

## Lab to develop interplanetary Internet

*'Father of the Internet' Dr. Vinton Cerf named JPL Distinguished Visiting Scientist*

By MARK WHALEN

Internet pioneer Dr. Vinton Cerf has been named a Distinguished Visiting Scientist at JPL to help develop an interplanetary Internet.

Cerf will serve a two-year post that will be in addition to his regular duties as senior vice president of Internet Architecture and Engineering at MCI Communications Corp.

"It took 20 years for the Internet to take off here on Earth," said Cerf, widely known as the "Father of the Internet" for co-developing the TCP/IP protocol, the computer language that gave birth to the communications medium. "It's my guess that in the next 20 years, we will want to interact with systems and people visiting the moon, Mars and possibly other celestial bodies."

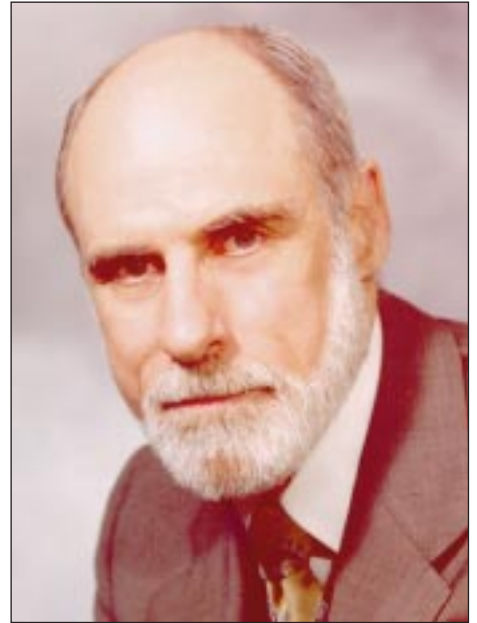
Cerf will work in concert with Adrian Hooke, manager of NASA's Space Mission Operations Standardization Program and a member of Gael Squibb's staff in the Telecommunications and Mission Operations Directorate. Cerf and Hooke will be supported by a small team of technical experts drawn

from the Internet community, other NASA centers, universities and the private sector to explore ways to merge the work of the Internet and space communications communities.

The first job of the team will develop a new interplanetary Internet architecture that can cope with the long transmission delays and noisy, intermittent data links inherent today in deep space communications. The traditional framework of TCP/IP will have to be radically adapted for interplanetary communications. Other challenges include the construction of interplanetary gateways and perhaps methods to provide for local caching of content—much in the same manner as many World Wide Web sites are mirrored in different geographic areas to optimize performance.

Cerf's work with JPL will also address how space missions can be made more openly accessible and exciting to the public by engaging individuals via the interplanetary Internet in voyages of interplanetary exploration and discovery. Together, Cerf and Hooke hope to enhance scientific research by allowing scien-

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Dr. Vinton Cerf

## JPL contributes to Chernobyl analysis

*'Pioneer' robot, which will enter and inspect facility, could be used this fall*

By MARK WHALEN

Twelve years ago, a catastrophic explosion rocked the nuclear power plant at Chernobyl in the Ukraine, killing 32 people and poisoning the surrounding environment. Today, the reactor remains highly radioactive and potentially deadly to humans, with the threat of nuclear waste seeping into the outside water and air.

A concrete sarcophagus built over the reactor following the accident is decaying. Radiation levels inside many rooms are still so high that people cannot work in them without serious health risks.

But thanks to the combined efforts of a couple of JPL teams—in collaboration with U.S. university and industry partners and Ukrainian engineers—efforts are under way to analyze and ultimately repair the deteriorating structure.

A 453-kilogram (1,000-pound), radiation-hardened robot called "Pioneer" has been constructed to inspect and assess the damage to the reactor. JPL provided two vital components of the robot's payload: a drill system to collect core samples of structural material to determine the integrity of impacted walls and columns; and software to generate photo-realistic 3-D images of Chernobyl's interior, based on Mars Pathfinder mapping technology.

Pioneer was built by RedZone Robotics Inc., a spinoff company of Carnegie Mellon University in Pittsburgh, which also developed a robot to clean up the Three Mile Island nuclear facility in Pennsylvania. Pioneer is based on a robot model made by the company to clean up nuclear waste storage tanks for the Oak Ridge National Laboratory in Tennessee. The robot will move on tank tracks and resem-

ble a mini-bulldozer.

After less than a year of designing and developing their contributions to the project, JPL engineers will take part in end-to-end integration and testing of the units at Carnegie Mellon by this fall. The robot is scheduled to be shipped to Chernobyl by late November.

Dr. Ali Ghavimi, a senior member of the technical staff in the Guidance and Control Analysis Group, Automation and Control Section, has led the task of developing a unique control system architecture for the Pioneer coring mechanism.

The control system design for the 91-centimeter (3-foot), 68-kilogram (150-pound) drill system, Ghavimi said, is inherited from earlier studies in the area of exploration of interplanetary small bodies, such as comets and asteroids. In a

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# News Briefs

**Dr. Charles (Chad) Edwards** has been named manager of the Telecommunications and Mission Operations Directorate's (TMOD) Technology Program Office 970.

Edwards most recently served as deputy manager of the office.

Concurrent with the appointment, Edwards was named end-to-end information system (EEIS) technology integration leader, reporting to TMOD Director Mike Sander. □



Dr. Chad Edwards

A NASA/JPL workshop called Biomorph Explorers for Future Missions will be presented on Lab Aug. 19 and 20.

A wide variety of presentations will be made by scientists from JPL and other NASA centers, Caltech and other universities, and industry.

The workshop will be subdivided into three sections: science applications, small mobile exploration systems and biomorph explorers component technologies.

For registration and other information, go online to <http://nmp.jpl.nasa.gov/bees>. □

Nominations for JPL's Space Flight Awareness Award are due Aug. 31 to Reward and Recognition Program Administrator **Monica Garcia**.

For information, including how to download the nomination form, go to the SFA home page at <http://eis/sec614/reward/sfa.htm> or call Garcia at ext. 4-3825 or **Laurie Lincoln** at ext. 4-8515. □

The Benefits Office reminds employees who have changed their primary residence and have not updated personnel records to provide their section office with the new address by Aug. 31.

This will ensure that employees receive benefit open enrollment materials in a timely fashion, according to **Patrice Houlemard** of the Benefits Office, who noted that employees may not list JPL's address as their primary residence.

For more information, call Houlemard at ext. 4-2549. □

The next JPL/Red Cross Blood Drive will be held in von Kármán Auditorium Aug. 11 from 10 a.m. to 3:15 p.m. and Aug. 12 from 7 a.m. to 12:15 p.m.

