SIRTF gets go-ahead

Design, development phase now under way; launch in late 2001

By MARY BETH MURRILL

NASA Administrator Dan Goldin last week authorized the start of work on the JPL-managed Space Infrared Telescope Facility (SIRTF), an advanced orbiting observatory that will give astronomers unprecedented views of phenomena in the universe that are invisible to other types of telescopes

The authorization signals the start of the design and development phase of the SIRTF project. Scheduled for launch in December 2001 on a Delta7920-H rocket from Cape Canaveral, Fla., SIRTF represents the culmination of more than a decade of planning and design to develop an infrared space telescope with high sensitivity, low cost and long lifetime.

The Space Infrared Telescope Facility will do for infrared astronomy what the Hubble Space Telescope has done in its unveiling of the visible universe, and it will do it faster, better and cheaper than its predecessors," said Dr. Wesley Huntress, NASA's associate administrator for space science.

"By sensing the heat given off by objects in space, this new observatory will see behind the cosmic curtains of dust particles that obscure much of the visible universe," Huntress said. "We will be able to study fetal stars, detect other solar systems and study the most ancient, distant galaxies at the edge of the universe.'

Conventional optical telescopes can study stars and other objects that glow brightly enough to emit light in the visible portion of the electromagnetic spectrum. But many objects, such as planets and unignited stars, do not "shine" in visible or ultraviolet light. Others that may burn brightly are still veiled from view behind the vast clouds of dust and gas that populate the universe.

Some of the most fascinating objects and processes in the universe may exist behind these cosmic curtains of dust and gas, such as black holes, quasars, regions where stars are forming in galaxies and regions where planets are forming around stars. The majority of these concealed attractions are detectable only with infrared telescopes, whose unique capability lies in their ability to sense the heat of dark, faint or hidden objects.

Infrared telescopes also provide the means to study the oldest and most distant objects at the edge of the expanding universe. Optical and ultraviolet light emitted from stars, galaxies and quasars since the birth of the universe has shifted, over time and distance, into the infrared portion of the spectrum. Recent studies of these objects made with infrared telescopes are providing important insights into when and how the first galaxies and stars formed.

SIRTF, cost-capped at \$450 million, will be

See SIRTF, page 2

Jet Propulsion Laboratory Verse Pasadena, California Vol. 28, No. 7 April 3, 1998

MGS will target imaging areas

Attempts will include Pathfinder and Viking landing sites, Cydonia region

By DIANE AINSWORTH

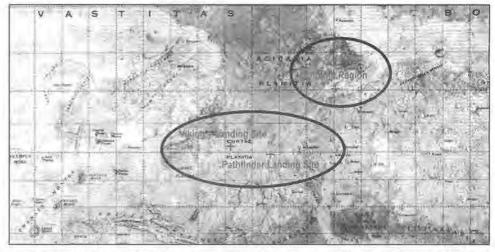
JPL's Mars Global Surveyor project has resumed scientific observations of the surface of Mars and has scheduled opportunities to image four selected sites: the Viking 1 and 2 landing sites, the Mars Pathfinder landing site and the Cydonia region.

Three opportunities to image each of the four sites using the spacecraft's high-resolution camera will take place over the next month, beginning on April 3 at 1:58 a.m. Pacific time, when Global Surveyor passes over the Viking 1 landing site. The spacecraft will next pass over the Viking 2 landing site at 1:37 p.m. Pacific time on April 3. On April 4, Global Surveyor will try to image the nowsilent Mars Pathfinder spacecraft at 1:16 a.m. Pacific time. It will then capture a portion of the Cydonia region of Mars, location of the socalled "Face on Mars," on April 5 at 12:33 a.m. Pacific time.

Attempts to rephotograph the sites will occur during two additional opportunities falling about nine days apart. A detailed schedule of the imaging attempts is listed below. Uncertainties in both the spacecraft's pointing and the knowledge of the spacecraft's ground track from its navigation data will provide only a 30- to- 50-percent chance of capturing the images of each site.

All of the selected targets are located south of Global Surveyor's periapsis, or point of closest approach to the Martian surface.

Shortly before the spacecraft reaches this point, the Global Surveyor spacecraft will rotate slightly so that when it nears the selected target, the camera's field-of-view will sweep across the target as the spacecraft flies south and rises



Target areas for Mars Global Surveyor imaging include the landing sites of Pathfinder (near bottom center of map above), Viking 1 (above Pathfinder) and the Cydonia region (to the right of center, near top). Another target area is the Viking 2 landing site, not shown on this map, which was created from Viking orbiter data.

The spacecraft will begin transmitting to Earth data stored on its onboard solid-state recorders about seven hours after the images are acquired, concluding about three hours later. Currently it takes radio signals from Mars Global Surveyor about 20 minutes to travel from the spacecraft to Earth.

Data will be received at one of NASA's Deep Space Network tracking stations at Goldstone, Calif., near Madrid, Spain or near Canberra, Australia, and then sent by satellite to JPL There the images, along with all of the rest of Global Surveyor's science and engineering data, are placed in the project database for access by flight controllers. This process takes only seconds for each bit of data. Consequently, the image data will not be available be on the ground until about 10.5 hours after they are acquired. Data received overnight will not be retrieved until 9 a.m. Pacific time on the following work-

When image data are retrieved by camera operators, the information is assembled into "raw" images. Raw images may contain data errors or drop-outs introduced by noise in the telecommunications channel between the spacecraft and the ground, as well as very slight picture element variations inherent in the camera. This data processing takes about 30

Raw images will posted on three World Wide Web sites: JPL's Mars news site at http://www.jpl.nasa.gov/marsnews, the Mars Global Surveyor project home page at http://mars.jpl.nasa.gov, and NASA's Planetary Photojournal site at http://photojournal.jpl. nasa.gov.

Information identifying the acquisition time, predicted center latitude and longitude of the target location, and the local solar time will accompany these images. Contrast enhancement will be performed by JPL's Multimission Image Processing Laboratory and posted on the World Wide Web a few hours later. The Global Surveyor project home page also contains spacecraft orbital velocity and distance to the planet in real time.

Images of the Viking and Mars Pathfinder landing sites will not be posted until image enhancement and identification of the vehicles have been completed, because the small spacecraft will be at the limits of the camera's resolution. This process will take about 24 hours. q

JPL families invited May 16

Tickets available April 6; event will precede public open house by two weeks

Family members of JPL employees and contractors will have a unique opportunity to get a close-up view of the Laboratory and its activities during Employee Family Day, scheduled for Saturday, May 16.

The event will be held from 10 a.m. to 3 p.m. Tickets are required; they will be available from April 6 to 24 at the following locations:

- ERC (Building 114-104)
- Public Services Office (186-113)
- . Emergency Preparedness Office (180-102)
- Observational Systems Division (306-416) • Compensation and Benefits (291-214)
- Systems Division (301-230K)
- · Credit Union (218)
- Environmental Laboratory (144-121)

Tickets will also be available outside each cafeteria on April 10, 17 and 24 from 11:30 a.m. to 1:30 p.m.

Visitors are restricted to immediate family members only, according to Nancy Kapell of Employee Services. Extended family and friends are welcome to the public open house May 30 and 31, she said.

See Family, page 3

Pacific Ocean warm water pool near normal, but El Niño expected to stay

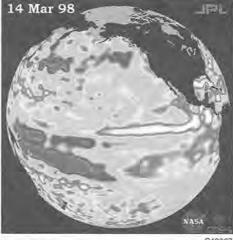
By MARY HARDIN

The most recent image from the JPL-managed TOPEX/Poseidon satellite shows the sea surface height along the central equatorial Pacific has returned to a near normal state and remnants of the warm water pool, commonly referred to as El Niño, are now situated to the north and south of the equator.

The image shows sea surface height relative to normal ocean conditions on March 14. Sea surface height is an indicator of the heat content of the ocean. Oceanographers indicate this is a classic pattern, typical of a mature El Niño condition that they would expect to see during the ocean's gradual transition back to normal sea level. These sea surface height measurements have provided scientists with a detailed view of how the 1997-98 El Niño warm water pool behaves because the TOPEX/Poseidon satellite measures the changing sea surface height with unprecedented precision.

Sea surface temperatures, as measured by the National Oceanic and Atmospheric Administration (NOAA), are still well above normal throughout the tropical Pacific Ocean and are expected to remain that way through April and into May,

Using satellite imagery, buoy and ship data, and a forecasting model of the ocean-atmosphere system, NOAA has extended an advisory



March 14 TOPEX/Poseidon image shows that the sea surface height along the central equatorial Pacific has returned to a near normal state and remnants of the El Niño warm water pool are now situated to the north and south of the equator. Sea surface temperatures, however, are still well above normal and El Niño conditions are expected to continue through the spring.

indicating that the so-called El Niño weather conditions that have impacted much of the United States and the world are expected to continue through the spring.

Tech Affiliates success story helps pilots avoid danger

By JOHN WATSON

Two new software packages enabling pilots to use laptops to avoid hazardous terrain and find their place on maps are the latest success stories of a JPL program bringing together entrepreneurs and space engineers.

Pilots of small planes, for whom such tools have been largely unavailable until now due to cost and the sheer size of bulky hardware, may soon be able to carry onboard the personal computer equivalent of collision-avoidance systems now used by the military and commercial airlines.

"TerrAvoid" and "Position Integrity" combine Global Positioning Satellite (GPS) data with high-resolution maps of the Earth's topography. Dubbs & Severino, Inc., based in Irvine, has developed software that allows the system to be run on a battery-powered laptop in the

The packages, designed primarily for military sponsors and now positioned to hit the consumer market in coming months, came about as

See Tech transfer, page 3

News Briefs

Friends and co-workers are invited to the dedication of a memorial bench in honor of former JPL mechanical engineer Jordan Kaplan April 6 at noon in the courtyard of Building 301.

Numerous donors from JPL and elsewhere supported construction of the bench, which was built in Kaplan's home state of Massachusetts under the supervision of his family.

Kaplan, 32, died March 23, 1997, eight days after an airplane he was piloting crashed in Pacoima.

Kaplan's parents and siblings are planning to attend the dedication. Music will be provided by The Patio Players, with whom Kaplan played music at the site of the memorial dedication.



Jordan Kaplan

JPL's Library, Archives and Records Section will celebrate National Library Week later this month in the library reference area at the west end of Building 111.

Activities will take place April 21–23 from 11 a.m. to 1 p.m. and will include hands-on demonstrations of the newest Bibliographic and Electronic Access Connection (BEACON) World Wide Web resources (http://beacon) and tours of the recently renovated facility. Also, the Online Search Center will demonstrate its mediated search capabilities; attendees will have the opportunity to sign up for a sample

Ten drawings will be held each day of the celebration, with prize winners receiving one of two books: Pioneering Venus: A Planet Unveiled or The Face of Venus: The Magellan Radar Mapping Mission.

For more information contact the Library at ext. 4-4200 or e-mail Library@jpl.nasa.gov . □

SIRTF

Continued from page 1

one of astronomy's most advanced telescopes. Its unconventional approach uses new technologies, an innovative mission design and small launch vehicle. It is being developed on a quick schedule that closely integrates the work of the contractor and academic teams responsible for SIRTF development and delivery. Its design promises high sensitivity and observing capability along with efficiency of operations and long lifetime of at least two-and-a-half to as many as five years.

SIRTF is the fourth and final element in NASA's family of spacebome "Great Observatories" that includes the Hubble Space Telescope, the Compton Gamma Ray Observatory and the Advanced X-Ray Telescope Facility, or AXAF.

SIRTF's findings will complement those of the other Great Observatories.

The project also represents a bridge to NASA's new Origins program—administered by JPL—which seeks to answer fundamental questions about the birth and evolution of the universe. SIRTF will lay the groundwork for many investigations that are fundamental to the Origins program, such as studies of the birth and evolution of galaxies, their stars, and searches for planets that orbit some of those stars. Astronomers around the world are invited to request observing time on SIRTF.

Cold is the key to success in infrared astronomy, and designing and maintaining the liquid helium-based cooling system for infrared telescopes has long been a major challenge because the detectors must be kept to near absolute zero (-273 degrees Centigrade or -479 degrees Fahrenheit). "We have to defend against the heat produced by the instruments and satellite systems themselves," said SIRTF project manager Larry Simmons of JPL.

"Once the cryogen is exhausted, the mission is over, so any steps we take to lower the consumption of the use of liquid helium increases the life span of the telescope."

One new approach is SIRTF's "warm launch architecture."

Previous infrared telescopes in space required large amounts of liquid helium to keep the entire telescope assembly cooled before launch. But SIRTF's telescope

assembly will be launched at ambient temperature and allowed to cool off in space, Simmons said. "This provides a huge savings in the amount of cryogen we need to place onboard, and greatly simplifies the overall handling and assembly of the observatory before it is launched."

Another key innovation is SIRTF's unconventional orbit around the sun, trailing the Earth by up to about 50 million kilometers (30 million miles). "This will prevent the telescope and its detectors from being exposed to heat from Earth, but allows SIRTF's solar panels to remain illuminated while the telescope enjoys an unobstructed view of the heavens," Simmons said.

The detectors that will form the heart of SIRTF's system have been developed under NASA sponsorship by industrial fabricators and university researchers who adapted technology originally developed for military applications. The result is a giant leap in sensitivity matched by a dramatic increase in the size of the arrays of detectors that will form the focal planes.

