak" (top), and "Big Crater" (lower right). The south polar layered deposits are generally devoid of the large craters and hills seen at the Pathfinder site. The "wavy" texture at the Pathfinder site (the result of the movement of sediment by the large flood that swept through that location billions of years ago) is replaced at the proposed Mars Polar Lander site by a random arrangement of very low ridges and grooves that suggest the surface has been exposed to erosion by ablation of ices.

Center keeps deep-space vision on cutting edge

By MARK WHALEN

Those who wonder what the future holds for deep-space exploration need look no further than a small group at JPL that is positioned to critically influence that future, as it works to keep the Laboratory on the cutting edge.

The Center of Excellence for Deep Space Communications and Navigation Systems (DESCANSO), one of six such centers at JPL, provides technical leadership and vision for deep-space communications and navigation, areas in which JPL is the acknowledged world leader. The organization facilitates ongoing communication among the Lab's world-class scientists and technologists through a series of meetings, symposia and monthly on-Lab seminars.

"The Center is about getting people together, seeing where the needs and opportunities are," said DESCANSO leader Dr. Catherine Thornton, who is also the deputy manager of the Telecommunications Science and Engineering Division (33). "The point is to get all of us on the same page on the technologies; to foster a better understanding of the state of the art and to stimulate cross-fertilization of ideas."

JPL's Centers of Excellence
One in a series

The organization's next such effort occurs later this month when worldwide experts convene at the International Symposium on Space Communication and Navigation Technologies at the Pasadena Convention Center (information is available online at http://descansymposium.jpl.nasa.gov. Also see accompanying box).

The two-day symposium will comprise five sessions, each of which will include the presentation of eight to 10 papers. Presenters are expected from JPL and other NASA centers, as well as national laboratories, universities and international space agencies. Space and Earth Sciences Programs Director Dr. Charles Elachi will deliver the keynote address. Up to 200 attendees are expected.

"We want the navigators and the communicators to have a better appreciation for each other's work," Thornton said. "The building of this kind of community is a major responsibility and we've made progress in that area. We want to help the experts answer: 'What are the important problems others are working on, and how does that relate to what I'm doing?'"

The international symposium is an example of how DESCANSO fosters dialogue on technology advancement needs and opportunities. The organization, which includes individuals from sections 312, 331, 333, 335, 336 and 345, and regularly interacts with other areas on Lab, also sponsors a monthly JPL technology seminar series for a Lab-wide audience.

"We also encourage joint proposals for advanced technology work across organizational lines at JPL and with outside partners," Thornton said, noting that well-established sources for funding such work includes the NASA Cross-Cutting Technology Program and JPL's Telecommunications and Mission Operations Technology Office Advanced Technology Program. Other research and development opportunities are encouraged by DESCANSO, such as NASA's Instrument Incubator Program and the X2000 Program.

Another key element of the Center is to keep an eye out for joint sponsorship opportunities available to JPL from non-NASA sponsors "interested in funding tasks that are synergistic with some of the things we're doing for our deep-space missions," Thornton said. Most of this type of funding comes from the Department of Defense. "Often, there is a potential NASA use for a technology, without sufficient NASA funding to support it. Sometimes there are non-NASA users that do have the budget and a near-term need."

DESCANSO's technology interests frequently overlap with those of the five other centers of excellence on Lab. Current examples are the development of formation flying, a capability promoted by both DESCANSO and the Interferometry Center of Excellence, and research in micro-electro mechanical systems (MEMs) technology sponsored by the Center for Integrated Space Microsystems and key to DESCANSO future spacecraft communications development. The centers of excellence are also interacting in the development of technology roadmaps—planning for technology needs for up to 15 years in the future—"a way to dream about what could be," Thornton said. "Once developed, the roadmaps could potentially assist the technologists in obtaining needed funding."

DESCANSO is currently encouraging joint work between Division 31 (Systems), Thornton's Division 33 and Division 34 (Avionic Systems and Technology) to develop an integrated system for autonomous precision landing. Such a system would involve various on-board sensors, and closely coupled guidance, navigation and control calculations.

BOB BROWN / JPL PHOTO LAB

Dr. Catherine Thornton leads the Center of Excellence for Deep Space Communications and Navigation Systems (DESCANSO).

"For example," Thornton said, "we have an opportunity to improve our ability to autonomously deliver a spacecraft to the surface of Mars with a precision of better than 100 meters. We're not there yet. There are some ideas on how to do that, but it's going to take all three divisions working together to make that a reality."

