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Dr. Harry Detweiler

Detweiler to direct OEMA

JPL Director Dr. Edward Stone has announced the appointment of Dr. Harry Detweiler to the position of Director for Engineering and Mission Assurance, effective Feb. 2.

Detweiler had served as manager of the Telecommunications Science and Engineering Division 330 since July 1996.

Detweiler joined JPL in 1968 as a member of the technical staff after earning a doctorate in electrical engineering from the University of Michigan, where he also earned bachelor's and master's degrees in the same subject.

He has held several positions within Division 330, has contributed to a number of flight projects and instruments and has worked closely with the Deep Space Network. ❑

Galileo sends data, images from Europa

No further attitude-control anomalies have occurred; next encounter Feb. 10

By JANE PLATT

JPL's Galileo spacecraft last week transmitting to Earth pictures and other science information gathered during the Dec. 16, 1997 flyby of Jupiter's icy moon, Europa.

The information, which had been stored on the spacecraft's onboard tape recorder, includes fields and particles observations of the interaction between Europa and Jupiter's magnetic and electric field environment. Also included are pictures and observations of Europa's wedged regions and hot regions. Important observations of surface changes on the volcanic moon Io will help later on in the Galileo Europa Mission, when one or two close Io flybys are planned.

In the first week of February, Galileo was to transmit science information and pictures of Europa's regions of fretted shapes and regions of dark lines, as well as images of the Gilgamesh region on another Jovian moon, Ganymede.

There have been no further occurrences of anomalous behavior by Galileo's attitude control subsystem, which controls where the spacecraft and scan platform are pointing. Team members have confirmed that a hardware error in one of the spacecraft's two gyroscopes caused the two anomalies, which temporarily slowed down the rate at which data could be transmitted to Earth.

The gyroscopes are used to point the spacecraft when very precise pointing control and knowledge of the spacecraft's position and orientation are needed, usually for camera and other remote sensing science observations or for maneuvers that adjust the spacecraft's flight path. The team will continue studying the anomalies to determine whether they may recur and to design ways to work around the situation for the remainder of the mission.

A flight path maneuver was performed successfully on Thursday, Jan. 22, to prepare for Galileo's upcoming Europa encounter on Tuesday, Feb. 10. Special precautions were

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El Niño's wrath looms large

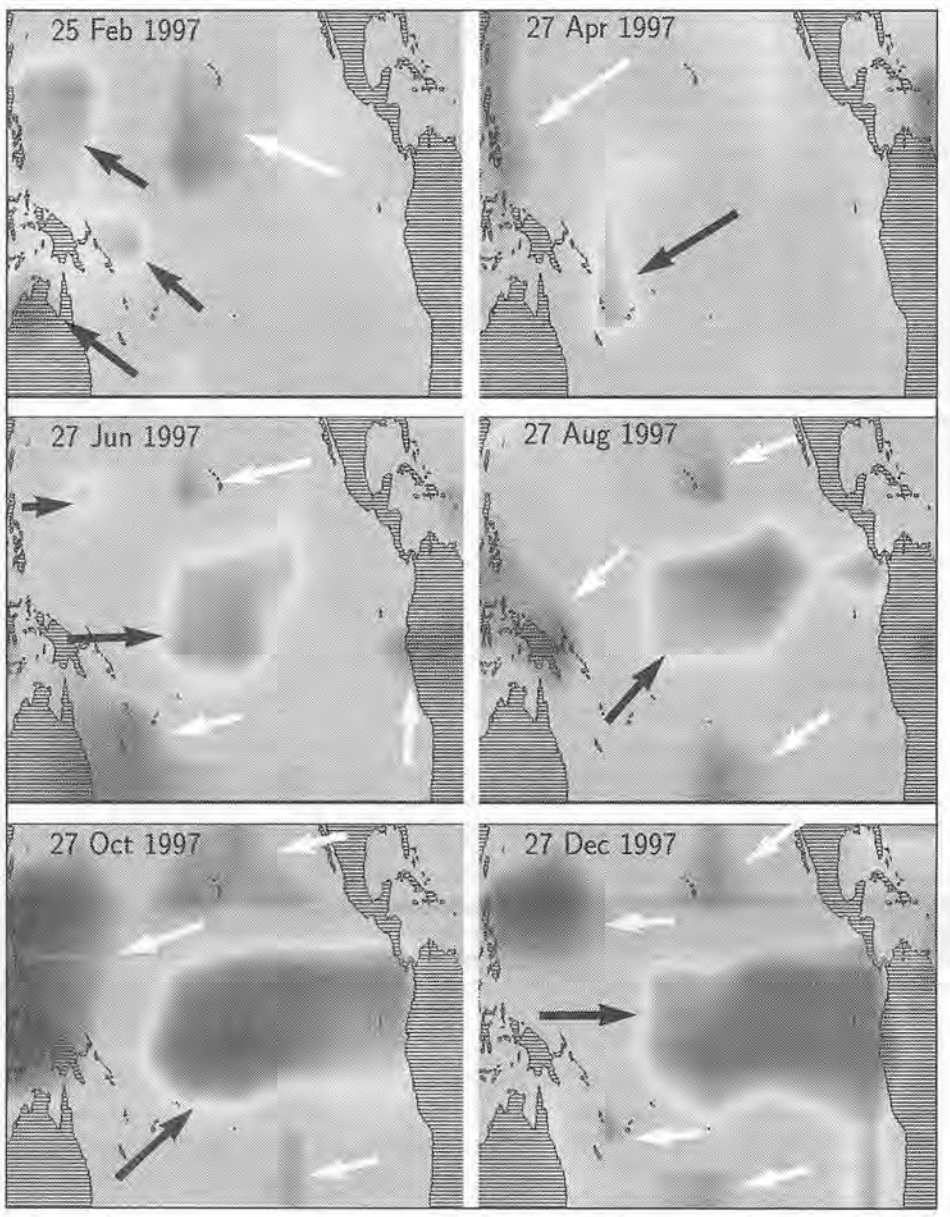
New MLS data show very high water temperatures off South American coast

New satellite animation shows the movement of water vapor over the Pacific Ocean during the 1997 El Niño condition. Higher-than-normal ocean water temperatures increase the rate of evaporation, and the resulting warm moist air rises into the atmosphere, altering global weather patterns.

The animation was created from data obtained by the JPL-managed Microwave Limb Sounder (MLS) instrument onboard NASA's Upper Atmosphere Research Satellite (UARS) from late December 1996 to late December 1997.

This series of six images, released Jan. 27, shows the movement from the western Pacific to the eastern Pacific of high levels of water vapor (black arrows) at 10 kilometers (6 miles) above the surface. Areas of unusually drier air (white arrows) appear over Indonesia and other areas of the western Pacific.

December 1997 data also show a rapid increase of water vapor off the coast of South America, the result of very high water temperatures in that region. At the same time, the western Pacific is much drier than normal. In the tropics, the warm water and the resulting tall cloud towers typically produce large amounts of rain. These data show significant increases in the amount of atmospheric moisture off the coast of Peru and Ecuador since measurements were made last November. The maximum water temperature in the eastern tropical Pacific, as measured by the National Oceanic and Atmospheric Administration (NOAA), is still higher than normal and these high ocean temperatures are likely responsible for an increase in evaporation and the subsequent rise in humidity. ❑



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Walls coming down between Lab's administrative divisions

Success depends on process-friendly, teaming environment

By MARK WHALEN

A major effort is under way among JPL administrative divisions to remove perceived barriers between them and embrace the Lab's efforts to foster a process-friendly, cross-functional organization.

In an effort to continue to serve JPL's new environment of quicker and more frequent missions, the Contracts and Finance Division 210, Acquisition Division 620 and Logistics and Technical Information Division 640 have embarked on a new initiative called "Teaming Together." The plan focuses on the fact that for JPL to thrive in an era of change, people must build new relationships, depend on each other and care more deeply about JPL's success.

Just as JPL is recognized as a world-class institution in scientific research, "We can do no less than provide world-class business support to the Laboratory," Business Operations Director Daryal Gant told a December meeting of the roughly 600 personnel comprising the three divisions.

To reach that lofty goal, section managers from the divisions have been meeting for several months to acquaint each other with their roles and responsibilities. They also created several teams that have worked to cross functional lines and transition staff members to a new processed-based environment.

The Teaming Together effort will come into play in a big way this spring with the first implementation of the Lab's New Business Solutions (NBS) Project, which will provide JPL with significantly improved administrative processes supported by the implementation of Oracle business software.

Changing JPL Workplace

One in an occasional series.

The first NBS phase in May will introduce a human resources management system, online hiring process tool, timekeeping and payroll systems, and general ledger. In July, a new budgeting system will come online, and this September—to start fiscal year 1999—NBS' project accounting, acquisition, property and services, finance and additional human

See Teaming, page 3

Additional experiments chosen for Mars 2001

NASA has selected additional instruments for the Mars Surveyor 2001 missions, which will study Mars' environment through the deployment of an orbiter and a lander.

The JPL-managed missions will follow two other robotic Mars missions to be launched in late 1998 and early 1999. All are part of NASA's long-term, systematic exploration of Mars in which two missions are launched to the planet approximately every 26 months.

The 2001 missions represent the first step in a NASA initiative to integrate the requirements for space science and the Human Exploration and Development of Space program into a single robotic exploration program.

"In a sense, these missions allow virtual presence by humans and provide precursor data and subsequent infrastructure for possible human missions in the 21st century," said Arnauld Nicogossian, associate administrator of NASA's Office of Life and Microgravity Sciences and Applications. "By adding capability to missions already planned, this near-term effort will result in cost effective, tangible progress in carrying

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News Briefs

NASA has renamed the Mission to Planet Earth enterprise the Earth Science enterprise. The Earth Science enterprise is one of the four strategic enterprises of the agency, responsible for a long-term, coordinated research effort to study the total Earth system and the effects of natural and human-induced changes on the global environment.

In announcing the change of name, Deputy Associate Administrator for Earth Science Programs **William Townsend** said, "We feel that 'Earth Science' more clearly conveys to the American people the goals of our program, and more directly focuses on the research that we're conducting. 1998 will include several major launches in the enterprise, including the first Earth Observing System missions, and we are pleased to enter this era with the new name." ❑

The next JPL/Red Cross blood drive will be held in von Kármán Auditorium Feb. 17 from 10 a.m. to 3:15 p.m. and Feb. 18 from 7 a.m. to 12:15 p.m.

Signup sheets are available prior to the blood drive at the ERC, the Occupational Health Services Office in Building 263 and the Occupational Health Services Web site at http://vision/jpl/medical/ . For those who have not signed up ahead of time or wish to change their appointment, call **Dawn Bailey** at the Pasadena Red Cross at (818) 799-0841, ext. 630. ❑

Papers, tutorials, and exhibits are being solicited for the 17th annual Digital Avionics System Conference, which will be in Seattle from Oct. 31 to Nov. 6.

The theme, "Electronics in Motion," symbolizes a focus on the integration of air, space and ground vehicle electronic systems. The conference will bring customers and manufacturers together in an industry forum.

One-page abstracts are due by March 1, 1998. Volunteers to lead the technical sessions also are needed.

For more information, check out the conference Web site at http://www.ai.com/datc or contact **Mike Jahan** at ext. 4-7644, or via e-mail at Michael.H.Jahan@jpl.nasa.gov. ❑

Music fans are sought to gauge the level of interest in forming a JPL club for performers.

Those interested in playing, rehearsing and recording any type of music can contact **Henry Castro** at ext. 4-7810 or by e-mail at Henry.Castro.@jpl.nasa.gov. ❑

JPL personnel are invited to join the Caltech Masters Swim Team. Practices are held at the Caltech pool from 6 to 7:30 p.m. Monday through Thursday and 7 to 8:30 a.m. on Saturday.

Dues are $25 per month. All levels of swimmers are welcome.

For more information, contact **Suzanne Dodd** at ext. 3-5865. ❑

Cassini in excellent health

By MARY BETH MURRILL

The Cassini spacecraft remains in excellent health as it travels on its Saturn-bound trajectory at a speed of approximately 120,000 kilometers per hour (about 75,000 mph). It has traveled more than 271 million kilometers (about 168 million miles) since launch last Oct. 15.

Cassini continues to fly with its 4-meter-diameter (13-foot) high-gain antenna pointed toward the sun so that the rest of the spacecraft is shaded. It will maintain this attitude, except during planned trajectory adjustments, for the first 14 months of flight as it travels the inner solar system.

Radio communications with the spacecraft are currently through low-gain antenna 2, one of the spacecraft's two low-gain antennas. Low-gain antenna 2 is located at the end of the spacecraft opposite the high-gain antenna. The low-gain antenna that is selected for a given period depends on the relative geometry of the sun, Earth and the spacecraft. The telemetry data rate from Cassini is currently 40 bits per second.

For about the next month, there will be an increase in the amount of telecommunications time allotted to Cassini by the Deep Space Network to meet the data needs of spacecraft navigators as they prepare for two long-scheduled trajectory refinements. In late January, Deep Space Network antennas were trained on Cassini about four times a week. In February, those episodes of tracking will be approximately doubled. The adjustments will be made in preparation for Cassini's flyby of the planet Venus on April 26.

The additional data gathered through the extra telecommunications time is used to refine knowledge of the spacecraft's location, which will aid navigators in setting precise parameters for the trajectory adjustments, such as the duration of thruster firings. ❑

Galileo

Continued from page 1

taken in the design of this maneuver to minimize its vulnerability to any gyro problems. Another flight path maneuver will be performed on Saturday, Feb. 7, if it is deemed necessary for fine-tuning before Galileo's Europa flyby on Tuesday. Because of the solar conjunction, when the sun is between Galileo and Earth, that flyby will include no data collection except for radio science information.

On Tuesday, Feb. 3, the spacecraft was turned slightly to adjust the antenna position. The turn was executed in normal mode with some precautions built in, but no problem was anticipated. This will be the final attitude adjustment needed before the end of February, when Galileo leaves its solar conjunction period. ❑

Workshop showcases electronic packaging advances by Lab, industry

More than 120 people, including about 60 from JPL, attended JPL's Electronic Packaging Workshop for Space Applications Jan. 13 and 14 at the Pasadena Hilton.

The workshop, sponsored by the Quality Assurance Office 506 and Electronic Packaging and Fabrication Section 349, highlighted many of the advanced packaging activities currently under way at JPL and at selected industry partners. In addition, a number of papers were presented that described the applied research activities of the Advanced Interconnect and Manufacturing Assurance Program Element in the Office of Engineering and Mission Assurance.

With JPL's development of microspacecraft, NASA's principal objective of smaller, faster, cheaper missions for unmanned space exploration has resulted in the integration of materials, electronics and systems that lack the proven space experience of previous missions. JPL has identified key enabling technologies for these goals, which depend on a detailed understanding of packaging technologies and microelectronics/micromechanical device nondestructive evaluation. Office 506 and Section 349 are investigating the adaptation of conventional microelectronics to meet the challenge of microspacecraft development.

JPL presentations included those

See Workshop, page 3

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.

HIV Support Group—Meets quarterly. Call employee assistance counselor Cynthia Cooper at ext. 4-3680 for more information.

Overeaters Anonymous—Meets Mondays at noon. For more information, call Occupational Health Services at ext. 4-3319.