SIRTF's 85-centimeter diameter (33-inch) primary mirror is significantly larger than mirrors used on previous infrared astronomy missions. The mirror is made of the ultralightweight rare metal beryllium. The entire optical system weighs just 31 kilograms (70 pounds).

Lockheed Martin Missiles & Space of Sunnyvale, Calif. is responsible for the spacecraft and for the SIRTF system integration and testing. Ball Aerospace and Technology Corp., Boulder, Colo., is responsible for the cryogenic telescope assembly. The manufacture and delivery of SIRTF's science instruments is due in April 2000, and the spacecraft and telescope are scheduled to be integrated in February 2001.

NASA's Deep Space Network will provide the telecommunications link between the orbiting telescope facility and a flight operations team at JPL. The SIRTF Science Center at Caltech will receive the data from JPL, process it, and serve as the interface with the astronomy community.

The project scientist at JPL is Dr. Michael Werner.

More information about SIRTF and other infrared astronomy projects can be found online at http://sirtf.jpl.nasa.gov/sirtf and http://www.ipac.caltech.edu.

A marathon effort



PHOTO BY JIM MORAN / JPL PHOTO LAB

JPL Deputy Director Larry Dumas meets with JPL employees who competed in last Sunday's Los Angeles Marathon. Top row, from left, Bob Edelson, Susan Merrill, Paul Herrera, Steve Schlaifer and Dumas. Middle row, from left: Ray Garcia, Debbi Dachinger, Greg Koellner, Michael Taylor and Carol Bruegge. Front row, from left: Padma Varanasi, Jennifer Harris, Rashmi Bansal, Jon Hamkins, Bill Taber, Mike Allen and Tom Hoffman.

Having better things to do than sit around the house last Sunday, 16 JPL employees decided to stretch their legs a bit—for 26.2 miles, to be exact.

They joined more than 19,000 others who ran, jogged, walked and wheeled through the grueling course on the

streets of Los Angeles in the city's annual marathon.

In addition to the runners pictured above, a number

of other JPL employees spent their day off by volunteering their time as ham radio operators for the marathon, which helped in medical and other emergencies. This vital communication support was provided by Bob Dengler, Jay Holladay, Allen Hubbard, Rick McKinney, Larry Ruple, Chuck Sarture, John Tallon, Jan Tarsala and Gerry Walsh. □

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.

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

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, April 3

ACW Seminar Series—Caltech and

USC law professor Edward McCaffery will discuss the social and political importance of tax, how tax systems affect women, and how tax reform can provide more options for achieving balance between work and family. At noon in von Kármán Auditorium.

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

JPL French Club—Club member Dr. William Smyth will speak about his working visits to Antarctica, where he has conducted seismology experiments. At at noon in Building 183-328. The program will be repeated at 7 p.m. in the San Marino home of another club member.

"Scotland and the Scottish Isles"— Joe and Mary Liz Adair will narrate their travel film at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$9 and \$7. For information, call (626) 395-4652.

Saturday, April 4

Chinese Golden Dragon Acrobats— This People's Republic of China company will present a spectacle of acrobatics, music and dance at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$26, \$23 and \$20. For information, call (626) 395-4652.

Sat., Apr. 4–Sun., Apr. 5

All-Mozart Concert—The Caltech Glee Clubs will present this free performance at 8 p.m. in Caltech's Dabney Lounge. For information, call (626) 395-4652.

Tuesday, April 7

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

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

Wednesday, April 8

"Can We Use Chemistry to Change the Way Our Genes Work?"— Caltech chemistry professor Dr. Peter Dervan will deliver this free lecture at 8 p.m. in Caltech's Beckman Auditorium. For information, call (626) 395-4652

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.

SESPD Lecture Series—Lute Maleki will discuss laser-cooling atomics physics research at noon in von Kármán Auditorium.

Thursday, April 9

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

Friday, April 10

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

Monday, April 13

Develop New Products Seminar— Michael Dickerson of Section 344 will present an overview of new rate structures for DNP strategic tools. At noon in von Kármán Auditorium.

Tuesday, April 14

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

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

Wednesday, April 15

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

JPL Hiking Club—Meeting at noon in Building 303-209,

Thursday, April 16

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

Von Kármán Lecture Series— Division 32 outreach specialist Marguerite Syvertson will discuss the Earth Observing System (EOS), which will provide land, ocean and atmospheric data that will allow scientists to study and eventually model changes in the Earth's environment and climate. At 7 p.m. in von Kármán Auditorium. Open to the public.

Friday, April 17

Flamenco Dancing—La Tania will appear at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$26, \$23 and \$20. For information, call (626) 395-4652.

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

Von Kármán Lecture Series—Division 32 outreach specialist Marguerite Syvertson will discuss the Earth Observing System (EOS), which will provide land, ocean and atmospheric data that will allow scientists to study and eventually model changes in the Earth's environment and climate. At 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Saturday, April 18

Lula Washington Dance Theatre—African American heritage will be explored with the troupe's blend of African, jazz and modern dance. Reserved seats are \$20. For information, call (626) 395-4652.

April 3, 1998

Tech transfer

Continued from page 1

the result of JPL's Technology Affiliates Program. Intended to give American industry assistance from Laboratory experts and to facilitate business use of intellectual property developed for the space program, the Technology Affiliates Program introduced the start-up company of Dubbs & Severino to JPL's Dr. Nevin Bryant four years ago.

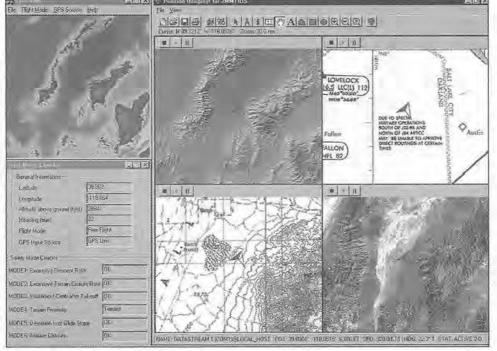
Dubbs & Severino had an idea for mapping software to help private airplane pilots, inspired in part by the fatal crash of a pilot friend of company president Bob Severino. The twist: the package was to be completely software-driven, instead of requiring expensive hardware, as was the norm up to that time.

Bryant's Cartographic Applications Group at JPL had developed GeoTIFF, an architecture standard providing geo-location tools for mapping applications. GeoTIFF proved to be the crucial key that the start-up company needed to bring the idea to fruition, allowing the firm to develop low-cost software packages.

GeoTIFF is now in the public domain, and its use for commercial product development has evolved into an industry standard over the last year. Through the Technology Affiliates Program, Dubbs & Severino obtained JPL's assistance early on and thus gained a jump-start in adapting the architecture for their products' specific needs. "JPL gave us a demonstration and opened up the red carpet. It was a match made in heaven," Severino said.

Merle McKenzie, manager of JPL's Commercial Technology Program, said that Dubbs & Severino's ability to utilize technology originally developed for NASA provides a strong example of the many advantages of technology transfer programs. "This is a win-win partnership through which yet another American business gets a boost from the space program," she said.

"TerrAvoid" is a terrain avoidance system



that graphically shows pilots if they are flying dangerously close to mountains: safe sections can be seen in green, while hazardous sections show up in red, with those proportions changing in real time as the pilot moves through hilly terrain. In a sense, the system "looks" out over a plane's flight path, sweeping 360 degrees, warning the pilot if there are any upcoming hazards. Integrating Global Positioning System (GPS) tracking data with maps on CD-ROM, this software package is approximately 1/20th the cost of its nearest competitor.

"Position Integrity," which also co-registers real-time GPS data with local maps on CD-ROM, is a moving map detailing the exact position of the pilot. Because of the unique features of GeoTIFF, this software can be adapted to operate with any map, chart or photo image in

the world, while comparable versions are limited solely to either military, scientific or commercial maps. GeoTIFF also enables the package to feature four windows at once, a useful and unique option for pilots who need to work simultaneously with maps, charts, photo images and sketches at different scales and zoom levels.

As Severino explains, "GeoTIFF enables terrain avoidance and navigation map packages to manipulate the pixels in each image intelligently, making costly hardware unnecessary. Its clever indexing scheme organizes large numbers of pixels efficiently and inexpensively, compressing and capturing huge amounts of data into a seamless image file. It has paved the way for sophisticated mapping software to be made available not just to major commercial airlines but also to small-plane pilots around the world." "TerrAvoid" and "Position Integrity" work together to provide pilots with enhanced situational awareness through the use of six mutually supporting graphic windows. In this snapshot, the aircraft is flying through the Dixie Valley near Fallon Naval Air Station, Nevada. The upper left screen shows how the Terrain Avoidance window provides a 60-nautical-mile depiction of the terrain around the aircraft. Onscreen colors show various altitude levels of terrain above or below the aircraft.

The lower left window, showing critical navigation information, shows six warning modes to reflect Federal Aviation Administration categories of concern about safe flight. In this example, Mode 4 is alerting the pilot to an impending terrain collision. Voice alerts are simultaneously broadcast into the pilot's intercom headset.

The other four windows show the "Position Integrity" moving map system. Each window is updated in real time using a Global Positioning System feed from the aircraft or from a portable receiver. The top center window shows a JPL-generated, shaded relief of the terrain, with the highest elevations shown to the pilot in the warmest colors.

Dubbs & Severino was formed in 1994 with a flight test contract for the Army, Navy and the Federal Aviation Administration, and today the corporation has eight research and development contracts with various military agencies. Just after start-up, it was awarded a U.S. Army Research Office Small Business Technology Transfer program grant that required it to team with a university or research laboratory, a further incentive for the company to work with JPL. Discussions are ongoing with wholesale software firms to bring "TerrAvoid" and "Position Integrity" to the consumer market by the end of the year.

Further details about JPL's technology transfer activities, including the Technology Affiliates Program, are available online at http://techtrans.jpl.nasa.gov/tu.html.

Lab-supported childcare available to more JPL families

Waiting lists shorter, more tuition assistance funds available

By ENRICO PIAZZA

Created to accommodate JPL employees' need for quality and conveniently located childcare, the Child Educational Center (CEC) has been serving the Lab community since 1979.

Since that time, close to 1,000 JPL families have been served. The center has expanded three times to meet service demands for its traditional client base of infants, toddlers and preschoolers, and has in recent years added programs for school-age children.

Despite the center's success, however, it has greater capacity to serve JPL employees than is currently being utilized.

According to CEC executive director Elyssa Nelson, two wide-spread misconceptions keep some JPL families from exploring enrollment. One has to do with a long waiting list and the other with tuition costs.

While there were times in which waiting lists for some age groups were as long as two years, that's not the case anymore. Openings are updated weekly on the jpl.forum newsgroup; enrollment is now underway for the center's summer camps for school-age children; and applica-

tions are available for fall 1998 enrollment for all age groups.

In addition, Nelson said some people don't realize that JPL families have priority enrollment over the general public.

"We were set up to serve JPL employees, and we take that commitment very seriously," Nelson said.

In terms of tuition costs, "The belief that the CEC is too expensive is a problem," Nelson said. Aside from the automatic discount JPL employees receive—ranging from 4 to 10 percent depending on the child's age—Nelson said not too many peo-

ple are aware of the center's tuition assistance program, which can reduce tuition costs up to 70 percent.

"We have reorganized our funding in such a way that we have more tuition assistance money for JPL employees than ever before," she said, "We want to encourage people who might have thought the CEC was too expensive to really check it out,"

While CEC tuition is not much higher than that of most private child-care facilities, the quality of the care offered is second to none, according to JPL parents with children at the CEC. The majority of caregivers have college degrees in child education, and the teachers-to-children ratio is

far above—in some age groups more than twice—the guidelines mandated by the state. The CEC is accredited by the National Academy of Early Childhood Education.

"The best part about the CEC is that children get the right kinds of attention," said Dr. Laif Swanson, a technical manager in the Telecommunications and Mission Operations Directorate's Technology Program Office. "There are no rigidly structured activities, like in other places where there is the writing hour, the playing hour and so on.

At the CEC "children can choose the activities they are interested in; See CEC, page 4

Lew Allen Award winners named

Three JPL scientists have been named recipients of the 1998 Lew Allen Award for Excellence.

The annual awards recognize and encourage significant individual accomplishments or leadership in scientific research or technical innovation by JPL employees during the early years of their professional careers.

The recipients are Dr. Shouleh Nikzad of Section 346, Dr. Bedabrata Pain of Section 385 and Dr. Paul Stolorz of Section 395. Nikzad was recognized for her outstanding contributions to the fundamental understanding and development of advanced scientific low-energy particle detectors.

Pain was cited for his technical leadership and creative inventiveness in maintaining and expanding JPL's lead role in advanced solid state imagers, particularly the active pixel sensor.

Stolorz received his award in recognition of outstanding research achievement in the areas of data mining, image analysis and massively parallel computing for the automated analysis of very large scientific data sets, and in the pioneering of concepts for onboard analysis of science data.

The award consists of a plaque and a grant of \$25,000 from the Director's Research and Development Fund, to be used at JPL to enhance the professional efforts of the awardees.

The award was established in 1990 in honor of Allen, who served as JPL's director from 1982–90. □

Daughters, sons to be welcomed April 23

JPL will again join thousands of employers throughout the nation in recognition of "Take Our Daughters to Work Day" April 23.

The Lab has aligned the name of its program in recognition of the nationwide event; however, both boys and girls continue to be welcome for the activities at JPL.