Using the example above, she said, "there is a need to demonstrate these things can be done, usually before the flight projects will adopt

See DESCANSO, page 7

Frontiers in Deep Space Communication and Navigation symposium

Pasadena Convention Center

Tuesday, Sept. 21, 1-7 p.m.
Session I, 2 p.m.: "Deep Space Communication Systems," Organizer: Keith Wilson, JPL
Reception, 5:15 p.m.

Wednesday, Sept. 22, 8 a.m.-5:15 p.m.
Session II, 8 a.m.: "Deep Space Communication Technologies," Organizer: Tsun-Yee Yan, JPL
Session III, 1:15 p.m.: "In Situ Communications," Organizer: Polly Estabrook, JPL
Banquet, 6 p.m.

Thursday, Sept. 23, 8 a.m.- 5 p.m.
Session IV, 8 a.m.: "Deep Space Guidance, Navigation and Control," Co-Organizers: Lincoln Wood and Stephen Lichten, JPL
Session V, 1:15 p.m.: "Mars Networks," Organizer: Steve Townes, JPL

Information:
http://descansymposium.jpl.nasa.gov

Gene Giberson dies

W.E. (Gene) Giberson, who retired in 1990 as JPL's assistant Laboratory director for flight projects and whose career spanned the history of space exploration, died of cancer Aug. 31. He was 76.

For the 1958 launch of Explorer 1, the first U.S. satellite, Giberson helped organize and man an improvised tracking site in a Los Angeles County Sheriff's station which verified that the satellite was in orbit.

As project manager, Giberson initiated the Surveyor program, which in the mid-1960s landed robotic spacecraft on the Moon to analyze its surface and scout potential sites for the Apollo landings. He managed the Mariner Venus/Mercury 1973 project, which was the first to visit two planets using the gravity-assist technique and whose Mariner 10 spacecraft took the first close-up pictures of Venus and Mercury.

Gene Giberson

"Gene displayed boundless energy and an integrity and personal warmth that inspired trust and friendship in others," said JPL Director Lew Allen when Giberson announced his retirement. "His contributions to the nation's space program were very much in evidence over the eight years he led the Flight Projects Office."

Giberson was also in charge of Seasat, an Earth-orbiting mission to pioneer space-based oceanography that demonstrated imaging radar and other techniques to be used in NASA's Earth Sciences Program.

Giberson also managed JPL's Guidance and Control Division and the Planning Office. He became assistant Laboratory director for flight projects in 1981.

A native of San Pedro, Giberson earned a bachelor's degree in electrical engineering from Marquette University. NASA awarded Giberson its Outstanding Leadership Medal and its Distinguished Service Medal.

Giberson is survived by his wife, Dorothy, and eight children. ❑

Briefs

Continued from page 2

• Fault Protection of Wax Thermal Actuator Applications

• Post Mission Hardware Drop Incident

• Use of Obsolescent Test Facilities Pose Risk to Hardware

• Design, Test and Inspection of Semi-Rigid RF Cables

• Inadvertent Powering of the Deep Space 2 Mars Microprobe

• Transient Start-up Perfor-mance of the WIRE Pyro Electronics

The address for the LLIS Web site is http://llis.nasa.gov. For further information on the lessons, contact Lessons Learned Committee Chairman **Jim Clawson** at ext. 4-7201 or data manager **Carol Dumain** at ext. 4-8242. ❑

The Occupational Health Services Office notes that NASA's Presidential Sports Award program, part of the President's Council on Physical Fitness and Sports (otherwise known as the Annual Fitness Challenge), continues through Dec. 31, 1999. JPL employees and affiliates are encouraged to participate. No entry fee is required.

The program is intended to motivate all Americans to become more physically active throughout life, emphasizing regular exercise rather than outstanding performance.

The gymnasium in Building 180 (for JPL employees) has been designed to encourage physical fitness at JPL, and can be used as a vehicle for participation in the Fitness Challenge. Because the gym is only open to employees at this time, JPL affiliates may want to consider the many other forms of exercise that are also included in this program.

To enter the Fitness Challenge, pick up a "Presidential Sports Award" brochure from Occupational Health Services, Building 310-202. The brochure will have a list of categories for competition in areas such as walking, running, weight training, swimming, etc., and the distance required for the participant to meet each day.

Participants are able to go at their own pace, and keep track of their exercise routine or distances weekly or monthly. Completed logs are mailed to Occupational Health Services by Dec. 31.