Sign-up sheets will be available prior to the blood drive at the ERC, Occupational Health Services (Building 263), and Occupational Health Services' home page at <http://eis/medical>.

For those who have not signed up ahead of time, or wish to change their appointment, call Ginger Morris at the Pasadena Red Cross at (626) 799-0841 ext. 630. □

## Special Events Calendar

### Ongoing

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

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

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

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

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

### Tuesday, August 11

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

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

### Wednesday, August 12

**Associated Retirees of JPL/Caltech**—Members

will attend the Lawrence Welk Theatre and Will Rogers Follies. Luncheon is included. Cost: \$43 with bus transportation; \$33 without. Cal Lila Moore at (818) 790-5893.

**Investment Advice**—Fidelity representative Jasson Rasmussen will be available for individual appointments. Call Patrice Houlemard at ext. 4-2549.

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

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

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

### Thursday, August 13

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

**SESPD Lecture Series**—Dr. Les Deutsch of the Space and Earth Science Programs Directorate's Program Planning Office will discuss the Deep Space Systems Technology Program, also known as X2000, at noon in Building 180-101.

### Friday, August 14

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

### Wednesday, August 19

**Investment Advice**—A TIAA/CREF represen-

tative will be available for individual appointments. Call Patrice Houlemard at ext. 4-2549.

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

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

**"Steps To Retirement"**—The Benefits Office, in conjunction with TIAA/CREF, offer this workshop tailored for employees who are within one year of retirement. From 1 to 3 p.m. in Building 291-202. Seating is limited. For reservations, call Patrice Houlemard at ext. 4-2549.

### Thursday, August 20

**Investment Advice**—A TIAA/CREF representative will be available for individual appointments. Call Patrice Houlemard at ext. 4-2549.

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

**JPL Bicycle Club**—Meeting at 5 p.m. in the Building 167 conference room.

**Von Kármán Lecture Series**—Deep Space 1 chief engineer Dr. Marc Rayman will discuss the mission at 7 p.m. in von Kármán Auditorium. Open to the public.

### Friday, August 21

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

# Thanks to JPLers, summer campers have fun with learning

Students in the Child Educational Center's (CEC) summer camp this year have enjoyed the usual arts and crafts, field trips and outings to the park.

Many of them, however, have also turned their summer activities into learning experiences, thanks to an outreach program led by several JPL employees whose children attend the CEC.

Hands On Science, supported in part by the National Science Foundation, is a one-hour, eight-session, enrichment program for children from pre-kindergarten through sixth grade. The goal of the program, said Kay Ferrari of JPL's Public Services Office, is to stimulate awareness of "science in your life" through the fun of active involvement in experiments, games, music and projects.

The children's hands-on activities include the construction of simple materials into learning tools. For example, by combining a cardboard tube, rubber band and piece of wax paper, they learned about the eardrum and how a sound is "felt." Another activity taught about the vocal cords through the use of rubber bands and tongue depressors.

The year-round program is generally taught during after-school hours, but was offered as an optional activity to students from grades 2 through 6 at the CEC's three summer camp sites.

JPL employees leading the summer activities were Arvid Croonquist, Pam Hoffman, Tom Hoffman, Jeanne Holm, Ron Holm, Brian Muirhead, Dave Redding, Jeff Srinivasan, Mark Whalen and Mary White.



PHOTO BY DUTCH SLAGER / JPL PHOTO LAB

**Mary White of the Space Instruments Implementation Section works with Child Educational Center summer camp students on making paper parachutes, part of the Hands On Science curriculum. From left are Ashley Hoffman, Elizabeth Phillips, Jennifer Parham and Laura Boyd.**

The Public Services Office sponsors this activity within the local community by supplying Hands On Science kits and instructor training to JPL employees who teach these classes at

elementary schools and youth organizations.

For information about the program or how to become an instructor, contact Ferrari at ext. 4-9312. □

# Educational web pages bring quake research to students

By MARY HARDIN

A new educational tool that allows students to track earthquake motions from their classrooms is now available online at a JPL web site.

The project is part of the Southern California Integrated GPS Network (SCIGN), an array of 250 Global Positioning System (GPS) receivers that continuously measure the constant, yet barely perceptible, movements of earthquake faults throughout Southern California.

"The project was initiated because many of our GPS stations are being placed at schools," said Dr. Andrea Donnellan, a geophysicist and SCIGN scientist at JPL. "We wanted students to have an opportunity to be involved in the project; however, the pages have been developed for use in any school and are also available to the general public and other organizations such as libraries. These web pages use earthquakes as a starting point and we hope the site will enable students to look at and use real data to solve problems. Also, in the event of an earthquake, they'll be able to get online and see how their area moved as a result of the earthquake."

The pages are available at <http://scign.jpl.nasa.gov/learn>.

"The site is designed for high school and beginning college students, but middle school teachers have told us they can use parts of it

too," said Maggi Glasscoe, the SCIGN team member who designed the pages. "Our hope is to illustrate math concepts, such as reading a graph, help students learn how to do research and encourage them to explore concepts ranging from plate tectonics and earthquake faults to earth science and physics. We've included a lot of animation and graphics that we hope will

get students excited."

The Southern California Earthquake Center is working with the team to have the educational pages reviewed by educators to meet current curriculum guidelines of the state of California.

At this time, there are about 50 GPS receivers in place around Southern California with new

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# Lab's maintenance, operations services outsourced

By MARK WHALEN

JPL has announced the outsourcing of its maintenance and operations services at the Oak Grove facility.

The Laboratory has signed a contract with JE Remediation Technologies, Inc., a subsidiary of Jacobs Engineering Group Inc. of Pasadena, to provide such services effective Sept. 21.

Vaji Nasoordeen, manager of the Facilities Maintenance and Operations Section 662, said 92 employees within the section will transfer their employment to Jacobs. All will remain at

JPL and will be guaranteed a minimum of one year of employment with the company.

The three-year contract, Nasoordeen said, affects four groups in the section—electrical services, mechanical services, building services and Space Flight Operations Facility operations.

"The intent is to make the change as seamless as possible to customers here at the Laboratory," Nasoordeen said, adding that a Lab-wide presentation is planned to provide information on how services will be offered under the Jacobs contract.

Jacobs is a provider of engineering, procurement, construction, construction management, operations and maintenance, design, environmental remediation and consulting services. It was formed in 1947.

The contract has a value in excess of \$38 million. A potential two-year extension may be negotiated in 2001. □



PHOTO BY CAROL LACHATA / JPL PHOTO LAB

SCIGN team member Maggi Glasscoe works on one of the home pages she designed to help students explore earthquakes.