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, February 6

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

Saturday, February 7

Science Bowl—This annual quiz-show-like competition, sponsored by the U.S. Department of Energy, features 24 local high schools vying to represent Southern California in the national finals in May. Check in at von Kármán Auditorium; the double-elimination round begins at 12:30 p.m., with the finals taking place at approximately 3:15. For more information, call the Public Services Office at ext. 4-0112.

Sunday, February 8

Chamber Music—The Vermeer Quartet will appear at 3:30 p.m. in Caltech's Beckman Auditorium. Tickets are $25, $21, $17 and $13. For information, call (626) 395-4652.

Monday, February 9

JPL Scuba Club—Meeting at noon in Building 168-427.

Tuesday, February 10

Caltech Credit Union Annual Meeting—Refreshments will be served at 4:45 p.m. to precede the 5:30 p.m. meeting, to be held at Caltech's Beckman Auditorium. Presentations will be made by the credit union president and board of directors chairperson, and a question and answer session will be included. Members and nonmembers alike are welcome; all in attendance will receive a free gift.

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

Wednesday, February 11

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.

Thursday, February 12

Caltech Women's Club—Delores Walker of the Pasadena Historical Museum will discuss "The Grand Old Resort Hotels of Pasadena" at 11 a.m. in the Athenaeum's Hall of Associates. Luncheon will follow. Tickets are $12.50 for members, $15 for guests. Contact Julie Woodward at (626) 405-8196 or by e-mail at jjkwood@earthlink.net.

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

SESPD Lecture Series—Johnny Kwok, facility engineer, will discuss the Space Infrared Telescope Facility (SIRTF) mission design. At 11:30 a.m. in von Kármán Auditorium.

Friday, February 13

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

Mock Ballet—Les Ballets Trocadero de Monte Carlo spoof such classics as *Swan Lake* and *Giselle* in their 8 p.m. performance at Caltech's Beckman Auditorium. Tickets are $35, $32 and $29. For information, call (626) 395-4652.

Fri., Feb. 13–Sun., Feb. 15

Henry V—Shakespeare's classic will be presented by Theater Arts at Caltech at 8 p.m. on Friday and Saturday, 2 p.m. on Sunday, in Ramo Auditorium. Tickets are $10. For information, call (626) 395-4652.

Saturday, February 14

Folk Music—Lou and Peter Berryman will present their original, humorous version of folk music at 8 p.m. in Caltech's Dabney Lounge. Tickets are $10. For information, call (626) 395-4652.

Sunday, February 15

At The Piano—Caltech pianist-in-residence James Boyk will give a free concert at 2:30 p.m. in Dabney Lounge. For information, call (626) 395-4652.

Wednesday, February 18

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

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

Thursday, February 19

Caltech-Occidental Concert Band—A free program will be presented at 8 p.m. in Thorne Hall at Occidental College, 1600 Campus Rd., Eagle Rock. For information, call (213) 259-2785.

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

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

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

Friday, February 20

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

Preservation Hall Jazz Band—New Orleans–style jazz is on the program for this 8 p.m. concert in Caltech's Beckman Auditorium. Tickets are $29, $26 and $23. For information, call (626) 395-4652.

Fri., Feb. 20–Sun., Feb. 22

Henry V—Shakespeare's classic will be presented by Theater Arts at Caltech at 8 p.m. on Friday and Saturday, 2 p.m. on Sunday, in Ramo Auditorium. Tickets are $10. For information, call (626) 395-4652.

Sunday, February 22

Chamber Music—The Jacques Thibaud Trio will perform a free concert at 3:30 p.m. in Caltech's Dabney Lounge. For information, call (626) 395-4652.

Von Kármán lectures now also held at PCC; NEAT talk Feb. 19-20

The monthly von Kármán Lecture Series has been expanded to include lectures for the general public at Pasadena City College, as well as those held on Lab.

Sponsored by JPL's Media Relations Office, the lectures are held at 7 p.m. on consecutive Thursdays and Fridays each month. Thursday lectures are held at von Kármán Auditorium, with Friday lectures set for The Forum at PCC, located at 1570 E. Colorado Blvd.

The only exception to the schedule is in March, when no PCC lecture is scheduled.

The next speaker in the series will be Dr. Eleanor Helin, who will discuss the Near-Earth Asteroid Tracking (NEAT) Program Feb. 19 at JPL and Feb. 20 at PCC.

For a complete 1998 lecture series schedule, call the Media Relations Office at ext. 4-5011. ❑

New planetary encyclopedia has definite JPL flavor

By MARK WHALEN

JPL scientist Jim Shirley and colleagues have completed a comprehensive reference book that is being noted among the best in its class.

The volume, *Encyclopedia of Planetary Sciences*, is part of publisher Chapman & Hall's "Earth Science" series. It is close to 1,000 pages in length and is packed with almost 500 articles submitted by 214 contributors, bolstered by numerous maps, planetary images, charts and tables.

Of note is the fact that more than 30 of those authors are current, former or retired JPL scientists, all of whom have extensive experience in authoring scientific articles for publication.

"We included a diversity of viewpoints, and some difference of opinion," said Shirley, the book's co-editor, who works on Galileo's Near Infrared Mapping Spectrometer (NIMS). He noted that separate articles cover all major lunar and planetary missions since the days of JPL's Lunar Orbiter, Ranger and Surveyor missions of the 1960s.

Although the book's manuscript was submitted for publication prior to Galileo's Jupiter orbit insertion in late 1995, there are major articles on both the Galileo and Cassini missions.

According to Shirley, the difference between his work and prior encyclopedic efforts to chronicle planetary science is the large number of articles. Most other books include only a few dozen articles at most, he said.

"We have limited the length of the major articles to about 5,000 words," Shirley said. "This allowed us to provide at least 10 times more content than any previous book that looks at the solar system or planetary science as a whole." He pointed to the book's comprehensive coverage of asteroids, meteorites, fields and particles; processes such as impact cratering and planetary accretion; and of techniques of remote sensing, image processing and celestial mechanics.

The standard articles are about 2,000 words in length. A third category in the encyclopedia covers definitions of geological, astronomical, physical and meteorological terms that range up to about 500 words. Also in this category are nearly 100 biographical entries on pioneering scientists.

Shirley, who noted with humor that the effort was a "hellishly time-consuming project," wanted to reach a wide readership, not just scientists. For example, he said, "We tried to make the book accessible for a high school student who might wonder how JPL produces such amazing images of planets."

The volume has been favorably reviewed in science journals. New Scientist magazine noted that the book "provides comprehensive and concise coverage of the whole gamut of planetary science in a form that will be of great use to professionals, students and interested general readers.

"When it comes to the planets, their characteristics, interrelations and environment, this is the book of the decade," declared the review's author.

Although the manuscript was completed more than two years ago, Shirley is not overly concerned that the book will rapidly become out of date. "The users of encyclopedia articles need a clear summary of the basic facts, together with a good list of references for further study. The latest interpretations, on the other hand, may become stale with time. Encyclopedia articles should help move the reader rapidly up the learning curve."

The encyclopedia is now available at the JPL Library, and may be ordered through the library's Web site at http://beacon. ❑

La Cañada thanks Lab for emergency preparedness

By MARK WHALEN

JPL has been honored by the city of La Cañada for the Laboratory's emergency preparedness efforts in support of the community.

Awarded in January by the city's chamber of commerce, the annual honor recognizes the organization that does the most toward improving emergency preparedness in and around the city.

JPL Emergency Preparedness Administrator Eric Fuller accepted the award on behalf of the Lab. Fuller is a member of La Cañada's emergency preparedness committee as part of the Lab's ongoing partnership with local fire, police and other agencies.

In addition to La Cañada, the partnership also includes the city fire departments of Alhambra, Burbank, Glendale, Monterey Park, Pasadena, San Gabriel, San Marino and South Pasadena, as well as the Los Angeles County Sheriff's Department's air rescue helicopter crew.

"In the event of a major disaster," Fuller said, "after ensuring that JPL's needs are taken care of, we would offer all our resources to La Cañada and any other of our partner communities we could help."

He added that JPL has that same assurance if it needs help from another agency.

JPL's forces include its fire department and plant protection officers. They are trained to respond to emergencies and natural disasters—earthquakes, fires, floods and hazardous material spills—and also support incidents such as civil disturbances, bomb threats and labor disputes.

Fuller said the award from La Cañada was also in recognition of JPL's Urban Search and Rescue and Hazardous Materials Team, which includes the Lab's fire department, plant protection officers and an 18-member volunteer group comprising Lab employees.

Team members undergo training weekly and are on call after hours and on weekends. Their capabilities include high-rise building and air ambulance rescue.

"Once JPL's emergency needs are met, why shouldn't we go out and help others in need?," Fuller asked.

He added that the JPL/Caltech Child Educational Center, located next to La Cañada High School, has been included in JPL's emergency response plan. Children of JPL and Caltech parents comprise 56 percent of the enrollment of the center. ❑

Want to help?

JPL's Emergency Preparedness Office and Fire Department Urban Search and Rescue Reserve Team are looking for a few good people who are willing to volunteer their time, get dirty and feel good helping other people. The team would be activated during disasters on Lab. Training includes safety at the disaster site and many rescue techniques.

Find out more at the orientation on Feb. 24 at noon in Building 180-101. Call Eric Fuller at ext. 4-1091 or Charlene Wolf at ext. 4-5535. ❑

Stardust, Galileo offer educator fellowships

JPL's Stardust and Galileo missions are seeking candidates to apply for educator fellowships to help field-test educational modules and to plan and participate in teacher training workshops developed by the projects.

The Stardust mission, which will launch in 1999, fly to a comet and collect a sample for return to Earth, is seeking applicants for 10 educator fellowships.

As part of a nationwide teacher training initiative, the Stardust project is developing educational modules, targeted at grades 4 through 8, that will be tested by the Stardust Educator Fellows chosen from around the country.

In late spring/summer 1998, a second announcement of opportunity will be distributed to solicit candidates from which an additional 15 Stardust Educator Fellows will be selected and trained in fall 1998.

Those selected for the educator fellowships will receive an all-expenses-paid intensive training workshop about the comet sample return mission this spring at Lockheed Martin Astronautics in Denver. Fellows will also receive guidance on presentation strategies and a complete teacher training presenter package so they can conduct their own Stardust teacher training workshops.

Ideal candidates are actively teaching or conducting teacher training in a formal or informal science environment (school district, science center, museum, educational organization, etc.). Selected candidates will be announced by March 6. Additional information for Stardust Educator Fellowship applicants is available on the Stardust home page at http://stardust.jpl.nasa.gov

Candidates are also being sought for the Galileo Europa Mission Educator Fellowship Program for 1998 and 1999. A team of 15 Educator Fellows will be selected for training at JPL. Individuals selected will receive a complete workshop package and educational materials to conduct their own teacher training geared toward middle and high school teachers. More information is available at http://www.jpl.nasa.gov/galileo/ .

The fellowships will focus on the Galileo Europa Mission, a two-year extension of the Galileo mission to Jupiter, which will study two of Jupiter's moons with opposite and extreme conditions. Icy Europa may have liquid oceans hidden under its surface, while Io is dotted with volcanoes.

Applications for the Galileo Europa Mission Educator Fellowships must be received by Feb. 16, with selected candidates to be announced on Feb. 27.

Application information for both Stardust and Galileo Europa Mission programs may be requested by contacting Kerri Beisser, Challenger Center for Space Science Education, 1029 N. Royal Street, Suite 300, Alexandria, Va. 22314; or by sending a query via fax to (703) 683-7546. Applicants should specify for which program they wish to apply. ❑

Teaming

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resources aspects will debut. (More details about the implementation schedule are available online at http://eis/ibs .)

These new process-based systems, however, won't succeed unless the people using them accept the tough challenge of behavioral change, noted JPL Controller Bill Harrison.

Emphasizing that the "S" in NBS stands for solutions, not software, Harrison noted that, "the theme is people. We have to instill and reinforce in our staff the attitudes to make the processes work."

"With all the changes happening, it all boils down to people," agreed Division 640 Manager Willis Chapman, in addressing the December all-hands meeting. "But," he cautioned, "NBS is not a panacea. NBS will not get us there by implementing the system without engaging you folks. We must eliminate the imaginary boundaries between our cross-functional organizations."

The meeting began that process in several ways. Besides learning firsthand of their managers' united support for the teaming effort, employees and contractors from the three divisions were treated to an ice-breaking, inspirational video produced by the Photo Lab that showed quick, candid clips of seemingly hundreds of them at their work stations. Many were caught by surprise by the camera but most seemed to enjoy the few seconds of "fame."

A fun and productive sidelight occurred during a coffee-and-doughnuts break, when attendees mingled and met many new colleagues for the first time. "It was difficult to get people back to their seats after the break," said Fraser Draper, manager of Division 620. "But that was a good sign."

At the conclusion of the meeting, teams of three were assembled, with each person spending an hour or two at work with the other team members. Called "job shadowing," the concept produced a new respect between colleagues, Draper noted.

A statement of mutual commitment was also issued, called the "Declaration of Interdependence," loosely based on Thomas Jefferson's 1776 document (see box). All staff members were issued a "Teaming Together" badge that contained the statement, which Chapman said he asked people to wear as a sign of commitment.

Gant illustrated the direction of the divisions' partnership by asking staff members to imagine a fast-moving parade. "You can either watch it or follow it (not acceptable); be part of it (which is OK); or be out in front, leading the parade and beating a drum . . . That's where we're headed."

According to Division 210 Manager Steve Dombrowski, the division managers pledged that staff members would feel a sense of professional satisfaction as a result of the initiative. In addition, the following commitments were also made to the staff to ensure the plan's success:

- Training on Oracle and its capabilities, as well as in Total Quality Management;
- Structured communication, including planning, process improvement, problem resolution and employee performance;
- Resources such as joint budget-planning discussions;
- Employee rewards that include linkage of pay to process performance, team pay awards and a cross-organizational reward and recognition system.

Another all-hands meeting is scheduled for June, which will include the Facilities Division 660. In the meantime, division and section managers continue to meet to map out the initiative's next steps.

The December meeting was "a terrific start to kick off a process-based and cross-functional Laboratory," Harrison noted. "More than ever, process owners now have a very strong incentive to design a functional process," which is at the heart of the upcoming NBS implementation.

Harrison, a veteran of the corporate financial world until he joined JPL about two years ago, noted that one would be hard-pressed to find any successful U.S. company that hasn't embraced process-based management in some way.

JPL's upcoming utilization of Oracle as administered by NBS, he added, "is Oracle's biggest project west of the Mississippi and one of the top two or three nationwide" in terms of the number of users (5,000) and software modules.

"Combine that with the massive reengineering that JPL has been doing over the last few years, as well as the short time we had to do it, and this will lead to spectacular recognition. We'll be widely benchmarked for this entire effort." ❑

Declaration of Interdependence

"We the people of the Contracts and Finance, Acquisition, and Logistics and Technical Information Divisions, in order to form a more perfect union, are committed to developing a customer-focused, team-based alliance between our organizations to provide best-practice services to all Laboratory personnel. This cross-functional teaming initiative will be implemented at all functional levels across our Divisions and will lead to more effective processes and use of resources. It will be supported by new technical capabilities to be introduced by New Business Solutions. The goal of the alliance will be to better contribute to achieving JPL's strategic goals by delivering on-time, high-quality products and services to our customers."

