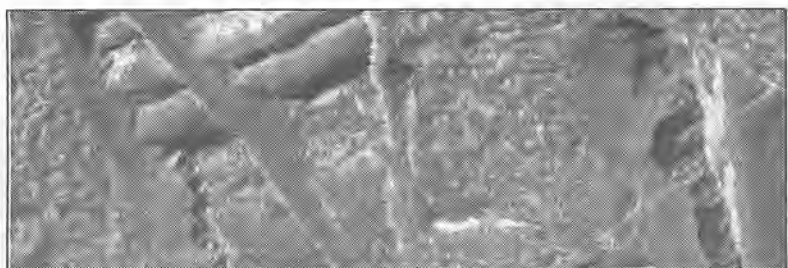


Galileo reveals best-yet Europa close-ups



P49631

New images taken by JPL's Galileo spacecraft during its closest-ever flyby of Jupiter's moon Europa were unveiled March 2.

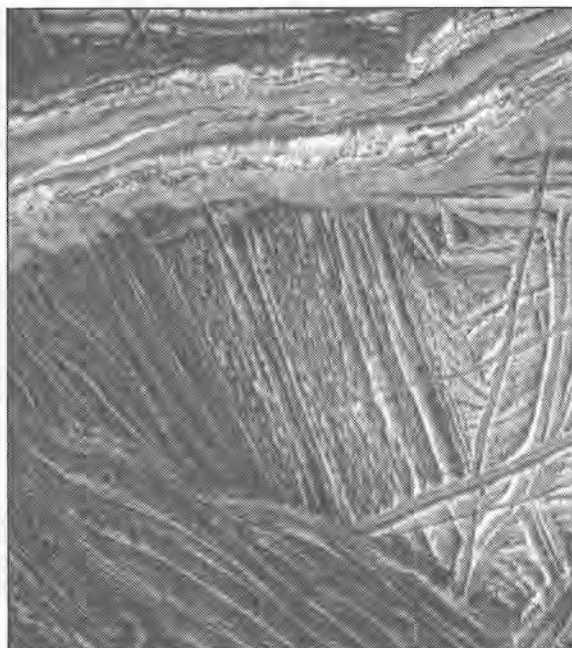
Europa holds great fascination for scientists because of the prospects that a liquid ocean might lie underneath its icy crust. The presence of water would increase the odds that life may have existed at some point in Europa's history.

The new pictures include high-resolution views of rough, broadly scalloped icy cliffs on Europa as high as Mt. Rushmore. Other images show an impact crater named Pwyll and the so-called Conamara Chaos region, where icy plates on the surface have broken apart and moved around. One large, icy fracture is big enough to be spanned by the Brooklyn Bridge.

The Galileo mission, which continues through December 1999, includes eight Europa flybys, four of the moon Callisto and one or two of the moon Io, depending on the spacecraft's health.

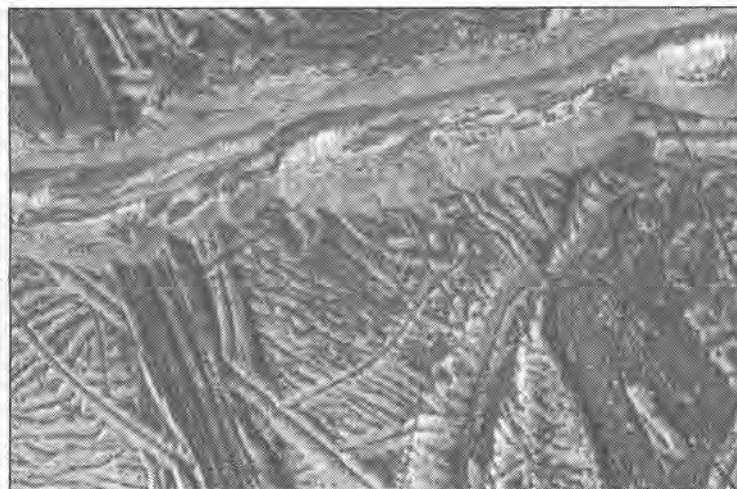
All recently released images are available online at <http://photojournal.jpl.nasa.gov>. □

The Conamara Chaos region on Europa, with cliffs along the edges of high-standing ice plates, is shown in the above photo. For scale, the height of the cliffs and size of the indentations are comparable to the famous cliff face of South Dakota's Mount Rushmore. The image at right shows an area of crustal separation. Lower resolution pictures taken earlier by Galileo revealed that dark wedge-shaped bands in this region are areas where the icy crust has completely pulled apart. Dark material has filled up from below and filled the void created by this separation.



P49633

The dark, relatively smooth region at the lower right hand corner of the high-resolution image at right may be a place where warm ice has welled up from below. The region is approximately 30 square kilometers in area (about 12 square miles). An isolated bright hill stands within it. The image also shows two prominent ridges that have different characteristics; the youngest ridge runs from left to top and is about 5 kilometers in width (about 3 1/2 miles).



P49629

Stone projects a promising future for Lab

By MARK WHALEN

JPL's future has never been stronger and its variety of challenges never broader, JPL Director Dr. Edward Stone told Laboratory staff last week in his annual State of the Laboratory address.

The Laboratory's transition from an organization focused on one large, innovative mission a decade to one that delivers several smaller, innovative missions every year "has not been easy, and it won't be in the future," Stone acknowledged. "But if it were easy, we wouldn't be asked to do it. We are asked to do these things because they are hard. That's the reason the nation, and NASA, need a place like JPL."

"That's what attracts and keeps most of us here," he added.

"Most of us can work elsewhere, and perhaps earn more doing so. What keeps us here is the challenge and the opportunity to do what no one has done before—to search for life elsewhere."

Videotapes of Dr. Edward Stone's State of the Laboratory address are available for loan from the Audiovisual Services Office. Call ext. 4-6666.

To help achieve success in its series of programs, the Lab must also continue its development of innovations in technology and in the implementation of new ways of doing business, he added.

Stone called 1997 one of the most exciting years in the Laboratory's history. Highlights included Mars Pathfinder's July 4 landing, marking Earth's first return to Mars in 21 years; Mars Global Surveyor's September arrival at the red planet; TOPEX/Poseidon's monitoring (and continued tracking) of the development of El Niño in the Pacific Ocean; Galileo, which finished its primary mission and began an extended study of Europa; and Cassini's October launch to Saturn "on schedule, under budget and full up in specification."

Pledging that 1998 will be "no less exciting," Stone cited Voyager passing Pioneer 10 on Feb. 17 to become the most distant human-created object in the solar system. He also noted that there will be six launches of JPL missions and instruments over the next 12 months.

JPL's missions are linked by the themes of searching for evidence of life outside of Earth as well as the discovery of the origins of galaxies, stars and planetary systems, Stone said. He called the search for life elsewhere "a shorthand term for one of the grand themes of what links many of our programs together."

Stone emphasized that since life has been detected "anywhere there's water on Earth—whether it's at the bottom of the ocean; around vents of near-boiling water from the interior of the Earth; in Antarctica, at near freezing; or in a rock two miles down—the search for life elsewhere, in a certain sense, is a search for liquid water elsewhere in the solar system."

Viking showed scientists the existence of water in Mars' past. But JPL's Mars program has already begun to step up the effort dramatically, as evidenced by its planned launches to the planet every 26 months for the next 10 years or more.

The Laboratory will also aggressively pursue the origins of life elsewhere in the solar system.

Under development are a half dozen missions that in the next 12 years will return samples of alien worlds for scientists' analysis: Genesis, solar wind, 2003 return; Stardust, comet, 2006; the Japanese MUSES-C, asteroid, 2006; Mars Surveyor, soil and rocks, 2008 and 2010; and Champollion/Deep Space 4, comet, 2010.

In addition, Stone noted that in the last few weeks NASA's Solar System Exploration Subcommittee proposed launch dates for several missions in the Outer Planets Kuiper: a Europa orbiter mission in 2003, Pluto Kuiper Express in 2004 and a solar probe mission in 2006 or 2007.

While the payoff from the Cassini mission may not be realized for another six years and more, Stone envisions a possibility of still further studies. "It's hard for me to imagine that after the success of studying Saturn and its moon Titan starting in 2004 we will not want to go back to further explore this world, which has on its surface layer upon layer of organic matter produced over millions of years, very much like our own polar caps have layer by layer records of our past climate in the layers of ice and snow."

At the same time, Stone said, the Origins program will step up the search for life beyond the solar system. The series of missions, which began with Hubble Space Telescope observations, will continue preparations for the next century with the development of the Space Infrared Telescope Facility (SIRTF), the Space Interferometry

See Stone, page 3

Lab recruits experts to help hunt for new planets and life

By JANE PLATT

Two newly arrived scientists at JPL will play a key role in the search for planets around other stars and the hunt for life beyond Earth. The appointments highlight a new JPL initiative to unite scientists from various disciplines, such as biology and astronomy, to study the evolution of planets and life in the universe.

Dr. Didier Queloz, a Swiss astronomer who co-discovered the first known planet around a star similar to our sun, is a Distinguished Visiting Scientist at JPL for the next year and a half. Dr. Kenneth Nealson has joined JPL as a Senior Researcher in Astrobiology, a new field whose goal is to understand how planets and life co-evolve.

While at JPL, Queloz will continue his search for planets and help the Lab develop sophisticated search technologies. His work will benefit NASA's Origins Program, a series of planned missions to study the formation of galaxies, stars, planets and life. The program has gained momentum from discoveries by Queloz, and subsequently other astronomers, of several planets orbiting stars beyond our sun. Many scientists believe this raises the odds that an Earth-like planet exists with suitable conditions for life.