## Quake

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sites being added every week. The earthquake network began in 1990 with only four GPS receivers as a prototype project funded by NASA. It detected very small motions of Earth's crust in Southern California associated with earthquakes in June 1992 in Landers and in January 1994 in Northridge.

SCIGN is a consortium of institutions with a common interest in

using GPS for earthquake research and mitigation. The consortium is coordinated by the Southern California Earthquake Center (SCEC), a National Science Foundation Science and Technology Center headquartered at USC. The lead institutions in the installation and operation of SCIGN are JPL; the Institute of Geophysics and Planetary Physics-Scripps Institution of Oceanography at the University of California, San Diego; the United States Geological Survey; and USC. □

## College degrees earnable on Lab; fall courses coming up

By BARBARA KOTULLA  
*Educational programs support*

In accordance with the Laboratory's goal of expanding opportunities for individual growth, JPL and Caltech employees are able to obtain an associate of arts degree from Glendale Community College, bachelor of arts degree from California State University, Los Angeles, or master's or doctorate from USC through programs offered on site through Professional Development.

The Glendale College (GCC) and Cal State L.A. (CSULA) programs are offered after hours at the Professional Development Center complex. CSULA courses run on Monday and Wednesday evenings, with a different course each night (two per quarter). GCC courses are offered Tuesday and Thursday, with one course being offered for a

16-week period.

The overall themes of both programs focus on JPL curriculum in science, environment and public policy. Key areas include business, human relations, technology and skills courses. Core classes include library and database research techniques, science-based courses and interdisciplinary study courses where students will be advised to pursue a research interest relevant to themes studied in the programs.

The University of Southern California Instructional Television (USC-ITV) program is offered daily from 7:30 a.m. to 9:30 p.m. Monday through Friday at the Professional Development Center using interactive television feeds from the USC campus. JPL is one of eight remote sites participating with USC.

Among the courses offered through the USC master's and  
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## Internet

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tists to use familiar Web-based tools via interplanetary gateways that operate throughout the solar system.

"The excitement we saw generated when people followed the exploits of the Mars Pathfinder is just the sort of thing we'd like to recapture on a regular basis," Hooke said. "What we'd like to do is involve wide segments of the public by letting them become part of the exploration experience—to actually have a hands-on sense of what it's like to be 'telepresent' on Mars and other places throughout the solar system. In fact, I wouldn't be surprised if the work we're beginning now might one day allow students to be able to control their own Mars rover in much the same way JPL scientists controlled the movements of Sojourner last summer."

One driving force behind this effort, he added, is the possibility that the Deep Space Network (DSN) could one day serve as an "interplanetary Internet service provider."

Hooke's office has worked for about 20 years within an international body known as the Consultative Committee for Space Data Systems (CCSDS) on the standardization of data transfer between spacecraft and ground stations. "In the next few years, a unique opportunity exists to unite the Internet and CCSDS space communications communities," he said. "By defining a long-range architecture for extending the current Earth Internet to be replicated on other planets and connected by high-performance long-haul links, we can help shape the investment decisions we make to upgrade the DSN in the future. In fact, it is quite possible that the network will evolve from being primarily ground-based to having significant components distributed in space around the solar system."

He said the development of what is termed the "InterPlanNet" (IPN) is inevitable, with current and emerging technologies and protocols becoming intertwined between the two communities.

"If we don't start thinking about the issues of expanding the Internet beyond Earth, then whatever changes they put into the Internet are virtually guaranteed to be incompatible with any messages that go outside of Earth," Hooke added.

As part of two days of intensive technical meetings held at JPL

Aug. 3 and 4 between Cerf, Hooke and members of the evolving InterPlanNet design team, Cerf addressed a von Kármán Auditorium audience as part of the Director's Topical Seminar Series, discussing where the Internet is now and the challenges it faces in both the near term and long term.

Noting the Internet was first deployed in 1983 and its first commercial services not delivered until 1990, he said he considers the medium still very young and in its "gold rush" stage. In the near future, he said, he foresees a transition from people's current "episodic" connections to the Internet to "dedicated," open-ended connections, where the Internet is always "on."

"We will begin to treat the medium as a different kind of resource," Cerf said, pointing to an instance where a device might be hooked up to the web and also equipped with a Global Positioning System (GPS) receiver to answer questions that are geographically related. In an era of "Internet-enabled" devices, for instance, a laptop computer operating over a cell-phone link might be able to rapidly find the closest Thai restaurant.

Cerf stressed the importance of coordinating new Internet-related communications technologies and protocols with JPL mission plans, as well as those of other agencies.

He listed a goal of a 2005 mission where Mars is accessible as a "node" on the Internet. In the years to follow, he saw the possibility that any spacecraft landing on a planet or other celestial body could "leave behind a little piece of the Internet" for future interplanetary communications development. By building up communications infrastructure in a planned way over many incremental missions, Mars could be gradually equipped with a sophisticated Internet capability for future use, he said.

"The challenges for all of us now are which technologies to develop for the terrestrial Internet that can be used for the interplanetary Internet," he said.

Among the critical issues to be considered in the design of the InterPlanNet, Cerf noted, are standardization of domain names, and security.

Also, he wondered, "will there be a single InterPlanNet, or competing ones?"

Among Cerf's numerous career honors, he and partner Robert Kahn in December 1997 received the U.S. National Medal of Technology from President Clinton for founding and developing the Internet. □

# Chernobyl

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small-body exploration task led by Donald Sevilla of Section 352, JPL developed technologies that enable autonomous sample acquisition and in-situ science in the presence of challenging environments such as low gravity, cold temperatures, unknown surface substrate properties, and rover or lander mobility and stability limitations. Under the task, JPL has developed technologies that allow the drilling operation to perform at a prescribed thrust force while archiving information on penetration rate, thrust force variances, and other subtle differences in bit interactions with substrate. JPL has developed analyses techniques that are able to differentiate between sample properties of various cometary simulant rocks.

"The Pioneer coring mechanism is designed to acquire core samples from various points in the interior of the Chernobyl power plant," Ghavimi said. "This process is essential to evaluating the structural integrity of the site by extracting core samples from the associated concrete walls and floor. The sample mechanical properties are studied further in order to estimate the degradation of the structure due to the aftermath of the explosion."

The coring mechanism consists of several subsystems. JPL has designed and implemented the end-to-end hardware/software interfaces, the closed-loop control software, appropriate data acquisition processing and archiving, and a user-friendly graphical interface. The control system is carefully designed to meet specifications and requirements imposed by the RedZone rover limitations.