—Divisions 210, 620 and 640

Workshop

Continued from page 2

by Tom Borden, who discussed the development of multi-chip modules based on the Power PC 603e to be used in Global Positioning Systems applications; Saverio D'Agostino, who presented a paper describing the challenges with "Managed Risk" as applied to the Deep Space 2 Mars Microprobe; and George Lutes, who discussed photonics applications for several projects including the Shuttle Radar Topography Mission (SRTM), Space Interferometry Mission (SIM), Gravity Recovery and Climate Experiment (GRACE) mission, Tropospheric Emission Spectrometer (TES) and Deep Space 1.

The workshop also highlighted part of the research and development efforts of a consortium that includes university, industry and JPL experts. Activities discussed included photonics, ball grid array, direct chip attachment and nondestructive evaluation.

Information about the Workshop can be obtained online at http://137.79.61.135:2001/workshop/package.htm . ❑

Retirees

The following JPL employees retired in February:

Leslie Mack, 48 years, Section 323; **William Kirhofer**, 44 years, Section 312; **Ronald Banes**, 42 years, Section 344; **Gerald Leach**, 32 years, Section 391; **Henry Doupe**, 30 years, Section 313; **Elsie Barker**, 29 years, Section 644; **Wayne Kohl**, 29 years, Section 341; **Jerry Sutton**, 29 years, Section 518; **M. Keith Meredith**, 28 years, Section 385; **Macgregor Reid**, 28 years, Section 100; **Mack Dowdy**, 26 years, Section 385; **Leo Espinoza**, 26 years, Section 662; **Carol Curtis**, 21 years, Section 345; **Robert Davis**, 20 years, Section 312; **Stanley Krauthamer**, 20 years, Section 344; **Robert Scott**, 20 years, Section 357; **Lawrence Seeley**, 20 years, Section 314; **Tommy Tomey**, 20 years, Section 313; **Robert Lowry**, 19 years, Section 661; **Gweneth Jackson**, 18 years, Section 180; **James Blain**, 16 years, Section 311; **Leon Kuo**, 13 years, Section 642; **James Rasmussen**, 11 years, Section 665; **R. Harry Ohls**, 10 years, Section 515. ❑

Passings

Lois Fite, 72, a retired computer analyst in Section 366, died of Alzheimer's disease Dec. 29 at a hospital near her home in Arkansas.

Fite joined JPL in 1955 and retired in 1980. She is survived by her husband, Louis.

Services were held Dec. 31 at Mount Olive Cemetery in Bauxite, Ark. ❑

Jack Pedigo, 76, a retired technical writer in Section 655, died of heart failure Jan. 23 in Oceanside.

Pedigo worked at the Laboratory from 1958–86. He is survived by his son Donald Kenney and daughter Betty Blake.

No services were held.

William Ruff, 67, a retired member of the technical staff in Section 352, died of drowning Jan. 23.

Ruff worked at JPL from 1976–94. He is survived by his wife, Judith Ann, along with five daughters, a son and 10 grandchildren.

Memorial services were held Jan. 28. ❑

2001

Continued from page 1

out the Human Exploration and Development of Space strategy and contribute to the Origins program of NASA's Office of Space Science."

Dr. Michael Hecht of JPL is the project manager for the Mars Environmental Compatibility Assessment, which will characterize Martian dust and soil to identify potential undesirable and harmful interactions with human explorers and associated hardware, and to evaluate properties of the soil. Dr. Thomas Meloy from West Virginia University is the principal investigator.

Additional investigators will include those from the Max Planck Institute of Aeronomy in Germany, the University of Arizona and Stanford University.

The 2001 lander and rover are due for launch in April 2001.

The orbiter is set for launch about a month prior to the lander. Its newly named investigation, the Martian Radiation Environment Experiment, will characterize the radiation environment in the orbit and on the surface of Mars simultaneously. This experiment will consist of radiation spectrometers on both the Mars 2001 Orbiter and on the Mars 2001 Lander. Dr. Guatam Badhwar from NASA's Johnson Space Center, Houston, is the principal investigator.

A team consisting of JPL and Lockheed Martin Astronautics of Denver will develop the missions. George Pace of JPL is the Mars Surveyor 2001 project manager.

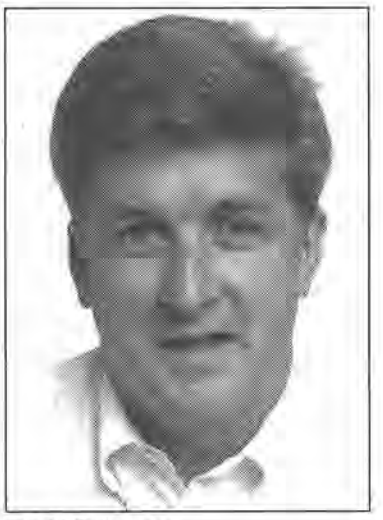
The radiation and dust investigations were selected from 39 proposals submitted to NASA in August 1997. ❑

Gallagher named Deep Space 3 project manager

David Gallagher has been named project manager of JPL's Deep Space 3 mission.

Part of the New Millennium Program, the mission will demonstrate formation flying optical interferometer concepts and associated technologies.

Gallagher, a JPL employee since 1989, previously served as project manager of the Pressure Modulator Infrared Radiometer (PMIRR) instrument, part of the science payload onboard the Mars '98 orbiter. He also managed the Drop Physics Module project and served as integration and test manager for the Wide Field Planetary Camera 2 aboard the Hubble Space Telescope.



David Gallagher

Gallagher earned a bachelor's degree in electrical engineering in 1982 from Purdue University. ❑

LETTERS

My family and I wish to thank all of our friends for their sympathy and understanding during my father's recent illness and death. Thanks to the ERC for the beautiful plant.

Gaylord Hammerwold

❑❑❑

We would like to thank all of our JPL friends for being so kind with gifts to our son, Jovan Rhys French.

Lloyd and Gindi French

❑❑❑

Thank you, friends and co-workers, for your condolences on the death of my sister. Thanks to the ERC for the lovely plant. The caring words, the touch of hands, and the hugs were comforting. Thanks so much.

Mary Gilmore

❑❑❑

I would like to thank the ERC and all my friends and co-workers at JPL for their condolences on the passing of my sister. At times like these I truly appreciate working at JPL.

Jim Erickson

❑❑❑

I would like to thank the INet group and friends at JPL for their cards and condolences on the death of my mother, and the subsequent hospitalization of my father. I would also like to thank OAO Corporation and the ERC for the pretty plants which were sent to me during this very difficult time.

Bonnie Ferguson

FOR SALE

AIR COMPRESSOR, 5 hp, 2-stage, 60 gal. upright, Campbell Hausfield, low hrs., $400 (retail $1,000); LAWN MOWER, 22" Murry, side discharge, $50. 805/722-6067, Darrol or Debi.

BABY ITEMS: Graco Swyngomatic, , $40; Graco Pack'n Play portable crib, $50; child car seat, $35; infant bouncer, $20; infant bouncer/carrier, $25; changing table, $85; all in exc. cond. 626/447-1551.

BABY ITEMS: high chair, gd. cond., $20; side-by-side twin stroller, $30; two pottys, $5 each; Gerry backpack, exc. cond., $25. 626/355-9733, after 6 p.m. or lv. msg.

BASEBALL CARDS, 1 unopened box Bowman 96, 36 unopened packs, lots of rookies, major stars & inserts, Beckett value $115, sell $50. 626/914-6083.

CARPET, wool, light slate blue, 12' x 13', exc. cond., pd. $750, sell $250/obo. 626/357-8210.

CELLULAR TELEPHONE, Motorola model #MICRO T-A-C 550, leather case, battery w/overnight charger, car adapter, charge cable, manual; hardly used; $145/obo. 570-0864.

COFFEE TABLE, glass, oval, 30" x 60", with gold-painted scroll style iron base; exc.; $200/obo. 249-8088.

COMPUTER, Dell Pentium Pro 200 w/15.9" monitor, 32 MB RAM, 4.3G HD, 33.6 fax/modem, 12X CD-ROM, Zip drive, PCI VB w/4 MB memory, AWE 32 sound card, speakers, Win. 95, exc. cond., $1,500. 626/564-1567.

COMPUTER , PowerMac 8600/200; with 200 MHz PowerPC 604e CPU, 32 MB memory, 256K L2 cache, 2GB hard drive, 12x CD-ROM drive, Zip drive; $1,800, flexible. 795-6530, eves.

DESK, executive "L" shaped model, in box, $400/obo. 626/403-9002.

DINING ROOM SET, oak rd. (45"dia.) w/4 Windsor chrs., $125; ENTERTAINMENT CENTER, oak, 5 1/2' x 5 1/2', $150; SEWING MACHINE, Singer, w/cabinet, 40 yrs., $25; DRESSER w/mirror, English oak antq., $100; all like new. 626/564-9155, after 5:30 p.m., Pasadena.

DINING TABLE, antique oak, 42" dia. w/3 leaves, $225; DINING CHAIRS, 6 oak Windsor, $210. 626/447-1551.

EXERCISE EQUIPMENT, Life Walker treadmill, fold-up, motorized, exc. cond., $325. 957-5382.

FIREWOOD for use next fall, $4/bundle. 248-0853.

HARDNESS TESTER, Rockwell, phase 2; exc. cond., hardly used; $600. 248-1369.

IGUANA/REPTILE ACCESSORIES, hot rocks, heat lamps,"Larry Lizard Lovers" manual, UV lamps, etc. 248-1369.

MONITOR, Compaq color, brand new, model P1425, $220/obo. 545-7254.

MONITOR, Radius 21", 2-page display monitor capable of showing 256 shades of gray, model #TPD, serial #Z000016581; barely used; $349/obo. 570-0864.

OFFICE EQUIPMENT: desks, file cabinets, general office materials. 626/794-4365.

PRINTER, inkjet color, Lexmark 1000, new in box, never used, with color cartridge, $120. 805/297-0219.

SEWING MACHINE TABLE, Singer, 3 drwrs., was $450, sell $200. 626/339-6185, after 5 p.m.

SKIS , Kastle Speed Machine GT, 193 cm, never been used, $199. 397-7333.

SNOW CHAINS for 12" & 13" tires, never used, cost $59, sell $29. 352-0075.

SOFA, 8 ft., slightly curved, quilted, off-white w/subtle floral design, vg cond.; $350. 626/797-3156.

SOFA, lg., full size; dark blue and white; great cond.; also has fold-out bed; $60/obo. 626/836-9254, Aaron.

SOFTWARE, "HTML Construction Kit", CD-ROM, new; cost $45, sell $20. 805/297-0219.

STAIR STEPPER, Voit SCX 100; exc. cond.; $40. 403-3815.

STEPPER, electronic readout, exc. cond., $75. 626/792-6706.

STOVE, antique Wedgewood CP late '40s; gas w/4 burners, grill on top, oven, broiler, storage; top cover and light on top; $500/obo. 626/287-5062.

STOVE, G.E., self-cleaning oven, microwave & storage bin, all in one, 30" x 5'11", $175. 626/355-2096.

SUBWOOFER, 15" dBx DAK, unpowered w/filters for speakers, brown wood grain finish, $50. 241-5289.

TABLE, w/6 chairs, nice wood (light pine), vg cond., $250. 249-3053, Linda or Dave.

TRANSCRIBERS, Sony, one BI-25 standard cass., $200 ($440 new); one BM-815T microcass., $175 ($380 new); BOOKS, assorted, for medical transcription, medical, surgical, radiology, pathology, $25 for the set. 626/797-6367.

TYPEWRITER, reconditioned IBM Selectric II, $75. 626/797-8082.

TYPEWRITER, Smith Corona Mark V electric, used very little, exc. cond., $40. 248-1369.

VENDING SNACK MACHINES, (9) table top, manual, 9 selections, no electricity, each holds approx. 110 snacks, $1,350. 248-9432, Stan.

VIDEO EDITING EQUIPMENT: SVHS/Hi 8 audio/video mixer, 3 color monitors, SVHS camcorder, ¾" U-matic VCR, full equipment rack, $1,850/obo for all. 352-0075.

VIDEO GAMES, Gameboy, "Star Wars" and "Batman", exc. cond., new, $10 ea. 957-6178, Leslie.

WEIGHT SET, Olympic; bench, apparatus, dumbbells, and over 350 lbs. in weights; $175/obo. 541-0794, Marty.

AUTOS

'87 ACURA Integra, 4-dr. sedan, auto, a/c, AM/FM/cass., pwr. steering, 75K mi., all white, exc. cond., $6,700. 790-2570.

'87 BMW 635 SCI, loaded, 122K orig. mi., Blaupunkt stereo, needs nothing, incl. car phone, red w/black interior, $6,500. 626-791-2700.

'86 BUICK Century Limited, 4 dr. sedan with AM/FM/cass. stereo, a/c, rebuilt trans. in '97, needs some work, $2,100. 626/797-9846.

'87 CADILLAC Seville, 142K mi., runs well, new tires, $2,850/obo. 909/624-5212.

'86 CADILLAC DeVille sedan, 104K mi., runs well, new tires, new paint, $2,500/obo. 909/624-5212.

'95 CHEVROLET Corsica, red/gray, 37K mi., auto, very clean, $5,250/obo. 504-6256.

'91 CHEVROLET S10 pickup, V6, 5 spd., a/c, cass., 2-tone black & gray, Tahoe pkg., new batt. & smog check, great cond., 92K mi., $4,000. 248-8789.

'89 DODGE Grand Caravan LE, power everything, new tires, trans. and timing belt; exc. cond., all services performed, always garaged, 81K mi., $6,995/obo. 909/593-2793.

'96 FORD Escort station wagon, loaded, auto, new tires, $5,400. 768-1612.

'96 FORD Taurus GL, bur./gray, 16K mi., pw, pl, alloy wheels, loaded, very clean, $9,250. 504-4905.

'92 FORD E350 van, vg cond., white, clean, reliable, custom interior, 11 reclining seats, 460 eng., tow pkg., meticulously serviced, 129K mi., $9,000. 805/265-9572.

'91 FORD LTD Crown Victoria, white, police package, $6,950. 626/395-6379, Rich.

'90 FORD Tempo, 4 dr., 90K, white, auto., clean, exc. mechanical cond., needs some body work, $3,100. 626/441-1496.

'79 FORD pickup, needs work, $1,500/obo. 626/797-9846.

'77 FORD Granada, 53K orig. mi., V8 engine, 2 dr., brand new battery (maintenance free), copper color, immaculate cond., $1,500. 243-1244, Jay.

'91 GEO Storm GSi, 2 dr., 5 spd, driver air-bag, black, a/c, am/fm cass., sunroof, gd. tires, vg cond., 65K mi., runs great, $4,850/obo. 790-4043.

'95 GMC Suburban SLE, dual air, full power, LoJack, alarm, 9 passenger, 3rd seat; orig. owner, only 8K mi., no dents/scratches, showroom cond., indigo blue, $29,500. 360-7863, eves. & wknds.

'89 HONDA Accord DX, gd. cond., blue, auto, newly replaced engine, new radiator, gd. transportation, 70K mi. on new engine, $3,000/obo. 246-2250.