Queloz, a Swiss citizen, got his degree in physics in 1990 from the University of Geneva, and worked on his doctoral thesis at Geneva Observatory with Professor Michel Mayor from 1991 to 1995. Using the French Elodie telescope in Haute Provence, France, they looked for signs of a Doppler shift in nearby stars. As a star moves closer and then farther away from Earth, the star's color shifts from red to blue. By detecting this motion, astronomers can infer that the star is being tugged by gravity from an orbiting planet.

"Back then, these experiments were considered a bit nutty," recalled Queloz. When Queloz

and Mayor first detected a Doppler shift from the star 51 Pegasus, Queloz said their first reaction was "We'd better check our instruments."

Even after they verified the instruments' accuracy, Queloz and Mayor spent several weeks monitoring 51 Pegasus to confirm the discovery. In July 1995, they were confident enough to buy a large cake and hold a celebration party in the south of France for family and friends. Queloz and Mayor formally announced their discovery, a Jupiter-sized planet orbiting 51 Pegasus, at an October 1995 scientific meeting in Florence, Italy.

Queloz and other astronomers face great challenges in finding new and better ways to detect planets more like Earth. Current techniques allow only for the detection of giant, Jupiter-sized planets, which are considered unlikely candidates for life.

While at JPL, Queloz will share his planet-finding experience with engineers who are designing more advanced technologies. Queloz is using a testbed interferometer at Caltech's Palomar Observatory to run tests on stars, to prepare for an observing program. This work will help pave the way for other Origins projects, including the W.M. Keck Observatory interferometer in Hawaii, the Space Interferometry Mission, and the Terrestrial Planet Finder, all being planned by JPL.

Interferometry combines and processes light from several telescopes to simulate a much larger



Dr. Kenneth Nealson



Dr. Didier Queloz

telescope, and holds great promise as a tool in the search for Earth-sized planets. "I'd like to play a role in future exploration by helping to define interferometry techniques," Queloz said.

Until very recently, an astronomer like Queloz would have had little if any interaction with a biological scientist like Nealson. But various disciplines such as astronomy, geology, biology and chemistry are joining forces to study the development of life on Earth and the prospects of life elsewhere. Therefore, the work of scientists like Nealson and Queloz is converging to form a broad, interdisciplinary approach.

"After all," said Nealson, "life is not a simple system and no science operates in a vacuum. Younger students are studying several disciplines to gain a more comprehensive view."

Nealson is part of this new wave of scientific training, as a geobiology teacher and faculty

See Planets/life, page 3

News Briefs

Gary Payton, deputy associate administrator for NASA's Office of Aeronautics and Space Transportation Technology, will be the keynote speaker for the ninth annual Advanced Propulsion Research Workshop and Conference being held March 11-13 in von Kármán Auditorium.

Experts from around the world will meet at the conference to discuss leading technologies related to space flight propulsion systems of the next century. The event is organized by JPL's Advanced Propulsion Technology Group for NASA's Marshall Space Flight Center, Huntsville, Ala.

Payton, a former astronaut who flew aboard Space Shuttle Discovery in 1985, heads up NASA's advanced propulsion concepts and reusable launch vehicle program. JPL Director **Dr. Edward Stone** will open the conference.

Session topics to be discussed include new studies analyzing the feasibility of a precursor to an interstellar mission, which JPL began conducting this summer on behalf of NASA. Other subjects are propulsion for the human exploration and development of space, advanced micro-propulsion, advanced chemical and fusion/fission propulsion systems, solar sails, tethers, and advanced materials for propulsion.

The registration fee for the conference is \$80 for the general public, \$50 for JPL employees and contractors.

For further information, e-mail Patricia Hayes-Rowe or call her at ext. 4-3637. □

JPL's Public Services Office is hosting the Eliot Middle School Science Fair March 24-26 in von Kármán Auditorium.

At least 50 JPL employees are sought to serve in the judging process for the competition, which will take place from 9 a.m. to 5 p.m. March 24 and from 9 a.m. to 1 p.m. March 26.

An awards program and project viewing will be held from 7 to 9 p.m. March 26 in von Kármán Auditorium.

If interested in serving as a judge,

contact **Kay Ferrari** at ext. 4-9312.

A mountain lion was recently seen on Lab. These animals and other wildlife live in the hills and brush surrounding JPL and are not normally a threat to people. However, JPL's Emergency Preparedness Office offers a few simple rules to maintain a peaceful coexistence.

- Do not leave food outside. The animals will depend on it.

- Do not attempt to approach them. Enjoy them at a distance.

- Do not move dead or wounded animals. Call ext. 3-3333.

- If animals enter buildings, do not attempt to remove them. Call ext. 3-3333 and keep other people from entering the area. Trapped animals can be dangerous.

If you encounter a mountain lion:

- Do not approach the animal.

- Don't run or make sudden moves.

- Do not crouch down.

- Stand tall; make yourself look as big as possible.

- Pick up children so you appear to be one large person.

- Face the animal.

For more information, call the Emergency Preparedness Office at ext. 4-1091 or 4-5535. □

Rick Shope of Section 311, who leads groups of educators and schoolchildren using mime and improvisational theatre techniques to teach about space exploration, is currently working to develop kinesthetic curriculum activities for the Galileo Europa Mission, Deep Space 1 and the Outer Planets/Solar Probe Project (previously known as the Ice and Fire Preprojects).

Shope is looking to form a group of JPL volunteers who are interested in learning how to lead such educational outreach activities in order to have a troupe to take part in upcoming events such as the JPL open house in May. He will host a performance workshop and audition March 19 at 3:30 p.m. in Kármán Auditorium.

For further information, please call Shope at ext. 4-3812 or e-mail to rick.shope@jpl.nasa.gov. □

Muirhead will manage DS4/Champollion

Brian Muirhead, project manager for JPL's Mars Pathfinder mission that delivered a lander and rover to the surface of Mars, has been named project manager for the Deep Space 4/Champollion mission to a comet.



Brian Muirhead

Planned for launch in 2003, the Deep Space 4/Champollion spacecraft will rendezvous with Comet Tempel 1 in 2005 and spend several months orbiting the comet nucleus, making high-resolution maps of its surface. The spacecraft will deploy a lander with a 1-meter-long (3.3-foot) drill to collect samples that will be analyzed on-site; an attempt will be made to return a sample to Earth in 2010.

The project is part of the Deep Space mission series under the New Millennium Program, designed to perform flight demonstrations of new spacecraft technologies for solar system and Earth-orbiting missions.

See Muirhead, page 4

Muirhead named engineer of the year

For his leadership of the high-risk, low-budget Mars Pathfinder mission, **Brian Muirhead** has been named 1998 Engineer of the Year by the readership of Design News, which represents a national audience of engineers and aeronautics specialists.

Muirhead will receive a \$25,000 educational grant, to be designated to his alma mater, Caltech, from the magazine's Engineering Education Foundation. He will also share an additional \$10,000 educational grant with

other winners of the magazine's Special Achievement and Quality awards. Both grants have been earmarked for economically disadvantaged engineering students attending Caltech, where Muirhead earned his master's degree in aeronautical engineering in 1982. He also holds a bachelor's degree in mechanical engineering from the University of New Mexico.

Muirhead will be honored at an awards ceremony to be held March 17 in Chicago. □

Manning named Mars Program chief engineer

Rob Manning, chief engineer of JPL's Mars Pathfinder mission, has been named chief engineer of JPL's long-term program of robotic exploration of Mars.

Manning's newly created position involves coordinating the engineering efforts of all robotic spacecraft and instruments currently in development or planned for future missions to Mars. Manning will

serve on the JPL engineering council, lead study teams, sit on review boards and solve engineering problems that cut across all Mars projects.

"We are delighted to have some-
See Manning, page 4



Rob Manning

1997-98 United Way campaign summary by directorate

JPL personnel contributed more than \$446,000 to the 1997-98 United Way campaign. Per capita contributions were \$89.89, up \$3.50 from 1996-97. Following are contributions by directorate.

Directorate	Employees	Contributors	% Participation	\$ Amount	Per Capita
1	176	129	73%	\$24,359.60	\$138.41
2	279	167	60%	\$13,188.00	\$47.27
3	3,359	1,682	50%	\$298,839.60	\$88.97
4	36	25	69%	\$6,192.00	\$172.00
5	200	149	74%	\$21,273.52	\$106.37
6	570	368	65%	\$31,769.80	\$55.74
7	157	98	62%	\$17,875.00	\$113.85
8	77	57	74%	\$11,728.00	\$152.31
9	113	92	81%	\$21,248.68	\$188.04
Total	4,967	2,767	56%	\$446,474.20	\$89.89

Special Events Calendar

Ongoing

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

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

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

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

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

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

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

Friday, March 6

JPL Dance Club—Meeting at noon in Building 300-217. Call Judy Pons at ext. 4-2077 or send an e-mail to jpons@jpl.nasa.gov for information on membership and nominations for club officers.

Saturday, March 7

The Glass Menagerie—Tennessee Williams' semiautobiographical play will be presented by Glendale's repertory theater, *A Noise Within*, at 8 p.m. in Beckman Auditorium. Tickets are \$26, \$23 and \$20. For information, call (626) 395-4652.

Caltech-Occidental Symphony Orchestra—Admission is free for this 8 p.m. presentation at Caltech's Ramo Auditorium. The program is to be announced. For information, call (626) 395-4652.

Sunday, March 8

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

Monday, March 9

SESPD Lecture Series—Frank Carsey will discuss the RADARSAT Antarctic Mapping Project at 11 a.m. in the Building 167 conference room.