The coring mechanism is designed to operate both autonomously and manually. Autonomous operations include both position- and force-controlled modes for various operational scenarios. "Special attention has been given to include 'smarts' to ensure robust operation of the coring mechanism in the presence of operational anom-

## African American culture interest group formed on Lab

The African American Resource Team was organized this summer, one of three cultural interest groups on Lab under an agreement with the Advisory Committee on Minority Affairs (ACMA).

AART's vision is to advance African American diversity at all levels of the JPL workforce and ensure that African Americans are viewed as valued and influential partners in JPL's business development, technical operations and growth, according to membership chair Tom May. He added that four subteams—membership, professional development, community outreach, and image and communication—were established to help accomplish this vision.

About 50 people attended the team's kickoff meeting on July 7. Meetings will be held quarterly and are open to all interested. For questions, call organization chair James Black at ext. 4-1961. □

alies, uncertain environments and material discontinuity," Ghavimi noted. Manual operation enables any human decision to control the operation of the mechanism, by passing autonomous operations entirely.

Ghavimi said that Pioneer is the first mobile robot equipped with a drill system and that its design posed unique engineering challenges. The drill is mounted to a flexible platform, the robot can move in response to the applied drill forces and torques at the coring bit, and the system structural modes may be excited throughout the operation, which may lead to instability. In addition, it was built to withstand a high-radiation environment.

Other robots entering the reactor have been unsuccessful due to high radiation, which freezes joints, short-circuits computers and destroys camera lenses.

The robot, and all of its parts, was built to withstand a lifetime radiation exposure of 1 million rads. By comparison, humans' exposure should not exceed five rads a year.

Dr. Mark Maimone of the Machine Vision and Tracking Sensors Group, Autonomy and Control Section, worked as mapping sensor lead for the Pioneer project.

The group provided hardware requirements and software needed to process stereo triples into range data that will enable generation of an online 3-D reconstruction of the interior.

Three cameras—each with an 8-millimeter (1/3-inch) focal length lens and CCD sensor—will be mounted on an L-shaped configuration and provide a 35-degree field of view. The

## Anniversaries

Service award ceremonies were held July 21 to honor the following JPL employees, who have completed 20 or more years of service:

### 45 years

Charles Stelzried.

### 40 years

Takashi Kiriyama, Walter Skotnicki, Thomas Sorensen, Donald Starkey.

### 35 years

Dan Bathker, Roger Brandt, Richard Green, Rolando Jordan, Jo Jean Kos, Warren Moore, Theodore Moyer, Linus Pakulski, Charles Vegas.

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JPL PHOTO LAB

Software engineer Fred Serricchio, left, and task leader Dr. Ali Ghavimi stand behind the coring mechanism for which they developed the control software. The entire unit, developed by Carnegie Mellon University, will be part of the Pioneer robot that will analyze the Chernobyl plant.

whole unit weighs about 9 kilograms (20 pounds).

Encased in lead, the three cameras will calculate the distance between the robot and various points on the walls of the structure. Eventually, the cameras will measure enough points to make a virtual model of the building.

"To enable accurate sensing, the stereo cameras need to be precisely calibrated," noted Maimone. "Geometric calibration consists of correctly modeling the optical path of each camera, which allows us to correctly predict the 3-D locations of objects from their two-dimensional images."

Others at JPL involved with the sensor work were Larry Matthies, Autonomy and Control Section; George Alahuzos, Avionic Equipment Section; and Jim Lloyd; Fabrication Services Section.

Maimone also noted that the work is one of many projects being funded out of the National Robotics Engineering Consortium, a NASA-sponsored organization located in Pittsburgh and co-directed by Dr. Neville Marzwell at JPL and Carnegie Mellon University.

Lawrence Livermore Laboratory is overseeing the Pioneer project, which is financed equally by the Department of Energy and NASA's telerobotics program, led by Dave Lavery of NASA Headquarters. Other organizations working on it include NASA's Ames Research Center, Westinghouse Electric Corporation's Science and Technology Center, the University of Iowa, and computer firm Silicon Graphics. □



Dr. David Bayard



Dr. Josette Bellan



Dr. Alan Harris



Dr. Nicole Rappaport

## Four appointed senior research scientists

Four JPL employees have been named senior research scientists.

Dr. David Bayard of Section 345 was recognized for his significant fundamental contributions to the theory and application of adaptive control systems.

Dr. Josette Bellan of Section 353 was named for her pioneering research and development of seminal models in the fields of multiphase flows dynamics and

combustion relevant to a multitude of applications.

Dr. Alan Harris of Element 3238 was recognized for his research specialty in planetary physics and for distinguishing himself as an international authority on the photometric and dynamic properties of asteroids.

Dr. Nicole Rappaport of Section was named for her international seminal work in planetary

ring dynamics, planetary gravity field determination, radiation pressure effects and numerous areas within radio science.

The senior research scientist grade—along with that of senior research engineer—was established in 1979 to give special recognition and promotion to outstanding individual research achievers. Eligibility for the grade is established by the demonstrated ability to

meet the research requirements typical of full professor at a leading university, as evidenced by outside peer review. In addition to demonstrated research leadership, appointment also depends on the individual's active participation in programs related to JPL's institutional goals.

Appointments to the positions are made by JPL Director Dr. Edward Stone, in consultation with Chief Scientist Dr. Moustafa Chahine. □

## First two ISO assessment rounds completed

By KERRY LYN CASSIDY  
*ISO 9001 Implementation Team*

The results of the second round of ISO 9001 internal assessments—held the week of July 13—reveal a growing understanding of the kind of documentation that is required when documenting a process. Round 2 assessors interviewed 82 process owners, six domain owners, nine sub-domain owners, and 187 other employees regarding their processes and procedures.

The first four rounds of assessments were specifically designated as training rounds. One of the purposes of these two rounds was to familiarize employees with the assessment process; a kind of trial run. In a sense, the objective was to create an environment where learning could take place.

For example, employees were asked to describe what they do and what process they work in. The answers given to assessors pointed to a general lack of overall understanding of the processes they work in and where to find the documentation for procedures related to those processes. Process owners were asked about element policy requirements (JPL terminology for ISO standards requirements such as management responsibility, design control and other ways of assuring a quality product) that need to be considered when writing their processes. This question also revealed a lack of understanding among process owners regarding

elements and how they relate to process policies. Assessors worked at providing explanations to help clarify these areas.

Training rounds 3 and 4 will introduce the notion of "corrective action," where documentation of the process or procedure is non-compliant or places where the documentation is not being followed; that is, it does not follow the ISO credo of "say what you do, do what you say and prove it." Corrective action is not a disciplinary procedure, but rather a way of rectifying gaps or discontinuities in what employees say they do. It helps to identify problems and avoid mistakes that affect the quality of the product.