For more information, call **Lori James** at ext. 4 6303. ❑

Retirees

The following JPL employees retired in August:

Ray Newburn Jr., 43 years, Section 323; **Alfred Schoepke**, 40 years, Section 345; **Gerald Copeland**, 37 years, Section 600; **Linus Pakulski**, 36 years, Section 357; **Judith Falstreaux**, 32 years, Section 221; **David Quarles**, 32 years, Section 353; **Mercedes Campos**, 30 years, Section 622; S. **Walter Petrick**, 30 years, Section 354; **Richard Rudd**, 22 years, Section 310; **James Painter**, 20 years, Section 622; **Clifford Moran**, 18 years, Section 353; **Paul Willis**, 11 years, Section 333. ❑

Former Chief Technologist Terry Cole dies

Dr. Terry Cole, former chief technologist for JPL, died of prostate cancer Aug. 20. He was 68.

Cole, who joined JPL in 1980 as the technologist for the Energy and Technology Applications Program, became the Lab's chief technologist in 1984 and served in that role until his retirement in June 1998. He later served as senior research associate in chemistry at Caltech.

As chief technologist, Cole developed JPL's Center for Space Microelectronics Technology (CSMT)—for which he received NASA's Exceptional Service Award in 1992—and its Microdevices Laboratory. He also initiated the Telescopes In Education program, a collaboration between JPL and the Mount Wilson Institute.

Cole earned a doctorate in physical chemistry from Caltech in 1958 after receiving a bachelor's degree in chemistry from the University of Minnesota four years earlier. After postdoctoral work at Caltech, he held technical management posts in chemistry and chemical engineering at Ford Motor Co.

Cole is survived by his wife, Margaret, son Vallance, daughters Catherine Cole-Braun and Sarah Rodriguez, and grandson Aaron Cole Braun.

Services were private. Memorial contributions are requested to Summer Undergraduate Research Fellowship, care of Carolyn Merkel, Caltech mail stop 139-74; and USC-Norris Hospital, 1441 Eastlake, room 8302, Los Angeles, CA 90033; specify "For Prostate Cancer Research Fund."

Dr. Terry Cole

❑❑❑

Paul Sutton, 52, spacecraft manager for Mars Polar Lander, died July 9 at his home in San Gabriel following a four-year battle with cancer.

Sutton had worked at JPL since 1984. He is survived by his wife, Joan, sons Philip and Andrew and daughter Elizabeth.

Memorial services were held at St. Luke Church in Temple City. ❑

Muriel Guidero, 75, a retired secretary from the former Section 318, died of emphysema May 27 in Bend, Oregon.

Guidero joined JPL in 1977 and retired in 1988.

She is survived by sons Michael and Steven, two granddaughters and one grandson.

Services were held at Forest Lawn Memorial Park in Glendale.

Paul Delano, 85, a retired instrument specialist in Section 664, died of cancer June 29 at Granada Hills Hospital.

Delano worked at the Lab from 1962-79. He is survived by his daughter, Karen Matthews.

Services were held at Kern Valley Cemetery in Lake Isabella, Calif. ❑

Deep Space 1 Project Manager David Lehman, in back row wearing glasses, recently presented certificates of appreciation to representatives of Ames Research Center and JPL for the cooperative effort by both centers resulting in the successful demonstration of the Remote Agent experiment onboard Deep Space 1. From left are Nicola Muscettola, Jack Hansen and Pandu Nayak, all from Ames; next to Lehman are Doug Bernard and Ben Smith of JPL; at right is Laboratory Deputy Director Larry Dumas.

JPL, Ames discuss cooperative ventures

A meeting last month between representatives of JPL and NASA's Ames Research Center examined past cooperative work and identified ways of working together in the future.

Ames and JPL signed a memorandum of cooperation covering technologies that Ames' Automated Software Engineering Group will infuse into JPL's Mission Data System Project, led by Al Sacks. Several tasks are already planned for this cooperative venture, said Tom Renfrow, manager of Section 389 and JPL's liaison to Ames, who organized the meeting.

Steve Zornetzer, director of information sciences and technology at Ames, discussed the Intelligent Systems Program the center is leading for NASA. Ames is inviting significant participation in this program by JPL, including several leadership positions. Plans were put in place for a joint-center team to establish better alignment between the program and JPL's mission communities.

Deep Space 1 Project Manager David Lehman awarded certificates of recognition honoring the cooperative effort by both centers resulting in the successful demonstration of the Remote Agent experiment onboard Deep Space 1.

Dr. Leon Alkalai, manager of JPL's Center for Integrated Space Micro-systems, discussed possible collaborations between CISM and Ames, including the use of several high-performance, real-time embedded computer testbeds such as the X2000 First Delivery Avionics, the Remote Exploration and Experimentation parallel computer, and the DARPA-funded Distributed Reliable Computing testbeds. He also briefed Ames on the status of the partnership between NASA and the National Cancer Institute on biomolecular nanotechnologies.