Tuesday, March 10

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

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

Wednesday, March 11

Dr. David Baltimore Reception—The inaugura-

tion of the new president of Caltech will be celebrated at 3 p.m. in the mall. Refreshments will be served. If planning to attend, contact the Public Services Office at pso@jpl.nasa.gov or ext. 4-0112.

Dr. Stephen Hawking Lecture—The renowned physicist will present a public lecture titled "Predicting the Future: From Astrology to Black Holes" at 8 p.m. in Caltech's Beckman Auditorium. It will be simulcast to von Kármán Auditorium.

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

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

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

Thursday, March 12

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

Friday, March 13

ERC Family Festival—Robin Williams' crazy antics highlight Disney's *Flubber*. At 6 p.m. in von Kármán Auditorium. Tickets are free and available in the ERC office Monday, March 9.

JPL Dance Club—Meeting at noon in Building 300-217. Call Judy Pons at ext. 4-2077 or send an e-mail to jpons@jpl.nasa.gov for information on membership and nominations for club officers.

Saturday, March 14

Downhome Music—Guitarist Doc Watson and

mandolinist David Grisman will team up for an 8 p.m. concert in Caltech's Beckman Auditorium. Tickets are \$32, \$29 and \$26. For information, call (626) 395-4652.

Sunday, March 15

Chamber Music—The quintet Calico Winds will perform a program of classical works at 3:30 p.m. in Caltech's Dabney Lounge. Admission is free. For information, call (626) 395-4652.

Wednesday, March 18

Associated Retirees of JPL/Caltech—Members will take an architectural tour of the Caltech campus, including lunch at the Athanaeum. Cost: \$15.

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

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

Thursday, March 19

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

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

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

Von Kármán Lecture Series—Dr. Anthony Freeman will discuss "Mapping the Amazon: Science, Supercomputers and Synthetic Aperture Radar," at 7 p.m. in von Kármán Auditorium. Open to the public.



Earth-imaging radar to go 3-D

Astronaut Donald Thomas visited JPL last month to view preparatory operations for the JPL-managed Shuttle Radar Topography (SRTM) mission.

During its 11-day mission in 1999, SRTM will employ the Spaceborne Imaging Radar-C/X-Band Synthetic Aperture Radar (SIR-C/X-SAR) hardware that flew twice on Space Shuttle Endeavour in 1994.

In left photo, Curtis Tucker, project element manager for SRTM's structural mechanical subsystem, points out features of the SIR-C antenna in the Spacecraft Assembly Facility to Thomas (center of group), JPL radar engineer Ed Carrow (to Thomas' left) and Johnson Space Center mission operations

staff who joined Thomas on his visit.

Below, as Thomas (left) and Carrow view SIR-C/X-SAR images of Brazil, they hold a space shuttle model that shows the scale of SRTM's 60-meter-long (200 feet) deployable mast, which will be added to the SIR-C/X-SAR hardware. When the shuttle reaches orbit, the mast will deploy, creating a fixed-length interferometer at both C-band and X-band frequencies.

Analysts will use the SRTM data to generate 3-D topographic maps of 80 percent of the Earth's land surface. Data will also be used to create 3-D pictures to study environmental factors that include flooding, erosion, landslides, earthquakes and climate. □



JPL PHOTO LAB

Stone

Continued from page 1

Mission (SIM) and the Next Generation Space Telescope.

To aid the Laboratory in carrying out its challenging Mars, Outer Planets and Origins programs now and in the future, the director pointed out that the New Millennium Program is a key element "to help us invest in, develop and demonstrate the flight technology we need to do these missions."

"Technical innovations have been our forte for the last four decades; that's not new," Stone said. "What's new is that we have to be innovative in an era of faster development and lower cost."

Stone said he was encouraged by four aspects of technical innovations recently implemented on Lab:

- **Innovative spacecraft technologies**, such as X2000, which has a goal of drastically reducing the size, mass and power requirements of spacecraft avionics. "Cassini's dry mass was about 2,000 kilograms; Mars Pathfinder nearly 1,000 kilograms; the new outer planet spacecraft will be 150 kilograms—that's the challenge. And 10 years from now, we want it to be 25 kilograms, down another factor of six."

- **Innovative spacecraft operations**, such as for Deep Space 1. "Not only does it have solar electric ion drive, which is an important step in interplanetary navigation, it will also have autonomous, or on-board navigation—clearly the next step in being able to fly a large number of missions is to have the missions be able to fly themselves. That clearly requires technical innovation."

- **Innovative sensor systems**, including New Millennium's Deep

Space 2 project onboard the Mars Polar Lander, in which probes will be embedded in Mars' surface to analyze the soil.

In addition, Stone added, such sensor innovations are also necessary on a much larger scale. "Mass to orbit is money. This also has tremendous significance for commercial applications—if you spend \$1 billion to put a system in Earth orbit, such as a radar, you have to sell an awful lot of product commercially to ever get your money back. On the other hand, if you can put a system up for \$100 million, it's one-tenth the amount of product you have to sell, and suddenly the commercial possibilities become real."

"So these innovations not only enable the kind of science we need to have in order to improve the quality of life here on Earth, it's also enabling us to become a more spacefaring nation."

- **Innovative approaches**. "SIRTF in 1990 was 5,700 kilograms, a multi-billion dollar program. Now it's been reduced to 900 kilograms, due to the innovative approach of putting it in orbit around the sun rather than around Earth, carrying enough liquid helium so the mission can last five years rather than three. That is the reason SIRTF is in the budget and will be launched in 2001—because of an innovative approach of going into orbit around the sun and changing the entire thermal environment in which this telescope will operate, which is at liquid helium temperatures."

Stone also said that both external and internal innovations in implementation also play key roles in JPL's success.

- **Innovative external implementation** is typified by JPL's partnership with Ball Aerospace in developing the QuikSCAT mission, which will replace the NASA Scatterometer (NSCAT), lost onboard Japan's

ADEOS satellite last year. Ball's experience in small, Earth-orbiting spacecraft will help JPL to complete QuikSCAT in 12 months.

"That's the kind of innovation in external implementation that will be critical for us to do all that we're being asked to do within finite dollar and work force resources," Stone said.

He also noted that three of eight finalists for NASA's Low Award (equivalent to the Baldrige Award for corporate business) are companies that worked with JPL on Mars Pathfinder. In particular, he cited ILC Dover, which developed Pathfinder's airbags.

"The problem was, we didn't know enough about airbags to write such specifications; the people who build airbags didn't know enough about space to be able to respond to any such specifications had we written them. We formed a working team that combined our expertise in space with their expertise in materials and airbag systems to create collaboratively the system that got Pathfinder on the surface of Mars last July 4."

"That was a true partnership, and was not the classic way of dealing with a contractor. It's that kind of mode, of working with external expertise, that's going to allow us to tap into the entire capability of this nation to create this program."

- **Innovations in internal implementation**. As evidence of successful innovations inside of JPL, Stone praised the efforts of the seven teams that won Process Improvement Awards last year, citing two as examples.

The Procurement Requisition Direct Entry Team, comprised of Francine Fisher and Virginia Kemp of Section 623, created a streamlined, online procurement system that saves time and about \$170,000 a year for the Lab. "I

asked them," Stone said, "What is the biggest challenge you had in doing this?" The answer was breaking away from the way it was always done."

The Electronic Parts Acquisition Team improved the procurement of space-qualified electronic parts. It created an online system that includes 200,000 parts that can be ordered and received in two days. It's estimated that the new system will save JPL \$800,000 a year.

"Ed Svendsen, the team leader, had a wonderful way of describing the challenge," Stone said. "He called it 'Shrugging off the dead hand of tradition.'"

"Tradition is important where it is a key to your success," Stone offered. "But it can be an inhibitor when it's getting in the way of changes you need to make."

"I often get asked 'Why can't we slow down the pace of change, put it on hold for awhile?' We've been at this internal change process for five years, but we're still not where we need to be to cope with faster, better, cheaper without burning out everyone in the process," he added.

That's an indication, Stone told the audience, of how difficult innovations in implementation are. In the next six months, the Develop New Products process and New Business Solutions Project will roll out a new set of systems on Lab. "We all have to resist the dead hand of tradition so that we can remain the best in the world at what we do."

Stone also said JPL has played a very important role in "setting up the circumstances" that have led to the nation's reinvestment in NASA's program. "We have made deals and have stuck to them," he said. "We do what we say we're going to do; we don't go back and ask for more."

"It's not an accident that space science has grown in the last two years in the president's budget," he added. "This is a result of clear strategic planning and leadership on the part of NASA Administrator Dan Goldin and clear leadership on the part of Wes Huntress. Their leadership has made it possible for the administration to send to Congress last year the first increase in the science budget in years, and this year to send back a budget with a still larger increase in the out years for space science."

In answer to an audience question, Stone said JPL is still on target for a work force in 2000 of around 5,000 people. "It's been a very painful five years in terms of the downsizing we've gone through, but fortunately the end is in sight. We should concentrate our work force on doing the really critical, innovative things—and finding our partners in universities, industry and other federal labs—to help us do the rest of the program."

"We still have some downsizing left to go, but once we get there the Lab will be in very good shape. I think NASA understands that where we're going to end up in a couple of years is where we're going to stay. That's the end of it; we've done our job."

Stone recalled the recent 40th anniversary of Explorer 1—the JPL mission that launched the United States into the Space Age—and stressed that all space missions since then "have been fueled by innovations here at the Lab."