Nearly 100 anonymous feedback questionnaires regarding assessment rounds 1 and 2 were received in the last two weeks, and showed a balance between those who feel they understand both ISO and process-based management (PBM) versus those who do not. The findings are currently being reviewed to help the ISO team see how they can best improve getting the Lab up to speed for certification.

New classes are being designed to address what ISO 9001 and PBM mean to employees—from process owners through all levels of the organization. The ISO 9001 management class will continue for group supervisors as well as any section managers and others who were unable to attend previous classes. An added emphasis will high-

light how PBM and ISO are related and clarify ways in which PBM can enhance readiness for and receptivity to change. This will help the organization adapt to change and encourage innovation at all levels.

The cornerstone for this approach is communication. Plans are under way to augment the training, assessments and upcoming November audit with flyers, presentations and speakers on the subject of ISO 9001 and PBM and what they mean for JPL. The ISO/PBM home page is expected to debut Aug. 10 and will contain a comprehensive "ISO Guide," describing ISO and how it is being implemented. Assessment results, presentations, a glossary of terms and a resource listing are included. Feedback is encouraged; buttons will be found on each page of the site for that purpose.

More information on ISO 9001 and process-based management at JPL can be found at a temporary home page at <http://iso>. □

## Correction

A story in the July 24 issue of *Universe* on last month's Safety Incentive Awards should have stated that JPL has reduced lost-time days by 84 percent over the last year—from 295 such days down to 47. The safer workplace has also resulted in a 90 percent reduction in lost-time days since the inception of the safety incentive program in 1990. □

# Passings

**Eleanor Victoreen**, 62, a retired administrative secretary from Section 352, died of cancer July 16.

Victoreen worked at JPL from 1958-82. She is survived by daughters Jane Cover and Joyce Flack, sons Ron and Rick Baker, and brothers Paul and Lester Vickers.

Services were held July 22 at Rose Hills Memorial Park in Whittier. □

**John Fuhrman**, 76, former manager of the Technical Documentation and Materiel Services Division, died of complications from surgery July 19.

Fuhrman joined the Lab in 1965 and retired in 1987. He is survived by his wife, Marguerite; sons John, Kevin, Donald and Andrew; and two grandchildren.

Services were held July 23 in Nevada City, Calif. □

**Dan Cain**, 69, a retired member of the technical staff in Section 368, died of a heart attack Aug. 2 at his home in Pasadena.

Cain, who worked at the Lab from 1959-94, is survived by his wife, Patricia Jacka Cain;

sons Timothy and Paul; daughter Mary Ann Istvanyi; and one grandson.

No services were held. □

# Education

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Ph.D. programs are computer science, electrical engineering, aerospace engineering and aeronautical engineering.

Undergraduate courses offered at JPL by both GCC and CSULA cost approximately \$3,000 per calendar year. The unit cost is reimbursable to eligible JPL employees. USC courses cost \$645 per unit, plus a \$100 per unit fee for ITV and a computer fee. The fees and units are covered under JPL's tuition reimbursement policy up to \$10,000 per calendar year.

Registration for GCC's biology course is open now, with class beginning Sept. 1. Students may also register now for the CSULA program, with instruction beginning Sept. 28. Registration for USC courses starts Aug. 27, with classes beginning in September.

For more information, call the author at ext. 4-0088. □

# Anniversaries

Continued from page 5

30 years

Harry Detweiler, Fred Krogh.

25 years

Marc Adams, Mary Bothwell, Victor Chavez, Nancy Durland, James Granger, Robert Irigoyen, Erik Ivins, Edward Morassini, Adriana Ocampo, Ladislav Roth, David Skinner, Henry Valtier.

20 years

Terrence Adamski, Genji Arakaki, Shari Asplund, Shehenaz Bhanji, Jeffrey Boyer, Garry Burdick, James Carter, Yolanda Castillo, David Clough, Richard Cofield IV, James Constantine, William Eggemeyer, Lee Elson, Robert Gustavson, Eric Hines, Rudolph Horton, Ronald Hungerford, Bolinda Kahr, Julius Law, Ray Morris, Eni Njoku, Michael Orr, Darlene Padgett, Thomas Pastorius, Joan Pojman, Robert Robinson, Claudia Romain, Arnold Ruskin, John South, Andrea Stein, John Trauger, Roy Vitti, Irving Webb, Kirby Willis. □

## LETTERS

Phil Eckman and I want to thank you all for coming to our recent retirement party in von Kármán. Special thanks to Esther, Shari, Barbara and Beatriz for "engineering" the whole event. This is a wonderful way to cap off our many years at JPL. Now with so many fond memories to take with us we both feel this is just another fine example of why JPL is a terrific place to work. Thank you all again.

Phil Eckman and Gerry Meisenholder  
□□□

Thank you all 662 employees for the wonderful farewell party. A special thank you for all the 662 trades mechanics. Without your guidance, training and patience I would not have the skills I have today. I will never forget all of your "unique" personalities and humor. Thank you again, my special friends. I will miss you all! Love,

Vicki Reifer  
□□□

Thank you very much for your kind and thoughtful condolences and support following the loss of both of my parents within 10 days. It certainly helped me get through the worst times. The fact that that is how my father wanted it also made it easier to bear. Thank you also for your generous contributions on their behalf. Mary and I have donated the money to the L.A. Times Summer Camp Fund so some kids, who otherwise couldn't, would get to go to camp this summer. My folks would have liked that.

Marty Nachman  
□□□

I want to express my thanks to the many friends and coworkers who participated in the two retirement events for me. You were much too kind and generous, and I will always remember the expression of good wishes. JPL is a special place because of you. Good luck.

Chuck Lifer

## FOR SALE

BEDROOM SET, woodgrain laminated corner group (corner desk, chair, cabinet with drawer, 3-drawer dresser), perfect for spare bedroom or teenager's room, vg cond., \$150/obo. 626/337-7522.

BEDSPREAD, king/"periwinkle", lightly quilted, very new: \$40. 626/398-4960.

BIKE CARRIER, hitch mount, four bikes, fits 1.25-in. hitch receiver, Thule Brand, near new, used twice; new \$150, sell \$100. 626/564-8405.

CAMERA, 3D, complete gift package with Nishika n8000 35mm, 3010 twin flashlight, leather case and video instruction; whole package for \$120. astai@hotmail.com.

CAMERA, Minolta x-700, 35mm SLR, Minolta 50mm F1.4 Lens, Soligor 80-200mm, F4.5 macro 700m Lens, Albinar 28mm F2.8 wide angle lens, skylight filters, Minolta auto 280px flash, case; all for \$150. 626/564-8405.