'84 HONDA Civic CRX, high fuel-econ. model, 65K orig. mi., new tires & batt., 1 owner, exc. stereo, $3,500. 626/791-2700.

'86 HYUNDAI Excel, 50K mi., exc. cond., new tires & battery, stereo, $1,400. 626/432-1846.

'93 JEEP Cherokee, 4L sport, 4 dr., auto/4 WD, turquoise, push bar, tow pkg., 78K mi., new tires, roof rack, al. rims, $12,500. 352-1482.

'78 JEEP CJ5,V8, 304, Golden Eagle, lifted, tilted wheel, bikini top, 4WD, $3,000. 805/250-8066, Wendy.

'94 MAZDA Miata, special edition, 21K mi., ps, pb, pl, 5 spd., leather, black/tan/tan, $8,750. 504-4905.

'89 MAZDA MX-6 GT Turbo, 75K, gray ext./burgundy int., ABS, 4 wheel discs; power steering, brakes, windows, locks; moonroof, tape, 10 CD changer, hitch, 1 owner, $5,600. 213/259-8604.

'88 MAZDA RX-7 GXL, 88K mi., 1 owner, loaded, exc. cond., $3,400/obo. 805/252-1243.

'85 MERCEDES 500SEL, new paint, chrome wheels, well-maintained, maint. record avail., 150K mi., runs great, extra clean, $15,495/obo. 570-0864.

'80 MERCEDES 300SD turbo diesel, a/c, pw, vg cond., silver w/black leather interior, chrome wheels, must sell, $4,900/obo. 626/351-0828.

'94 MERCURY Sable, loaded, 75K mi., $8,700. 626/797-2503.

'93 MERCURY Villager LS minivan, 50K mi., loaded, exc. cond., white 2-tone color, $12,995. 909/599-3230.

'89 NISSAN Sentra, 2 dr., 5 spd., a/c, am/fm cass., vg cond. thruout, no dents, paint exc., $2,300. 248-1369.

'72 PONTIAC Firebird, V8 350, auto, runs well, new paint, dk. green, $900. 352-1482.

'97 TOYOTA Tercel LE, 4 dr., auto, 30K mi., $6,950. 768-1612.

'96 TOYOTA Previa S/C minivan, sport pkg., rear spoiler, dual sunroofs, CD player, tinted windows, a/c, cruise ctrl., tilt wheel, 25K mi., alarm, pwr. windows & locks, $23,000/obo. 541-0131.

'96 TOYOTA Tercel, green metallic, 20K mi., perfect cond., a/c, alarm, stereo/cass., $10,000/obo. 626/449-2007.

'95 TOYOTA Previa LE S/C van, immac., 39K mi., 4-wheel ABS, alarm, a/c, cass., tilt wheel, cruise control; power windows, locks & mirrors; burgundy w/gray interior, $20,800/obo. 909/980-3508.

'87 TOYOTA pickup, 86K mi., 4 WD, vg cond., shell, 5 spd., a/c, $4,000. 626/798-7446.

'85 VW JETTA GL, 4 dr. sedan, 4 cyl., 1.8L engine, 5 spd. manual, a/c, AM/FM radio, radial tires, white w/extra side molding/pinstriping; major servicing a year ago; 1 owner; no accidents; 150K mi.; $3,900. 598-3718.

'66 VW Type 3 Karmann Ghia, very rare, less than 100 operating in N. America, show quality, award-winning collector's piece, 86,500 actual mi. 790-6851, Roger or Margaret.

WANTED

CAMERA or body, Pentax "Super Program". 626/355-0905.

CLOTHING, equipment and furniture for infant and/or baby. 626/798-0799.

COMPUTER CONNECTOR KIT for ImageWriter II, AppleTalk; will trade Imagewriter II without AppleTalk for one with. 790-6851, Roger.

REGULATOR for medical oxygen tank. 626/798-5553, Bill.

SCOOTER, electric, for handicapped person. 626/798-5553, Bill.

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

VANPOOL RIDERS, full and part-time for van #5, w/stops at Orange Mall and Fullerton (Magnolia and Orangethorpe). Ext. 3-3928, Balu.

VANPOOL RIDERS, full and part-time for van #20, w/stops in Northridge and Granada Hills. Ext. 4-7076, Suzanne.

FREE

BASKETBALL STAND and hoop in concrete block; you pick up. 626/798-7339.

CAT, 6-mo.-old calico, very affectionate and sweet, of indeterminate sex. 626/792-8113, Florance.

MATTRESS, Cal. king size, vg cond. 626/797-6737.

STEREO (console), mid-to-late '60s, Mediterranean styling in French walnut; stereo doesn't work, but the cabinet is very nice. 353-6369.

FOR RENT

ALTADENA, 2 rooms in a home; 3 min./JPL; parking on st.; spa; on cul-de-sac; non-smoker, no pets, share utils.; $375-450. 626/798-0799.

ALTADENA ranch-style house, 2 bd. plus den w/fp, lg. yd., double garage, area for washer & dryer, lg. kitchen dining area, 1 1/2 ba., $1,125. 445-0123 x-210, Romie.

ALTADENA, immaculate 2 bd./1 ba. house near Christmas Tree Lane; hdwd. floors, f/p, refrig., stove, washer/dryer, fenced bkyd., fruit trees; incl. water, gardener, trash. $1,250, negotiable. 626/794-9579.

ALTADENA, rear house, new carpet, fenced yd., 1 lg. bd., 1 ba., small kitchen, near JPL, $500 + dep. 626/398-8109.

ALTADENA, room in lg. house, lg. bkyd., $450 + utils. 626/794-4365.

ALTADENA, roommate wanted to share 3-bd., 2-ba hse, hrdwd. flrs., frplc., cent. a/c-heat, top Christmas Tree Ln.,3 mi./JPL, $400 + 1/3 utils. 626/398-3933,Jenifer.

ARCADIA, furn., cozy room; incl. kitchen privileges, laundry, pool; no smoking; $350. 626/448-8809, Shary.

DUARTE condo, 2 bd., 1 1/2 ba.; upgrade appliance, carpet, and blinds; small complex, only 39 units; near top of 605 & 210 fwy.; dbl.-car garage and patio; 20 min./JPL; lease w/option to buy, $1,050. 626/301-9487, after 5 p.m.

LA CRESCENTA, rm. in comfortable, quiet home, 10 min./JPL, pleasant, priv. ba., limited. kitchen priveleges, non-smoker, refs. req., $365 + fair share of utils. 957-5774.

MONTROSE duplex, close to JPL, 1 bd., lg. living rm., den or bonus rm., stove, carpet, new mini-blinds, a/c, yd. w/fruit trees, prkg., $610. 248-9561.

MONTROSE, studio, unfurn. or part. furn. (no bed), many trees, quiet, for single, no pets, 4 min./JPL, 2332 Montrose Ave., $490. 249-7793.

PASADENA condo, 1 bd., 1 ½ ba.; pleasant unit located on tree-filled st. nr. Euclio & California Aves.; lg. lanai, lndry. facil., pool, security; $750 + sec. 626/398-7504.

PASADENA, 2 bd. apt., stove, a/c, disposal, new crpts., drapes, lino., paint; lndry, cvrd. prkg.; $630. 790-7062.

PASADENA, charming 2-story English, 3 bd., 2 ba., LR, formal DR, cozy f/p, lndry. rm., lg. bkyd., pool, patio, wet bar, blt.-in BBQ, wood deck, nice landscape, from 3/15, $1,275 incl. pool & gardener. 626/574-7027.

SIERRA MADRE CANYON cottage, quiet, charming, secluded, 2 bd., 1 ba., recently remodeled kitch. & bath; covered laundry area has washer and dryer; incl. parking spot; avail. Feb. 1; $895. 626/564-9607, Diana deNoyelles; e-mail: ddenoyel@co.la.ca.us.

SOUTH PASADENA, 1718 Huntington Dr., good area east of Marengo; fully furn. bungalow studio apt., carport, laundry, air cond./heat; non-smoker; avail. April 1; utils. pd., $565. 626/792-9053, Marilyn.

SUNLAND townhouse, 3 bd., 2 1/2 ba., kit./blt.-ins + laundry hkups., ca/h, liv.rm./frpl., lg. patio off din. rm., dir. access dbl. gar., pool/Jacuzzi/ tennis, close to 210/stores/park, $1,075. 353-7778.

REAL ESTATE

ALTADENA, exc. cond., 3 bd., DR, f/p in LR, updated kitchen, skylights, lg. garage, quiet cul-de-sac, 5 min./JPL, $173,900. 626/798-9244.

BIG BEAR, new cabin 2 blks. from lake, 2 bd., 2 ba., mud/laundry room, $129,000. 909/585-9026.

DUARTE condo, 2 bd., 1 1/2 ba.; upgrade appliance, carpet, and blinds; small complex, only 39 units; near top of 605 & 210 fwy.; dbl.-car garage and patio; 20 min./JPL; $135,000. 626/301-9487, after 5 p.m.

GREEN VALLEY LAKE, a secluded village in the San Bernardino Mtns., custom 3-story log home and buildable adjacent lot; beautiful 180-deg. view w/lg. decks, shade trees; walk to lake and skiing; cabin $149,000, adjacent lot $19,900; call for flyer. 303-1927.

PASADENA, Caltech condo, totally remodeled 2 bd., 2 ba., 1,200 sq. ft., new kitchen and h/w floors, new carpets & paint, top unit in park-like setting; walk to Caltech or Lake Ave., 15 min./JPL; nice pool and spa; $169,000. 626/585-9048.

VACATION RENTALS

BIG BEAR cabin, cozy 2 bd., near village, slps. 8, compl. furn., TV/VCR, $75/night. 249-8515.

BIG BEAR LAKE cabin, 1 mile to ski slopes, lake, shops, village, forest; 2 bd., slps. 6, fully furn., f/p, TV, VCR, phone, full kitchen, microwave, BBQ and more; JPL disc. price from $65/night. 909/599-5225.

BIG BEAR LAKEFRONT luxury townhome, indoor pool/spa, near skiing, stone f/p, slps. 6. 714/786-6548.

BIG BEAR, 7 mi. from slopes, full kitchen, f/p, 2 bd., 1 ba., slps. 6; no smokers, no pets; exc. hiking, biking, fishing nearby; reasonable rates, 2-night min. 909/585-9026, Pat & Mary Ann Carroll.

FRENCH RIVIERA, gold crown resort condo in Nice, one week, March 7-14; 2 bd., kitchen, slps. 6, all amen.; $530/obo. 310/336-4192, day or 626/570-4610, eve. & wknd.

KONA, HAWAII (Big Island), oceanfront condo, 1 bd., 1 ba., all amen.; 50 yds. from ocean, great views, lots of activities nearby; timeshare, one week only, July 10-17; $75 night or $450 for full week. 790-8069.

MAMMOTH at Snow Creek, 2 bd., 2 ba. + loft, slps. 6-8, fully equipped kitchen incl. microwave, d/w, cable TV, VCR, phone, balcony w/view to mtns., Jacuzzi, sauna, streams, fishponds, close to Mammoth Creek; JPL disc. 626/798-9222 or 626/794-0455.

MAMMOTH condo in Chamonix at lifts 7, 8, 16, 17; walk to warming hut; 2 bd., 2 full ba., slps. 6, fully equipped elec. kitchen, incl. microwave & extras, f/p & wood, color TV, VCR, cable, FM stereo; o/d Jacuzzis, sauna, game, rec. & lndry. rms.; conv. to shops, lifts; spec. midweek rates. 249-8524.

MAMMOTH condo, 2 bd. + loft, 3 ba., slps. 8, spa, full kitchen, TV/VCR, JPL disc. rates; walk to Canyon Lodge. 249-8088.

MAMMOTH condo, studio + loft, 2 ba., fireplace w/wood supplied, Jacuzzi, sauna, game rm., color cbl. TV/VCR, full kitchen w/microwave, terrace, view, amen. 714/870-1872.

MAUI condo, on beach w/ocean view, 25 ft. from surf, 1 bd. w/loft, compl. furn., incl. phone, color TV, VCR, microwave, 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, less 10% JPL & Caltech disc. 714/348-8047.

OCEANSIDE, on the sand, charming 1 bd.+ condo, panoramic view, walk to pier/marina, pool, spa, game rm. 714/786-6548.

PACIFIC GROVE hse., 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd. kit. w/microwave, beaut. furn., close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discnt. 441-3265.

PALM SPRINGS, 1 bd. condo, completely furn., pool, spa, t.c. cab. TV/VCR, really nice; all furn., rugs, paint & cooking utensils new. 626/445-0884.

PINE MOUNTAIN, Big Bear w/o the traffic; 2 bd., 1 ½ ba. 310/831-4234, Peter.

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, tennis ct., priv. secure prkg., 18-hole golf course w/in 5 mi., 20 mi. south of border. 626/794-3906.

SAN FRANCISCO, Nob Hill honeymoon suite, kitchen, maid, concierge, $105/night. 626/797-3156.

VENTURA, 3 bd. beach house (choose season); in exchange for one week at a Mammoth condo during ski season. 248-0521.

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.

Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 186-118, or via electronic 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.

For change of address, contact your section office or the HRS Help Desk at ext. 4-9559 (on-Lab personnel) or Xerox Business Services at (626) 799-3968 (for JPL retirees and others).

Jet Propulsion Laboratory

Universe

Pasadena, California Vol. 28, No. 4 February 20, 1998

MGS views Mars '98 landing zone

Closeups show strange, layered Martian polar terrain

By DIANE AINSWORTH

Swirling bands of eroded, layered rock, reminiscent of the edges of Alaskan ice sheets, and an array of light and dark mottled patterns blanket the frigid floor of Mars' south pole, where JPL's newly named Mars Polar Lander will touch down in late 1999.