"The first 40 years were extremely exciting for JPL; the next 40 can be even more so. It will be hard, will require innovation and will be unpredictable, but if anyone can do it, we can, and that's the reason we've been asked to do it." □

Planets/life

Continued from page 1

associate in Caltech's Geology and Planetary Sciences division. At JPL, Neelson has been appointed to head a new astrobiology unit. Neelson said that over the next few years his astrobiology group will develop an understanding of the way life and planets have evolved, and will define the signatures of life.

"Not many foolhardy souls have ventured into this area," Neelson said. "How can you find life if you don't know what you're looking for? This is a very, very important problem to be solved because right now

we're not sure how to distinguish life from non-life. Our goal is to develop tools to make that distinction clearly."

In recent years, microbiologists have made startling discoveries about the hardness of life on Earth, studying living organisms in thermal vents, acid lakes and other unlikely environments. Neelson pointed out, "This has opened the eyes of scientists to the notion that life could exist under seemingly inhospitable conditions on other planets."

Astrobiologists will also study changes in Earth's chemical composition over billions of years. They will then apply this knowledge to other planets to look for "chemical signatures" that might indicate that life has

existed or could exist there.

Neelson said astrobiology will be useful for numerous space missions, including the Mars sample return mission, scheduled to bring back Martian rocks in the middle of the next decade. Astrobiology will also benefit the Origins Program's Terrestrial Planet Finder, which will look for Earth-like planets around other stars and hunt for signs of life-sustaining chemicals. Neelson said astrobiological studies may prove valuable in the study of Jupiter's moon Europa, which may have liquid oceans under its frozen surface. This icy moon is currently being studied by JPL's Galileo Europa Mission, and a new Europa Orbiter has a planned launch in 2003. □

Computer security heightened

JPL, along with all other NASA centers and some other federal government installations, experienced a computer security breach earlier this week, another in a series of recent break-in attempts.

Dr. Richard Green, deputy manager of the Institutional Computing and Information Services (ICIS) Office, said the most recent incidents occurred in the evening hours of March 2 through midday March 3. He termed the break-in as a "denial of service" attack, which primarily affected users of the Windows NT operating system.

About 95 percent of such users were affected, he said. The attack denied service to authorized users until their sys-

tems were rebooted, but no data is known to have been lost, he added.

The incidents are under investigation by JPL computer security officials and NASA's Office of the Inspector General.

JPL Deputy Director Larry Dumas earlier this week issued a memo to all personnel outlining new computer system security measures to deal with the recent attempts at unauthorized use of JPL systems and data. Plans include the installation of banners to be installed on computers to warn unauthorized users.

For online information, see <http://security.jpl.nasa.gov/banner.html>. □

Focus on safety

From JPL's Safety Operations Section

Safety record set at end of '97

JPL employees set a safety record during the last three months of 1997, as no lost-day injuries were reported on Lab.

In fact, said Charlayne Fliege of the Safety Operations Section, the Lab had never before recorded two such consecutive months, much less three.

The Safety Operations Section's web site at <http://techno.jpl.nasa.gov/jpl/safety/index.html> includes a new link for the Lab's lost-time records, which will be updated monthly. □

New standard helps alleviate injuries

In mid-1997, the California Occupational Safety and Health Administration (CAL/OSHA) enacted an ergonomics standard

that requires each employer to establish a program to minimize repetitive musculoskeletal injuries (RMI) through worksite evaluation, control of exposures that cause RMI, and training.

As one part of a response to this standard, the Facilities Engineering and Construction Section and Safety Operations Section have established ergonomic design standards for office workstations for offices that accommodate one to four persons. The designs involve combinations of the use of existing standing furniture, new furniture and fixtures.

Under-the-table keyboard platforms with mouse extensions are now provided at each computer workstation. Acquisition of ergonomic chairs will still require an ergonomic evaluation. The Safety Office still provides ergonomic training and evaluations upon request.

For further information, call Tam Antoine at ext. 4-4206 or Alison Weisbin at ext. 4-8527, or visit the Safety Operations Section's web site. □

NBS to deliver online timekeeping system

By TIM SCHECK
NBS communication manager

The first module of the Lab's New Business Solutions (NBS) Project to be delivered this year that will affect all JPL employees will be the new timekeeping system. Employees will enter their time on a personal online time record, which will greatly simplify the current tedious, paper-based process.

Supervisors will review time records online on an audit basis. Happily, the familiar but antiquated paper time cards will soon become history.

The system will be web-based and

accessible from any JPL computer with a web browser, including those with remote access to the "jpl.nasa.gov" domain. Employees who do not have computers will record their time at conveniently located kiosk computers. (The new timekeeping system will not be used by contractors.)

Employees will be brought up on the new system at the rate of 1,000 per week, starting in late spring. The NBS training team has developed a schedule to train users during the same week that they begin using the system. It is envisioned that this new

system will be quite simple to use; however, on-screen messages, local timekeeping subject matter experts and a customer support service will be available to ease users through the transition to the new system. A training liaison person in each major organization has been identified to work with NBS to ensure the needed training is available.

Kathy Harris, who heads NBS training, will describe how Laboratory users will be trained to use the new NBS/Oracle business applications during a noon presentation Thursday, March 19 in Building 180-101. □

Muirhead

Continued from page 2

A native of Chicago, Muirhead joined JPL in 1978 and has worked on missions including Galileo to Jupiter and the Earth-orbiting Spaceborne Imaging Radar (SIR-C). Muirhead also managed JPL's Advanced Spacecraft Development Group and Mechanical Systems Integration Section. He joined the Pathfinder mission as flight system manager and was responsible for the design, development, test and launch of the spacecraft. After launch, he served as deputy project manager before being named project manager upon Pathfinder's successful landing last July. □

Manning

Continued from page 2

one of Rob's caliber in this position," said Donna Shirley, manager of the Mars Exploration Program Office. "Establishing a chief engineer at the program level will allow us to save money and avoid duplication of effort."

Manning oversaw all technical aspects of the Pathfinder spacecraft. He managed the technical aspects of the novel entry and landing approach and led the team that designed, developed, tested and operated the spacecraft's entry, descent and landing system.

With an expertise in spacecraft computing and fault-tolerant computer systems, Manning has held key positions in the development of a variety of interplanetary spacecraft, including Galileo and Magellan. More recently, he served as the cognizant engineer for all onboard computers on the Saturn-bound Cassini spacecraft.

Manning earned a combined bachelor of science degree in mathematics and physics in 1980 from Whitman College, Walla Walla, Wash. He joined JPL in 1981 and a year later completed a second bachelor's degree in engineering and applied science at Caltech. □

LETTERS

Nancy and I thank our friends, colleagues and the ERC for their kind expressions of sympathy upon the recent death of my mother.

Dick Sphehalski

□□□

Thank you so much to my JPL and OAO friends and co-workers for the many prayers made for my sister's behalf during her years of surgeries and treatments. She is now at peace and your expressions of love and sympathy will comfort me in the days ahead.

Sandra (Saunie) Edwards
□□□

I want to thank all who were at my retirement luncheon on Feb. 20 for the wonderful time and for the great gifts. I also want to give special thanks to Annie Aroyan, Minnie Perry and Mark Underwood for arranging it. But my real thanks must go to all of you JPLers, both active and retired, who I have worked with these past 41+ years for the often difficult but always challenging adventure extending from the Sergeant missile—which was named for a rank that I never attained while serving in the Army—to Sojourner Truth, named for a fine lady whose faith in Jesus Christ as her Lord and Savior I share. I know I will see many great reports as JPL continues this incredible adventure well into the next millennium.

Ron Banes

FOR SALE

AQUARIUM/TERRARIUM, 40-gal., no leaks; \$25. 626/797-3156.
BABY ITEMS: second-hand playpen, carry crib and changing table. 626/791-7044, Laurence.
BASEBALL CARDS, '96 Bowman unopened box, 24 unopened packs, major stars and rookies, \$115

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Universe

Editor
Mark Whalen

Photos
JPL Photo Lab

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Beckett value, sell \$40. 626/914-6083.
BICYCLES, his and hers Huffy 12 spd. street bikes, 27" and 26", \$80/obo for both. 909/393-9586.
BIKES, man & ladies, \$30 & \$40; FUTON, frame only, new cond., \$20. 289-2688.

CABOVER CAMPER, self-contained, slps. 6, fits light truck; incl. qn. size bed, stove, fridge and more; \$600/obo. 626/357-6851.

CARPET, wool, slate blue, exc. cond., 12' x 13', pd. \$750, sell \$200. 626/357-8210.

CELLULAR PHONE, Motorola Tac Lite XL, recharger, & car adapter, \$130. 626/795-6538.

COFFEE TABLE, oval glass top, 30" x 60", with gold-painted iron base in scroll pattern; exc.; \$150/obo. 249-8088.

COMIC BOOKS, various titles, exc. cond.; call for specifics. 626/335-5249.

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

COMPUTER GAME, Blade Runner, 4 CD-ROM adventure game for PC, all instr. and pkg., \$35. 310/278-8140.

COMPUTER, Mac Performa 635 CD, 33 MHz 68040 cpu, 32 MB RAM, 260 Meg HD, 8 bit color video, CD-ROM, Ethernet port (10 base T and 10 base 2), mouse, keyboard; 17 in. multisync monitor (Mac and PC compatible); sys. 7.5, easy upgrade to 7.6 or 8; comes with Claris Works (word processor, spreadsheet, database), American Heritage Dictionary, misc. freeware; \$600. 562/695-9303, eves.

COUCH, sectional, blue really fine corduroy, double cushion back, can be used in corner or long line; 3 sitting cushions on one side, 2 on the other; whid-den footrest that comes out; vg cond.; \$250. 893-3108, Carole.