CANDLES, boxes of 12, 12" & 8", various colors: \$6/box. 626/398-4960.

CANISTERS ceramic, for tea, sugar, coffee; two 5" diameter and two 6" diam.; white w/blue flower designs; all 4 for 11/obo. 626/568-8298.

COFFEE TABLE, white marble, 23" x 69", \$120. 626/797-6982.

COMPUTER, 486DX2-66MHZ Turbo, 32MB RAM, TEAC 58E, CD-ROM 2 HDs, Fujitsu 1285 MB, Maxtor 345 MB, 2 floppy drives, 3.5 & 5 1/4 (1.2M & 3.5M); 38.4 baud modem, ELIDE BIOS-upgrade, Propoint mouse, Keytronic keybd.; Windows 95 Microsoft Office, games, screen saver, numerous (3.5 & 5 1/4) software disks, etc., \$475/obo. 805/481-8914; e-mail shnhb@juno.com.

COMPUTER, Apple Mac plus, 2.5MB RAM, 60MB ext. hard disk, built-in 9-in. black/white display, keyboard, mouse, Appletalk, tilt/swivel stand, software; all for \$100. 626/564-8405.

COMPUTER, Apple Mac II FX, 20MB RAM, 317MB HD, dual floppy, 13-in. color monitor, CD ROM drive, sound, speakers, modem, Ethernet, AppleTalk, software; all for \$400. 626/564-8405.

COMPUTER, Packard Bell, 486 SX-25, w/Windows 3.1, extremely compact, no monitor, \$50. 626/398-4960.

COMPUTER, Pentium II 300 MMX, 32 MB RAM, 4.2 GB HD, 4 MB AGP video, 32X CD-ROM, 15" monitor, 56K fax, 2 USB ports, PS2 mouse and keyboard, 1.44 floppy, sound card, less than a month old, has original win95 cd, \$1,300/obo. 247-5272, pgr. 327-3227.

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

COMPUTER POWER CONTROL CENTER, 5 power switches + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, \$15. 790-3899.

COMPUTER SYSTEM, 166Mhz Pentium, multimedia PC (7280P), 1.66MB RAM, 2.5GB HD, 8xCD ROM, photodrive, 33.6 modem; includes 15" monitor & Epson stylus color 800 printer; \$2,500 (includes extended warranty). 773-8933.

COMPUTER SYSTEM, IBM PS1 386SX w/Windows 3.0, PS1 printer, works fine, \$20/obo. 805/254-6134.

COMPUTER SYSTEM, PowerBook DUO 280C, 12MB RAM, 320 HD, docking station w/2 MB V RAM, 1 GB HD, keyboard, mouse, SCSI cable, AC adapter, leather case, etc., \$700/obo. 832-5556.

DISHWASHER, Maytag, exc. cond., \$200; CONVECTION OVEN, GE Profile under-counter model, exc. cond., \$500; both used less than 3 years; reasonable offers considered. 248-9432, DStan.

DRESS for flower girl, sz. 7/8, white chiffon, trimmed in white satin w/detachable peach/white flowery bow, peach/white flowery crown, white satin gloves, sz. 7/8 and white satin basket; see to appreciate; \$100. 626/798-0033.

END TABLE, \$20; EXERCISE BIKE, \$15; TYPEWRITER, Olympia electronic, extra-wide carriage, font/pitch change, underlining, correction, etc., exc. cond., incl. 6 new ribbons and 12 correction tapes, \$100/obo; SOFTWARE, Quicken for Windows, unopened, \$20. 626/355-3886, Rosemary/Ed.

ETHERNET CARD, PCMCIA, brand new in box, type II, 10 BaseT, Win95/NT, Ecgler model no. EXPBK-ET10BT, \$45. 591-1218, eves.

EXERCISE WALKER, Stamina Advantage Walker 2000, \$70/obo. 626/799-1707.

FUTON BED, king size, gray, \$100. Montrose, 541-0782.

GUITAR AMPLIFIER, Peavey 5150, Eddie Van Halen model, half stack w/slant cab, exc. cond., \$799/obo. 626/446-0165.

HAIR DRYER, professional, beauty salon style, \$35. 956-1744.

LAWN MOWER, Murray 22" 3.5 HP, runs great, \$30; EDGER, Black & Decker, used twice, \$15. 805/291-1912.

LOVESEAT SOFA, 2 brown & beige, exc. cond. \$30 ea.; COF-

FEE TABLE, square, oak, exc. cond., \$25; END TABLE, oak, exc. cond., \$20; all 4 items for \$100. 249-2669.

MATTRESS and foundation, California king-size, firm, gd. cond., \$200. 909/598-0065.

MOVING SALE, everything less than 1 year old; queen-sz. bed, \$250; Sharp TV, 20" with desk, \$190; many other things at very good prices. 626/844-9227.

ORGAN, 1962 Hammond C-3 console with 22R single-speed Leslie speaker, tremelo, walnut cabinetry, exc. cond., \$3,000/obo. 249-6731.

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

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

PAINTING, orig. oil on canvas, impressionistic landscape, 42" x 52", w/invisible frame, \$250. 626/797-3156.

PRINTER, Epson 1070+, 132 column, both tractor & pressure feed, bought new \$419; including 15' cable, all manuals incl., approx. 15 sheets of paper been run through; perf. cond.; \$250/obo, incl. 1/2 box of paper. 805/481-8914; e-mail shnhb@juno.com.

PRINTER, HP 870 Cse, like new, used for 15 months, prints black 8 pgs./min., 600 x 600 dpi; prints color 4 pgs./min., 600 x 300; C-RET, supports 125 True Type fonts for Windows and 27 for Mac; single-sheet feeder for paper or envelopes; works w/Windows 3.1, '95 or Mac; cables & s/w drivers included; \$250. 626/963-1960, eves.

REFRIGERATOR, large side-by-side, \$250/obo; DISHWASHER, portable \$150/obo; MICROWAVE/ CONVECT oven, \$50/obo (old but works). 626/457-8435.

REFRIGERATOR/FREEZER, almond color, 18"; runs well, \$100. 353-3836.

SEWING MACHINE, Singer featherweight, exc. cond., \$550/obo. 626/355-2957.

SHOWER & TUB DOORS, Sears, still in box, high quality; \$100 for tub, \$55 for shower. 626/355-3950, pager 626/256-5453.

SLEEPING BAG, 3-season REI down, rated +20; used twice; exc. cond., incl. stuff sack and storage bag, \$75. 353-6369, eves.