"The program is designed to celebrate a girl's worth—to value her opinions and ideas, to speak her mind, to never stop asking questions, and to take pride in who she is," noted event coordinator Carmen Nuñez of the Advisory Council for Women (ACW).

"The event was conceived in response to research conducted by Harvard University and the American Association of University Women on the adolescent development of girls, which found that girls tend to like or dislike themselves based on aspects of their physical appearance, and suffer from lower expectations than do their boy counterparts," said ACW chair Jeanette Mills. "Spending a day in the workplace gives girls a glimpse of their own potential and helps them make the crucial connections to their future development."

"Girls and women continue to

struggle—albeit with some improvement—particularly in areas with math, science or technical emphasis," Nuñez added. "We hope to offer a stimulating experience to these young minds, and provide them with options and aspirations for their future.

"At the same time, it's a great bonding experience for parent and child," she said.

The event is also supported by the Human Resources Directorate, Public Affairs, Advisory Committee on Minority Affairs, and Security and Plant Protection.

The event is open to JPL employees only, with approval required from their supervisor. It is limited to one child between the ages of 9 and 17 per participating employee.

An application form was sent to all employees last week. The deadline to apply is April 10. □

Family

Continued from page 1

Tour sites will include the space simulator, Microdevices Lab, von Kármán visitor center, ERC, Observational Instruments Lab, Spacecraft Assembly Facility, Space Flight Operations Facility and Professional Development Center. An astronaut presentation and children's activities are also planned.

JPL personnel are also encouraged to take their families to their work locations. Lunch and entertainment will be provided in the mall.

For more information, call Kapell at ext. 4-9432. \square



Former JPL Director Dr. Lew Allen, left, current Director Dr. Edward Stone, second from right, and Chief Scientist Dr. Moustafa Chahine, right, join Lew Allen Award winners (from left) Dr. Shouleh Nikzad, Dr. Bedabrata Pain and Dr. Paul Stolorz.

CEC

Continued from page 3

they are constantly stimulated in learning about themselves first, and they become comfortable in taking on new challenges," she said.

"You can sense (CEC caregivers) love the children, and the children love them," Swanson added.

Alice Wessen, an outreach specialist in JPL's Commercial Technology Program, said she had a similar experience at the center.

"As first-time parents, (my husband) Randii and I felt overwhelmed," she said. But as CEC staff provided needed coaching, life as parents became less intimidating.

"What I like best about the CEC is its sense of community," Wessen said. "Children and parents 'grow' together."

She said CEC staff provided support and helped model ways of handling and talking to the infants.

"Soon I felt better about how I was doing as a mom," Wessen said. "I remember the caretakers in the infant room really talking to the infants, holding them, kissing and loving them. I was so impressed at the level of care."

The sense of community that transpires from these parents' experiences is not casual. Rather, it is the result of the CEC's philosophy and educational practices, which emphasize that "learning takes place in the context of the community and human relationships," Nelson said. "And it is in this nest of caring, involved adults that children thrive.'

Curiosity is a natural part of being human, she said, and children have within themselves all of the "hardware" necessary to learn, to discover and to ask questions. "The problem is in many cultures and education systems this curiosity is conditioned out of us," Nelson said.

The opposite is true at the CEC, she stressed.

"We take very seriously the importance of keeping this curiosity alive and nourishing it by creating relationships of very loving, involved people in the child's life so they really can develop fully," Nelson said, adding that this allows the CEC to provide for both the emotional and cognitive needs of children.

"We don't focus on memorization, we focus on higher level thinking skills," Nelson said. "We focus on the skills we all need to creatively solve the problems that inevitably come up numerous times in the course of the day, and on math and literacy learning that is embedded in activities that have meaning for the children."

To complete the full spectrum of interactions between children and adults, the center encourages parent visits

"It is very important to me that the CEC has a very open environment," said Dr. Chad Edwards, deputy manager of the TMOD Technology Program Office. He added that having the center less than half a mile from the Lab's south gate was another positive factor when his children attended

"My wife Ruth and I were often able to spend our lunchtime with our children," he said. "A half-hour in the infant room certainly puts the day-today pressures of work in their proper perspective."

Edwards said that the center's well-being influences the Lab's work-

"I think it's very important for JPL to support the CEC," he said, because having such a high-quality childcare center in the vicinity of the Lab helps JPL attract young, talented people to work here."

In its 4,180-square-meter (45,000square-foot) main site at 140 Foothill Blvd.-adjacent to La Cañada High School-the center accepts infants as young as six weeks old up to age 5. The CEC also has two after-school programs-one at the main site and one near Caltech-for children up to age 12.

For more information or to inquire about a center visit, call ext. 4-3418. □

Royal visit



PHOTO BY JIM MORAN / JPL PHOTO LAB

JPL Director Dr. Edward Stone presents a Spaceborne Imaging Radar-C/X-band Synthetic Aperture Radar (SIR-C/X-SAR) image of north-central Thailand to that country's Princess Maha Chakri Sirindhorn, who visited JPL last month. Her tour included overviews of JPL's Earth science and remote sensing programs, as well as the Mars Pathfinder mission control area.

LETTERS

Wally Castellana would like to thank all those who donated blood in his name at a recent JPL blood drive. As of this time, he is still waiting for a donor and the surgery. A special thank you to Warren Moore, who got the word out about the need for Wally and Ginny Castellana

We would like to thank our respective Sections 357 (Kathleen Bickler) and 511 (Julie Corpe) for planning two of the most unforgettable retirement par-ties ever. We would also like to thank all our family, friends and co-workers for joining us at our lun-cheons. We were overwhelmed with all our family and friends at each. We have nothing but wonderful memories of our 28 and 29 years each at JPL. We are very happy in our retirement home up here in Big Bear watching all our birds, squirrels and the spectacular sun rises and sunsets over the lake. Thanks to everyone for your good wishes on our

Julie and Henry Delgado 000

My heartfelt thanks to all of those who contributed blood and platelets and who sent cards, letters, prayers and offers of support during the ordeal which led to the death of my wife, Vicki Schechtman, on March 7. A scholarship fund to support women pursuing degrees in the sciences is being set up in her name. Information on the fund, Vicki's life and the illness that resulted in her death is available on the Web at home.sprynet.com/sprynet/bbon/vickien-

FOR SALE

ART PRINT by Gloria Eriksen, Pharaoh with Ankh and Queen, 37" x 37", \$200; GUITAR AMP, Park G10, new in the box, \$100, 248-0178. BABY ITEMS: 2 pottles, \$5 each; backpack, Gerry, exc. cond., \$25. 355-9733, after 6 p.m. or leave

msg. BIKE (road), Cannondale, tall 63 cm, w/1997

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NOTICE TO

Universe

Mark Whalen

JPL Photo Lab

Editor

Photos

CA 91109.

ADVERTISERS

CAAD III frame & Shimano Ultegra components: exc. cond.; \$800/obo. 626/446-0568, Steve. BOOKCASE, all metal, 48" w x 48" h, 3 shelves;

\$25, 365-3799. CAR COVER, '94-'98 Mustang GT; brand new, in box; water resistant, breathable; soft, non-abrasive; cable and lock incl.: \$100, 213/265-3181.

CAR SEATS: infant, \$15; infant/toddler, \$25. 626/585-1374, after 5 p.m. CARBURETORS (SU), two, 1 1/2", for Austin

Healey 100-4, Uni-Syn carburetor synchonisor, SU factory workshop manual; \$30 for all. 541-1123. CLOCKS, new old stock elec., Pepsi Cola, \$15; BUFFALO SKULL, old, \$75; TELEPHONE INSU-LATORS, old glass, \$1 ea.; RADIO, 1946 wood cabinet, looks like spice cabinet, \$50; HORSE HAINES, antique, 2 pair, \$10 pr.; RECORDS, vintage 78 RPM, \$25-\$3 ea.; ALBUM SETS, 78 RPM, Bing Crosby/Al Jolson, \$10 set. 248-5282.

COAT, women's leather, full-length, burgundy, "trench coat" style, rarely worn, exc. cond.; made by Beged-Or; \$150. 249-6883.

COFFEE TABLE, cherry wood, oval with Queen Anne legs, exc. cond., \$65/obo. 957-4722. COFFEE TABLE, It. gray laminate, 36 in. sq. tiered

base, \$49, 626/793-8783. COMPUTER, 486, 33 MHz, 1.5 GB hard drive; mullimedia, internet capable; monitor not incl.; \$75.

COMPUTER, Apple IIC Plus, Mac ImageWriter printer, Apple 13" composite monitor, 5 ¼" external

disk drive; all for \$100, 353-5402. COMPUTER, PC 486, 66 MHz, 256K cache, 8 MB memory, 420 MB hard drive, Panasonic double spin CD-ROM, Teac 1,44 floppy drive, video card w/1 MB, 15 in, CTX SVGA monitor, 14.4K fax/modem, MS mouse, mid tower, sound blaster 16 MCD, speakers, Windows 95, \$350, 909/596-4712. COMPUTER, IBM AT 386, 40 MHz, incl. color mon

itor, \$400/obo. 541-9655. COUCH/FUTON, vg cond., \$100. 714/449-9714. DAYBED, oak, twin, 1½ yr. old, \$200/obo. 249-

DESK, in box, cherry finish, designed for computer equip., great for home office, \$350. 626/403-9002. DINING ROOM TABLE and 4 chairs, glass top table, black finished chairs and table base; great cond.; \$150/obo. 626/398-7090. EDITING/DUPLICATING EQUIPMENT (audio and

video), cables and mikes; box of misc. items, \$20; AUDIOTAPE, blank, \$2 each. 789-1995, Ken. END TABLE and coffee table, Lane, solid walnut, vg

cond. \$150 for both, 249-4603. ENLARGER, Durst RS35; print washer, trays, easel, timer, darkroom light, etc.; \$30 for all. 541-

EXERCISE EQUIPMENT, Tunturi stepper, hardly used, \$75, 626/797-7793. FUTON, qn. size, convertible, gd. cond.; \$75, 541-

GAME SYSTEM, Virtual Boy, 32 bit RISC Proc. dig. stereo sound, high res. 3D graph w/double grip contr., digital stereo spkrs, w/AC adapter & 2 games (baseball, tennis); S40, 626/445-3510, Christopher. GOLF CLUBS, tull set (3-9, PW irons, 1,3,5 metal voods), gd. cond., \$125/obo. 626/798-9395

American-made Stratocaster, black w/maple neck; comes w/Carvin gig bag & luzz pedal; \$250. 626/446-0568, Steve. HAM RADIO TOWER, HAM 40 toot tubular tele scoping tower (US MA40), hinged base, co-ax arms, mast extension, Hy-Gain Explorer-14 beam antenna with 40M dipole add-on, and Hy-Gain antenna rotator (HAM IV); all for \$600. 626/914-

MOVING SALE: 2 drawing tables, 1 - 6' x 3 steel adjust. - \$150 (new \$500), and 1 - 4' x 2.5', \$50 drafting stool, \$75 (new \$200); 2 drafting lights, (new \$120 ea.); Canon copier, \$175 (new \$450); all in exc. shape and working cond.; also YORX compact AM/FM stereo w/T.T. & speakers, \$30; and 2 birch bunk beds w/matt., \$100, 626/398-4455,

MOVING SALE: refrigerator, \$100; bunk beds w/mattress, \$85; mini-trampoline, \$7; speakers, \$7/ea.; cross-country ski machine, \$50/obo; comforters, \$7/ea.; wedding dress, petite size 5, w/hanging storage case, \$75; alarm clock radios, \$4/ea.; dining chair cushions, \$15/all 6; cameras. \$15/ea. 626/585-1374, after 5 p.m.

REFRIGERATOR, GE, gd. cond., \$150/obo. REFRIGERATOR, Kenmore side-by-side, 22 cu.

in., gd. cond., \$100. 768-4436. ROLLTOP DESK, never used, approx. 24" deep x

54" wide, \$250/obo. 310/659-6424. SATELLITE DISH and receiver, Sony model sat-b2; incl. remote and smart card; single Inb; works great; subscription to DirecTV required; \$175/obo. 249-

SKYLIGHT, 2 x 4 ft, frosted double pane dome: used less than 2 yrs.: \$35. 352-6778, Dave.
SLEEP SOFA, off-white, full size, gd. cond., bed. rarely used, \$125, 626/793-8783

SOFA, 8 ft., slightly curved, quilted, off-white w/sub-

tle floral design: vg cond.: \$150, 626/797-3156. STOVE, gas, gd. cond., green, \$50, 241-0710. TOY, Ty Princess Beanie Baby, \$100, 626/332.

2979, Bertie, after 7 p.m.
TRAMPOLINE, 'Rebound' Professional, 40 in. dia. rarely used, \$49, 626/793-8783. 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, after 6 p.m. TYPEWRITER, reconditioned IBM Selectric II:

\$75/obo. 626/797-8082. VACUUM, Royal upright w/attachs., gd. working cond., \$49. 626/793-8783. WASHER/DRYER (gas), '94 Whirlpool, large cap, matching, white, exc. cond., \$350 for both. 626/449-0102.

WATERBED, king sz., exc. cond., \$350; DRYER, gas, Maytag, gd. cond., \$60. 790-2915.
WATERBED, qn., 12 drawers; new 30-yr. waveless mattress and heater; mirror hdbrd. w/shelves; per-

fect pecan wood; \$1,000, 249-6615. AUTOS / BOATS / RVs

'87 ACURA Integra LS, all white, blue interior, 4 dr., auto, 1 owner, vg cond., a/c, easy to drive, 75K mi., \$6,000/obo, 790-2570.