DINING ROOM SET, pecan, 42" x 56" oblong table w/6 chairs and 24" leaf, \$200; CHINA CABINET, matching glass front, \$150; \$300 for both. 790-1649.

DRESSER w/mirror, antique oak, exc. cond.; photo avail.; \$595. 952-8455.

DRYER, electric, exc. cond., avail. 3/15, \$150. 626/304-0565.

ENTERTAINMENT CENTER, oak, L-shaped cabinet w/beveled glass door; holds TV, VCR and stereo components w/extra storage for CD's, tapes, records; top lifts for turntable access; exc. cond.; must sell ASAP; \$175/obo. 626/791-7645.

FREEZER, 20 cu. ft., Kenmore upright, manual defrost, vg cond., \$200. 790-1649.

HOME THEATER EQUIPMENT: Sony STRD-2020 receiver w/Dolby Prologic & DSP, 120W front, 15W rear, 2 digital inputs, \$275; Yamaha amplified (30W) center channel spkrs., \$25; pair of RSL 3800 Studio Monitor spkrs., 3-way (12" woofer, 4" midrange, 1" tweeter) w/loor stands, \$300. 626/288-5877.

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.

POOL TABLE, 4' x 8' oak w/leather pockets; 2 sets of balls, cues and misc. access.; \$700. 249-3628.

RECLINERS (2), twin, new, burgundy, soft suede, long, \$500; small recliner, blue, soft fabric, med., \$75; SOFA BED, 6 1/2', gd. cond., desert colors, \$125; EXERCISE MACHINE, cross country glider, new, easy to work, \$100. 626/441-2097 or 441-6065, after 6 p.m. M-F or after 8 a.m. Sat.-Sun.

RECORDS, lots of 45's and LP's, \$25-.50 ea.; CLOCKS, 2 new old stock Pepsi Cola, \$15 ea.; BUFFALO SKULL, old, \$85; HORSE HAIR, 2 pr. vintage, \$10 pr.; TELEPHONE INSULATORS, several old green, \$1 ea.; RADIO, portable, 1941 black Zenith, clean, but not working, \$35. 248-5282.

ROCKER, upholstered, \$20; CHAIR, upholstered, \$20; chair on wheels, leather, upholstered, \$20; END TABLES (2), \$3 each; SOFA BED, \$75. 626/441-4098 or 441-2097, after 6 p.m. M-F or after 8 a.m. Sat.-Sun.

SHELVING, sturdy metal, 7' tall, 36" x 18" wide, 7 shelves; have 7 sets; \$30/each. 893-3108, Dean.

SOFA, 8 ft., slightly curved, quilted, off-white w/ subtle floral design; vg cond.; \$250. 626/797-3156.

SOFTWARE, Turbotax, '98 Fed final/final CD-ROM (std ed.) + '98 Calif. final, \$10 takes both. 805/297-0219.

SOFTWARE, website authoring "HTML Construction Kit", new, \$10; 805/297-0219.

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

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

TICKETS for Kings hockey, 2 tickets + parking in Forum lot; on blue line, colonnade, row 11; Thurs.,

March 5 vs. Carolina and Thurs., April 9 vs. Edmonton; \$45 each game. 626/331-9998.
WASHING MACHINE (Maytag) and DRYER (electric), almost new, \$300 for pair/obo. 248-1790.
WEDDING KIMONO, heavily embroidered red and gold brocade, 100% silk, perfect cond., \$500. 626/577-2217.
WEIGHT BENCH, \$30. 310/618-8977.

AUTOS / RVs

'89 CADILLAC Allante, pearl white, 120K mi., \$15,000. 626/795-6538.

'89 CADILLAC DeVille Sedan, dark blue in/out, loaded, digital dash, leather, 66K mi., \$8,500, orig. owner. 790-4028.

'96 CHEVROLET Tahoe, emerald green, V8, 4 dr., fully loaded., 25,300 mi., pwr. w/everything, LoJack alarm sys., cass./CD player w/8 speakers, roof rack, mirror w/compass, exc. cond., must sell. 626/268-1963.

'90 CHEVROLET 1500 X-cab, short bed pickup, fully loaded Silverado V8, auto, trans., cass. tape, 120K mi., \$9,000. 626/284-1564.

'81 CHEVROLET Caprice wagon, recently repainted and overhauled; vg cond.; best offer. 626/796-4677, after 7 p.m.

'89 DODGE Caravan, great family car, auto., turbo, white/blue, c.c., air, loaded, privacy glass, AM-FM cass., dealer maint., all records; bought new Caravan, must sell, \$3,300/obo. 240-2104.

'94 FORD Explorer XLT, with H.D. service and tow pkg., white w/tan interior, 45K mi., \$13,200. 626/357-7347.

'91 GEO Storm, 60K mi., vg cond., Alpine CD player, a/c, 5 spd., \$4,900/obo. 626/303-3880.

'90 GEO Prizm, 4 dr. sedan, pwr. steering & brakes, AM/FM stereo, auto, air, \$3,700/obo. 626/793-9150.

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

'88 LAYTON 5th wheel camper, 28 ft., exc. cond., very little use; a/c, central heating, full kitchen & bath, elec. jacks, awning, slps. 6; '89 CHEVROLET Silverado pickup truck 1 ton w/454, ext. cab, new body style, 57K orig. mi., runs great; must sell, will accept any reasonable offer. 626/798-6405, Marco.

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

'89 MAZDA MX-6 GT Turbo, a/c, moonroof, ABS, pwr. everything, gray ext., burg. int., trailer hitch, \$5,200. 213/259-8604.

'77 MERCEDES 280 SE, mint cond. & well-maintained, runs like new; charcoal gray, 4 dr. w/sunroof, \$4,500/obo. 213/669-5700, Mary.

'73 MERCEDES 280 SE, white, 4 dr., classic V8, auto, blue leather int., spotless, 139K mi., vg cond., \$3,500 firm. 626/968-3479, eve.

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

'87 NISSAN Maxima, 1 owner, 93K mi., new tires, exc. cond., auto., a/c, runs great, svc. record, \$3,000. 213/257-7217, eves.

'90 SKAMPER camper trailer, model 211C; slps. 5, equipped for elec. or propane use, stove, fridge, sink, elec. hook-up for towing, tow ball incl., \$2,000. 626/358-1786, Dave.

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

'93 TOYOTA truck 4X2, red, bed liner, CD player, 130K, exc. cond., blue book \$6,300, will sell \$5,400. 244-0751.

'91 TOYOTA Tercel DX, white, 4 dr. sedan, a/c, auto trans., pwr. steering, stereo w/cass., 77K mi., exc. cond., \$5,800/obo. 626/447-1953.

'86 TOYOTA Celica GT, exc. cond., auto, 4 cyl., black, 1 owner, cruise, air, r/d, 47K mi., \$4,000/obo. 352-5608.

'91 VOLVO 240, exc. cond., electric windows & door locks, a/c, radio w/cass., 127K mi., serviced regularly, \$9,500/obo. 895-2866.

WANTED

AIRLINE MILEAGE from United; if willing to donate United mileage-plus miles for a friend with cancer

who wants to go to Orlando, FL through Dalmation Friends (adult version of Make-a-Wish for kids); please call for further info. 909/596-4390.
BOY SCOUT MEMORABILIA: patches, uniforms, etc., for collection. 909/946-0920.
CHEST, cedar or hope, 48-54" wide preferred. 626/794-2108.
SPACE INFORMATION & memorabilia from U.S. & other countries from past & present. 790-8523, Marc.
TREADMILL, Landice 8700 series or equivalent. 249-7028, eves, John.
VANPOOL RIDERS, full and part-time for van #20, w/stops in Northridge and Granada Hills. Ext. 4-2918, Michele.

FREE

CAT, black & white, long hair, very friendly. 626/796-3466.

CATS, good homes sought for 3 lovable felines; female gray tabby, 2 yrs.; female black longhair, 4 yrs.; male orange tabby, 1 1/2 yrs.; all shots, spayed/neutered; good w/children. 952-8465, Alex.

DOG, 4 mo. male pit bull, brown & white. 548-3442.

PUPPY rescued, brindle; owners abandoned him when they moved; 4 mos. old, wonderful disposition, cat friendly. 626/796-3466.

FOR RENT

ALTADENA guest house, living/dining rm., kitchen, bd., priv. bldy.; 437 E. Marigold; \$575 incl. utils. 626/296-0431.

ALTADENA ranch house, 2 bd., plus den w/fp., 1 1/2 ba., lg. liv. rm., area for washer & dryer, lg. kitchen w/dining area, double garage with lg. yd. 445-0123 x210, Romie.

ALTADENA, 1 bd. back house, Florencia area, short walk to JPL, pets OK w/dep; fenced yd., Indry, kitchen, clean & quiet; \$425 + part utils. 626/794-6076.

ALTADENA, 3 bd., 3 ba., plus studio room; on cul-de-sac, 437 E. Marigold; \$1,100. 626/296-0431.

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

GLENDALF, light & airy, 700 sq. ft., 2 bd., 1 ba., apt. over garage & studio apt.; stove, refrig., garage prkg. for 1 car; 15-20 min./JPL; \$650 incl. gas & water. 249-3602.

MONTCLAIR, 3 bd. condo/townhouse, 2-car attached garage w/ndry, hookups, small yd., complex incl. pool & Jacuzzi. 909/465-1713.

MONTROSE/GLENDALE deluxe 2 bd. condo, 1 1/2 ba., cent. air, well decorated, pool, Jacz., rec. rm., exercise rms., Indry, facil., sec. bldg., 5 min./JPL, near 2 hwy.; \$1,150. 626/447-1953.