SPRINKLER VALVE ADAPTERS, Lawn Genie automatic model 756LG 3/4, new, \$10/ea. 790-3899.

SWATER, Coogi, from Australia, size small/medium, new, Nordstrom sells for \$325; sell \$100. 790-3899.

TABLE, dining rm., oval, cherry; sits 8 w/one extension; exc. cond., \$300/obo. 626/796-7330, Ben or Connie.

TABLE, dining rm., round, mahogany; sits 8 w/two extensions; almost new; incl. 6 matching chairs, \$1,000/obo. 626/568-8298.

TEACUPS, Franciscanware, Desert Rose pattern; \$7/ea. 626/398-4960.

TELEVISION, color, used, 27" Toshiba, stereo, sharp picture, exc. cond., \$245/obo. 626/446-9991.

TELEVISION STAND, oak, on coasters w/storage below, can easily accommodate up to 27" TV, \$50. 626/398-4960.

TENT, cabin, 9' x 11', 80" high, free-standing, sleeps 6, gd. cond., \$60. 626/797-6982.

TREADMILL, manual, gd. cond., \$80. 626/303-2735.

VCR, Sony 4-head, \$75; STEREO RECEIVER, JVC basic model, \$30; CD PLAYER, Kenwood portable, \$50. 957-2898, Keith.

Continued on page 8

VERTICAL BLINDS, assorted sizes, good cond., white aluminum, \$20/ea. 909/598-0065.

WASHER & DRYER, Kenmore portable (larger than stackable), electric (120V, 15A), ~2 yrs. old, perfect for apt. or condo; \$250 for both. 637-8456.

WATERBED, oak frame, motionless mattress, needs base, \$50. 805/291-1912.

WEIGHT SET & BENCH, w/additional equipment, like new, \$250; BIKE, Peugeot, 10 speed men's, exc. cond., \$125. 248-0610, Randy.

## VEHICLES / ACCESSORIES

'89 ALFA ROMEO Spider Graduate convertible, 4 cyl., 5 spd., 2 litre, red, black soft top, tan interior; willing to trade for 4-dr. Saturn or \$6,800/obo. 626/237-4153, Albert Ramirez.

'88 BMW 735i, loaded, beautiful, chrome wheels, mini-disc/CD changer, 140k miles, \$11,000/obo. 790-7129.

'92 CADILLAC STS touring sedan, black interior/exterior; meticulously kept, with maintenance/repair receipts; body style same as that through '97; fully-optioned incl. heated windshield; factory security system; zebano wood & leather; Bose sound system incl. CD; shop manual; warranty avail.; Kelley retail blue book is \$15,100, sell \$13,500. 626/796-1239.

'89 CADILLAC Sedan DeVille, dark blue in/out, loaded, digital dash, leather, 4.5L V8, 69K mi., exc. cond., orig. owner, \$6,300. 790-4028.

'91 CHEVY Corsica, auto, air, 4 door, V6, airbag, new paint, 107,000 miles, runs great, \$3,400. 957-5678.

'51 CHEVY 1/2-ton pickup, off-frame restoration, spent over \$14,000; sacrifice for \$8,750/obo. 248-0610, Randy.

FLOOR CONSOLE for SUV mini-vans, etc. w/front bucket seats; storage, cupholders, coin, cassette holder, etc.; 27 x 8 x 14 in. high; black, exc. cond.; new \$90, sell \$40. 626/564-8405.

'93 FORD Taurus GL, V6, 3.8L, 4 dr., ABS, a/c, AM/FM cass., exc. cond., great family car, moving, must sell, \$5,200/obo. 626/844-9227.

'91 GEO Storm hatchback, 73K, dark blue, 5 spd, A/C, AM/FM/cassette stereo, good cond., fun to drive, \$2,900. 893-6084.

'91 HONDA Civic DX, auto, am/fm, A/C, 2-dr, white, 94 K, runs exc., minor body, \$4,200/obo. 626/796-7941.

'89 JEEP Cherokee 4x4, all power, newer tires, brakes, shocks, tow pak, \$9,450. 626/799-8776.

'84 LAZY DAZE RV, 22 ft., 50-gal gas tank, new tires, exc. cond., \$13,500. 626/355-2096.

'86 MASERATI Quattroporte, all orig., 41k mi., dk. gray metallic paint, saddle tan leather int., garaged for the last 8 yrs., needs a new home with TLC, \$12k/obo. 909/624-2880.

'95 MAZDA Miata convertible, red exterior, black interior, loaded, 51K mi., exc. cond., \$12,950. 909/598-0065.

'86 MERCEDES 190E, auto, good cond., orig. owner, \$3,450.

790-3802, Bill.

'92 MITSUBISHI Eclipse, 82,000 miles, 5 spd., black, 16 valve, power windows, locks, mirrors; \$6,500. 249-6068.

'91 NISSAN 240SX SE coupe 2d, 4-cyl., 2.4 L, 5-speed manual, loaded, \$2,500. 832-5556.

'92 PONTIAC Grand Am coupe, only 53K mi., white, ABS, pwr. windows/mirrors/locks, cruise, fog lights, auto alarm, AM/FM/cass., delux sound, exc. cond., runs/looks great, \$5,900/obo. 626/796-3442.

'87 TOYOTA, Corolla, 4 dr., automatic, vg cond., must see, \$2,000/obo. 626/793-7475.

'85 TOYOTA 4 Runner, good cond., 134,000 mi., rebuilt eng., \$4,500. 805/285-1287.

'70 VW, 1835 c.c. motor, good cond., \$1,100. 562/464-0446.

'64 VW bug, crank sunroof, changed carb., new tires w/warranty, good brakes, good trans., needs minor details, runs great, \$1,800/obo. 626/793-3948, Alex.

'88 VOLVO 240 DL, 4 door, 5 speed, 110k, grey metallic, exc. cond., orig owner, good tires & battery, needs paint. \$4,999/obo. 626/446-0165.

## WANTED

BICYCLE, tandem for beach cruising. 562/423-2224, Fred.

HOUSEKEEPER, 2 times monthly, own transportation for Sierra Madre area. 626/355-2957, after 6 p.m.

PORCH SWING, old-fashioned with canvas canopy, desperate. 626/395-3705, Barbara Buckley.

PRINTER PART, HP 19C, working or not. 626/398-3192, George.

ROOM/APARTMENT in JPL/Caltech area for students working at JPL for 7-wk. period from end of Aug. until mid-Oct. 626/797-5674 or e-mail gonzo@WPL.EDU.

ROWING MACHINE, good cond., cheap. 626/303-3016.