Other JPL officials participating in the meeting included JPL Deputy Director Larry Dumas; Technology And Applications Programs Director Mike Sander; Dr. David Atkinson, deputy manager of the Information Technologies and Software Systems Division; and Dr. Satish Khanna, deputy manager of the NASA Technology Program.

Ames representatives included Jack Hansen, deputy director for research, and Peter Norvig, manager of the Computational Sciences Division. ❑

DESCANSO

Continued from page 5

them and use them. It might be a Mars Program need, where there are a number of projects being planned, and they have defined some of their requirements. But I'd like to see us go beyond the current capabilities, push the envelope and say, 'Yes you can probably do that mission, but what else might you do if we could land the spacecraft within 10 meters of your target?' "

DESCANSO members are also working closely with the Telecommunications and Mission Operations Directorate on its Mars infrastructure study. "(TMOD Director) Gael Squibb asked us to support it," she said. "We've been very involved in that study from the beginning.

"The Center of Excellence has a recognized responsibility to encourage these activities. I see myself, and the Center, as a facilitator and influencer, to get people working together on things that will benefit all of us." ❑

SOHO

Continued from page 3

by its special ability to observe simultaneously the interior and atmosphere of the Sun, and particles in the solar wind and the heliosphere.

The spacecraft spun out of control and communication was lost on June 24, 1998. The Goldstone Solar System Radar Group located the satellite in orbit and determined its spin rate, verifying its ability to be recovered. The Resource Allocation Planning and Scheduling Office then helped to work out Deep Space Network scheduling, with support from other projects, to accommodate the SOHO recovery. Goldstone operations staff responded successfully to the numerous changes in telecommunications requirements, and AlliedSignal staff provided technical direction to aid the DSN in the recovery.

Control of SOHO was regained last Sept. 16. ❑

Ad deadline extended

Due to the Sept. 6 Labor Day holiday, the deadline for submission of *Universe* ads for the Sept. 17 issue has been extended to Tuesday, Sept. 7 at 2 p.m. ❑

LETTERS

On behalf of my family, I would like to thank all of those at the Lab who have sent their thoughts and prayers for the speedy recovery of my son Joshua. The outpouring of support has reassured him that those who hate are far outnumbered by those who love.

Alan Stepakoff

My wife and I would like to thank our colleagues for their expressions of sympathy in the recent loss of my father-in-law. We also greatly appreciate the beautiful plant we have received from ERC on this occasion.

Homayoun Seraji

FOR SALE

AIR CONDITIONER, GE, exc. cond., used only once last summer when purchased, 13,800 BTU, filler panels incl., have all paperwork, $500. 626/289-4792.

APPLIANCES: vacuum cleaner, Hoover, upright, w/attachments, gd cond., $60; steam iron, GE Power Spray, vg cond., $25; floor lamp, black base and pole, off-white shade, gd cond., $15. 626/577-8107.

BABY BEDS, toddler (2), Graco, white metal/plastic frames with mattresses, used 8 months, $150/obo for both. 626/303-5595.

BABY FURNITURE, crib, cradle, swing, car seat, high chair, baby carrier and more, exc. cond. 661/252-8470.

BABY ITEMS, Dutailer glider & autumn (like new) $250; oak crib w/canopy & mattress $175; Fischer Price toddler bed w/mattress $30; wood high chair $25; plastic high chair $15; walker $3. 957-8653.

BABY ITEMS: steel crib w/mattress $60; musical mobile $15; baby play gym $6; infant car carrier $5; child car seat $20; booster car seat (new) $45; walker (almost new) $10; toys $.50-$5; girl clothes (0-3 yrs) $10/bag; tricycle $8; umbrella stroller (like new) $12. 626/795-4975, Wen.

BABY ITEMS, Graco swing set with bassinet $40, crib rocker $10, Baby Bjorn carrier $20. 323/342-0607, Grace.

BABY ITEMS, white Childcraft crib with mattress, $80; KidCo stairway gate (adjustable 28" to 46"), $30; safeway gate, $20; safety 1st 900 MHz nursery monitor (120' range), $20. 790-8442.

BABY ITEMS, white wood crib, $50; crib mattress, $30; crib sheets and comforter sets, $25; Graco playpen, $30; all items hardly used. 562/790-8187.

BAKERS RACK glass and oak shelves, $250/obo; TWIN BED, Bassett, 5-drawer dresser, oak book shelf, mattress and box springs, $700. 957-4770.

BRIDAL GOWN, sizes 8-11. 783-4151, Ana.

CHAIR, brown, high-back, executive office chair, $60; 1970's light-up Olympia beer sign, $35. 248-5282.

CHAIRS, recliner, 2 This-End-Up recliner chairs, wood sides, with dark blue cushions, exc. condition, $75/ea/obo. 249-4096.