N. ALHAMBRA, lg. 1 bd. duplex in gd. residential area; 700 sq. ft., clean, hwd. floor, 1-car garage; stove, window a/c, refrig., washer; avail. 3/15; water, trash and gardener provided; \$600. 683-9935, eves.

PASADENA guest house, 1 bd., refrig., stove, a/c; Chapman Woods area; utils., \$750. 626/793-7937.

PASADENA, end-unit townhouse, 1 bd., 1 ba., attached private garage, laundry hookups, patio; corner Magnolia/Alpine, 5 min./CIT, 10 min./JPL; pool/Jacuzzi/sauna; avail. 3/98; water incl., \$975. 626/568-8298, eves.

PASADENA, rear 1 bd. cottage, 1 ba.; light, airy, quiet lg. bd. and closet carport; stove and refrig. turn; water pd., \$690 + \$400 sec/cleaning dep. 626/797-4745.

PINE MOUNTAIN, 2 bd., 1 1/2 ba. house; carpool to JPL avail.; \$550. 310/831-4234, Peter.

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: ddenoyel@co.la.ca.us.

SOUTH PASADENA townhouse, 3 bd, 2.5 ba., 2-car att. garage; 1,125 sq. ft., built 1988; 1037 Arroyo Verde Rd. #C; \$1,100, 1-yr min. lease. 548-2671.

SOUTH PASADENA, 1718 Huntington Dr., good area east of Marengo; fully furn. bungalow studio apt., carport, laundry room, a/c-heater; non-smoker; utils. pd.; avail. immediately & 4/1. 626/792-9053, Marilyn.

TUJUNGA, duplex, upper; 2 bd., 1 ba., 2 patios, new crpt., fresh paint, stove, refrig.; no pets because no yd.; splendid view; 20 min./JPL; \$560. 352-5608.

VALENCIA, 4 bd., 3 ba., 2-story house, fully marbled ground floor, living rm., dining rm., family rm.,

kitchen, Indry. rm.; rent/lease, \$1,350. 805/296-6934, Rose.

REAL ESTATE

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

HIGH DESERT, 7 1/2 acres, custom home, all fenced, 2 wells, 7 lakes w/fish, 2 mobile sites (income), hundreds fruit & shade trees; photos avail., much more; \$189,750. 626/797-8776.

NEWBERRY SPRINGS, 5 acres, horse property, 1,600 sq. ft. custom home; fenced, 2 wells, 3 lakes, 75/80 fruit & almond trees, storage bldgs., mobile home site, etc.; photos avail.; \$169,750. 626/797-8776.

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; \$125,000. 626/564-9607, Diana deNoyelles; e-mail: ddenoyel@co.la.ca.us.

VACATION RENTALS

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

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

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

KONA, HAWAII (Big Island) condo, 1 bd., 1 ba., slps. 4; 50 yds. from ocean; all amen., private beach; lots of activities and good restaurants nearby; only avail. July 10-17; \$75/night or \$450 full

MGS views Martian dust storm

New data also reveal deeply layered terrain, magnetic features

By DIANE AINSWORTH

For the first time in Mars exploration, a spacecraft has captured the development of a Martian dust storm from start to finish. JPL's Mars Global Surveyor mission also has brought new focus to the deeply layered terrain and mineral composition of the Martian surface, and to highly magnetized crustal features that provide new insights into the planet's interior.

These findings are among the early results from the Mars-orbiting mission being reported in the March 13 issue of Science magazine.

This first set of formal results comes from data obtained in October and November 1997, while the spacecraft was just beginning to use the drag of Mars' upper atmosphere to lower and circularize its orbit via aerobraking. At the time, a dust storm was brewing on Mars and had grown to about the size of the South Atlantic Ocean.

The Global Surveyor data suggest that it began as a set of small dust storms along the edge of the planet's southern polar cap, according to Dr. Arden Albee of Caltech, the Mars Global Surveyor mission scientist. By Thanksgiving, it had expanded into a large regional dust storm in Noachis Terra that covered almost 180 degrees longitude, while spanning 20 degrees south latitude to nearly the tip of the Martian equator.

"As this storm obscured the Martian landscape, we followed it in detail using several instruments onboard Mars Global Surveyor," Albee said. "The thermal emission spectrometer mapped the temperature and opacity of the atmosphere while the camera followed the visual effects. The effects of the storm extended to great heights of about 80 miles and resulted in great

See Mars, page 3

**PATHFINDER REMAINS
SILENT ON MARS** Page 3



PIA00805

Rare tear-shaped dark dunes are revealed in this 6.4- by 7-kilometer (4- by 4-1/3-mile) image of Crommelin Crater, centered near 47 degrees south, 341 degrees west.

Asteroids found in Hubble archive

By DIANE AINSWORTH

Astronomers have stumbled on an unusual asteroid hunting ground: the thousands of Hubble Space Telescope images stored in its archive.

The hunt, by Robin Evans and Karl Stapelfeldt of JPL, has yielded a sizable catch of small asteroids—about 100. Their preliminary analysis suggests that a total population of 300,000 small asteroid—essentially rocks just over 1 kilometer to 3 kilometers wide (half a mile to about 1 1/2 miles)—are orbiting between Mars and Jupiter in a band of space debris known as the main belt. Currently, there are 8,319 confirmed main belt asteroids whose orbits have been measured, and about the same number have been sighted but not confirmed.

The asteroid hunters also were intrigued that they didn't find evidence of small comets passing near Earth, a finding announced last year.

Most astronomers stalk the Hubble archive for bigger game, such as quasars, distant galaxies, and supernovae, but Evans and Stapelfeldt have discovered that the pursuit of smaller prey such as asteroids can be equally successful.

Over a three-year period, the two astronomers and their collaborators have searched through more than 28,000 Wide Field and Planetary Camera 2 (WFPC2) images, looking for wide, looping streaks of light, the telescope's tell-tale signatures of asteroids. Most of the ones they found are too faint to be observed by current ground-based search programs. Hubble captures their images purely by accident: nearby asteroids inevitably wander across the telescope's field of view while other, higher priority targets are being observed.

"The archive images are distributed fairly evenly across the sky, so we find asteroids according to both their position in the sky and their number," Evans said. "As expected, we see the asteroids concentrated towards the ecliptic plane and we see small asteroids because they are the most numerous. Small main-belt asteroids such as these are the ones most likely to evolve into Earth-crossing asteroids due to encounters with their larger neighbors. Some of the asteroids in our survey could eventually migrate toward Earth."

An accurate asteroid census is an important part of assessing how many of these small bodies there are that could potentially pose a hazard to Earth. The Hubble archives represent a newly-tapped information resource that could help scientists more precisely estimate the risks they pose to Earth.

The Hubble archival data also strongly suggest a limit in the number of small comets that could be passing very near Earth, according to Evans and Stapelfeldt.

Last year, Dr. Louis Frank of the University of Iowa in Iowa City, using data from NASA's Polar spacecraft, reported he found evidence that about a dozen small comets strike Earth's upper atmosphere each minute. Evans and Stapelfeldt estimate the such small comets should be bright enough to produce thousands of detectable trails in the Hubble archival images, but these were not seen.

The Hubble images capture an asteroid as a long trail produced by its motion across the camera's field of view. The trails appear like the streaks of light found on photos taken at night of speeding cars with their headlights on. In Hubble's case, asteroid trails show a unique curvature due to the continuously shifting

See Asteroids, page 3



SPACE TELESCOPE SCIENCE INSTITUTE

A bright asteroid roaming in the constellation Centaurus is captured in the Hubble Space Telescope image above. The asteroid's trail above the center of the image is shown against background stars. This asteroid has a diameter of 2 kilometers (1 1/4 miles), and was located 140 million kilometers (87 million miles) from Earth and 251 million kilometers (156 million miles) from the sun.

Asteroid won't hit Earth in 2028, JPL astronomers say

Asteroid 1997 XF11 will pass well beyond the moon's distance from Earth in October 2028 with a zero probability of impacting the planet, according to JPL astronomers.

Last week the International Astronomical Union's Central Bureau for Astronomical Telegrams issued a news release stating that while the chances of asteroid 1997 XF11 colliding with Earth in 2028 were small, a collision "is not entirely out of the question."

The asteroid "is predicted to pass at a rather comfortable distance of about 600,000 miles (about 960,000 kilometers) in 2028," reported Drs. Donald Yeomans and Paul Chodas, JPL scientists who specialize in computing the predicted orbits of comets, asteroids, planets and other bodies in the solar system.

Data on the asteroid from March 1990 (well before its discovery in December 1997) was integrated into the orbit calculations by Yeomans and Chodas to arrive at the distance the asteroid will pass Earth. The 1990 observations of the object were found March 12 in the Palomar Planet Crossing Asteroid Survey conducted at Caltech's Palomar Observatory, by JPL's Eleanor Helin and Ken Lawrence and by Brian Roman, formerly of JPL. □

Dinosaur demise theory strengthened by findings

New Central America crater sites show impact by asteroid or comet

By DIANE AINSWORTH

Two new impact crater sites in Belize and Mexico add further evidence to the hypothesis that an asteroid or comet collided with Earth about 65 million years ago, subsequently killing off the dinosaurs and many other species on the planet.

Researchers Adriana Ocampo of JPL and Kevin Pope of Geo Eco Arc Research, La Canada-Flintridge, led an international team that discovered the two new sites during a recent expedition sponsored by NASA's Exobiology Program and the Planetary Society.

"We discovered an important new site in Alvaro Obregon, Mexico, about 230 kilometers (140 miles) from the rim of the Chicxulub crater," Ocampo said. "This crater was formed when a 10-to-14-kilometer diameter (6-to-8-mile) asteroid or comet collided with Earth."