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

TOY pieces or sets, "K'nex" and "Brio Mec." 626/303-3016, Eilyn.

VOLLEYBALL PLAYERS, coed, all levels of play; every Tuesday nt. 8:00-10:00 at Eagle Rock High School; \$4/nt. 956-1744, Barbara.

## FREE

COMPUTER, IBM PC x86, two floppy drives, keyboard, monitor. 626/683-9414, Craig.

DOG, boxer/shepherd mix, 4-yr-old female, loyal, good with kids, good watchdog, includes 20-lb. bag of food, dish, collar. 249-4536.

KITTENS, 3 mos. old, to loving homes, 3 females (two calicos, one black and white), 1 male (orange tabby); cute, smart, litter-trained. 626/357-2741, eves.

## LOST & FOUND

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

## FOR RENT

ARCADIA, furnished, cozy rm., includes kitch. priv., laundry, pool, \$350. 626/448-8809, Shary.

EAGLE ROCK, 1 bd. duplex, approx. 10 miles from JPL, 5087 Glen Iris Ave. 626/355-2096.

LA CRESCENTA, private 2-bd. home with pool, high above Foothill, fireplace, beamed ceilings, \$1,350. 952-6007.

LAKE HOLLYWOOD, 2-bd. apt. in 7-unit bldg. (adjacent to Universal Studios, Griffith Park, and Toluca Lake in Burbank); pleasant hillside community w/close freeway access; outside floor entrance, newly remodeled, hardwood oak floors, small private patio, refrig., a/c, solar-heated water included, laundry rm. downstairs, parking; non-smoker. 626/798-3235.

MONTEREY PARK room, bright, airy, spacious; lots of closet space, off-street parking; quiet, tree-lined community; \$98/wk. 626/280-7659.

N. GLENDALE, rm. in big Spanish house, nr. college, kitch. priv., priv. ba., must not be allergic to cats, non-smoking only, female pref. \$425 + \$100 sec. dep. 242-3633, eves.

PALM DESERT, exquisite, 2 bd., 2 ba. villa for vacations or long term, newly remodeled, w/skylight, patio & 2-car gar.; located across Living Desert; great locality; priv., secure resort w/ tennis cts., multiple pools, spas and clubhouse facilities; around 2 top resorts. 909/620-1364.

PASADENA twnhse., 2 bd. + den, 2 1/2 ba., Caltech area, 2-car garage, fireplace, washer/dryer; \$1,250. 626/585-1400, Dunken.

PASADENA apt., 2 bd., lanai, garage, Indry. rm., a/c, stove, garbage disposal, carpets, miniblinds, good closet and cabinet space, outdoor lighting; gardener, water & trash paid; great area, Sierra Madre Blvd. near California, close to Caltech, \$840. 805/967-7725.

PASADENA, lux. condo, spacious 2 bd., 2 ba., 1 blk. from Caltech, private end unit on 3rd flr. w/mtn view, patio, pool, parking, central heat & a/c, washer/dryer in unit; \$1,400, includes some utilities. 818/249-3059.

PASADENA, nr. Caltech, 2 bd., 2 ba., townhouse-style apt., central a/c, crpts., drapes, refrig., blt-in oven, covered parking, \$975. 626/355-0417.

PASADENA, rent-to-own condo, 2 bd/ba.; first 6 months rent can be used as down payment; security building, 2nd level, spacious, forced-air heat & cooling; Sierra Madre Blvd., \$895. 626/584-6526.

PASADENA, 1 bd. in nice 3-bd., 1-ba. townhouse, crss/Caltech, backyard, Indry., garage, all hse privgs., \$320 + share utilis; long-term prfrd. 626/795-5284, Damien.

SOUTH PASADENA, fully furn. studio apt. on 1 level; nice area on Huntington Dr. betw. Milan and Marengo, near shopping area;

utilities pd., laundry facilities on premises, + parking space; non-smoker; \$565. 626/792-9053, Marilyn.

TUJUNGA, 2 +1 + bonus, picket fence, roses, air, appliances, hdw. flrs., lrg. yd., gar., patio, mtn.vw., quiet, \$1,150. 353-4705.

## REAL ESTATE

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

LAKE COUNTY, N. Calif., 2 1/2 acre lot, in beautiful Kelseyville near Clear Lake, perfect site for permanent or retirement home, 30 walnut trees, paved road, electricity, \$36,000. 626/337-7522.

LAKE VIEW TERRACE home, 3 bd., 2 1/2 ba., fireplace, covered patio, built in '84, 20 min./JPL, \$168,000. 626/303-5243.

MEXICO CITY, Fr. Provincial style, artisan hand-carved façade, forged iron gate & fence, 3 stories, master suite, 3 add'l bd. w/balcony, 1 1/2 ba., liv. rm. w/ Fr. doors & fireplace, sep. maid's qtrs. w/priv. ba., sep. serv. rm., priv. din. rm., lg. kitch. & dining area, studio, fam. rm., spiral stairway to roof solarium, 2-car carport. 626/794-0455, Olivia Tyler, Tu/Th, 6-9p.m., Sat/Sun 9 a.m.-6 p.m.

NORTH HILLS home, great family home 25 min. from JPL, 4 bd., 2.5 ba., 2,450 sq. ft., 21x17 LR, formal DR, FR w. fp & wet bar, central ac/heat/vacuum, sec. syst., covered patio & nice yard, drastically reduced to \$169,000. 893-6084.

NORTH SAN GABRIEL, close to San Marino, excellent Temple City schools, 11 yrs. old, custom detached planned unit development, like new, looks like single-family home, 3 bd. and den/4th bd., 2.5 ba., 1,654 sq. ft., new paint, flooring and landscaping, security shutters, exc. cond., \$268,000. 909/598-0065.

PALM DESERT, exquisite, 2 bd., 2 ba. villa, newly remodeled, w/skylight, patio & 2-car gar.; located across Living Desert; great locality; priv., secure resort w/ tennis cts., multiple pools, spas and clubhouse facilities; around 2 top resorts. 909/620-1364.

PASADENA, prestigious Ritz-Carlton area, by owner, custom-built contemp. w/Buf and Hensman-designed patio & ent. area; 3 bd., 2-1/2 ba., att. 2-car gar. on huge lot (approx. 17,000 sq. ft.); very tranquil & priv. on tree-lined st.; addl. prkg. for 5 extra cars on long driveway; many extras, \$658,800. 626/799-6308.

PASADENA, rent-to-own condo, 2 bd/ba.; first 6 months rent can be used as down payment; security building, 2nd level, spacious; Sierra Madre Blvd., \$895/mo. 626/584-6526.

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Mark Whalen

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