'80 AUDI 5000S sedan, maroon, garaged, \$1,500 firm. 626/793-9346.

96 BMW 325ES, 2 dr., gd. cond., orig. owner, com-plete service records; \$7,000. 310/318-6372. 77 CADILLAC Brougham, classic luxury edition, perf. cond., 50K orig. mi., deep brown exterior w/beige leather interior; \$5,000, 626/794-5196. '85 CHEVROLET Cavalier type-10, 2 dr., light blue,

99K mi., runs well; \$1,000. 626/287-6148, San

81 CHEVROLET Caprice wagon, recently repainted and overhauled; vg cond.; best offer, 626/796-4677, after 7 p.m. '70 CHEVROLET EI Camino, 350, 82,400 mi

orange wiblack roof, big tires, exc. cond., 10½ to 1 compression, \$6,200. 626/914-6083.

189 DOOGE Caravan SE, 4 cyl., turbo, auto, white/blue int., c.c., air, tint, AM/FM cass., dealer maint.; new: tires, brakes, smog. reg.; all records; bought new Caravan, must self; \$2,900. 240-2104. 78 DODGE B300 stretched van camper; toilet & shower, propane furnace, water heater and more; \$2,400. 790-2013.

'89 FORD Taurus LX, 3.8 L V6, fully loaded, full power, recent paint, tires & brakes, orig. owner, vg cond., no accidents, \$3,800. 626/355-3886, Ed/Rosemary

'87 FORD Taurus wagon, runs well, \$1,500/obo 249-8271, Diana.

243-6271, Diana. '91 GEO Storm, 60K mi., recent tune-up, Alpine CD/stereo, 5 spd., a/c, sporty, drives well; \$3,900/obo, 626/303-3880. '68 GMC Suburban, 307 ci V8, 3 spd. manual with

O/D; 3 dr., front bucket seats plus 2nd and 3rd seats; 1 owner, all orig.; all records; mechanically sound, needs some cosmetic restoration; \$5,000. 626/358-6685, Mark. '91 HONDA Civic, red, 3 dr. hatchback, 4 spd.,

records, 86K mi., vg cond., extremely reliable, clean HONDA Accord, 115K mi., auto, a/c,

AM/FM/cass., cruise, orig, owner; recent: trans., compressor, water pump, CV boots; exc. cond.; s4,900/obo. 909/592-2279.
77 HONDAMATIC hatchback, green, major tune-

up, will need a valve-grind job; sell all or part-out; \$500, 249-6071. 86 HYUNDAI, 109K mi., running cond., \$550/obo.

'84 MERCURY Cougar, It. blue, V6, 3.8 engine, full pwr., recent tune-up, smogged on 3/7/98; new fr. disk brakes, head, liner; auto. trans., \$1,400. 249-

'96 NISSAN Pathfinder SE, 4x4, 5 spd., 4 dr., a/c,

CD, moonroof, extras, vg cond., 27K mi., \$26,000. 310/315-1075. '89 NISSAN 240SX, 2 dr. SE Fastback, auto, a/c, sunroof, AM/FM, 83K mi., \$4,950/obo. 909/860-

'85 NISSAN 200SX, white; new: paint, battery, and alternator; \$2,100/obo. 714/487-7307, Alex or 714/325-6007, Lily. '94 SANTANA 23' sailboat, Yamaha outboard

motor, Zieman trailer, repo credit union; see c.u. for bid forms; \$8,000/obo. 952-4444 x220. '95 TOYOTA Camry LE, 31K mi., auto, pwr. windows & locks, cruise, CD changer, \$13,950, 952-

'87 TOYOTA Supra, 5 spd., turbo, targa top, exc. cond., \$5,500/obo. 626/794-6142.

'86 TOYOTA Celica GT, auto., 4 cyl., blk., 1 owner, crulse, air, OD, exc. cond., 47K mi., \$4,000/obo. 82 TOYOTA pickup, short bed w/camper shell, tan, 5 spd., AM/FM/cass., clean, runs well, orig. owner,

\$1,700. 626/794-3358 VOLVO wagon, needs major repairs; body & tires in gd. cond.; great, safe, easily maneuverable

'82 VW Westfalia, auto, exc. cond., 5K on new engine, \$5,000, 957-2091.

car; make offer, 957-5774.

WANTED

CARPOOLER in Arcadia. Ext. 4-1024, Shary, CARPOOLERS from Diamond Bar (fwy. 57 and Pathfinder park and ride) to Foothill Facility (Bldg. 502/507/511). 626/584-4435, Mike or 626/584-4429, Sunil

HOUSEKEEPER (or service) recommendations 626/284-9424.
SPACE INFORMATION & memorabilia from U.S. &

other countries from past & present. 790-8523, Marc. TUBE TUNNEL, collapsible, for kids. 242-8914.

FREE

DOG HOUSE, older, 30" x 36"; you haul, 790-3299.

FOR RENT

ALTADENA, 1 bd. back house, Florecita area, short walk to JPL, fenced yd., pets OK w/dep., Indry., kitch., clean & quiet, \$425 + part utils. 626/794-

ALTADENA, partially turn, room in 3-bd, house, 3 mi./JPL, share kitchen, laundry, fireplace, hdwd. floors, quiet neighborhood, \$380 + 1/3 utils. 626/798-4492

AZUSA, 2 bd., 2 ba. house, hdwd. ilrs., detached garage, fenced front and bkyd., laundry rm., \$870. 626/812-0872, Debbie.

LA CRESCENTA, furn. room, kitchen, laundry privileges, garage; 2915 Montrose Ave. #426; utils, incl., \$375, 957-7911.

LA CRESCENTA, room w/priv. bath in spacious home, limited kitchen & Indry. privileges; long term (or summer employee, min. 3 mo.) OK; non-smok-

(or summer employee, min. 3 mo.) Or, non-smox-er; \$365 + utils. 957-5774. N. ALHAMBRA, Ig. 1 bd, duplex in gd. residential area; 700 sq. th, clean, Modd. floor, 1-car garage; stove, window a/c, refrig., washer; water, trash and gardener provided; \$600. 683-9935, eves. PASADENA, 3 bd., 21/2 ba. apt., blt.-in range/ovan.

central a /c, carpets, drapes, cvrd. prkg., Indry., disposal; \$990. 790-7062. PASADENA, room in 4 bd., 2 ba. house nr. Orange

Grove/Allen; share w/Caltech grad students; huge kitchen, storage, off-street parking, 626/440-9953,

SAN GABRIEL, housemate needed to share 3 bd., 2 ba. house; 23 min./JPL; \$500. 626/281-2179, Mike.

Mike.

SE PASADENA, 1 bd. guest house; incl. refrig., stove, a/c, and utils:; \$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; option to purchase; \$895. 626/564-9607, Diana deNoyelles; e-mail: dde

SOUTH PASADENA, amazing 2 bd., 2.5 ba., split level townhouse with cath. ceilings; best area, nr. 110 fwy.; - 1,600 sq. ft., LR w/fpl./Fr. doors/patio, formal DR w/wet bar, lq. kitch, w/all appliances, den w/built-in office; 2 master suites w/vlt. ceilings, skylts., walk-in closets, very lg. ba. and wd. shutters everywhere; 2-car att. gar. w/opener, washer/dryer, pool, hot tub, sauna; \$1,700. 626/799-3020, Stella Meng or 626/218-2729.

SOUTH PASADENA, furn. apt., good area on 1718 Huntington Dr., near Marengo; elec. heat/air cond., parking and Indry. facil.; non-smoker; \$565, incl. utils. 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. TUJUNGA, comfortable family home, 3 bd./1 ba.,

dining rm., f/p, Indry., upgraded kitchen, fenced yd., 7141 Summitrose St.; \$1,000, 352-7471, TUJUNGA, duplex upper apt., splendid view, new

crpt., fresh paint, stove, refrig., 2 bd., 1 ba., 2 paties; no dogs (no yd.); 20 min./JPL; \$650. 352-5608.

REAL ESTATE

ALTADENA / N. Lake area condo, 2 bd., 1 3/4 ba., w/fireplace and upgraded kitchen, custom closets and patio; community pool, parking, and storage built in 1981; very close to JPL; \$139,999. 626/398

BIG BEAR, new cabin 2 blks. from lake, 2 bd., 2 ba, mud/laundry rm., \$129,000. 909/585-9026. CRESTLINE, 3 bd., 1 1/2 ba., great lake view home, A-frame, loft, vinyl siding, newer roof, great fishing (Lake Gregory); pics. avail.; \$89,900. 909/739-0786

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; PALMDALE area (8 mi. south), 2.2 acres view prop-erty, has water & utils., legal parcel, 330 ft. of frontage, \$30,000, 246-3331.

cabin \$149,000, adi. lot \$19,900, 303-1927.

PASADENA, 3-level townhouse, Altadena Dr. and Orange Grove, across Victory Park; 3 bd., 2.25 ba., fireplace, balcony, pool, spa and sauna, 1,300 sq. ft; sharp and close to JPL; no agents; \$166,000. 626/398-5303.

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. TUJUNGA, comfortable family home, 3 bd./1 ba., dining rm., f/p, Indry., upgraded kitchen, fenced yd., 7141 Summitrose St.; will consider lease/option, \$149,900. 352-7471.

VACATION RENTALS

BIG BEAR cabin, quiet area nr. village; 2 bd., slps. 8, compl. lurn., f/p, TV/VCR; \$75/night. 249-8515. BIG BEAR LAKEFRONT luxury townhome, indoor pool/spa, near skiing, stone f/p, slps. 6. 714/786-

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

4; \$125/night for 2, \$175/night for 4, 248-8853. KONA, HAWAII (Big island) condo, 1 bd., 1 ba., slps. 4; 50 yds./ocean; all amen., private beach; lots of activities and good restaurants nearby; avail. July 10-17; \$75/night or \$450 full week. 790-

LAGUNA BEACH, luxury resort apt., slps. 4; steps to beach, walk to town; htd. pool & spa; avail. May 15-22/98; \$89/night, \$534/7 nights. 626/797-3156.

LAKE TAHOE, N. Shore; great location; 2 bd. condo, 2 1/2 ba., fully furn.; private beach, pool, sauna; 3-day min. through mid-June; weekly summer rates mid-June through Labor Day; JPL disc. rates. 626/355-3886, Rosemary or MAMMOTH at Snowcreek, 2 bd., 2 ba. + loft, slps.

MAMMOTH at showcreek, 2 bd., 2 ba. + loft, sips. 6-8, fully equipped kitchen incl. microwave, d/w, cable TV, VCR, phone, balcony w/view to mtns., Jacuzzī, 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, FM stereo; o/d Jacuzzis, sauna, game, rec. & Indry, rms.; conv. to shops, lifts;

spec, midweek rates, summer rates begin May. 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, slps. 5; shuttle stop nr. condo; downtown; \$50 Sun.-Thurs., \$65 Fri. & Sat. 353-

MAMMOTH condo, studio + loft, 2 ba., fireplace w/wood supplied, Jacuzzi, sauna, game rm., color amen.; great snow. 714/870-1872.

MAMMOTH ski cabin in Knolls, 4 bd., slps, 10, f/p, deck. 626/445-7443 or 310/375-8421. 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*1 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 discrit, 441-3265. PALM SPRINGS, 1 bd. condo, compl. furn.; pool,

spa, tennis, cable TV/VCR, carpets, paint, cooking utensils new; rent daily, weekly, wknds.; avail. Easter week. 626/445-0884.

PINE MOUNTAIN, 2 bd., 1½ ba., \$60/night wknds., \$500/mo. 310/831-4234, Peter.
ROSARITO BEACH condo, 2 bd., 2 ba., pool, ten-

nis ct., 18-hole golf course w/in 5 ml., ocean view, short walk to beach, priv. prkg. 626/794-3906. SAN FRANCISCO, Nob Hill honeymoon suite; maid concierge; \$105/night. 626/797-3156. SOUTH LAKE TAHOE KEYS waterfront home, 4 bd./3 ba., slps. 12+; f/p on 2 levels, decks overlook-

ing 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 ski-ing, 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

April 3, 1998

following issue.

Jet Propulsion Laboratory

Pasadena, California Vol. 28, No. 8 April 17, 1998

Face it: This is Cydonia

Mars Global Surveyor imaged the Viking 1 and 2 landing sites, the Mars Pathfinder landing site and the so-called "Face on Mars" during two recent passes over those areas of the red planet.

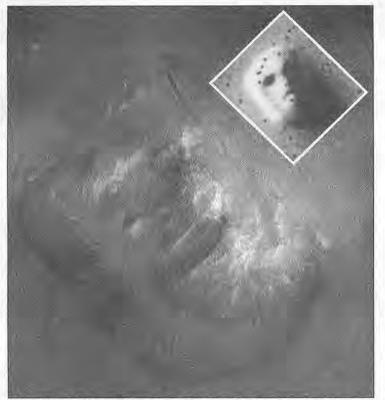
The spacecraft's high-resolution camera captured the "Face," as well as an adjacent set of features known by some as "The City," during imaging passes April 5 and 14 with resolutions 10 and 20 times better than the best images taken by the Viking mission in the 1970s. The images are posted on JPL's Mars news site at http://www.jpl.nasa.gov/marsnews, on the Mars Global Surveyor project home page at http://mars.jpl.nasa.gov, and on NASA's Planetary Photojournal site at http://photojournal.jpl.nasa.gov.