CHINA SET, 60 pc., $70/obo. 909/592-0780, Ana.

CHINA SET, 6 Noritake 5-piece place settings (Rothschild design), $100. 626/403-9002.

COMPUTER, antique '80s IBM PC, AT syst. 1800, sgl. 5.25" floppy drive, grn LED monitor, 286 proc.?, $50. 626/794-8720, Andy.

COMPUTER POWER CONTROL CENTER, 5 switches + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, $20. 790-3899.

DESK, perfect for home office, new, never used, $200/obo. 626/403-9002.

DINING ROOM FURNITURE: Ethan Allen cherry wood server, Georgian Court collection, 40"x21"x34", exc. cond., $825; matching wall-mounted shelf, $45. 626/577-8107.

DIET TAPES, Jenny Craig, set of 14, $50; 790-3899.

DISHWASHER, portable Kenmore 1-yr-old (includes faucet adapter), exc. cond., cost $500 new; new home has built-in, so no longer needed, $375. 626/794-8720, Andy.

DRYER, electric, used 4 months, gd cond., $180/obo. 626/401-2571.

ENCYCLOPAEDIA SET, "New International," complete 23-vol., contains over 18,400 pgs. + "Courses of Reading & Study" vol. publ. 1915/16, many pictures (some color) & fold-outs, turn-of-century time capsule ideal for history buffs and/or book collectors, gd cond., forest grn cloth binding w/gold lettering, $300/obo. charlespaige@netscape.net or eves/weekends or 626/798-5014, Chuck.

EXAM TAPES for educ. contractor (16) for CA law & general trade, cabinet and mill work, w/training manuals, $300. 249-6071.

EXERCISE BIKE, Tunturi Ergometer, $50. 790-8442.

FURNITURE, white pine bedroom set for young girl, canopy bed w/trundle, $200; 5 drawer dresser, $150; desk, $150. 957-8653.

FURNITURE, queen sleeper sofa, like new $200; loveseat recliner (match), $200; washer/dryer, $200. 805/582-9494.

Continued on page 8

GRANDFATHER CLOCK, incl. moon dial, 3-chime setting w/key drive, $975. 249-6071.
MICROWAVE, oven, sharp, 900w, 1.2 cu. ft, walnut, runs fine, $40/obo. 909/593-4046.
MISC, table/sew mach., solid wood, $48; computer 486DX100/monitor, will deliver, $250; moving boxes (120plus)/paper, will deliver, $100; bicycles, 26", will deliver, $80. 805/582-9494.
MISC, Harvard Ping Pong tbl $200 (like new); couch $80; Weber BBQ $25; redwood picnic table & 2 benches $25; Rhodegear child bike seat (new) $40; Honda moped $100; portable playpen $30; child bike $25; Huntington desk & chair $200; B&D garden blower $30; 14-ft alum. ladder, $30. 626/643-9769.
MISC, Piano, Wurlitzer spinet, w/bench, $875; Advent utility speakers w/stands, gd cond., $80/pr.; BMX-style bike, silver, new seat, good treads, vg overall cond., $40. 952-8455.
MODEM, Apple Geoport adapter fax/modem, model M1694 express for power Mac, $25. 541-0062.
MODEMS, external US Robotics Courrier V. everything 56k baud $150; US Robotics Sortster 28.8 k baud $50; Cardinal 33.6 k baud, $25. 626/791-1779.
ORGAN, Yamaha 415 electronic console w/13 pedals, 3 keyboards, 144 rhythm patterns, pd. $7,500, sacrifice for $3,000. 790-3899.
PHONOGRAPH, antique, hand-crank console, mahogany cabinet restored, circa 1920s, lots of records, $550; DESK CHAIR, high back uph. brown, $60; BEER SIGN, Olympia, $35. 248-5282.
PHOTOGRAPHS, 40" x 30", color, framed; 2 tall-ship pics by a prof. photog., vg cond., 1 of Span. ship in SF bay, 1 of German ship nr Puerto Rico, $70/each, $120/both obo. 626/568-8298.
PRINTER, Apple Color Style Writer 2400, $50/obo. 790-6851, Roger or Margaret.
PRINTER, Xerox Diablo 630 daisywheel w/print wheels/ribbons, exc. cond., works great, $10/obo. 626/568-8298.
RANGE, Litton electric, ceramic top, microwave oven above, $35; REFRIGERATOR, GE, 22 cu. ft., $105. 790-6738.
REFRIGERATOR, Kenmore 19 cu. ft.,with ice maker, $250/obo. 790-6851, Roger or Margaret.
REFRIGERATOR, mini, Kenmore 4.5 cu. ft, exc. cond., 2.5 years left on warranty, great for workshop, rm rental or dorm rm, $100/obo. 626/345-0079, Ron.
RINGS: Amythest Ring set in 14K, w/2 sm., diamonds, size 6 $75; lg. pearl set in 14K, size 5-1/2 or 6 $50. 626/398-4960.
SOFTWARE, Avery Kids Printertainment kit w/supplies & CD-ROM for Windows or Windows95; designs/prints greeting & laminated ID cards, door signs, stickers, etc., works w/HP, Canon & other popular inkjet or laser printers, $10. 626/332-2682, Steve.
SPRINKLER VALVE ADAPTERS, Lawn Genie automatic 756LG 3/4, new, $10/ea. 790-3899.
TABLES, glass, four 2-shelf tables with brass feet, three make up a coffee table (one round 2.5-ft. dia., two "half-moon"), 4th is round end table (2.5-ft. diam.), $125/obo. 909/592-0780, Ana.
TABLE SAW, Rockwell 10", blade adjusts up/down & angles, ripping/side tables left & right, 1 3/4 hp motor, 7-8 yrs. old, low hrs., $295/obo. 626/303-5595.