"The site contains two layers of material, or ejecta, thrown out by the impact that flowed across the surface like a thick fluid, known as fluidized ejecta lobes," added Pope. "This is the closest surface exposure of ejecta to the Chicxulub crater that has yet been found and the best example known on Earth from a really big impact crater."

Centered on the coast of Yucatan, Mexico, the Chicxulub crater is estimated to be about 200 kilometers (120 miles) in diameter. The impact 65 million years ago kicked up a global cloud of dust and sulfur gases that blocked sunlight from penetrating through the atmosphere and sent Earth into a decade of near-freezing temperatures. The drop in temperature and related environmental effects are thought to have brought about the demise of the dinosaurs and about 75 percent of the other species on Earth.

The Earth orbits the sun in a swarm of so-called near-Earth objects, whether they are comets or asteroids, yet the science of detecting and tracking them is still relatively young. Only a handful of astronomers around the world search for these objects, and they estimate that currently only about one-tenth of the population of near-Earth objects has been detected. Chicxulub is the only impact event that has been correlated with mass extinctions to date. The site has been dated geologically to the boundary between the Cretaceous and Tertiary periods, also known as the K/T boundary.

Local geologist Brian Holland of Punta Gorda, Belize, guided the expedition to another new ejecta site about 480 kilometers (290 miles) from the crater rim. This Belize site contains tiny spheres of altered green glass, called tektites. Tektites are rocks that have been melted to glass by the severe heat of an impact. Expedition

See Crater, page 3

Lab welcomes new Caltech president

By MARK WHALEN

Laboratory personnel welcomed new Caltech president Dr. David Baltimore to JPL during an informal reception on the mall March 11, two days after his inauguration on campus as the institute's sixth president.

Hundreds of employees and contractors came to hear Baltimore speak about his new position as well as his impressions of the Laboratory, and many queued up to meet the Nobel Prize-winning biologist and his wife, Dr. Alice Huang.

In a brief address, Baltimore told the audience that he considers JPL activities "as important as anything done at Caltech. In fact, the truth is you are more visible than most of Caltech is. The newspaper would rather cover what happens on Mars than what happens in a petri dish. You are the ambassadors for the rest of Caltech—what people know about Caltech often is JPL."

See Baltimore, page 3

News Briefs

JPL's Benefits Office reminds employees who last year participated in the health care and/or dependent care spending accounts that the deadline for requesting reimbursement for expenses incurred during 1997 is March 30, 1998. Any money remaining in individual spending accounts after March 30 is forfeited, in accordance with Internal Revenue Service regulations on spending accounts.

Spending account claim forms are available from the Benefits Office in Building 291-218. For more information, call ext. 4-3760.

For questions about the status or filing of claims, contact ReliaStar at (800) 826-0519. □

A new feature of the NASA home page now offers Internet users the ability to search the hundreds of World Wide Web servers across all NASA centers.

The NASA-wide search engine—developed by Boeing Information Services and NASA's Headquarters Information Technology & Communications Division—indexes publicly accessible NASA documents (360,000 and growing) and provides users with the ability to search by center, date and other variables. (By design, NASA-only and center-only documents are not available through the search engine.)

The permanent URL for the "Simple Search" page is <http://www.nasa.gov/search>. Click on "Search with Options" to fine tune your search. □

NASA Headquarters is hosting its annual Presidential Sports Award Fitness Challenge and is encouraging JPL personnel to participate. No entry fee is required.

The program, intended to motivate all Americans to be more physically active throughout life, emphasizes regular exercise rather than outstanding performance. If achieved, NASA's Healthy People Fitness Goal would have 30 percent of its employees exercising regularly by 2000.

To enter the competition, pick up a Presidential Sports Award brochure

from Occupational Health Services, Building 263. The brochure will have a list of categories for competition in areas such as walking, running, weight training and swimming, as well as the distance required for the participant to meet each day.

Participants are able to go at their own pace and keep track of their exercise routine or distances on a weekly or monthly basis.

Completed activity logs are to be mailed to Occupational Health Services by Sept. 4. For more information, call ext. 4-3320. □

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

Section 211: Linda Moore.

Section 232: Dean Ines.

Element 3237: Akiko Hayash, Victor Zlotnicki.

Section 333: Abner Bernardo, John Daeges, Vanessa Foster, Scott Morgan, Beverly Shank, Watt Veruttipon.

Section 385: James Kaufman, Clayton LaBaw, Alan Stevenson,

Ansel Teng.

Section 392: Wendy Bell.

Section 501: Maya Daswani, Carol Dumain.

Section 503: Elizabeth Ingram.

Section 505: Edward Konefat, Richard Kuberry, Elizabeth Mangun, David Newell, Tien Nguyen, William Peer, Carol Young.

Section 506: John Arnold, Nickolas Climes, Theresa De Greve, James Kimberling, Hui-Yin Shaw.

Section 507: Deborah Drake, Stephen James, Albert Johnson, Russell Lawton, David Peters, Michael Sandor, Donna Turnbow.

Section 515: Richard Brace.

Section 516: Darrell Schmit.

Section 622: Patricia Parrett, Larry Meeks.

Section 642: Vickie Baxter, James Newton, Patricia Warmer, Michael Wright.

Section 643: Barbara Amago, Ann Bagne, Teresa Bailey, John Bluth, Judith Castagno, Raymond Hewitt, Patty McCauley, Jennifer Momjian.

Section 644: Rose Ackerley, Sheela Clements, Margery Fea, Diana Meyers, Kathryn Mika. □

QuikSCAT subsystem now in SAF for integration and testing

The command and data subsystem (CDS) for SeaWinds on QuikSCAT was delivered on Feb. 26 to JPL's Spacecraft Assembly Facility for instrument level integration and testing. Developed primarily by Division 34 engineers and technicians with support from industrial partner Lockheed Martin in Pomona, the unit is the first flight article to be delivered for the fast-paced mission, which will be launched on Nov. 1, 1998, less than 12 months after formal approval was given.

The CDS performs the command and telemetry functions of the instrument and is the electrical interface to the spacecraft. The unit was initially designed for the ADEOS II spacecraft, but was rapidly modified for the unique QuikSCAT spacecraft inter-

face. The unit will undergo testing with the engineering model units of radar systems until the other flight subsystems arrive in March.

"Some of the most difficult innovations are those in implementation," JPL Director Dr. Edward Stone told the development team. "Congratulations to all involved for having developed a new approach."

Kim Reh, deputy manager of the Avionic Equipment Section 344, also congratulated the CDS team. "You did an incredible job, ahead of schedule, and we are all very proud of you. This is what I call a breakthrough in our ability to deliver and you were responsible for it happening."

"Thanks for your individual commitment and team effort. The incredible results are obvious." □

Going out on a high note



PHOTO COURTESY OF DICK TURNER

JPL Director Dr. Edward Stone, left, congratulates Cassini science and mission design manager Charley Kohlhasse after presenting him with NASA's Exceptional Achievement Award. Kohlhasse retired from JPL this month.

Candidates sought for system architects program

As the Space and Earth Science Programs Directorate's Architect Development Program enters its third year at JPL, it is looking for two or three additional people to join the program in 1998. This two-year internship program aims to identify, recruit and train the next generation of system architects who will design and implement future JPL missions.

The program has completed its planned two-year pilot within SESP and this year will transition to the Engineering and Science Directorate, specifically the Center for Space Mission Architecture and Design. The driving concept behind this program is in concert with the overall changes being undertaken at JPL to reengineer the spacecraft design and development processes, and especially to make use of such state-of-the-art JPL design facilities as the Project Design Center, Design Hub and Flight System Testbed to develop and implement more efficient and effective science missions for NASA.

It is the system architects who are envisioned as playing a major role at JPL in producing new, innovative missions and spacecraft architectures. According to Section 702 manager Dave Smith, who will be administering the program, this training will "enable our high-potential engineers to gain expertise across a range of technical disciplines. Also, a system architect will not only understand how to provide an end product to satisfy a customer's needs, he or she will keep sight of related issues such as flight hardware and software compatibility, concerns about cost and schedule, and working in tandem with institutional goals when developing a product from concept to delivery."

"We need people who can lead the way in changing and improving our processes and ultimately our product," added Nick Thomas, deputy manager of Section 702, "as well as enable a synergy between programs by seeing the bigger picture and planning for the future."

For two years, opportunities for trainees in this program include being assigned to work on mission proposal responses to announcements of opportunity; working with the Advanced Projects Design Team, Team X (made up of representatives of all major spacecraft and mission subsystems); becoming familiar with JPL tools in the automated design process; working with partners in industry to gain a different perspective on how design is performed;

working at other NASA centers; working in project-specific roles; and working in the newly established JPL Centers of Excellence.

The Architect Development Program will select new trainees this spring. Qualities being sought in system architects include strong technical and problem-solving skills, leadership in technical innovation, an ability to be an effective team builder and facilitator, and skills in leading mentoring and helping others succeed.

Candidates will be evaluated specifically on the following criteria:

- Excellent technical skills and knowledge
- Good communication skills
- Demonstrated innovation and leadership skills
- Broad-based experience in design and development
- Experience with flight systems
- A minimum of five years' work experience since acquiring a bachelor of science degree.

Each candidate is required to submit a one- or two-page paper stating their interest in applying for the program and why they should be considered for inclusion.

This article is to be considered a formal call for applicants for this program. Applications should consist of a current resume and the statement-of-interest paper and should be submitted to the candidate's division office, as well as to Thomas (mail stop 301-375). Applications must be received by April 10. Division management will prescreen candidates from their division and submit a short list to the selection board.