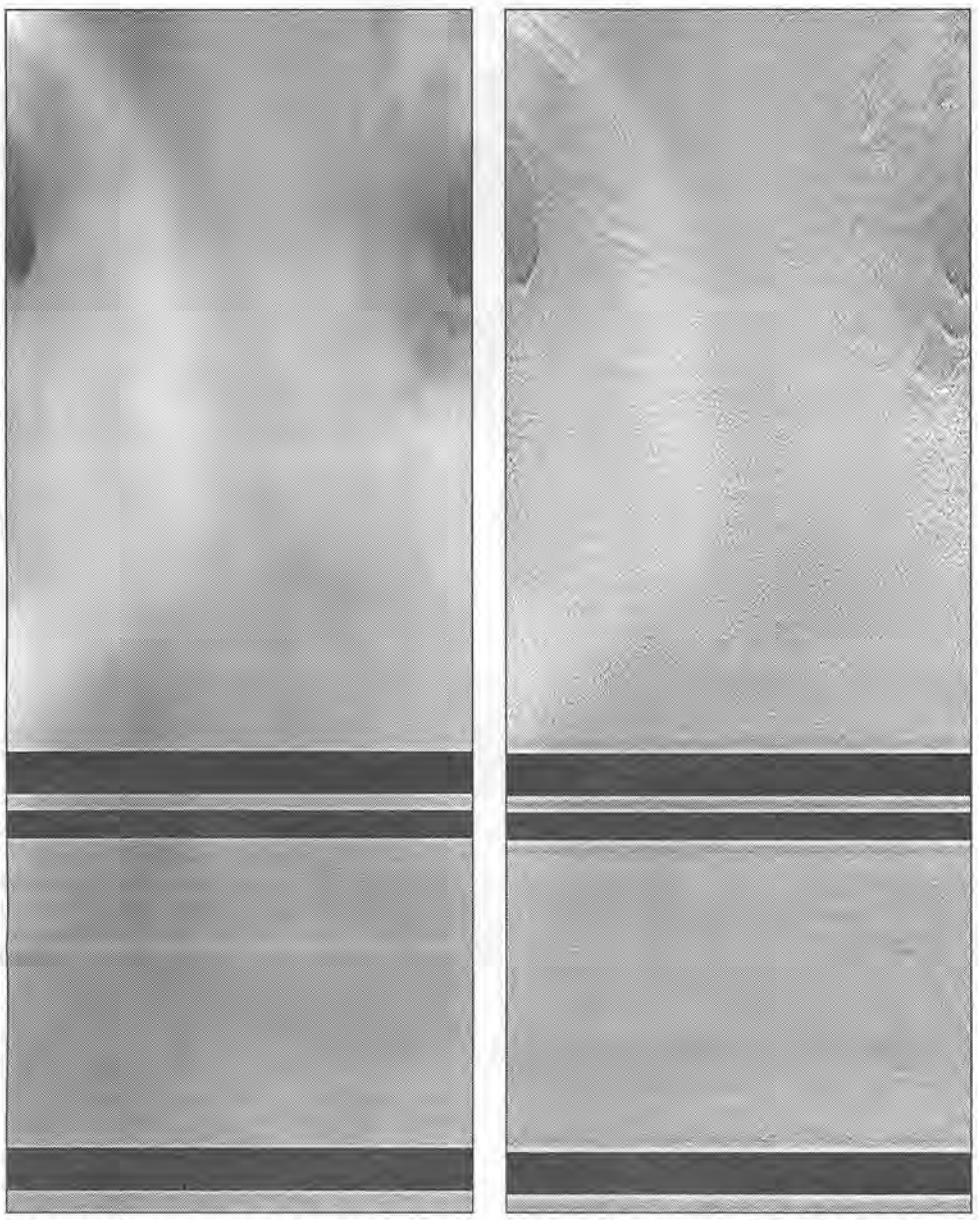
The new images of the landing zone for the Mars Polar Lander, taken by the camera aboard Mars Global Surveyor, confirm that this strange, layered terrain in the south polar region represents a dramatic departure from the now-familiar Martian landscapes observed by the Viking landers and Mars Pathfinder. In December 1999, the next lander in a steady series begun by Pathfinder will set down in this uncharted territory to dig for traces of frozen, subsurface water.

"Despite ground fog that obscures part of the surface in these images, we can see much more surface detail than we've ever seen before, which suggests that the 75-degree south latitude landing zone is quite a bit more rugged and geologically diverse than we had previously thought," said Dr. Michael Malin of Malin Space Science Systems, Inc. in San Diego. Malin is principal investigator of the Global Surveyor camera and the cameras on the 1998 missions, the Mars Polar Lander and its newly named partner, the Mars Climate Orbiter.

In the current images from Mars Global Surveyor, obtained during an aerobraking orbit from about 2,800 kilometers (1,700 miles) above the planet's surface, objects about 15 meters (48 feet) across can be resolved. Once the spacecraft reaches its final mapping orbit early next year, at an average of 378 kilometers (234 miles) above the surface, the camera will be able to resolve ground features as small as 2 to 3 meters (7 to 9 feet) across. This greater clarity will enable views of objects as small as boulders or as subtle as sand dunes.

Over the next year, the Global Surveyor images will be used in concert with other spacecraft data such as that obtained by the thermal emission spectrometer to better characterize the geology of Martian south pole. After Global Surveyor has reached its mapping orbit, data from the spacecraft's laser altimeter, which measures the height and roughness of Martian surface features, will be combined with imaging data to aid the final choice of landing sites.

"We have a wonderful opportunity in the next year to study this region with data from Mars Global Surveyor, which underscores the true advantage of conducting a continuing program of Mars exploration," said Dr. John



This pair of images, which show an area measuring about 30 kilometers left to right and about 80 kilometers top to bottom, shows the Mars Polar Lander's landing zone. They show the same location, but the right image has been computer-enhanced to remove the effects of haze to reveal finer areas of detail. Layered terrain is visible at the top of the right image.

McNamee, Mars Surveyor '98 project manager at JPL. "We will be able to characterize the geology of the whole region and find the best spot to land, one that presents a balance between lander safety and scientific interest. This process does not have to be finalized until June 1999, five months after the lander has been launched and six months before it lands."

The landing site images are currently available on the Internet at JPL's Mars News web site at http://www.jpl.nasa.gov/marsnews/ .

See Mars, page 3

Voyager 1 now most distant human-made object in space

Spacecraft launched in 1977 has passed Pioneer 10

By MARY HARDIN

In a dark, cold, vacant neighborhood near the very edge of our solar system, the Voyager 1 spacecraft has broken another record and become the explorer that has traveled farthest from home.

At approximately 2:10 p.m. Pacific time on Feb. 17, Voyager 1, launched more than two decades ago, cruised beyond the Pioneer 10 spacecraft and became the most distant human-created object in space at 10.4 billion kilometers (6.5 billion miles). The two are headed in almost opposite directions away from the sun.

As with other spacecraft traveling past the orbit of Mars, both Voyager and Pioneer derive their electrical power from onboard nuclear batteries.

"For 25 years, the Pioneer 10 spacecraft led the way, pressing the frontiers of exploration, and now the baton is being passed from Pioneer 10 to Voyager 1 to continue exploring where no one has gone before," said JPL Director Dr. Edward Stone, who is also the Voyager project scientist.

"At almost 70 times farther from the sun than the Earth, Voyager 1 is at the very edge of the solar system," Stone said. "The sun there is only one five-thousandth as bright as here on Earth, so it is extremely cold and there is very little solar energy to keep the spacecraft warm or to provide electrical power. The reason we can continue to operate at such great distances from the sun is because we have radioisotope thermal electric generators (RTGs) on the spacecraft that create electricity and keep the spacecraft operating. The fact that the spacecraft is still returning data is a remarkable technical achievement."

Voyager 1 was launched from Cape Canaveral on Sept. 5, 1977. The spacecraft encountered Jupiter on March 5, 1979, and Saturn on Nov. 12, 1980.

Then, because its trajectory was designed to fly close to Saturn's large moon Titan, Voyager 1's path was bent northward by Saturn's gravity, sending the spacecraft out of the ecliptic plane—the plane in which all the planets except Pluto orbit the sun.

Launched on March 2, 1972, the Pioneer 10 mission officially ended on March 31, 1997. However, NASA's Ames Research Center in northern California intermittently receives science data from Pioneer as part of a training program for flight controllers of the Lunar Prospector spacecraft now orbiting the moon.

"The Voyager mission today presents an unequaled technical challenge. The spacecraft are now so far from home that it takes nine hours and 36 minutes for a radio signal traveling at the speed of light to reach Earth," said Ed Massey, project manager for the Voyager Interstellar Mission. "That signal, produced by a 20-watt radio transmitter, is so faint that the

See Voyager, page 3

AIRSAR reveals hidden remains at ancient Angkor

JPL-developed radar shows evidence of prehistoric civilization, remnants of ancient Cambodian temples

By MARY HARDIN

New evidence of a prehistoric civilization and remnants of ancient temples in Angkor, Cambodia have been discovered by researchers using highly detailed maps produced with data from an airborne imaging radar instrument developed by JPL.

Experts say the findings, made possible by the Airborne Synthetic Aperture Radar (AIRSAR), may revolutionize the way archaeologists view the ancient city's development.

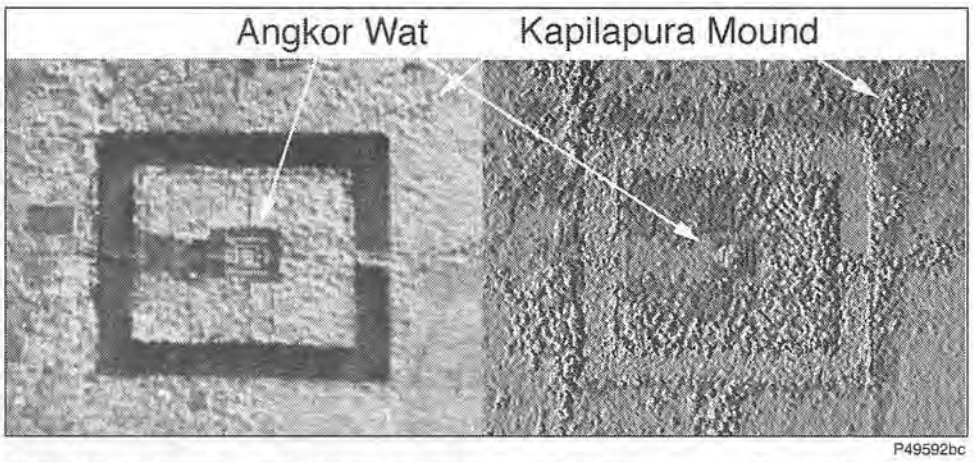
Angkor is a vast complex of some 1,000 temples covering more than 160 square kilometers (about 100 square miles) of northern Cambodia. Little is known of the prehistoric occupation of this fertile flood plain, but at its height the city housed an estimated population of 1 million people. The famous temples were built from the 8th to 13th century and were accompanied by a massive hydrological system of reservoirs and canals. Today, much of the civilization of Angkor is hidden beneath a dense forest canopy and is inaccessible due to poor roads, land mines and political instability.

"The radar data have enabled us to detect a distribution of circular 'prehistoric' mounds and undocumented temples far to the northwest of Angkor," said Dr. Elizabeth Moore, head of the Department of Art & Archaeology at the School of Oriental and African Studies at the University of London. "The site's topography is highlighted by the radar, focusing our attention on previously neglected features, some at the very heart of the city.

"The radar maps not only bring into question traditional concepts of the urban evolution of Angkor, but reveal evidence of temples and earlier civilization either absent or incorrect on modern topographic maps and in early 20th century archaeological reports," she said.

"The radar images make apparent many features that are not readily identifiable on the ground," said Dr. Anthony Freeman, a radar scientist at JPL who has collaborated with Moore for the past three years in studying the use of radar on the Angkor site. "We can see differences in vegetation structure and some features that are obscured by vegetation cover."

In December 1997, Moore surveyed a small



P49592bc

This pair of images—best viewed in color online at http://www.jpl.nasa.gov/releases/98/angkor98.html—was created with data taken by JPL's Airborne Synthetic Aperture Radar (AIRSAR) of the Angkor Wat temple area in Cambodia. The image on the left is a false-color radar image, while the image on the right shows topography data made while AIRSAR was being flown in its interferometric mode. Every tourist to the ancient city visits Angkor Wat but close by, yet unknown, is the Kapilapura mound shown in the upper right corner. The mound was spotted by JPL scientists using the radar data and led archaeologists to survey the area, which is now a deserted forest. These data were collected on Dec. 6, 1996 as part of AIRSAR's mission to the Pacific Rim.

mound on the perimeter of the famous 12th century temple, Angkor Wat, that Freeman had first noticed in the radar image. "Previous archaeological accounts from 1904 and 1911 note only two temples and make no mention of the distinct cir-

See AIRSAR, page 3

News Briefs

The contract between JPL and the OAO/DNS alliance that provides for desktop computer services for JPL personnel was signed by Deputy Director **Larry Dumas** on Feb. 11. The alliance had operated under a letter contract since Dec. 22, when OAO began providing services.

"We are now under contract with OAO and their alliance partners for five years," said **Rick Green**, Institutional Computing and Information Services (ICIS) Office deputy manager and DNS program manager. "This is NASA's first outsourcing effort for desktop computing and is an opportunity for us to assist the agency with its upcoming desktop computing outsourcing effort.

"We want to hear ideas from JPL personnel about how this service can be improved and to fix any problems people may be experiencing."

Green said JPL staffers should contact either him; **Steve Bluhm**, DNS contract technical manager; or **Ed Ng**, DNS advocacy group chair via e-mail with questions or feedback.

More information about the DNS contract and the OAO/DNS alliance is available on the ICIS home page (http://icis.jpl.nasa.gov). ❑

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

Section 100: Elisabeth Dettinger.

Section 109: Gilbert Clark, David Seidel.

Section 140: Edda-Suzanne Barber, Charley Kohlhase Jr., Reed Wilcox.

Section 180: Yvonne Samuel, Betty Shultz, Alan Wood.

Section 181: Diane Ainsworth, Petra Kneissl, Mary Beth Murrill, Franklin O'Donnell, Richard Pavlovsky, Jane Platt, Jurrie van der Woude, John Watson, Mark Whalen, Stephanie Zeluck, Alison Ziats.

Section 190: Richard Hann.

Section 195: Sheri Kazz.

Section 311: Sandra Dawson, Wayne Lee, Paul Vandamme.

Section 312: Norma Simpson.

Section 314: Judith Nelson, Randii Wessen, Laura Barnard, James Carter, Fred Gangloff, Robert Gustavson, Linda Lee, Patricia Lock, Rhonda White.

Section 320: Marguerite Syvertson.

Element 3237: William Patzert.

Element 3238: Stephen Edberg, Dennis Matson, Ellis Miner, Robert Nelson.

Section 344: Ronald Banes, Robert Campbell, Gregory Carr, Kenneth Hicks, Ann Ibaven, Joseph Toczylowski, John Treichler, Wilson Watkins.

Section 345: Alejandro San Martin.

Section 357: Oscar Avalos, Peter Bruneau, Timothy Cox, Henry Delgado, Rennie Green, Raymond Kariger, Mark Koehler, Robert Kovac, Dennis Maciej, Eduardo Martinez, Robert Moncada, George Nakatsukasa, Juan Pacheco, Paul Pangburn, Alex Perez, Larry Ruple, Norman Schwartz, Robert Scott, James Shmitka, John Shuping, Danal Snyder, Joachim Voeltz, Kent Wayner.

Section 385: Cesar Sepulveda.

Section 391: Carl Deforrest, Thomas Fogle, Ross Goodman, Stephen Spohn.

Section 395: Amir Fijany, Alexander Gray, Kathryn Little, Joseph Provenzano, John Weidner, Cris Windoffer.

Section 410: Robert Manning.

Section 430: Sam Thurman.

Section 642: Dennis Ferren, Michael Nieto.

Section 644: George Shultz.

Section 660: Lawrence Koss.

Section 662: Mark Kingsbury, Joseph Novelli, Richard Orozco.

Section 706: Mark Pine, Anita Sohus.

Section 707: Peter Jones. ❑

The Pasadena Tournament of Roses Association is seeking new members among those who live and/or work within 15 miles of Pasadena City Hall. Members must be a minimum of 24 years old, available for year-round committee meetings and assignments and must work on New Year's Eve and New Year's Day. Association dues are $45.