The spacecraft also successfully imaged the site of the Viking I lander in Chryse Planitia on April 12, after missing that target by a small margin on its first try April 3. Global Surveyor targeted the location of the Viking 2 lander in Utopia Planitia on April 3 and 13, but during both attempts the site was completely clouded over, with surface visibility reduced by about 70 to 80 percent.

Continuing inaccuracies in navigation data used to target the Mars Pathfinder landing site resulted in Global Surveyor missing that site on both attempts April 4 and 13, the second time by about 40 pixels. The flight team plans to update the navigation data before making a third and final attempt to capture the site next week.

Inaccuracies in the navigation data used to target selected sites and spacecraft performance gave the flight team a 30 to 50 percent chance of capturing each target during any given pass.

The last set of opportunities to image these four regions of Mars will occur Tuesday through Thursday, April 21–23. Meanwhile, all spacecraft operations continue to go well as Global Surveyor carries out a five-month period of data-gathering before aerobraking resumes.



The high-resolution image of the "Face on Mars" feature in the Cydonia region above—as imaged by Mars Global Surveyor on April 5—contrasts with the same area as imaged by the Viking 1 orbiter in 1976 (inset).

Decommissioned DSN antenna becomes students' key to the stars

By MARK WHALEN

Thanks to NASA and JPL's commitment to education, an old space communications and tracking antenna has been converted into a radio telescope for the use of students and teachers around the nation.

The telescope at the Deep Space Network's Goldstone complex is remotely controlled from the newly expanded Science and Technology Center in the high desert. The center is a branch of the Lewis Center for Educational Research that was dedicated April 3 in Apple Valley in San Bernardino County.

"The key to the 21st century is education,"

NASA Administrator Daniel Goldin told a gathering of students, teachers, supporters and guests at the dedication ceremony. "(It will take) a commitment by the adults to the children; not just to talk about education, but to really make it happen."

JPL's plans to dismantle a decommissioned 34-meter antenna at Goldstone in 1995 changed when the Apple Valley Unified School District and the Science and Technology Center contacted NASA to request the use of the antenna for radio astronomy. A feasibility study by the DSN Science Office soon followed, and JPL began to implement a plan to convert the telecommunications antenna to a remotely controlled radio telescope. The Goldstone Apple Valley Radio

Telescope (GAVRT) project became a reality when the Science and Technology Center took control of the antenna in the spring of 1997.

The recent dedication marked new classroom and office expansions to the facility, as well as the renaming of the center as the Lewis Center for Educational Research, in honor of U.S. Rep. Jerry Lewis, who was noted as a key supporter to the project's success.

In addition to Goldin and Congressman Lewis, those attending the dedication included JPL Director Dr. Edward Stone; Gayle Wilson, wife of California Gov. Pete Wilson; former astronaut Dick Covey; and Gael Squibb, JPL's director of Telecommunications and Mission Operations.

Dignitaries were given a tour of the center's mission control area, where students in Michigan and Kentucky joined those in Apple Valley to operate the giant radio telescope from their classrooms via the Internet.

JPL is collaborating with the center to develop fundamental science and technology curricula to support the middle school and high school students who use the radio telescope. The first of these curriculum elements is called "Jupiter Quest," where participants are measuring the planet's temperature, analyzing its atmosphere, and monitoring changes in the high-energy radiation belts around Jupiter.

"I think it's very appropriate that one of the objects being studied by the students is Jupiter," Stone noted, "because this very antenna, during its first 30 years, was a principal point of contact with missions such as Pioneer 10, Pioneer 11, and Voyager 1 and 2—which flew by Jupiter beginning in 1973—and then tracked Voyager well past Neptune in 1989."

Dr. Michael Klein, manager of the DSN Science Office, attributed the success of the program to the fact that students have the opportunity to do real astronomy experiments.

"They compare their measurements with those we do routinely at Goldstone," Klein said. "They're now making measurements nobody else is making and we're merging those into our See Apple Valley, page 3 EOS launch delayed until end of year

AM-1 spacecraft scheduled for June liftoff has Lab's ASTER and MISR onboard

NASA has found software performance problems with ground system software required to control, monitor and schedule science activities on the Earth Observing System (EOS) series of spacecraft.

Officials believe these problems will delay the software, which will impact the launch date for the Earth Observing Spacecraft AM-1. The launch, originally planned for late June from Vandenberg Air Force Base, will be delayed at least until the end of the year.

JPL's contributions to EOS AM-1 are the Advanced Spaceborne Thermal Emission Reflectance Radiometer (ASTER) and Multi-Angle Imaging Spectroradiometer (MISR).

ASTER, a cooperative effort between NASA and Japan's Ministry of International Trade and Industry, has 14 channels in the visible, near infrared, shortwave infrared and thermal infrared, and will allow scientists to study volcanoes, geology, topography, clouds, ice and land changes at spatial resolution of 15 to 90 meters.

MISR comprises nine cameras that observe the Earth at nine different angles, both fore and aft of the spacecraft. Each camera operates at four different wavelengths (red, green, blue and infrared) for a total of 36 different images. The multi-angled images are designed to analyze airborne dust and haze, clouds and the surface.

The ground control software, called the "Flight Operations Segment" (FOS) software, is part of the Earth Observing System Data and Information System (EOSDIS), the ground system responsible for spacecraft control, data acquisition, and science information processing and distribution for NASA's Earth Science enterprise, including the EOS flight missions.

The problem is with the control center system FOS software that supports the command and control of spacecraft and instruments, the monitoring of spacecraft and instrument health and safety, the planning and scheduling of instrument operations, and the analysis of spacecraft trends and anomalies.

Program managers expect it to take several weeks to clearly understand whether correcting the current software or taking other measures is the best approach.

"We're concurrently looking at commercial off-the-shelf technology that was not available when this software system initially was designed," said Arthur "Rick" Obenschain, project manager for EOSDIS at NASA's Goddard Space Flight Center, Greenbelt, Md.

Previous versions of the software successfully demonstrated real-time commanding functions with the AM-1 spacecraft. In the new version, however, a number of problems identified in the previous software deliveries were not corrected as expected, and significant problems were found in the new capabilities. Problems include unacceptable response time in developing spacecraft schedules, poor performance in analyzing spacecraft status and trends from telemetry data, and improper implementation of decision rules in the control language used by the flight team to automate operations.

Government/contractor teams have been formed to evaluate options for correcting these problems to minimize impact on the AM-1 launch. A recovery plan is being developed and will be reviewed during the last week of April. □

Galileo discovers new dust ring around Jupiter

Scientists have found evidence for a new ring of dust that occupies a backward orbit around Jupiter, based on computer simulations and data from JPL's Galileo spacecraft, it was reported in the journal Science this month.

A team led by researchers at the University of Colorado at Boulder reported that a faint, doughnut-shaped ring of interplanetary and interstellar dust some 1,126,000 kilometers in diameter (about 700,000 miles) appears to be orbiting the giant planet. Evidence for the new ring's existence comes from computer simulations that correlate with data collected by a dust

See Galileo, page 4



JPL Director Dr. Edward Stone addresses the audience at the April 3 dedication of the Lewis Center for Educational Research in Apple Valley. Jerry Lewis, the congressman for whom the facility was named and who represents the high desert area, sits at right. At left is Rick Piercy, Apple Valley Science and Technology Center chief operations officer.

News Briefs

NASA astronaut and former Galileo engineer **Stephanie Wilson** will appear at JPL's Employee Family Day on May 16.

Wilson, who was selected as an astronaut candidate two years ago, will give hourly presentations in von Karmán Auditorium on NASA's Space Flight Awareness program.

Tickets are required for Family Day and are available through April 24 at the ERC (Building 114-104), Public Services Office (186-113), Emergency Preparedness Office (180-102), Observational Systems Division (306-416), Compensation and Benefits (291-214), Systems Division (301-230K), Credit Union (218) and Environmental Laboratory (144-121).

Tickets will also be available outside each cafeteria on April 17 and 24 from 11:30 a.m. to 1:30 p.m. □

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

Section 190: Susan Henry. Section 194: Mark Banuelos. Section 195: Paul Gowler.

Section 346: Lloyd Doug Bell II, Greg Cardell, Debra Cuda, Edward Fortier III, Winn Hong, James Lamb, Korla Mcfall, Linda Miller, Richard Muller, Barbara Nakamura, Daniel Pinion, Thomas Van Zandt, Roger Williams, James Wishard.

Section 354: Yoseph Bar-Cohen, Patricia Hayes-Rowe, Dean Johnson, Jack Jones, Anthony Lai, Christian Lindensmith.

Section 391: Robin O'Brien, Linsey Ray. □

JPL personnel are reminded that all computers capable of being used for external communications must be bannered for security purposes. Unix, Novell and Windows NT computers in particular must be bannered by the end of April 1998.

Computer security measures were outlined in a March 3 memo sent to employees by Deputy Director Larry Dumas (available online at http://icis.jpl.nasa.gov/iis/overview/dumas_memo.htm). Instructions for installing the banner on all computer platforms are available online at http://security.jpl.nasa.gov/banner.html. \square

JPL personnel are invited to submit their best landscape and nature photographs for possible inclusion in a revised version of the "Welcome to Outer Space" multimedia production.

Those interested may submit color 8- by 10-inch photos or color slides to **Sherri-Rowe Lopez** at von Kármán Auditorium (mail stop 186-AUD).

A tribute to a colleague



PHOTO BY BOB BROWN / JPL PHOTO LAB

About 100 friends, coworkers and family members of the late JPL mechanical engineer Jordan Kaplan gathered earlier this month to dedicate a memorial bench in his honor. Kaplan died in March 1997 as a result of injuries suffered in the crash of an airplane he was piloting. Kaplan's father Henry, right, stands aside the new bench in the courtyard area of Building 301 as he addresses the group. From left are Kaplan's sister Deborah; his mother, Phyllis; sister Cynthia; and brother Josh. Next to Henry Kaplan is Jancis Martin of Section 311, who often performed music with Jordan in the same courtyard as a member of the Patio Players. Members of that group performed for the gathering during the memorial dedication.

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.

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, April 17

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

Flamenco Dancing—La Tania will appear at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$26, \$23 and \$20. For information, call (626) 395-4652.

Von Kármán Lecture Series—Division 32 outreach specialist Marguerite Syvertson will discuss the Earth Observing System (EOS), which will provide land, ocean and atmospheric data that will allow scientists to study and eventually model changes in the Earth's environment and climate. At 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Saturday, April 18

Lula Washington Dance Theatre—African American heritage will be explored in the troupe's Muddy Waters, a blend of African, jazz and modern dance. Reserved seats are \$20. For information, call (626) 395-4652.

Sunday, April 19

Chamber Music-Quartet Sine Nomine will

appear at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$25, \$21, \$17 and \$13. For information, call (626) 395-4652.

"Jazz and Jokes"—The Caltech Jazz Bands will appear at the Ice House, 24 N. Mentor Ave, Pasadena, with two shows, starting at 7:30 p.m. Admission is \$8, with a two-drink minimum. The best joke of each set from either audience or band members will win a \$25 gift certificate to a local CD store. Call the Ice House at (626) 577-1894.

Tuesday, April 21

Eudora Quick Start Session for Technical Users—This overview is for cc:Mail PC users who have not yet begun to use Eudora Pro. At noon in the Building 167 conference room. For other Eudora classes, see the ICIS home page at http://icis.jpl. nasa.gov.

National Library Week—Activities at the JPL Library will take place 11 a.m. to 1 p.m. and will include demonstrations of catalog, online and business-resource requests on Bibliographic and Electronic Access Connection (BEACON) World Wide Web resources (http://beacon), as well as tours of the recently renovated facility. For more information, contact the Library at ext. 4-4200 or e-mail Library@jpl.nasa.gov

Wednesday, April 22

Award for Excellence Ceremony—To be held at 2 p.m. in von Kármán Auditorium. Seating will be limited, but the ceremony will also be aired live on JPL television monitors. For more information about the award and a list of recipients, visit the Reward and Recognition home page at http://eis/sec614/reward/rr.htm.

Caltech/JPL Flying Club—Member Garrett Reisman will speak on his experiences interviewing to be a NASA astronaut. The club provides airplanes for rent, insurance and club-approved instructors. Prospective members or simply the curious are welcome. A general membership meeting will be held at 7:30 p.m on the Caltech campus in 269 Lauritsen. Included will be the club's election of its board of directors. For information, call Peter Gluck at ext. 4-9425

"Increasing Your Value as an Office Professional"—This live satellite event, sponsored by the Director's Advisory Council for Women, will cover the American Management Association's 11th annual Conference for Secretaries. Topics will include practical ideas and detailed advice on developing communication skills; managing time, work and self; handling demands of multiple managers; and effectively using technology. From 10 a.m. to noon in

Building 180-101.

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

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.

National Library Week—The JPL Library will dedicate its re-opening with a ribbon-cutting ceremony at 11:30 a.m., followed by speakers Willis Chapman, Division 64 manager; Deputy Director Larry Dumas; Business Operations Director Daryal Gant; and Library, Archives and Records Section Manager Linda Kosmin. Refreshments will follow.