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.

TV CART, on casters, light oak, holds 27" TV, storage and space for VCR, $50/obo. 626/398-4960.
TELEVISION, RCA ColorTrak, 25", attractive cabinet, rotates on base, overall 34"x19"x30", gd cond., $40; indoor TV antenna (rabbit ears), rotating type, RCA, vg cond., $10. 626/577-8107.
TRADING CARDS, baseball (unopened), '90 or '91, each w/56 players, $3/deck; '95 Tombstone Pizza set, $12; Star Trek "First Contact" advertising placards for Ca. lottery scratch-off ticket game, approx 25"x17", $5/ea. 626/332-2682.
WEDDING DRESS, exc. cond., used once, kept in garment bag, white, straight, long sleeves, bow in the back, $40/obo. 626/568-8298.

VEHICLES / ACCESSORIES

CAR RAMP, heavy duty, 8-ton rated, knock down design, $40. 249-6071.
'98 CHEVY S-10 LS, truck, white, 9,000 mi., 5-sp. manual, airbags, ABS brakes, A/C, alloy wheels, Sony CD player w/AM/FM radio, tinted windows, under warranty, exc. cond., $11,000. 952-0047.
'74 CHEVY Bel Air, runs great, body in poor shape, gd for student, $400. 626/447-6423.
'96 FORD Escort LX, 4-dr., air, FM/cass, alarm, 5-spd., extended warranty, exc. cond., $7,000/obo. 353-4725.
'93 FORD van, FISO conversion, TV/VCR, 7-passenger, $12,500/obo. 504-6256.
'82 FORD Courier truck, camper shell, 2.3 4 cyl., 4-sp. manual, rear air shocks ,am/fm cass., runs great, grt mileage. 626/303-5595.
'95 HONDA Magna motorcycle, only 2,100 mi., nearly new, red, w/cover, windscreen 2 helmets, $4,700. 693-4811.
'92 HONDA Civic LX, dk. blue, p.w., auto, a/c, 4-dr., vg. cond., $5,200/obo. 626/812-0460.
'83 HONDA Civic 1500, hatchback red w/blk int., manual, 147K, runs great, needs body work, $300/ obo. 626/441-8572, Jason.
'83 HONDA 200X, ATC, 3-wheel off-road motorcycle, vg cond., runs great, $850/obo. 626/303-5595.
'87 JAGUAR XJ6, silver w/blue interior, well maintained, low miles, $7,000. 952-1716.
'91 JEEP Cherokee Limited edition, 4x4, white w/gold pin strip, tan leather int., AM/FM cass, tow pkg, V6, 148k miles, well maintained, $9,500/obo. 909-599-3032.
'81 KAWASAKI 250cc, 5-spd, classic style, last registered '94, garage cleanout, first $100 takes it. 616/791-3950.
'64 LINCOLN Continental, 112k orig. mi., new paint, upholstery, tires, shocks, power doors, windows, seats, AM/FM cass. and more, see ERC photo, $5,500/obo. 246-6689.
'95 MAZDA Miata, babied, many extras, 45k miles, $10,000. 626/643-9769.
'97 PLYMOUTH Grand Voyager SE, 7 pass/5 dr, auto, dk.grn., 55K mi., loaded, keyless entry, CD/8 spkrs, cc, airbags, front/rear A/C; sep driver/pass temp cntrls, tinted, roof rack, exc. cond; all records. Blu Bk: $21K, $14,900/obo. 626/836-4960.
'95 PLYMOUTH Acclaim, 4-dr, silver gray, auto, AC, PS, PW, PL, cruise, tilt wheel, V6, 90K miles, AM/FM, cassette, very roomy 6 passenger, original owner, good cond, $6345. 790-0335.
SCANNER, All Test, for troubleshooting on domestic vehicles from '82-96; bi-directional capabilities, all cables and manual, also a 300-pg manual OBDII, $400. 249-6071.
'90 TOYOTA Corolla, blue, 260 m/motor, gd cond., $2,300. 562/464-0446.
'88 TOYOTA Celica, moonrf., air, elec. windows, fold-down back seat to enlrg. trunk, 138K mi., gd for another ?, tires/brakes in gd cond., runs well, needs new finish on hood and new tape player, Blue Bk $4,000, $3,000/obo. 843-6442.
'86 1/2 TOYOTA Supra, white, 5 sp, leather seats, fully loaded, tint windows, runs great, well maintained, mint cond., orig. owner, 98k miles, $4,200/obo. 626/443-9774.
'85 TOYOTA Camry, new motor, smog, mint. cond. except for door damage, $2,800. 562/464-0446.
'93 VOLVO 940 Turbo, green, 4-dr., auto, air, leather, moonroof, security, exc. engine cond., records avail., 126k mi., $10,000. 909/590-7025.
'86 YAMAHA Fz750, 37k mi, new tires/brakes/chain, orig. owner, vg cond., runs great, many extras, see ERC photo, $1,600. 626/345-0079, Ron.