The application deadline is 5 p.m. Friday, Feb. 27. Applications are available at Tournament House at 391 S. Orange Grove Blvd. or by calling (626) 449-4100. ❑

Arcadia High scores Science Bowl hat trick

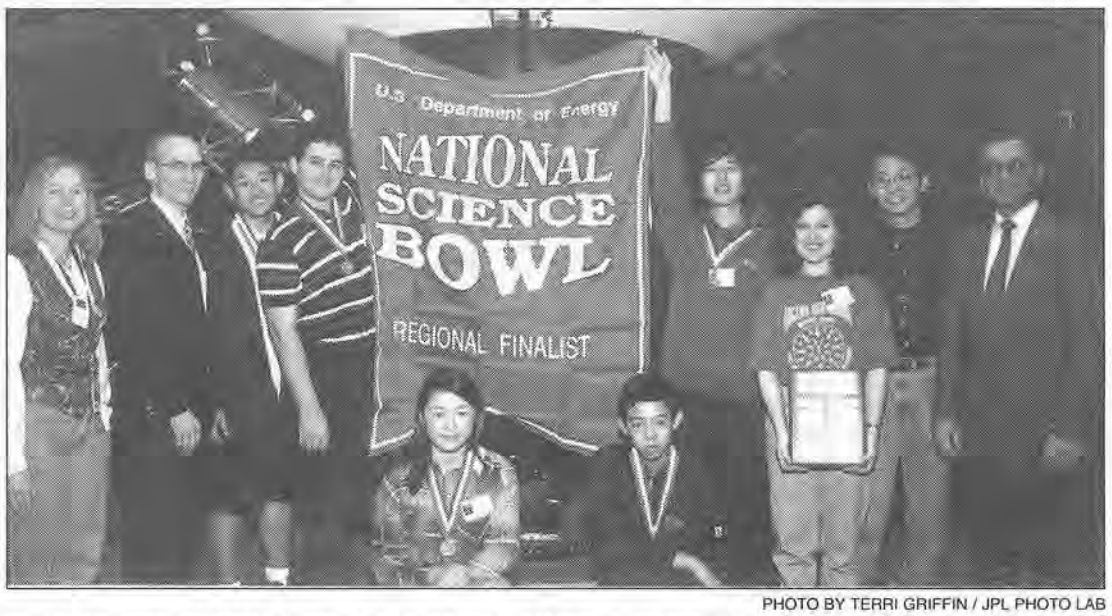


PHOTO BY TERRI GRIFFIN / JPL PHOTO LAB

With its Feb. 7 victory over co-finalist Warren High School of Downey, Arcadia High School's Science Bowl team won the regional competition at JPL for the third year in a row and will move on to national competition in May. Public Services Manager Kim Lievense and JPL Director Dr. Edward Stone, left, and Space and Earth Sciences Programs Director Dr. Charles Elachi, right, join team members (from left) Alex Hong, Alex Fabricant, Silvia Ngo, Vincent Auyeung, Brian Li and coach Barbara Young. Next to Young is competition advisor Wayne Lee of Section 311.

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.

HIV Support Group—Meets quarterly. Call employee assistance counselor Cynthia Cooper at ext. 4-3680 for more information.

Overeaters Anonymous—Meets Tuesdays at noon. For more information, call Occupational Health Services at ext. 4-3319.

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, February 20

Eudora Migration for Mac Users—This quick-start session is for cc:Mail users who have not yet begun to use Eudora Pro. It will feature an overview of Eudora features, details on preparing and addressing new messages and a comparison of Eudora and cc:Mail terminology. At noon in the Building 167 conference room. Information from this talk will be available on the Web in the "Tips & Techniques" section under "Information Technology Education & Training" on the ICIS home page at http://icis.jpl.nasa.gov.

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

Preservation Hall Jazz Band—New Orleans–style jazz is on the program for this 8 p.m. concert in Caltech's Beckman Auditorium. Tickets are $29, $26 and $23. For information, call (626) 395-4652.

Von Kármán Lecture Series—Dr. Eleanor Helin will discuss the Near-Earth Asteroid Tracking (NEAT) Program at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd.

Fri., Feb. 20–Sun., Feb. 22

Henry V—Shakespeare's classic will be presented by Theater Arts at Caltech at 8 p.m. on Friday and Saturday, 2 p.m. on Sunday, in Ramo Auditorium. Tickets are $10. For information, call (626) 395-4652.

Sunday, February 22

Chamber Music—The Jacques Thibaud Trio will perform a free concert at 3:30 p.m. in Caltech's Dabney Lounge. For information, call (626) 395-4652.

Monday, February 23

Eudora Migration for PC Users—This quick-start session is for cc:Mail users who have not yet begun to use Eudora Pro. At noon in the Building 167 conference room. See Feb. 20 listing for Mac users for more details.

Tuesday, February 24

ACW Seminar Series—"Achieving Excellence in Teams," a live satellite event presented by the American Management Association, will be shown from 10 a.m. to noon in Building 180-101. Featured speakers are Lynn Martin, former U.S. Secretary of Labor, and Deborah Harrington-Mackin, author of "The Team Building Tool Kit" and "Keeping the Team Going."

Caltech Management Association Lecture—Thom Swick, principal owner of GEI Tax & Financial Services, will discuss the Tax Reform Act of 1997, one of the largest tax-reform laws in the last two decades. At 11:45 a.m. in von Kármán Auditorium. Caltech Management Association membership is open to all JPL and Caltech employees for $10 per year. For applications, contact Madeline Wallace, mail stop 180-401, ext. 4-8304.

Wednesday, February 25

"El Niño and Global Warming: What's Happening to Our Weather"—Caltech planetary science professor Dr. Andrew Ingersoll will speak at 8 p.m. in Beckman Auditorium. For information, call (626) 395-4652.

Future Directions For Web Technology at JPL—This talk will feature an overview of JPL/NASA Web technology goals; the evolution of desktop, server and applications technologies; and the future computing environment. At noon in von Kármán Auditorium. Information from this talk will be available on the Web in the "Tips & Techniques" section under "Information Technology Education & Training" on the ICIS home page at http://icis.jpl.nasa.gov.

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

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

JPL French Club—A film about France's Basque culture will be shown during the club's noon meeting in the Building 167 conference room.

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

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

New Business Solutions (NBS) Technology—David Werntz, NBS' information technology manager, will address the computer technology aspects of JPL's upcoming business software system. Topics include NBS' use of the Web; security; hardware and software architecture; performance and workstation recommendations. At 9 a.m. in von Kármán Auditorium.

Oracle Applications—New Business Solutions Project Manager Marc Montgomery will describe new applications that will be implemented this spring. Topics include functionality, implementation timeline, and training plans for Lab personnel. At 10 a.m. in von Kármán Auditorium.

Thursday, February 26

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

Social Security—A representative will be on hand from 9 to 11 a.m. in the Building 167 cafeteria. Staff members may make an appointment to file a claim; request a "Personal Earnings and Benefit Estimate Statement;" request information regarding Social Security benefits; request a replacement or change of name on a Social Security card; or ask general questions.

Friday, February 27

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

Fri., Feb. 27–Sat., Feb. 28

Red Hot and Blue!—The Caltech Men's and Women's Glee Clubs present their annual winter concert featuring pop, jazz and blues favorites. At 8 p.m. in Dabney Lounge. Admission is free. For information, call (626) 395-4652.

Fri., Feb. 27–Sun., March 1

Henry V—Shakespeare's classic will be presented by Theater Arts at Caltech at 8 p.m. on Friday and Saturday, 2 p.m. on Sunday, in Ramo Auditorium.Tickets are $10. Call (626) 395-4652.

Tuesday, March 3

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

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

JPL Softball—An organizational meeting for the 1998 season will be held in the Building 167 conference room at 11:30 a.m. Team managers and new players are encouraged to attend. For more information, contact Scott Morgan at ext. 4-4972 or Toby Solorzano at ext. 4-2401.

Wednesday, March 4

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

"DNS Today"—This town hall meeting will feature a look at the JPL business case for outsourcing Desktop and Network Services, the current state of DNS services and expectations for the next few months. At 11:30 a.m. in von Kármán Auditorium.

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

Thursday, March 5

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

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

Friday, March 6

The Glass Menagerie—Tennessee Williams' semiautobiographical play will be presented at 8 p.m. in Beckman Auditorium. Tickets are $26, $23 and $20. For information, call (626) 395-4652.

Mars

Continued from page 1

The images are being studied while the 1998 Mars Climate Orbiter and Mars Polar Lander are undergoing key hardware integration and testing at the facilities of Lockheed Martin Astronautics in Denver, NASA's industrial partner in the mission. The spacecraft are currently being prepared for transfer to the Lockheed Martin environmental test chambers to ensure that they can survive and operate in the extreme conditions at Mars. At the completion of this testing, the spacecraft will be flown separately to the Kennedy Space Center in Florida for integration with their launch vehicles.

The 1998 Mars lander and orbiter missions are designed to learn more about the history of Mars' climate and the behavior of related Martian volatiles, such as water vapor and ground ice. The orbiter, scheduled for launch on Dec. 10, will conduct a two-year primary mission to profile the Martian atmosphere and map its surface. The lander, scheduled for liftoff on Jan. 3, 1999, will carry out a three-month mission to search for traces of subsurface water in this frozen, layered terrain and any evidence of a physical record of climate change.

To meet these scientific objectives, the orbiter will carry a rebuilt version of the Pressure Modulated Infrared Radiometer (PMIRR) that was lost with Mars Observer in 1993. This atmospheric sounder will observe the global distribution and time variation of temperature, dust, water vapor and condensates in the Martian atmosphere. PMIRR is a collaboration between JPL, Oxford University and Russia's Space Research Institute.

Like Mars Global Surveyor, the Mars Climate Orbiter carries a dual camera system, but this one is contained in an amazingly compact package about the size of a pair of binoculars. The Mars color imager's 0.5-kilogram (1 pound) wide-angle camera will return daily low-resolution global views of the planet's atmosphere and surface, while its medium-angle camera will provide higher resolution (40 meters or 30 feet per pixel) images. The medium-angle camera will build global and regional maps of Mars in multiple colors over the course of the mission. These maps will be used to characterize surface properties and changes in the distribution of dust.

The 1998 lander carries three scientific packages: the Mars descent imager, again provided by Malin, which will view the landing site at increasingly higher resolution as the lander descends to the surface of Mars; the atmospheric lidar experiment, provided by the Russia space institute, which will monitor the presence and height of atmospheric hazes, coupled with a miniature microphone furnished by Pasadena's Planetary Society to record the sounds of Mars; and the Mars Volatile and Climate Surveyor (MVACS) package, led by principal investigator Dr. David Paige of UCLA.

MVACS includes a surface stereo imager based on the Mars Pathfinder camera, both built at the University of Arizona; a meteorology package, built at JPL; a robotic arm, also built at JPL, to acquire soil samples and close-up images of the surface and subsurface; and the thermal and evolved gas analysis experiment, built at the University of Arizona. JPL will oversee mission operations with the spacecraft team at Lockheed Martin Astronautics and the instrument teams located at their home institutions during the lander and orbiter missions.

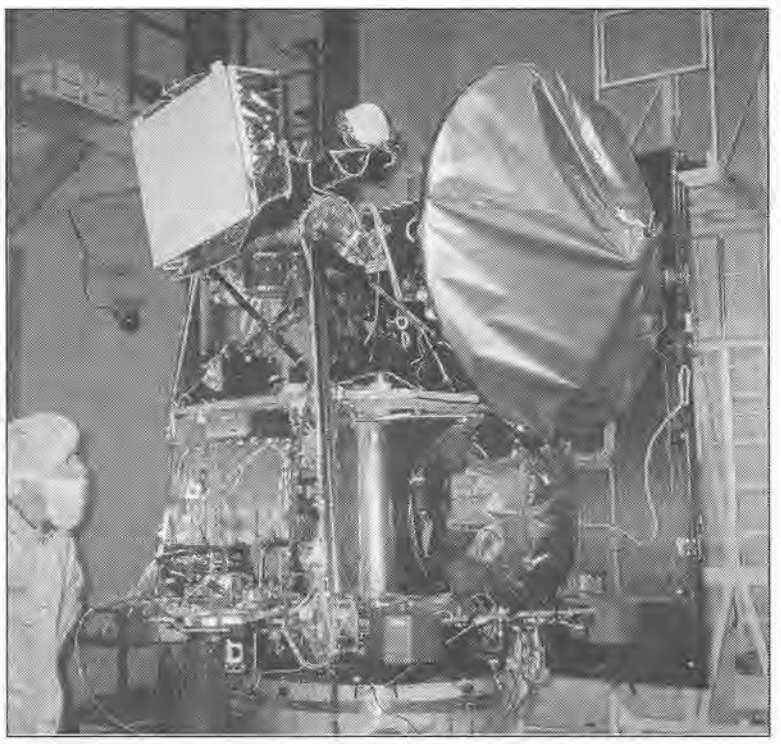
"MVACS and the other science experiments are tailor-made for the exploration of Mars' south pole," said Dr. Richard Zurek, project scientist at JPL. "The robotic arm, which is reminiscent of the Viking arm and scoop that were used to carry out biology experiments in the mid-1970s, is, in fact, much more versatile. It can reach farther out, dig up to 1 meter (3 feet) below the surface and then place soil samples in a miniature oven, called the evolved gas analysis experiment, where the samples are 'cooked' and analyzed for chemical and gas content."

Piggybacking on the Mars Polar Lander are two small, 2-kilogram (4.5-pound) microprobes, provided by NASA's New Millennium validation program.

Deployed before landing, they will penetrate and embed themselves beneath the Martian surface to study subsurface materials. ❑

PHOTOS BY STEPHANIE ZELUCK

Technicians at Lockheed Martin Astronautics in Denver work on the cruise stage of the Mars Polar Lander, above. Hardware integration and testing are also being conducted on the Mars Climate Orbiter, right.



Contest produces Mars '98 logo

Dave Seal of Section 311, above right, said the central design in his winning entry in the Mars '98 logo contest is "the Mars past/future globe, trying to illustrate that Surveyor would be studying Mars to uncover its surface history so we could determine what its climate was like long ago."

NASA calls for Software of the Year award entries

NASA has opened nominations for its 1998 Software of the Year Award, which recognizes software developed and owned by the agency.

Last year, the competition resulted in nearly $200,000 awarded. The winner was a JPL invention called Dynamics Algorithms for Real-Time Simulation (DARTS), a multi-body dynamics software simulator that works in real time with high fidelity to conduct closed-loop design, test and verification. For information, go online to http://www.hq.nasa.gov/office/codei/swy97win.html .

The award, which will include a trophy, a certificate signed by NASA Administrator Daniel Goldin and a monetary award of up to $100,000, will be presented to author(s) of software that (1) NASA has an intellectual property interest in, (2) has been supported, adopted, sponsored or used by NASA, and (3) is significant to the NASA mission. Software programs must be commercial-grade (not alpha or beta phase) products.

Entries will be judged by the NASA Software Advisory Council, comprised of software development experts from all NASA centers.

After its review, the council will submit its selection(s) to the Inventions and Contributions Board, which may recommend a monetary award of up to $100,000 for the winner(s) depending on the value of the

See Award, page 4

CD-ROM to carry names to Mars

NASA is inviting schoolchildren to be a part of the Mars Polar Lander mission by submitting their names to be included on a CD-ROM that will fly onboard the spacecraft.