Thursday, April 23

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

The Future of UNIX at JPL—Dr. Steve Jenkins, deputy manager of the Enterprise Information System, Section 175, will speak at noon in von Kármán Auditorium.

National Library Week—Activities at the JPL Library will take place 11 a.m. to 1 p.m. and will include demonstrations of catalog and online requests on Bibliographic and Electronic Access Connection (BEACON) World Wide Web resources (http://beacon); Cambridge scientific abstracts; and electronic journals, as well as tours of the recently renovated facility. For more information, contact the Library at ext. 4-4200 or e-mail Library@jpl.nasa.gov

Social Security—Agency representative Ann Valleroy will be on hand from 9 to 11 a.m. in the Building 167 cafeteria. Employees may make an appointment to file a Social Security claim; request a personal earnings and benefit estimate statement, information on Social Security benefits, a change of name or replacement of their Social Security card, or ask general questions.

Friday, April 24

JPL Dance Club—Meeting at noon in Building

Fri., Apr. 24-Sat., Apr. 25

Capitol Steps—Current and former congressional staffers perform song parodies spoofing politicians and other newsmakers at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$32, \$29 and \$26. For informa-

tion, call (626) 395-4652.

Sunday, April 26

Chamber Music—Winners of the Coleman Chamber Ensemble competition will perform at 3:30 p.m. in Caltech's Ramo Auditorium. Tickets are \$10. For information, call (626) 395-4652.

Tuesday, April 28

Develop New Products Seminar—Ted Kopf of Section 344 will deliver a talk titled "Building Electronic Design Models: The Process and The Tools" at noon in Building 180-101.

Eudora Quick Start Session for Business Users—This overview is for cc:Mail PC users who have not yet begun to use Eudora Pro. At noon in the Building 167 conference room. For other Eudora classes, see the ICIS home page at http://icis.jpl. nasa.gov.

Wednesday, April 29

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

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

Thursday, April 30

Fidelity Workshops—Investment Basics 1, which will focus on first-time investors and a refresher of investment choices, will be offered at 10 a.m. in Building 180-101. Those attending Investment Basics II, Mapping Out a Plan for Your Retirement will learn about the importance of saving early, and calculating how much to save each year. At 2 p.m. in Building 180-101.

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

Friday, May 1

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

Saturday, May 2

Big Band Music—The Big Band Alumni Orchestra will perform at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$32, \$29 and \$26. For information, call (626) 395-4652.

Engineering, art come together in DS2 'spider'

By SUZANNE D'MELLO New Millennium Program outreach coordinator

In January 1999, Deep Space 2's twin probes will take off for Mars riding piggyback aboard the Mars Polar Lander spacecraft. The experimental mission is designed to test a number of advanced, miniature instruments and systems inside the probes to see if they can perform experiments beneath Martian soil after surviving crushing impacts on landing and extremely cold temperatures.

On their journey to the red planet, each probe will be housed in a protective shell that will be attached to the larger spacecraft with a device called a "spider." which is part of an overall attachment structure. The spider is so-called because its curved, three-legged frame resembles the body of that arthropod.

What is striking about this seemingly fragile piece of aluminum is that it's not only functional hardware—needing to withstand the extreme conditions of launch and travel into deep space—but with its spare, elegant, Art Deco-like form, is industrial design at its most beautiful.

Satish Krishnan, 23, who designed the spider, was just a few months out of college when assigned the task by DS2's mechanics lead engineer, Tom Rivellini, in late 1996. Rivellini provided Krishnan with an initial concept, which required that the egg-shaped shell be held on to at three, equidistant points.

With a preliminary design of a three-pronged structure in hand, Krishnan worked closely with Rivellini, structural analysts Darshan Sutharshana and Faz Keyvenfar, manufacturing engineer Bob Moncada, machinist Nelson Leiva, and DS2's graphics designer, Frank Ramirez, during the year it took to complete the part. "This had to be a collaboration from the very start," Krishnan pointed out. "The very nature of this part required it."

Heavily constrained by issues of cost and manufacturability while working concurrently in JPL's "faster, better, cheaper" era, he adapted his design several times on the advice of the others. The single most important question that Krishnan faced in creating the spider was whether to make it one part or three. "We knew that making the



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The life cycle of the Deep Space 2 'spider' is shown above. Starting out as a 250-kilogram bar of aluminum, after several stages of development it was eventually shaped into its final shape at lower right. Spider designer Satish Krishnan, below, joins the Deep Space 2 microprobes with the spider onboard the Mars Polar Lander at Lockheed Martin Astronautics in Denver.



spider a single part would be very difficult," he said, "but assembly of three parts would have been a night-mare because of the tolerance mismatches we'd have to contend with—tolerance is the degree of precision required in a dimension. So we decided to bit e the bullet and make it a single part."

"This is the toughest part I've ever worked on," admitted Moncada, who added, "The part wouldn't have been as rigid or strong if it had been three pieces, and this was the cleanest, easiest way to mount the shell inside the spider."

Making the spider a single part was not that much easier a task, either. The finished spider, which weighs a mere 590 grams (1.3 pounds), had to be crafted out of a giant, 250-kilogram (550-pound) billet of aluminum.

Why such a large chunk? Detailed drawings hadn't yet been created when Krishnan decided to make the device a single part instead of three. Ordering a large billet of metal ensured that engineers would have plenty of material to work with once

Krishnan figured out the outer dimensions of the spider.

Leiva machined the spider into its final shape using the process of "undercutting" to hollow out the legs of the spider. Undercutting, a process invented by JPL engineer Don Bickler for the Mars Pathfinder mission, is an innovative way of hollowing out a piece of metal without having to cut it in two. Bickler used the process for the Sojourner rover's "rocker bogie" suspension system, which allowed the rover to negotiate the Martian terrain with its system of joints that rotated and conformed to the contour of the ground.

To drill holes in the precise locations that Krishnan had pinpointed in the legs of the spider, Leiva used a series of fine tools, knowing that if he was off by even an infinitesimal amount the part wouldn't be functional. At one point he even had to contend with having the material move while he tried to machine it. After consulting with materials engineers the problem was solved, and Leiva completed the spider in October 1997.

The device has since successfully passed all its tests and Krishnan is very pleased with its design. "I think when you look at this part, what makes it interesting is the method we used to hollow it out," he said. "I don't think it would have actually looked as neat if we had used an alternative method."

Though Krishnan may be indebted to Bickler for the aesthetics of his design, he also has Leiva's extraordinary craftsmanship to thank for producing an industrial device that is a perfect blend of functionality and beauty.

Science team chosen for DS2 microprobe mission

Nine researchers have been selected to be the science team for the Mars Microprobes, also known as Deep Space 2 (DS2), a technology validation mission that will hitchhike to the red planet aboard JPL's 1998 Mars Polar Lander.

Two identical probes will be carried as a secondary payload on the lander, due for launch in January 1999. Following an 11-month cruise, the microprobes will separate from the lander before it enters the Martian atmosphere, and then hit the ground at approximately 645 kilometers per hour (400 mph).

During the impact, each microprobe will separate into two sections: the forebody and its instruments will penetrate up to six feet (two meters) below the surface, while the aftbody will remain near the surface to communicate with a radio relay on the Mars Global Surveyor orbiter while making meteorological measurements.

The nine selected scientists are David Catling, NASA Ames Research Center, Moffett Field, Calif.; Ralph Lorenz, University of Arizona; Julio Magalhaes, NASA Ames; Jeffrey Moersch, NASA Ames; Paul Morgan, Northern Arizona University, Flagstaff; James Murphy, NASA Ames; Bruce Murray, Caltech; Marsha Presley, Arizona State University; and Aaron Zent, NASA Ames.

The scientific objectives of the Mars Microprobes include searching for the presence of water ice in the soil and characterizing its thermal and physical properties. A small drill will bring a soil sample inside the probe, heat it, and look for the presence of water vapor using a tunable diode laser. An impact accelerometer will measure the rate at which the probes come to rest, giving an indication of the hardness of the soil and any layers present. Temperature sensors will estimate how well the Martian soil conducts heat, a property sensitive to different soil properties such as grain size and water content. A sensor at the sur-

See DS2, page 4

Redlands High

and Nillie

School students

Whitney Price, left,

Alemozaffar demonstrate mission con-

quests at the dedica-

trol operations to

tion of the Lewis

Center for Educa-

tional Research.

Standing, from left,

wife of California

are NASA Administrator Daniel

Gov. Pete Wilson;

Rep. Jerry Lewis;

and JPL Telecom-

munications and

Mission Operations

Director Gael Squibb.

Apple Valley

Continued from page 1

database. Together, we're watching how Jupiter changes over weeks, months and years, and a new program is designed to search for day-to-day changes."

Eventually, the students' results will be published in scientific journals.

Klein said development of a variety of curriculum elements is planned. The next project will map the sun and compare the radio maps with optical and ultraviolet observatory measurements.

The science center and its curriculum are about far more than astronomy, however.

"The mission to Jupiter idea really opens the door to students' curiosity," Klein noted. "Soon they start talking about scenarios: 'Well, if you're going to send a ship with people in it, you'll have to send food—maybe you'll have hydroponic gardening.' Then they get into issues like radiation protection.

"These young people come up with practical questions that—in their minds—need to get answered. It isn't just an astronomy course. It really does broaden out subject matter to include biology, math, physics and chemistry. They also discover that to do science, you have to write. It isn't just math and numbers; you have to learn how to communicate with others."

Another part of the students' real-world experience involving communication includes learning about proposal writing. In a pilot program last fall, a high school served as a project's "prime contractor," teaming with two middle schools who were "subcontractors." The middle school students came up with problem-solving

ideas that were "peer-reviewed" by the high schoolers.

"If this were just a radio astronomy experiment, it would be rather limiting," Klein said. "The kids get excited as they watch the data come in, take things off the screen and enter them on a spreadsheet; the next day they get the official spreadsheet that comes off our data log. They can look for things like noisy data, bad measurements because of interference—learning the practical aspects of what it's like to get data."

Klein echoed a remark by Goldin that whether the students at the center may become scientists or engineers is not the issue; rather, that understanding the functions and roles of science and technology are essential for all citizens in the future.

"I would be thrilled if every kid in a class will learn that science is a process, not a set of facts to memorize," he said, "and that they have some understanding of what the scientific method is and how we learn about nature.

"We're not trying to clone scientists." he added. "One of the things I've consistently had to make people aware of is this is definitely not a sandbox for the honors kids."

It's possible that hundreds of schools nationwide could participate in running the radio telescope experiments, with telescope time being a limitation. However, thousands more could still be a part of the program by using the curriculum if unable to do the actual observations.

Community colleges and universities may also participate, but must first agree to partner with a high school, Klein said.

Within a couple of years, he added, the curriculum currently developed for middle school and high school students will be adapted to accommodate students from kindergarten to 12th grade.

JPL, with assistance from AlliedSignal person-

nel at Goldstone, will continue to develop the capability of the radio telescope, maintain it and keep it functioning. Because the telescope is remotely operated, all softcan be developed at JPL and run through mission control at Apple Valley to operate the radio telescope Goldstone.

The teachers who have so far participated are considered the program's

developers, rather than users. They spend a week at the center, including one day at Goldstone. "They become part of the project and work with us throughout the year," Klein said. "We hope they will stay with the project into the future."

Ten schools—from California (including South Pasadena Middle School), Alabama, Idaho, Kentucky and Michigan—are part of the core group, and more will be added in the fall.

"Eventually we'll have the curriculum robust enough to where we can accommodate users who don't have to go through this training and development process," Klein said.

The original Science and Technology Center, built nearly 10 years ago, has been expanded to



STUDIO WEST PHOTOGRAPHY

support a charter school (K-12) and to house an observatory, Air Force jet flight simulator, computer center, weather station and related handson learning tools for students, which includes mission control for the GAVRT radio telescope. The new center hopes to draw far more than the 80,000 students and teachers from across the nation who have visited since 1989.

It is now staffed by a small professional staff and about 600 volunteers.

Contributions from NASA and corporate sponsors supported the development of a digital TV studio, amateur radio station and control room, which will allow students to produce and broadcast educational programs to more than 35,000 homes.

Continued from page 3

face will measure atmospheric pressure in tandem with a sensor on the Mars Polar Lander.

The mission is scheduled to be the second launch in JPL's New Millennium Program of technology validation flights, designed to enable advanced science missions in the 21st century.

"I'm delighted with the selection of this excellent group of investigators. The Mars microprobe will give us a glimpse of the subsurface of Mars, which in many ways is a window into the planet's history," said Dr. Suzanne Smrekar, the Deep Space 2 project scientist at JPL. "The region of Mars we will explore is similar to Earth's polar regions in that it is believed to collect ice and dust over many millions of years. By studying the history of Mars and its climate, we are likely to better understand the more complex system on our own planet."

In addition to the miniaturized science instruments capable of surviving high velocity impact, technologies to be tested on DS2 include a non-erosive, lightweight, singlestage atmospheric entry system or aeroshell; power microelectronics with mixed digital/analog advanced integrated circuits; an ultra-low temperature lithium battery; an advanced three-dimensional microcontroller; and flexible interconnects for system cabling.

"The combination of a singlestage entry vehicle with electronics and instrumentation that can survive very high impact loads will enable us to design a whole new class of very small, rugged spacecraft for the insitu exploration of the planets," explained Sarah Gavit, DS2 project manager at JPL.