WANTED

CAT, orange tabby, green-eyed female, spayed, shots current, approx. 5 yrs. old., needs gd home quickly. 626/398-4960.
SPACE INFORMATION/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.
SHOPPERS, Ladies Auxiliary-sponsored dress party, "Shop Til You Drop", Sept. 8, 5:30-8:30 p.m. at Arcadia Elks Lodge, 27 W. Huntington Dr.; no admission chg., summer/fall fashions fr. Nordstrom, Macy's, Robinson's-May, Bloomingdale's, 50-70% off store prices, nothing over $38, sz. 4-24, ample parking in rear lots. 626/797-1310.
SNOWBOARD, w/bindings, snowboard boots, gloves for child about 54" tall, shoe size 3; snowboard boots, men's size 7-8, clean. 952-8455.
VACATION RENTAL in San Diego for Dec. 26, '99 to Jan. 3, 2000. 626/683-9177, Laurence.
VANPOOL RIDERS, JPL van #3 from Fontana, Ranch Cucamonga, Upland, Claremont, La Verne areas to JPL main facility. Ext. 4-8343, Mike or 4-5831, Rhea.

FREE

DOG, rescued, in temp. home, natural blonde cocker spaniel needs gd home, loves kids, 4 yrs. old, neutered, male, gd disposition, well cared for. 843-6442.
KITTENS, orphaned, need TLC, please adopt. 626/791-0809.

FOR RENT

ALTADENA, affordable 1 bd. guest house, fenced yard, Florecita area above JPL, new carpet and paint, clean, quiet, $425 + utils., (approx. $70), $450 security deposit. 626/794-6076.
ALTADENA, Rubio Canyon area, room in private residence, kitchen & laundry, ok, no smoking, no pets, $350. 626/797-8082.
ALTADENA, 3 mi. JPL, furn. rm + share lg. 3-bd. quiet hilltop house w/owner; pool, view, all amenities incl. kitchen, laundry, cable TV, priv. bath; off-st. parking spot; smoking OK, $500/incl. util. + deposit, 3-mo. min. occupancy. 626/794-1050, eves., Harry.
ARCADIA condo, 2 bd. + den, 1-3/4 ba., pool and spa, 2-car enclosed gar. w/storage space, balcony, C/A, include W&D, quiet, close to all, walk to Holly Elementary School, no pets, $1,325 + sec. deposit, avail. 10/1, 626/446-2989, before 9 p.m.
CLOSE TO JPL, room in lg. house, shared ba., requires non-smoker, clean, must love dogs, 475 + 1/3 util. 626/797-5570.
EAGLE ROCK, furn. rm in single-fam. house, nice area, 10 min./JPL, priv. entr. and ba., share kitch. & laundry privileges, $350 incl. util. 323/256-1785.
GLENDALE, roommate wanted, charming 3-bd., 2-ba. home, great neighb'h'd near frwys & park w/ tennis courts, lg. backyd., hardwd., a/c, w/d, f/p, indoor cat, N/S only, $600 + 1/3 util. 213/740-5488, Stacey.
MT WASHINGTON, lg custom home, 3 bd., 2½ ba., fam. rm, view, 2,000 sq.ft., Mt. Wash. primary schools, furn/unfurn, avail. Sept., 15-min. commute, ask for JPL discount, $1,600 to $1,800. 323/255-1474.
PASADENA luxury condo, 2-bd., 2-ba., fireplace, pool, Jacz., security bldg, underground pkng, close to JPL, PCC, Old Town, $1,350. 626/963-0570.
PASADENA condo for lease, 2 bd., 1¾ ba., stove, refrig., a/c, washer/dryer, microwave, fireplace, 2-car gar., view, water paid, dishwasher, avail. 10/1, $1,050. 323/856-9630.
SOUTH PASADENA, fully furn. studio apt, nice area at 1718 Huntington Dr. between Marengo and Milan streets, car space, laundry facilities on premises, utilities pd., non-smoker, no pets, $565. 626/792-9053, Marilyn.