Students who register online at http://comet.hq.nasa.gov/mars98 or http://spacekids.hq.nasa.gov/mars/home.htm will have their names recorded for the CD-ROM. In addition, they can view and print a special certificate that commemorates their participation in the event.

The agency's goal is to collect 1 million names of schoolchildren from around the world for the CD-ROM. ❑

Huntress to leave NASA

Dr. Wesley Huntress Jr., NASA's associate administrator for space science, has announced his departure from the agency in the near future.

Huntress is responsible for NASA's programs in astrophysics, planetary exploration and space physics. "I have served in this position for more than five years now," he said, "and it is simply time to move on."

"Thanks in no small part to the magnificent team [Huntress] assembled at the field centers and Headquarters, the space science enterprise has become one of NASA's crown jewels," noted Administrator Daniel Goldin. "We shall miss him."

Huntress began his career at JPL as a National Research Council resident associate in the 1960s, joining the Lab permanently in 1969 as a research scientist specializing in ion chemistry and planetary atmospheres. Huntress and his research group gained international recognition for their pioneering studies of chemical evolution in interstellar clouds, comets and planetary atmospheres.

NASA will begin a search for his replacement immediately. ❑

AIRSAR

Continued from page 1

cular form of the mound. We found four to six temple remains, including pre-Angkorean structures," Moore said. "This suggests occupation of the 12th century site some 300 years earlier, radically changing accepted chronologies of Angkor."

Angkor's beauty is seen its in temples, but the greatness of the Khmer city lies in the multitude of water-related constructions, according to Moore. Management of water was essential—both for control during the monsoon rains and conservation during the dry season—and involved the construction of moats, dikes, canals, tanks and reservoirs. The largest of these reservoirs, dated to the 12th century, is eight kilometers (five miles) long and its function remains a matter of archaeological debate.

"These new detailed topographic maps have shown us many more hydrological features and highlighted how they function in the rituals and daily life of the Khmer people," Moore explained.

"Using a technique known as radar interferometry, which combines two images to create a three-dimensional topographic map, we can construct a map of the area surrounding Angkor that is more accurate than most maps we have of the United States," said Dr. Scott Hensley, a JPL radar engineer. "This map lets us see both natural and human-made water management features at the site with great clarity."

The Angkor radar images were taken in late 1996 as part of an AIRSAR Pacific Rim deployment and were a follow-up to the 1994 study of Angkor with data collected by the Spaceborne Imaging Radar-C/X-band Synthetic Aperture Radar (SIR-C/X-SAR) that flew on Space Shuttle Endeavour.

Like SIR-C/X-SAR, AIRSAR transmits and receives three radar frequencies in both horizontal and vertical polarizations. While both systems use C-band and L-band wavelengths, AIRSAR has the added benefit of P-band, a longer wavelength that can penetrate below the forest canopy. In addition, AIRSAR can be flown in a mode called TOPSAR that allows it to measure topography and create three-dimensional images of the surface.

AIRSAR images of the Angkor region are posted on the Internet at http://www.jpl.nasa.gov/news .

AIRSAR flies on a NASA DC-8 aircraft that is managed at NASA's Dryden Flight Research Center in Edwards, Calif. ❑

Voyager

Continued from page 1

amount of power reaching our antennas is 20 billion times smaller than the power of a digital watch battery."

Having completed their planetary explorations, Voyager 1 and its twin, Voyager 2, are studying the environment of space in the outer solar system. Although beyond the orbits of all the planets, the spacecraft still are well within the boundary of the sun's magnetic field, called the heliosphere. Science instruments on both spacecraft sense signals that scientists believe are coming from the outermost edge of the heliosphere, known as the heliopause.

The heliosphere results from the sun emitting a steady flow of electrically charged particles called the solar wind. As the solar wind expands supersonically into space in all directions, it creates a magnetized bubble—the heliosphere—around the sun. Eventually, the solar wind encounters the electrically charged particles and magnetic field in the interstellar gas. In this zone the solar wind abruptly slows down from supersonic to subsonic speed, creating a termination shock. Before the spacecraft travel beyond the heliopause into interstellar space, they will pass through this termination shock.

"The data coming back from Voyager now suggest that we may pass through the termination shock in the next three to five years," Stone said. "If that's the case, then one would expect that within 10 years or so we would actually be very close to penetrating the heliopause itself and entering into interstellar space for the first time."

Science data are returned to Earth in real time to the 34-meter Deep Space Network (DSN) antennas in California, Australia and Spain. Both spacecraft have enough electricity and attitude control propellant to continue operating until about 2020, when electrical power produced by the RTGs will no longer support science instrument operation. At that time, Voyager 1 will be almost 150 times farther from the sun than the Earth—more than 20 billion kilometers (almost 14 billion miles) away.

Voyager 1 is departing the solar system at a speed of 17.4 kilometers per second (39,000 mph). At the same time, Voyager 2 is about 8.1 billion kilometers (5.1 billion miles) from Earth and is departing the solar system at a speed of 15.9 kilometers per second (35,000 mph). ❑

Anniversaries

Service award ceremonies were held Feb. 11 to honor the following employees, who have completed 20 or more years of service.

45 years

Carl Sauer Jr.

40 years

Charles Kurzweil, G.W. Meisenholder, Robert Toomath.

35 years

Richard Arguijo, William Charlan, Arthur Collins, Gustavo Faist Jr., Daryal Gant, Thomas Gavin, David Griffith, Richard Grumm, Robert Hamilton, Robert Howick, James Kelley, William Thogmartin, James Young.

30 years

Adeline Carr, Arthur Kiesow, Edgar Svendsen, Carolyn Stevens.

25 years

Charles Acton Jr., Edward Contreras, Robert Detwiler, Roger Hoon, Patti Jansma, Michael Keesey, Robert Kinkade, Salvatore Mansolino, Thedra McMillian, Donald Moore, Charles Porter, Julie Selders.

20 years

Izeller Cureton-Snead, Louis Damario, Karen Dean, Edward Fortier III, Stuart Kerridge, Robert Klotz, Gloria Lang, Udo Lieneweg, David Maynard, Patricia McGuire, Brian Muirhead, Glenn Orton, John Peterson, Ralph Ridley, Leigh Rosenberg, Casper Sagoian, Robert Scott, Elliott Sigman, Philip Stanton, Ernest Stone, Louis Trabbie, Michail Zak, Wayne Zimmerman. ❑

Award

Continued from page 3

contribution to government and industry. The award will be presented by NASA officials later in the year on behalf of the NASA administrator.

Call Karen L. McLaughlin at ext. 3-3423 for an application (NASA Form 1329). Copies of the software, sample applications and data, and descriptive documentation of the package should be included in the entry, in addition to evidence demonstrating its impact and degree of innovation and suitability. This information will be the primary data used by the panel in recommending awards.

Entries and supporting material are due April 17. ❑

Craig Sholes meets once and future astronaut John Glenn at SFA event.

From left, guest Bill Spuck and astronaut Carlos Noriega join Space Flight Awareness honorees Linda Graham, Phil Yates, Harvey Frank, Karen Jolicoeur, Craig Sholes, Ana Maria Guerrero, Ellen Walsh and Long Tuyen Ly. Guest Dr. Bill Weber (with glasses) and astronaut Jeff Ashby are at right.

8 receive SFA honors

Eight JPL employees were recent recipients of NASA's Space Flight Awareness award, the highest tribute paid by the agency to government and industry workers.

The honorees joined approximately 250 others from NASA centers, contractor companies and the U.S. Air Force as they toured Kennedy Space Center, attended a reception in their honor with about 20 astronauts and viewed the launch of STS-89 on Jan. 22. JPL distinguished guests Dr. Bill Weber and Bill Spuck joined the group.

To find out more about the JPL SFA program and STS-89 mission, go online to http://epic/sec614/reward/sfa.htm .

The next SFA event will be the STS-91 launch, scheduled for May 28. ❑

LETTERS

Giovanna and I would like to thank all those who expressed their sympathy and condolences upon the passing of Giovanna's mother on Christmas Day, with a special thanks to ERC for the lovely plant. Giovanna's mother was special to all she met. She will truly be missed as a mother, grandmother and mother-in-law, but more so as the kind, gentle, and loving person she was.

Cecil and Giovanna Brower

❑❑❑

Thanks to all who had a part in my retirement party on Jan. 29, and to those whom I've worked with who couldn't make it. JPL has provided a unique time and place to spend a career that spans almost 37 years. Good luck in your future endeavors.

Joe Cork

❑❑❑

I want to thank the ERC and my fellow workers for the beautiful plant and flowers that came to my house after the passing of my brother Bill. They were of great comfort to me at this time.

Evan Davies

❑❑❑

On behalf of our family, we would like to thank the ERC, co-workers and friends for your prayers, cards, gifts, plants and condolences during the illness and death of our mother, Marlene Nichols. A very special thank you to the Educational Affairs Office for dedicating a grove of 6 trees in her name. Your kind expressions of sympathy during this difficult time is deeply appreciated.

Lisa and Lawrence Campbell

❑❑❑

I wish to thank all of my friends and co-workers for their calls, cards and prayers upon the recent death of my beloved father. Your caring words and hugs were very comforting. A special thank you to the ERC for the beautiful plant and card.

Patricia Reed and family

FOR SALE

BABY ITEMS: highchair, gd. cond., $20; two pottys, $5/ea., Gerry backpack, exc. cond. $25. 355-9733 after 6 p.m. or leave msg.

BABY ITEMS: high chair, $25; white Childcraft crib/mattress, $95; diaper Genie, $20. 805/297-7668, Dan/Jackie.

BASEBALL CARDS, 1 box Bowman 96, 36 unopened packs, lots of rookies, major stars and inserts, Beckett value $115, sell $50; 5-card die-cut Mickey Mantle promo set, rare, $25. 626/914-6083.

BEDROOM SET, Rosewood from Plummers, double dresser and two night stands, exc. cond., $1,500. 248-9432, Stan.

CAMERA, Canon Rebel-XS single lens reflex with Tamron, 24 - 70 mm f/3.3-f/5.6 pro-quality zoom lens, and Op/Tech cushioned strap, perfect cond., $205 (would cost over $530 new). 248-7934.

CLOCKS (4), cuckoo, working, 7" to 17" tall, $35-65; Lux old novelty clock, $45; old school clock, Japanese, key wind, as is, $45; STEER HORNS, Texas, 7' 2" long, $185; BUFFALO SKULL, $85; RECORDS, vintage 78 RPM. 248-5282.

COAT, rain, men's formal trench-style, beige, zip liner, 38 regular, exc. cond., rarely used, $25. 626/359-2048.

COFFEE TABLE, 37 in. square; END TABLE, 28 in. square; both glass on turquoise metal frames; $100. 626/797-4758.

COFFEE TABLE, maple; CHINA CABINET, lg.; KITCHEN TABLE or dining area, glass, and chairs; RADIO/RECORD PLAYER, maple; all in vg cond. 249-2742.

COFFEE TABLE w/matching end table, rectangular glass top, marble base, exc. cond., $200/obo. 952-3820.

COMPUTER, Macintosh Performa 630; incl.: 14" monitor, external CD-ROM drive, 14.4 modem, speakers & software; 8 MB RAM (upgradeable to 36 MB) and 256 MB hard drive; a steal at $500. 626/799-9743.

COMPUTER, Motorola BitSURFR Pro ISDN modem for Macintosh, external, unopened; for more info. see http://www.kithrup.com/~bsp; $140. 626/449-6358, Brian or bsp@kithrup.com.

COMPUTER CD software for Macintosh, call for list, all $25 and under. 790-3899.

DESKS, a beautiful 50" oak roll top w/chair, $380; and a corner computer desk w/bookshelf, $40. 626/813-9959, Paul.

EXERCISE MACHINE, Soloflex, latest model, exc. cond.; all attachments, weights, and manuals incl.; payment plan options considered. 626/398-5667, lv. msg.

FREEZER, Sears, 31 cu. ft., upright, exc. working cond., 1-yr. serv. warranty, needs paint on outside, $125. 248-1369.

ORGAN, Yamaha 415 electronic console w/13 pedals, 3 keyboards, 144 rhythm patterns, pd. $7,500, sacrifice for $3,000. 790-3899.

MICROWAVE OVEN, Sharp Carousel II, rarely used, $60/obo; BICYCLE, girl's 16" Huffy "Secret Treasures" w/training wheels, great shape, $35/obo; ROCKING HORSE, great shape, $30/obo; TYPEWRITER, Smith-Corona portable, $40/obo; BIKE SEAT, children's (up to 40 lbs.), $20; TOYBOX, Little Tykes, $20; AUTO BIKE RACK, rear-mounted, holds 2 bikes, $25; CHILDREN'S BOOSTER SEATS, $7 each; CAR RAMPS, $10. 714/996-9334.

MODEL, Space Shuttle Challenger, still in box, collector's item, $75. 310/455-0987.

PERSONAL INFORMATION MANAGER, Seiko "Phone-Pal", $25. 790-3899.

PIANO, spinet, exc. cond., $900. 626/795-8962.

POOL TABLE, full size, adjustable (for flatness); incl. all balls and rack, several sticks; gd. cond.; you move; only $200. 626/398-3192, Gordy.

PRINTER, Brother HR20, with display/keyboard, manuals, cable, font disk WP 5.1, 5 daisy wheels, 2 correctable ribbons, ser. & parallel outputs, $50/obo. 626/914-1715.

PRINTER, Citizen dot matrix, $80. 626/813-9959.

PRINTER, NEC, Superscript 100C color inkjet, new, never used, $125. 790-1419.

SAFE, Canon-Bernadini, 2-hr. fire rating, 65" H x 26" W x 29" D, weighs 2,200 lbs., wholesale $3,500, sell $2,500. 248-1369.

SKI BOOTS, women's size 8, Salomon, used less than 10 times, black, $45. 626/794-6860, eves.

SKIS, brand new, Kastle Speed Machine GT, 193 cm, never been used, $199. 397-7333.

SKIS, Rossignol 4S, 195 cm, Marker bindings, fine cond., $125. 790-6185, Tim.

SPA/GAZEBO, Calif. Spas, enclosed 16' x 20' redwood fencing, spa - 8' x 8' (seats seven); incl. 1 table, 4 chairs, 1 bar table, 4 bar stools, 4 redwood planters; hardly used, vg cond.; $2,900. 626/447-0197, David.

SPEAKER SYSTEM, Bose Acoustimass multimedia, for computers or anything w/an earphone jack (not home theater or regular stereo syst.), self-amplified subwoofer (black) at 50W RMS, 2 x 40W satellite cubes (white); new, in box, $400 ($600 at Fry's). 249-6786.

STEREO EQUIPMENT: bookshelf speakers, 1 pair Bose 402 Bass Reflex, $130; 1 pair Boston Acoustics, $180; portable CD player, Kenwood, $75. 957-2898, Keith.

STROLLER, Graco "Stroll-a-Bed", light blue, used; reversible handle for pushing in either direction; chair back reclines for bed position; $25/obo.

SWEATER, Coogi, from Australia, new, $325 at Nordstrom, sell $100. 790-3899.

TELEVISION, Emerson portable 5.5" AC/DC color with AM/FM radio; incl. car adapter, AC plug, rechargeable batteries; $75. 249-2779.

TRICYCLE, adult, 2-seater side-by-side tandem, 3 spd.; w/trailer, 4' x 8', collapsible; both in exc. cond., $495 total. 805/251-7616, Ben.