"Slamming high-precision science instruments into the surface of Mars at 400 mph is very challenging, no doubt about it," said DS-2 program scientist Dr. Michael Meyer of NASA Headquarters. "But once this type of technology is demonstrated, we can envision future missions that could sample numerous regions on Mars or make network measurements of global weather and possible Marsquakes."

Further information on DS2 is available on the Internet at http://nmp.jpl.nasa.gov/ds2. 🗖

Galileo

Continued from page 1

detector aboard the Galileo space-Laboratory university's

most of the interstellar and interplanetary dust particles appear to be in a "retrograde" orbit-that is, moving in the opposite direction of the rotating planet and its moons, Colwell said. The reason for the backward orbit of the tiny particles is not yet clear, he said.

The paper in Science was authored by Colwell, research associate Dr. Mihaly Horanyi, also of the Laboratory for Atmospheric and Space Physics, and planetary scientist Dr. Eberhard Grun of the Max Planck Institute for Astrophysics in Heidelberg, Germany, who is the principal investigator on Galileo's dust detector.

JPL's Voyager 2 spacecraft detected an uneven dust ring around Jupiter in 1979 that scientists believe was created by the collisions of small moonlets with micrometeoroids in identified ring of dust with smokesize particles originating from beyond the Jovian system appears to be much larger, more sparse and, possibly unique in the solar system.

"I suspect we may wind up seeing something similar at Saturn," said Colwell. Launched in 1997, JPL's Cassini spacecraft will reach the ringed planet in 2004.

Retirees

The following JPL employees retired in April:

Gary Coyle, 39 years, Section 350; Charles Kohlhase Jr., 39 years, Section 140; Gustavo Faist Jr., 35 years, Section 389; Douglas Clay, 33 years, Section 323; Carl DeForrest, Section 391, 32 years; William Stinnett, Section 394, 29 years; Paul Kresch, Section 351, 27 years; Robert Detweiler, Section 341, 25 years; Ronald Klemetson, Section 350, 22 years; Karen Potter, Section 506, 19 years; Ojars Sovers, Section 335, 19 years; Ronald Van Hek, Section 333, 19 years; John Blizzard, Section 665, 17 years; Henry Gundersen, Section 385, 17 years; Martre Grable, Section 334, 10 years.

Passings

Lee Brimmer, 78, a retired electronics specialist from Section 343, died of natural causes March 12.

Brimmer joined the Lab in 1947 and retired in 1983. He is survived by his wife, Catherine, and sons Jay and Sam.

Services were held at Rose Hills Memorial Park in Whittier,

Robert Cole, 63, a Galileo software engineer from Section 314, died of multiple myeloma March 21 at his home in La Cañada.

Cole had worked at JPL since 1978. He is survived by his wife, Elizabeth, and daughters Mindy Morrison and Martha Cole-Mendez.

Services were held April 2 at Forest Lawn Memorial Park in Glendale.

Robert Ruppenthal, 80, a retired engineering assistant from the former Section 151, died of a stroke April 5 at a nursing home.

Ruppenthal, who worked at JPL from 1961-79, is survived by his wife, Arolene, and two daughters.

Services were held April 8 at Oakdale Memorial Park in Glendora, 🗆

new: paint in/out, foundation, ac/forced air, kitchen, baths, roof, tile and hdwd. floors, Bachelder fire-place, 4 bd., 1.75 ba., \$259,000. 626/796-6220 or

SUNLAND townhouse, Alpine Meadows complex, 2 bd., 1,5 ba., 2 story, 2-car gar., pool, spa, tennis ct., rec. rm., well maintained, \$110,000, 248-0178,

626/792-2020.

LETTERS

Thank you for your kind thoughts and sympathy on the passing of my husband, Gordon Dillinger. The outpouring of love was warming and the beautiful azalea plant helped brighten the days.

My sisters and brothers would like to thank all of my JPL colleagues, co-workers and the ERC for their kind expressions of sympathy upon the recent passing of our mother.

Jeanette Dillinger and family

Charles A. Crawford

FOR SALE

ART PRINT by Gloria Eriksen, Pharaoh with Ankh and Queen, 37" x 37", \$200, 248-0178. BABY ITEMS: potty, \$5; backpack, Gerry, exc. cond, \$25, 355-9733, after 6 p.m. or leave msg. BEDROOM SET, antique; qn. size frame, hdbrd.

box spring & mattress, 2 night stands tall chest of

box spring & mattress, 2 night stands tall chest of drawers, mirrored chest of drawers, mirrored vanity & seat, \$1,000/obc; BIKES, boy's, two 18-spd. Huffy, \$50 ea. 846-4159.

BOOKCASES, two 3 x 6, \$30 ea.; CONSOLE, Grundig; stereo/AMFM/sw/record player, \$300/obc; DINETTE TABLE and 6 chairs, \$50; LOVESEAT, \$75; COFFEE TABLE, wood, rectangular, \$40; LAWN MOWER, real, \$40; TV CONSOLE, Magnavox, \$50. 846-4159.

BOXES, used, std. sz., suitable for moving or storage, bundles of 10 for \$5, 367-0969.

age, bundles of 10 for \$5, 367-0969.
CAROUSELS, Kodak, 37 140s and 2 80's; one or all; exc. cond; reasonable. 248-3364.
CELLULAR TELEPHONE, Motorola Tac Lite XL,

w/recharger, new battery, and car adapter cord; \$100. 626/795-6538. CHAIRS, 2 wooden rockers w/upholstery, \$20/ea.;

1 chair on rollers w/upholstery, \$20; SOFA BED, blue floral design, \$75; END TABLE, \$15. 626/441-4098, after 7 p.m. M-F, 9 a.m. Sat/Sun, COAT, women's leather, sz. 10, burgundy, full-

length, french-coat design, rarely worn, exc. cond., \$150, 249-6883. COMPUTER, Power Computing 120 MHz 601 (PowerMac 7300 clone), 48 MB RAM, 500 MB HD,

Mac OS 7.5.5. incl. bundled software, \$75.0. 626/568-9890. Alan, after 7 p.m. COMPUTER, dual Pentium PC, 32 MB RAM (expandable to 192 MB), 1.6 G HD, 2 MB Matrox Millenium graphics, 16-bit sound card + speakers.

All housing and vehicle advertise-

ments require that the qualifying per-

son(s) placing the ad be listed as an

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NOTICE TO

Universe

Editor

Photos

CA 91109.

to six lines.

following issue.

Mark Whalen

JPL Photo Lab

ADVERTISERS

CD-ROM, SCSI card, Ethernet ready, 28.8 fax/modem, Windows 95, 7 expansion slots, processors upgradeable, keyboard/mouse, selected software, \$1,200. 310/542-5055, Tom.

COMPUTER CD software for Macintosh, call for list, all \$25 and under, 790-3899.
ENTERTAINMENT CENTER, dark oak; L-shaped

cabinet w/beveled glass door; holds TV, VCR, stereo components w/extra storage for CDs, tapes, records, books, etc.; top lifts for turntable or top loader access; small sized, perfect for apt. or small house; exc. cond.; must sell ASAP, \$125/obo. 626/791-7545, Bob/Sharon. EXERCISE BIKE, Voit magnetic stationary bike,

programmable-computerized, heart-rate monitor clip, elec, digital read, like new W/manual, \$250, 952-6372. EXERCISE EQUIPMENT: Body by Jake hip & thigh

machine w/instruc. video, \$40/obo. 367-0969. EXERCISER, glider, new & good for the cardiovas-cular, \$100; 2 ig. RECLINERS, new & ultra suede burgundy, 2 for the price of 1, \$500; small recliner,

blue corduroy, \$75, 626/441-2097, after 6 p.m. M-F, 9 a.m. Sat./Sun. GUITAR AMPLIFIER, Park G10, new in box, \$100. GUITAR AMPLIFIER, Peavey 5150, Edward Van

Halen model, exc. cond., ½ stack w/slant cab., \$1,000, 526/446-0165.

S1,000. 626/496-0165.

SUITAR CASE for Gibson hollow body electric, '70s vintage, \$100. 248-0178.

JACUZZI, 6 x 6 x 4, vg working cond., new motor, hard cover, some chemicals, used for a very short time; GAZEBO, redwood, 8 x 8 x 7, plus 3 ft. roof, needs minor work; \$2,100 for all. 626/836-0188.

COM. Nilvs. LeCiber, 45 in, wide solid maple in

LOOM, Nilus LeClerc, 45 in. wide, solid maple in new cond. (used once); incl. warping rack, shuttles, instructions; \$500/obo. 626/355-0254. LOVE SEAT, Herculon, earth-tone stripes; exc.

cond.; \$100/oba. 248-3364. ORGAN, Yamaha 415 electronic console w/13 ped-als, 3 keyboards, 144 rhythm patterns, pd. \$7,500, sacrifice for \$3,000. 790-3899.

PERSONAL INFORMATION MANAGER, Seiko "Phone-Pal", \$25, 790-3899. PRINTER, Epson Action Laser II, needs photoconductor unit; as is, \$100. 626/797-6089.

RIMS, 15" IROC, set of 4 w/tires, \$475/obo, 626/307-1706.
REFRIGERATOR, GE side-by-side, 21 cu. ft., avo-

cado green; gd. cond.; \$150/obo. 626/355-0254. SKIS, Autier w/Marker II titanium bindings, 194 cm, exc. cond., \$75; SKI BOOTS, Lange 55, meri's sz. 12, exc. cond., \$75. 626/793-3561

SUITCASE, women's 27", w/wheels, exterior shoe holders, soft cover/green, 1 yr. new, exc. cond., \$55, 626/793-3561.

SWEATER, Coogi, from Australia, new, Nordstrom \$325, sell \$100. 790-3899. TELEPHONE, cellular, DiamondTel DT-20X, bat-

tery w/overnight charger, car adapter charge cable, gd. cond. 626/844-4383. TELEPHONE ANSWERING MACHINE, General

Electric, black, microcassette, voice time/day stamp, hardly used. 626/844-4383... TELEVISION, 25* RCA console, 16 yrs. old, needs work on A/C ckt.; walnut cabinet; \$45/obo. 360-

TICKETS, all-you-can-eat pancake breakfast; Sat.

May 9, 6:30-11 a.m. at Crescenta-Canada YMCA on Foothill just west of Glendale fwy. termination; supports the Y Indian Guides and Princesses program; incl. "free" ticket for 1-day admission to Y facility good through 12/31/98; \$3 ea. 249-6852,

TRAILER, 2-wheel, 6' x 4', all steel, Model T pickup bed style look, \$100. 562/464-0466.
TRICYCLE, adult 2-seater, side by side, tandem, 3

spd.; w/trailer, 4" x 8", collapsible; both in exc. cond., \$495 total, 805/251-7516, Ben, after 6 p.m. TRUMPET, Holton "Collegiate", exc. cond., Monel valves, case, 2 mutes, "Arban's" authentic edition textbook; all for \$390, 248-1369.

textbook; all for \$390. 248-1369.

WASHER/DRYER, Kenmore/Whirlpool; \$70 & \$150. 846-4159.

WASHER/DRYER (gas), '94 Whirlpool, large cap., matching, white, exc. cond., \$350 for both. \$25/449-0102.

WATERBED, qn., 12 drawers; new 30-year wave-

less mattress and heater; mirror hdbrd, w/shelves; perfect pecan wood; \$1.000, 249-6615. WRITING DESK, slant top w/key, partitioned spaces inside, middle drawer, 2 bookshelves below, compact, 27L x 42H x 9 34D, vg cond., \$125.626/793-3561.

AUTOS / RVs / MOTORCYCLES

85 BMW 528E, orig. 87,000 mi., service records, AT, pwr. window-door-seat, sun roof, runs great, \$5,000/obo. 616/443-9774, eva. '70 CHEVROLET El Camino, exc. cond., orange,

big tires, 350 eng., 10 ½ to 1 compression, black leather seats, \$5,000/obo. 626/914-6083. 95 CHEVROLET Impala SS 409 orig., \$8,500/obo. 805/867-2671.

CROWN 35' motor home, 220 Cummins, slps. 6; \$15,000/aba. 805/867-2671

'88 DODGE Caravan LE, 3.0 V6, 100K ml., power everything, vg running cond., clean, all sched, maint., \$3,100, 360-3481.
'94 FORD Explorer XLT, 2 WD, 45K ml., a/c, roof

'89 FORD Escort GT, 1.9L EFI 4 cyl., 5 spd., 130K, white 2 dr. hatchback, pwr. steering & brakes, cc, left dr. dntd., runs strong; 3/98: tune-up, oil, alignment, fuel fltr., catalytic converter, muffler, exhst.

pipe, smogged. Monrovia, Albert don_alberto@ usa.net, 626/237-4153. bashet, occupants LX, 3.8 L V6, loaded, recent paint, lires, brakes; orig. owner, vg cond., \$3,800/obo. 626/355-3886, Rosemary/Ed.