REAL ESTATE

BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 ba., mud/laundry rm, $129,000. 909/585-9026.
LA CANADA, 3 bd., 2 ba., family rm, cntrl heat & air, hdwood flrs, FP, newly decorated inside, new landscaping, $394,000, 244-8253.
PALM DESERT, designer furn. condo on dbl.-vw. fairway at Palm Valley C.C., 2 bd., 3 ba., den, sep. din/liv rms, 12" tile floors w/bordered carpeting, marble frplc., Corian counters in kitch./ba., mirrored walls, built-in wall units/cabinets, auto. awning on patio, nr. pool, many more upgrades, sale by owner, price negot. 888/659-3540.
PASADENA, townhouse built '98 nr Rose Bowl, 3.5 mi./JPL, gated community, approx. 1,450 sq. ft., 3 bd./2.5 ba., 2-car att. garage, prof. organized closets, tiled FP, alarm, ceiling fans w/lights in all bedr., covered balcony off master, Pergo maple flrs everywhere, all Corian counters, lg enclosed backyd fully landscaped w/auto sprinklers, palm/fruit trees, pool, Jacz., basketball court, $260,000/obo. 626/568-8298.

VACATION RENTALS

BIG BEAR cabin, quiet area near village, 2 bd., sleeps 8, compl. furn., F/P, VCP, $75/nt. 249-8515.
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 LAKE cabin, near lake, shops, village, forest trails, 2 bd., sleeps up to 6, fireplace, TV, VCR, phone, microwave, BBQ and more, JPL disc., from $65/nt. 909/599-5225.
BIG BEAR LAKEFRONT lux. townhome, 2 decks, tennis, pool/spa, beaut. master bd. suite, slps. 6. 949/786-6548.
CAMBRIA, ocean front house, sleeps up to 4, exc. view. 248-8853.
HAWAII, Maui condo, NW coast, on beach w/ocean vw., 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwv., dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate: $95/nite/2, 12/15-4/14 rate $110/nite/2, $10/nite/add'l person. 949/348-8047.
LAKE TAHOE, N. shore, 2 bd., 2½ ba., sleeps 6-7, private sandy beach, pool, great location, all amenities, hiking, kayaking, river rafting, bike trails, 2 mi./casinos, JPL discount, 3-day min. 626/355-3886, Rosemary or Ed.
MAMMOTH, Chamonix condo, 2 bd., 2 ba., slps 6, fully equip. elec. kitch., microwave & extras, frplc., cable TV, VCR, FM ster., pool, sun area, o/d Jacz., sauna, gm., rec. & laundry rms, BBQ, conv. to shops, hiking, summer events, daily/weekly rates, sum. rates thru Oct. 249-8524.
MAMMOTH condo, studio + loft, 2 ba., fireplace w/ wood supplied, Jacuzzi, sauna, game rm., color CB. TV/VCR, full kitchen w/microwave, terrace, view, amen., low summer rates. 714/870-1872.
OCEANSIDE, on the sand, charming 1 bd. condo, panoramic view, walk to pier or harbor, pool, spa, game rm., sleeps 4. 949/786-6548.
PACIFIC GROVE hse, 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well eqpd kit w/microwave, beaut. furn, close to golf, bches, 17 Mile Dr, Aquarium, Cannery Row, JPL discnt. 626/441-3265.
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.
SOUTH LAKE TAHOE KEYS, waterfront, 4 bd., 3 ba., hcp access fair, sleeps 12+, frplc. on 2 levels, decks overlook priv. dock/ski lifts, gourmet kitch., bikes, 20' sail & paddle boats, 3 color TVs, VCR, stereo, assn. indr./outdoor pools, hot tub & beach, lighted tennis, 10 min./skiing, casinos, golf, 1 hr./wine country, 3-day min.; $1,095/wk for high seas., 15 June to 15 Sept., 22 Nov. to 1 March; $495/wk low season, + $90 cleaning fee. 949/515-5812, Jim Douglas.