VENDING SNACK MACHINES (9) table top, manual, 9 selections, no electricity, each holds approx. 110 snacks, $1,350. 248-9432, Stan.

WASHING MACHINE, full size, super capacity, gd. cond., $90. 909/596-5774.

AUTOS / RVs / MOTORCYCLES

'84 BUICK Century Limited, Olympic special, 4-dr. sedan, V6, auto, a/c, Michelin tires, exc. cond., 130K mi., $2,500. 626/793-6123.

'89 CADILLAC Sedan DeVille, dark blue in/out, loaded, digital gages, leather, 66K mi., orig. owner, $9,000. 790-4028.

'96 CHEVROLET Tahoe, emerald green, V8, 4 dr., fully loaded., 25,300 mi., pwr. w/everything, LoJack alarm sys., cass./CD player w/8 speakers, roof rack, mirror w/compass, exc. cond., must sell, $30,000/obo. 626/266-1963.

'84 CHEVROLET S-10 Blazer, 4x4, auto, V6, a/c, 140K mi., new heads, needs some engine work; $2,500. 249-9577.

'89 CHRYSLER New Yorker, 4 dr. white, auto., all pwr., auto. door locks, digital dash, premium sound system, burgundy interior; needs some work, must sell (too many cars); $3,200/obo. 626/795-1687, Anthony.

'89 DODGE Grand Caravan LE, 124K mi., 3.3L V-6, a/c, cruise, tilt, am/fm cass., pwr steering/brakes/swindows/locks/seat, running boards, CB, serv. manual, recent smog, clean, orig. owner, $3,900. 353-9404.

'96 FORD Escort station wagon, loaded, auto., new tires, $5,400/obo. 768-1612.

'91 FORD Explorer XLT, 5 spd., 2WD, newly rebuilt 4.0L V6 engine, rear ABS; pwr.: windows, locks, steering, brakes, mirrors; a/c, AM/FM/cass. stereo, garage kept, $7,499. 805/538-0766, John.

'90 FORD Tempo, 4 dr., 90K, white, auto., clean, exc. mechanical cond., needs some body work, $3,100. 626/441-1496.

'80 FORD Courier pickup, runs great, reliable, $1,000. 909/620-7467, Darin.

'91 HONDA CRX Si, white on black, MOMO steering wheel and stick shift, new tires, leather hood cover, alarm, pwr. door lock, $2,500 stereo system; prewired for Motorola cell phone kit; mint cond.; 80K mi.; $7,000. 803-8686, pgr.

'89 HONDA CRX, 5 spd.; runs great, good commuter or student car; well cared for but no frills; $2,600 incl. chains. 626/821-0130.

'83 HOLIDAY RAMBLER motor home, 33', exc. cond., lots of extras, 73K mi., $12,000/obo. 760/726-5529.

'90 KAWASAKI Ninja 750, 4K mi., new Metzlers, like new, $3,700. 790-1649.

'95 MAZDA Miata MX-5 convertible, 2-seater, classic super red exterior/black interior, 1.8L dohc 16-valve inline 4-cyl. engine, auto., a/c; pwr.: steering, windows, & mirrors; alloy wheels w/locks, cruise cont., AM/FM stereo w/anti-theft coding, cass., premium sound w/headrest speakers, leather-wrapped steering wheel, dual air bags, carpeted floor mats, exc. cond. w/upgrades, 46K mi., firm $14,995. 626/939-3853, David.

'94 MAZDA Miata special edition, 21K mi., ps, pb, pl, 5 spd., leather blk./tan/tan, $8,750/obo. 504-4905.

'83 MERCEDES 300D Turbo diesel, bought new, well maintained, auto, p/s, p/b, a/c, CD player, new tires and battery, new brake rotors and pads, $5,500. 952-0047.

'85 NISSAN Stanza 4 dr., 116,408 mi., exc. cond., $1,800. 353-2467.

'93 SAAB 900, white, 4 dr., fully equipped, air, ABS, leather, sunroof, etc.; exc. cond.; $10,500. 805/251-3854.

'97 TOYOTA Tercel LE, 4 dr., auto, 30K mi., $6,950. 768-1612.

'96 TOYOTA Previa S/C, sports. pkg., rear spoiler, dual sunroofs, CD player, a/c, pwr. windows/locks, alarm, tilt wheel, tinted windows, 25K mi., new brakes, exc. cond., $22,900. 541-0131.

'91 TOYOTA Tercel DX, white, 4 dr. sedan, a/c, auto. trans., pwr. steering, stereo w/cass., 77K mi., exc. cond., $5,800/obo. 447-1953.

'87 TOYOTA pickup, 86K mi., 4 WD, vg cond., 5 spd, a/c, cruise ctrl, shell, $4,000, 626/798-7446.

'86 TOYOTA Celica GT, 4 cyl., 1 owner, o/d, cruise, air, exc. cond., 47K mi., good buy, $4,000. 352-5608.

'86 TOYOTA Supra, 2-dr. hatchback, incl. new car cover and unused privacy cover, $4,000. 352-2882.

'66 VW Type 3 Karmann Ghia, very rare, less than 100 operating in N. America, show quality, award winning collector's piece, 86,500 actual mi. 790-6851, Roger or Margaret.

'86 VOLVO wagon, needs major repair, good tires, clean interior; safe for family once repairs are made; make offer. 957-5774.

WANTED

AIRLINE MILEAGE from United; if willing to donate United mileage-plus miles for a friend with cancer who wants to go to Orlando, FL through Dalmation Friends (adult version of Make-a-Wish for kids); call for further info. 909/596-4390.

SINGER: tenor, alto, soprano to join Pasadena madrigal group. 626/791-3802, Audrey.

SKIERS to join in the fun of the JPL Ski Club. 956-1744, Barbara.

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

VOLLEYBALL PLAYERS, coed, all levels, all ages, open plan; every Tuesday night from 8-10 at Eagle Rock High School; $4/night. 956-1744, Barbara.

FREE

CLOTH SCRAPS; many kinds of fabric; good for craft projects. 790-0335.

FENCING, chain link, welded & redwood picket; PLANTS, jade; PLYWOOD REMNANTS; SOLAR WATER HEATING SYSTEM. 790-6241.

RECORD CUTTING EQUIPMENT and supplies for hobbyist. 248-5456.

LOST & FOUND

Lost: Bike, woman's 3-spd. Schwinn; yellow; old, but has sentimental value; lost someplace on Lab. 957-5774.

FOR RENT

ALTADENA, partially furn. rm. in 3-bd. house, 3 mi./JPL, share kitchen, laundry, fireplace, hdwd. floors, quiet neigborhood, $380 + 1/3 utils. 626/798-4492.

ALTADENA, furn. rooms near Christmas Tree Lane, kitchen priv., lndry., utils. pd., $325. 626/797-6862.

ALTADENA ranch house, 2 bd., plus den w/fp, lg. yd., double garage area for washer & dryer, lg. kitchen, dining area, 1 1/2 ba.; $1,125. 445-0123 x-210, Romie.

ALTADENA, Spanish casa, 3 bd., 1 ½ ba., f/p, pool, view, sauna; walk to JPL; avail. 60 days; $1,000 includes water & yd. maint. 790-6241.

EAGLE ROCK, furn. room in single family hse., nice area, 10 min./JPL, share entrance, ba., kitch. & lndry. privileges, $330 incl. utils. 213/256-1785.

EAST PASADENA, 2 bd. rear house, new carpet & paint; 1 blk. below New York Dr. off of Allen, less than 3 mi./Lab, 1796 E. Woodbury Rd.; $750. 626/449-5400.

LA CANADA house, 2 bd., 1 ba., c/heat & air, f/p, lndry. hookup, carport; no pets; $1,100. 249-9577.

MONTROSE, studio, unfurn. or furn.; 5 min./JPL; for single person, no pets; 2332 Montrose Ave.; $490. 249-7793.

MONTROSE duplex, close to JPL, 1 bd., lg. living rm., den or bonus rm., stove, carpet, new miniblinds, a/c, yd. w/fruit trees, prkg., $610. 248-9561.

PASADENA, end-unit townhouse, 1 bd., 1 ba., attached priv. gar., laundry hookups, patio; at end of 110 fwy., 10min./CIT/JPL; pool/Jacuzzi/sauna; avail. 3/98; $975, water incl. 626/568-8298, eves.

PASADENA, NE, near Washington & Altadena Dr.; 2 roommates wanted to share 4 bd., kitch., din., liv., den, 2 full ba., Spanish style house, garage, lg. pool, yard w/big oak tree, dishwasher, refrig., w/d, fp; 15 min./JPL, nice neighborhood; cleaning/gardening/pool service incl., $450. 626/398-3192.

PASADENA, part-time roommate (commuters/others) wanted to rent 1 bd./1 ba. (of 2) in quiet complex, nice central area; 5 min./fwy., close to JPL; heated pool/Jacz. avail.; security; central air/heat; $20 nightly (min. 2/week). 796-5046.

PASADENA, charming 2-story English, 3 bd., 2 ba., LR, formal DR, cozy f/p, lndry. rm., lg. bkyd., pool, patio, wet bar, blt.-in BBQ, wood deck, nice landscape, from 3/15, $1,275 incl. pool & gardener. 626/574-7027.

PASADENA condo, 1 bd., 1 ½ ba., located near Euclid & Calif. Aves. on quiet tree-lined st.; lg. lanai, a/c, pool, lndry., security; $750 + dep. 626/398-7504.

PASADENA, spacious guest house in very nice area; too many amen. to list all; $750. 626/793-7937.

SIERRA MADRE CANYON cottage, quiet, charming, secluded, 2 bd., 1 ba., recently remodeled kitch. & bath; covered laundry area has washer and dryer; incl. parking spot; $895. 626/564-9607, Diana deNoyelles; e-mail: ddenoyel@co.la.ca.us.

SOUTH PASADENA, 1718 Huntington Dr., good area east of Marengo; fully furn. bungalow studio apt., carport, laundry, air cond./heat; non-smoker; utils. pd., $565. 626/792-9053, Marilyn.

SUNLAND townhouse, 3 bd., 2 1/2 ba., kit./blt.-ins + laundry hkups., ca/h, liv.rm./frpl., lg. patio off din. rm., dir. access dbl. gar., pool/Jacuzzi/tennis, close to 210/stores/park, $1,075. 353-7778.

REAL ESTATE

BIG BEAR, new cabin 2 blks. from lake, 2 bd., 2 ba., mud/laundry rm., $129,000. 909/585-9026.

COVINA, charming 3 bd., 1 ba., beautiful hdwd. floors, central air & heat, fireplace, lg. bkyd. w/redwood deck. 626/858-9846.

GREEN VALLEY LAKE, a secluded village in the San Bernardino Mtns., custom 3-story log home and buildable adjacent lot; beautiful 180-deg. view w/lg. decks, shade trees; walk to lake and skiing; cabin $149,000, adjacent lot $19,900; call for flyer. 303-1927.

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.

SAN GABRIEL, 209 W. Fairview Ave., 2-house property, $236,000. 213/221-2714.

SUNLAND townhouse, Alpine Meadows complex, 2 bd., 1.5 ba., 2-story, 2-car garage, pool, spa, tennis ct., rec. rm., well-maintained, $110,000. 248-0178.

SUN VALLEY, 3 bd., 1.75 ba., 2 fplcs., 2,000 sq. ft. home in La Tuna Cyn., 12 min./JPL, spa, lg. master suite w/walk-in closet, cent. air/heat, RV access, $199,900. 805/250-8521.

TEHACHAPI area (Caliente), new custom home, 2,200 sq. ft., 3 bd., 2 ba., LR, DR, oak kitchen, panoramic views, 2 ½ acres, 2-car garage, 2,800 sq. ft., new Dutch barn, $185,000 (owner may carry). 626/446-0078.

WRIGHTWOOD, beautiful mtn. view home, 2 bd., 2 ½ ba., 1,600 sq. ft., 2 fireplaces, 2 decks, recently remodeled, newly repainted, $141,000. 626/449-6096.

VACATION RENTALS

BIG BEAR cabin, 2 bd., slps. 8, compl. furn., TV/VCR, fireplace, $75/night. 249-8515.

BIG BEAR, 7 mi. from slopes, full kitchen, f/p, 2 bd., 1 ba., slps. 6; no smokers, no pets; exc. hiking, biking, fishing nearby; reasonable rates, 2-night min. 909/585-9026, Pat & Mary Ann Carroll.

BIG BEAR LAKE cabin, 1 mile to ski slopes, lake, shops, village, forest; 2 bd., slps. 6, fully furn., f/p, TV, VCR, phone, full kitchen, microwave, BBQ and more; JPL disc. price from $65/night. 909/599-5225.

BIG BEAR LAKEFRONT luxury townhome, indoor pool/spa, near skiing, stone f/p, slps. 6. 714/786-6548.

CAMBRIA, ocean front house, exc. view, slps. up to 4. $125/night for 2, $175/night for 4. 248-8853.

LAKE TAHOE (Incline Village), 3 bd., 2 1/2 ba. townhouse, fully furn., pool, golfing, skiing, close to the lake and the Hyatt. 714/779-9939, Linda.

MAMMOTH condo, 2 bd. + loft, 3 ba., slps. 8, spa, full kitchen, TV/VCR, JPL disc. rates; walk to Canyon Lodge. 249-8088.

MAMMOTH condo, studio + loft, 2 ba., fireplace w/wood supplied, Jacuzzi, sauna, game rm., color cbl. TV/VCR, full kitchen w/microwave, terrace, view, amen. 714/870-1872.

MAUI condo, on beach w/ocean view, 25 ft. from surf, 1 bd. w/loft, compl. furn., incl. phone, color TV, VCR, microwave, 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, less 10% JPL & Caltech disc. 714/348-8047.

OCEANSIDE, on the sand, charming 1 bd.+ condo, panoramic view, walk to pier/marina, pool, spa, game rm. 714/786-6548.

PACIFIC GROVE hse., 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd. kit. w/microwave, beaut. furn., close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discnt. 441-3265.

PALM SPRINGS, 1 bd. condo, completely furn., pool, spa, tennis ct., cab. TV/VCR, really nice; all furn., rugs, paint & cooking utensils new. 626/445-0884.

PINE MOUNTAIN cabin, 2 bd., 1 ½ ba.; Big Bear w/o the traffic; $80/night. 310/831-4234, Peter.

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis ct., 18-hole golf course w/in 5 mi. w/ocean view, security prkg. 626/794-3906.

SOUTH LAKE TAHOE KEYS waterfront home, 4 bd./3 ba., slps. 12+; f/p on 2 levels, decks overlooking private dock and ski lifts; gourmet kitch.; bicycles, 20' sail & paddle boats, 3 color TVs, VCR, stereo w/tape & disk; assn. indoor & outdoor pools, hot tub & beach; 8 lighted tennis cts.; 10 min. to skiing, casinos, golf; 1 hr. to Western Sierra wine country; $995/wk. for high season (June 15-Sept. 15; Nov. 22-Mar. 1); $495/wk. low season, + $90 cleaning fee; 3-day min. 626/578-1503, Jim Douglas.

NOTICE TO ADVERTISERS

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Universe

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Mark Whalen

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JPL Photo Lab

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