'86 FORD F250 4x4 XLT pickup, Lariat pkg. w/all options and bed liner; diesel engine w/88K mi.; can be seen on Caltech campus daily; \$7,500 firm. 967-

76 FORD LTD, 4 dr., orig. Interior, well kept, rebuilt heads, \$350/obo. 213/262-7685.

'88 GMC 1-ton PU, extended cab, loaded, very

93 HONDA Accord EX station wagon, 66K mi., min cond., has everything, orig. owner, \$13,500. 213/654-0387.

steering wheel and stick shift, new tires, leather hood cover, alarm, pwr. door locks, \$2,500 stereo syst.; pre-wired for Motorola cell phone kil; mint cond.; 80K mi.; \$7,000. 803-8686, pgr.

red, \$2,850. 248-0491, Dan. '86 HONDA Accord, 4-dr. sedan, 115 K.mi., auto., a/c, AM/FM/cass., cruise, orig. owner, recent trans-

dows/sunroof/steering, AM/FM cass. stereo, cruise control, a/c, alarm, 126K mi., \$2,800/obo. 548-

80 HONDA Accord hatchback, 5-speed manual a/c, radio, heater; 120k miles, eng. good; original owner; drive train needs repair as of 4-3-98; \$300/obo. 790-7477, John.

'89 JEEP Cherokee, 4x4, low mi.; all pwr.: brakes, steering, doors, etc.; new shocks, brakes, tires; must see, \$10,800, 626/797-8776, Pasadena.

maintained, AM/FM radio, new tires, \$1,000/obo.

95 TOYOTA Carnry LE, 31K mi., auto, pwr. windows & locks, cruise, CD changer, new tires,

cruise control; pwr. windows, locks & mirrors; burgundy w/gray interior, \$20,800/obo. 909/980-3508. '87 TOYOTA Supra turbo, 5 spd., targa top, exc. cond., \$5,500, 626/794-6142.

'88 VOLVO 240 DL, 109K, 1 owner, exc. cond., very clean, new battery, new tires, \$6,000. 626/446-

70 VW Bug, rebuilt engine; new; seats, chrome wheels, tires, and battery; needs wiring completed, not running, as is, good project car, \$950/obo.

626/309-0429.

89 YAMAHA YZ250 dirt bike, Weisco piston, pro circult pipe & silencer, Renthal bars & sprocket, '92 plastic, new tires, very fast, comes w/parts; \$1,800/obo. 626/307-1706.

WANTED

ACCOMMODATION in cent. Pasadena (nr. Cattech/JPL), non-smoking English post-doc requires either 1 bd. fum. apt. or rm. in a friendly shared house. E-mail Andy Bingham (awb1001®

BABYSITTER, part-time (2-3 days/wk.), preferably from 5:30-8:30 or so: willing to pay good salary; child is approx. 3 yrs. old. 957-0252.

BABYSITTERS needed for occasional week and whild, eves, in Monrovia area; must be good w/children, accountable, and have own transportation; exp. nec., references required. 626/303-2808,

BIKE, BMX style (Huffy, Mongoose, etc.), in gd. BOOKCASES, any size, 248-3364.

PLACE to live alone or with others, in Pasadena or

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

TUBE TUNNEL, collapsible, for kids. 249-8914. TUBE TUNNEL, collapsible, for kids, 249-8914. VANPOOL RIDERS for van #20, serves North-ridge/Granada Hills area. Ext. 4-0307, Marilyn. VOLLEYBALL PLAYERS, coed, all levels of play; every Tuesday night from 8-10 at Eagle Rock High School; \$4/night. 956-1744, Barbara.

LOST / FOUND

Lost: Brown leather Amulet/Medicine Bag necklace with silver feather charm on top, has fringe and leather cord, approx. 3 " long x 1 1/2 " wide, has sentimental value. 805/250-8066.

CATS, gd. homes sought for female gray tabby, 2 yrs.; female black tonghair, 4 yrs.; male orange tabby, 1 1/2 yrs.; all shots; spayed/neutered; gd. w/children. 952-8465, Alex. FROG, lives in water, approx. size 2" x 4", incl. lg.

attractive container. 626/791-2464.

PVC PIPE, 1", various lengths up to 6', unused. 626/440-0609.

FOR RENT

1 bd., 1 ba., sec. bldg./pkg., pool, spa, stv./fridge, top fir., dishwasher, Indry., rec. & exercise rms., mtn. view, f/p, cent, air. 626/440-9427.
ALTADENA, 1 lg. bd., 1 ba., living rm., breakfast area, patio, 1 covered prkg. space, pool, sec. gate; 6 mo. lease, \$750. 626/787-5861.

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

626/788-4492.

GLENDALE (north), room in big Spanish house, by Mountain; kitchen privileges, priv. ba.; must not be allergic to cats, non-smoking female preferred; avail. mid-April; \$450 + \$100 sec. dep. 242-3633, GLENDORA, young professional looking for same

to split Ig. 3 bd. + den home with a Ig. fenced yd. in a quiet cul-de-sac; extra rm. is a fully equipped office; only 25 min./JPL; gardener incl., \$495 + ½ expenses. 626/335-4409.

expenses. 626/335-4409.

LA CRESCENTA house, above Foothill, 3 bd., 2 ba., 2 fp, fruit trees, fncd patio, quiet cui-de-sac, easy fwy access, 10 min/JPL, \$1,600. 957-7554.

N. SAN GABRIEL house, 3 bd., 2 ba., lg. liv. rm., lam. rm., 2 fp, sun rm., remodeled, 2 att. gar, lg. yd., refrig., washer/dryar, \$1,600. 626/309-1667.

PASADENA, room in 4 bd., 2 ba. house nr. Crange Grove/Allen, shore witcher burge. Grove/Allen; share w/Caltech grad. students; huge kitchen, storage, off-street parking. 626/440-9953,

leave msg. PASADENA townhouse, nr. Lake, 10 min/JPL, covered pkg., priv. ba., Jacz., \$500 + ½ util., deposit req. 626/395-0678, eves.

PASADENA townhouse, near Lake, 10 min./JPL; cvrd. prkg., priv. ba., Jacuzzi; \$500, ½ utils., dep. required. 626/395-0678, eves. ROOM w/view and priv. ba. in lovely single family

house, quiet area up on the hills; use of kitchen, washer/dryer, garage and pool; 7 mi./JPL; non-smoker; monthly maid service and utils. pd., \$400.

SOUTH PASADENA, furn. apt., good area on 1718 Huntington Dr., near Marengo; elec, heat/air cond. parking and Indry, facil.; non-smoker, \$565, incl parking and Indry, facil.; non-smoker, utils, 626/792-9053, Marilyn.

bilis, bcb/92-9055, Maniyit. SYLMAR townhouse, 3 bd., 2 1/2 ba., spacious kit., dishwasher, gar. disp., stove, din. area, sliding glass dr. onto walled patio, direct access dbl. parage/door opener/laundry fac., liv. rm /frol., ca/h end unit, pool/Jacz., close to frwys., \$995, rent or lease/buy, 352-0507.

VALLEY VILLAGE townhome (near Studio City), 2 bd., 3 ba., attached 2-car gar. (+ storage rm.), security syst., fireplace, breakfast nook in kitch., appliances incl., lease/rent, \$1,050. 909/272-

VAN NUYS, house for lease; good central Valley location, 20 min./JPL; 2 bd., 1 ba., + bonus patio rm., garage, stove, paint, carpated; washer/dryer hookups; water & gardener pd.; child/pet OK. 501-

8161. WHITTIER, charming 2 bd. cottage; \$875, first, last, sec. 562/464-0446.

REAL ESTATE

ADELANTO, buildable lots (7,000-8,000 sq. ft.), only \$100 down and \$100/mo, 952-9467. BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 ba., mud/laundry rm., \$129,000. 909/585-9026. GREEN VALLEY LAKE, a secluded village in the San Bernardino Mtns., custom 3-story log home and buildable adjacent lot; beautiful 180-deg. view wilg, decks, shade trees; walk to lake and skiing; cabin \$149,000, adj. lot \$19,900, 303-1927. LAKE CO., N. Calif., 2 1/2 acre lot, in beautiful Kelseyville near Clear Lake, perfect site for a permanent or retirement home, 30 walnut trees, paved

road, electricity, \$35,000, 626/337-7522. PASADENA. completely restored craftsman home. SYLMAR townhouse, 3 bd., 2 1/2 ba., spacious kitch., dishwasher, gar. disp., stove, din. area, siiding glass dr. onto walled patio, direct access dibl. garage/door opener/laundry fac., liv. rm./trpl., ca/h, end unit, opener/laundry Tac., liv. Im./frpi., carh, end unit, pol/Jacz., close to frwys., \$105,000, 352-0507. TEHACHAPI area, new custom home, 2,200 sq. ft., 3 bd., 2 ba., 2-car garage, cent. heat/air; panoramic views on 2 ½ acres, new Dutch barn; ready to move in, fenced; \$185,000 (OMC), 626/446-0078. WALKER BASIN mtn. home, 3 bd., 1 ba., complete campdet 25 scene (fees. Views.)

remodel, 2.5 acres, trees, private, \$98,500. VACATION RENTALS

BIG BEAR, 7 mi. from slopes, full kitch., f/p, 2 bd., 1 ba., sleeps 6; reasonable rates; 2-night min.; no smokers, no pets, exc. hiking, biking, fishing near-by, 909/585-9026. Pat & Mary Ann Carroll. BIG BEAR cabin, quiet area near village; 2 bd., slps. 8; f/p, TV/VCP, compl. furn.; \$75/night. 249-

BIG BEAR LAKEFRONT luxury townhome, indoor pa, near skiing, stone t/p, slps. 6, 714/786-

CAMBRIA, ocean front house, exc. view, slps. up to CAMBRIA, ocean front house, exc. view, sips. up to 4; \$125/night for 2, \$175/night for 4, 248-8859. HAWAII, on 160 ft. of priv. ocean front, house and guest house comfortably sip. 6; 3 bd., 2 ba.; swimming, snorkeling, fishing, spectacular views, walk to golf courses. 626/584-9632. KONA, HAWAII (Big Island) condo, 1 bd., 1 ba., sips. 4; 50 yds. from ocean; all amen., priv. beach; lots of activities and ocod restauratis nearby; avail.

lots of activities and good restaurants nearby; avail. July 10-17; \$75/night or \$450 full week. 790-8069,

LAKE TAHOE, N. Shore, 2-bd., 2-1/2 ba. condo, sleeps 6-7, great location, all amenities, JPL dis-count rates avail., 3-day min. thru mid-June, week-ly summer rates mid-June thru Labor Day; private beach, pool, sauna. 626/355-3886, Rosei

MAMMOTH condo, slps. 5, shuttle stop nr. condo; downtown; \$50 Sun.-Thurs., \$65 Fri. & Sat. 353-

MAMMOTH condo, 2 bd. + loft, 3 ba., sips. 8, spa, full kilchen, TV/VCR, JPL disc., spring rates; walk to Canyon Lodge. 249-8088. 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, FM stereo; o/d Jacuzzis sauna, game, rec. & Indry. rms.; conv. to shops, lifts; spec. midweek rates, summer rates begin May. MAMMOTH at Snowcreek, 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, studio + loft, 2 ba., fireplace w/wood supplied, Jacuzzi, sauna, game m., color cbl. TV/VCR, full kitchen w/microwave, terrace, view, amen., spring rates, great snow. 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" 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., lp, 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, compl. furn.; pool,

spa, tennis, cable TV/VCR, carpets, paint, cooking utensils new; rent daily, weekly, wknds., avail. Easter wk. 626/445-0884. PINE MOUNTAIN, 2 bd., 1 ba.; Big Bear-like but

closer; \$65/night, \$550/mo. 310/831-4234, Peter. ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis ct., 18-hole golf course w/in 5 mi., short walk to beach, priv. prikg.; \$50/day during wk., \$75 Fri. & Sat./night. 626/794-3908, SOUTH LAKE TAHOE KEYS waterfront home, 4

bd /3 ba., sins. 12+: f/p on 2 levels, decks overlooking private dock and ski lifts; gournet kitch.: blcy-cles, 20' sail & paddle boats, 3 color TVs, VCR, stereo w/tape & disk; assn. indoor & outdoor pools, hot tub & beach; 8 lighted tennis cis.; 10 min. to ski-ing, 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. TIMESHARE, based on availability: 1 full wk. in Europe, \$450; U.S., Canada, Hawaii, Mexico, \$350, 626/296-9398.

April 17, 1998

JPL retirees and others).

craft has detected this ring by capturing some of its dust, said Dr. Joshua Colwell, a research associate at the Atmospheric and Space Physics.

Surprisingly, the researchers say,

the Jovian system. But the newly

rack, tow pkg., alloy wheels, extras, \$13,200. 626/357-7347;

191 GEO Storm, 60k mi., 5 spd., a/c, Alpine CD/stereo, recent tune-up, new tires, drives exc., dependable, fun to drive, \$3500/obo, 626/303-3200 Date. clean, camper shell w/carpet kit; 10' self-contained Dolphin camper also avail., very cln. 957-7554.

'93 HONDA Nighthawke, black, 4,500 mi., perfect

cond., never been dropped, w/extras, \$2,200, 803-8686, pager. '91 HONDA CRX Si, white on black; incl.: MOMO

88 HONDA CRX Si, exc. cond., 5 spd., air, sunroof,

mission/A-C compress/water pump/CV boots, exc. cond., \$4,400/obo. 909/592-2279. 85 HONDA Prelude Si, auto, red, great running and body cond., well-maintained in and out, pwr. win-

\$13,450, 952-0052. '95 TOYOTA Previa LE S/C van, immaculate, 39K mi., four wheel ABS, alarm, a/c, cass., till wheel,

cus.cam.ac.uk).

CLIPPER/SHREDDER in good running cond. 366-

surrounding area, no smokers, no pets, up to 5460/mo. 626/798-4492, Linda.