"The selection process will take place during April and May with the third group of trainees being chosen by the end of May," said Thomas, "so we encourage people who are interested to submit their applications as soon as possible."

Candidates chosen for the program will participate in the planning of their two-year internship, which will be tailored to their individual expertise and interests, but will also include study in areas considered to be crucial to their development as well-rounded system architects. Formal course work that will help participants gain a better understanding of the organizational context of their roles, insight into the NASA community, and more technical knowledge will be part of the training.

For additional information, contact Thomas at ext. 4-7033 or Cliff Anderson at ext. 4-9843, or visit the Architect Development Program home page at <http://eis/adp>. □

Special Events Calendar

Ongoing

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

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

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

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

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

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

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

Friday, March 20

JPL Dance Club—Meeting at noon

in Building 300-217. Call Judy Pons at ext. 4-2077 or send an e-mail to jpons@jpl.nasa.gov for information on membership and nominations for club officers.

Monday, March 23

Eudora Quick Start Session for PC Users—This overview is for cc:Mail 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, March 25

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

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

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

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

Thursday, March 26

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

Friday, March 27

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

Tuesday, March 31

How to Use DNS Services—Originally scheduled as part of a March 4 town hall meeting, the JPL business case for outsourcing Desktop and Network Services will be presented by Jim Doane, institutional operations manager. Steve Bluhm, JPL DNS technical manager, will also present details about DNS services and the procedures for using them. From 1 to 3 p.m. in von Kármán Auditorium.

Wednesday, April 1

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

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

Thursday, April 2

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

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

Friday, April 3

"Scotland and the Scottish Isles"—Lecturers 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 more information, call (626) 395-4652.

Baltimore

Continued from page 1

Baltimore also called for more collaborative science activities between the campus and JPL, in addition to a strengthening of technology transfer activities from both organizations in order to benefit local industry and the economy.

"The challenge I see is to continue to bring together the efforts of the JPL community and campus community so that we can jointly pursue our common set of goals," Baltimore said. Noting that JPL and Caltech share many interests, he said "one that illustrates very well what we can do together is the understanding of the environment on Earth, which is so well surveyed by the activities here and studied at other levels on campus."

"(JPL Director Dr.) Ed Stone, (Deputy Director) Larry Dumas and I, and others, are working together to find mechanisms by which there can be more joint activities and more strength coming out of the joint types of science we can do."

In terms of technology transfer, Baltimore said he is "quite convinced that we have a mandate from NASA,



Dr. David Baltimore's wife, Dr. Alice Huang, and JPL Deputy Director Larry Dumas look on as Caltech's new president speaks to Lab personnel March 11.

Congress and the industrial world to see if we can't bring our activities to the local community.

"We have the opportunity, in this particular case, to stimulate the growth of industry in the local area to the benefit of the environment we live in, to the benefit of the people who live around us, and to the benefit of the general economy of Southern California."

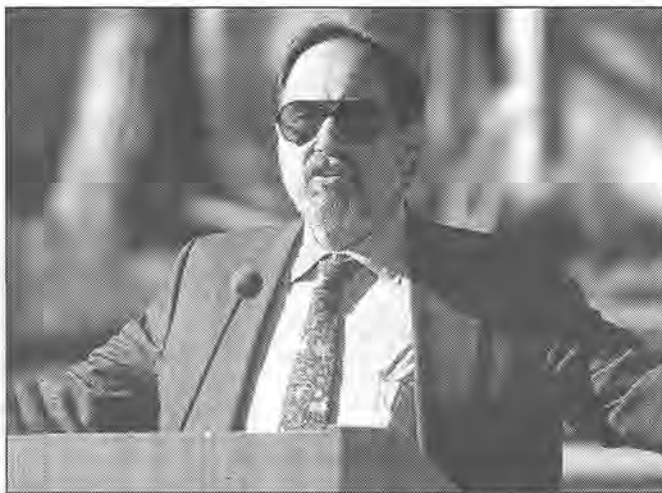
Baltimore acknowledged that in the five months he has been in his new position, "some of my most rewarding

moments have come from discussions with people at JPL." Of particular interest, he said, is the exploration of the possibility of life elsewhere in the solar system or the universe in its entirety. "That's the kind of question that's behind so much of the work here at JPL and generally at NASA, but also, nothing could be more fascinating to a biological scientist than to think about the issue of whether there are other ways of organizing living systems, whether there are other kinds of life. I've talked to some people here

and on campus who have posed the question: can there be life that is not based on DNA?

"So if you all can find for us any evidence of life elsewhere, if we can understand what its genetic program is or how in fact it programs itself to function, I think we'll get some very deep insights into how important the particular structure of DNA is, or whether in fact it is just one solution to a problem that has many potential solutions."

"From everything I've learned," Baltimore concluded, "from all the



PHOTOS BY DUTCH SLAGER / JPL PHOTO LAB

Mars

Continued from page 1

increases in both atmospheric density and variability from orbit to orbit. These atmospheric measurements have great significance to future Mars missions that will be using aerobraking techniques too."

Before the storm, atmospheric dust was generally distributed very uniformly, Albee said. Observations of the limb of the planet in the northern hemisphere revealed both low-lying dust hazes and detached water-ice clouds at altitudes of up to 55 kilometers (34 miles). Movement of these clouds was tracked by the spectrometer as the planet rotated. Atmospheric turbulence disrupted these cloud patterns as the small storms began to rise and kick more dust into the air. As the storm began to abate, small local storms began to crop up again along the edges of the south polar cap, and ice clouds formed in depressions as the carbon dioxide cap continued to retreat.

In addition to these unprecedented observations of a full-blown Martian

dust storm, measurements from the spacecraft's magnetometer and electron reflectometer have yielded new findings about Mars' strong, localized magnetic fields. These patches of the crust, which register high levels of magnetism, are beginning to unlock some of the mysteries surrounding Mars' internal dynamo and when it died, said Dr. Mario Acuña of NASA's Goddard Space Flight Center, Greenbelt, Md.

"These locally magnetized areas on Mars could not form without the presence of an overall global magnetic field that was perhaps as strong as Earth's is today," Acuña said. "Since the internal dynamo that powered the global field is extinct, these local magnetic fields act as fossils, preserving a record of the geologic history and thermal evolution of Mars."

Magnetic fields are created by the movement of electrically conducting fluids, and a planet can generate a global magnetic field if its interior consists of molten metal hot enough to undergo convective motion, similar to the churning motion seen in boiling water.

"The small size and highly magnetic nature of these crustal features,

which measure on the order of 50 kilometers (30 miles), are found within the ancient cratered terrain rather than within the younger volcanic terrain," Acuña said. "By correlating crustal age with magnetization, we have a perfect window on Mars' past, which will help us to determine when Mars' internal dynamo ceased operating."

High-resolution images of dunes, sand sheets and drifts also are helping reveal earlier chapters of Martian history. Landforms shaped by erosion are almost everywhere, according to Albee, and many bear a striking resemblance to Colorado's Rocky Mountains. Rocky ridges poke through the Martian dust just as the jagged edges of cliffs pierce through a blanket of snow in the Rockies. Martian dust appears to have spilled down the sides of ridges just as fresh snow slides down a ski slope.

"One almost expects to see ski tracks crisscrossing the area," Albee added. "These images present a sharp contrast to the images of boulder-strewn deserts found at the Viking and Pathfinder landing sites."

The Martian crust also exhibits much more layering at great depth

than was expected. The steep walls of canyons, valleys and craters show the Martian crust to be stratified at scales of a few tens of yards, which is an exciting discovery, Albee noted. "At this point we simply do not know whether these layers represent piles of volcanic flows or sedimentary rocks that might have formed in a standing body of water," he said.

The thermal emission spectrometer, led by principal investigator Dr. Philip Christensen of Arizona State University, is beginning to obtain a few infrared emission spectra of the surface, although it is still too cold on the surface for the best results. The best spectra clearly indicate the presence of pyroxene and plagioclase, minerals that are common in volcanic rocks, with a variable amount of dust component. No evidence was found for carbonate minerals, clay minerals or quartz. If present in these rocks, their abundance must be less than about 10 percent.

Their absence indicates that carbonates are not ubiquitous over the surface of the planet, but they may still be found in specific locations that either favored their initial deposition or their subsequent preservation. This finding could have important implications for identifying areas that may preserve signs of ancient life on Mars, since carbonate minerals are commonly formed in biological processes, Albee said. □

Pathfinder doesn't answer final call

Two hundred fifty days after Mars Pathfinder's historic landing on the red planet last July 4, the long goodbye to the lander and the Sojourner rover ended March 10 when the lander failed to respond to the final command to communicate with JPL controllers. The Pathfinder mission, which operated three times longer than its original 30-day planned lifetime on the Martian surface, is acknowledged as one of NASA's most successful endeavors as a dramatic example of the agency's new style of "faster, better, cheaper" planetary exploration.

The last-ditch effort to listen for a signal from Pathfinder effectively ends the mission, said Project Manager Brian Muirhead. No further attempts will be made to communicate with Pathfinder, he added.

Pathfinder flight controllers Ben Toyoshima and Rob Smith at JPL spent nearly four hours alternately commanding the lander to turn on its transmitter, then listening for a response via the Deep Space Network's 34-meter antenna at Goldstone, Calif. One-way radio communications to Mars from Earth take nearly 20 minutes.

The final Pathfinder telecommunication session ended at 1:21 p.m. when no transmissions had been detected from Pathfinder.

Flight Director Jennifer Harris thanked the team for working one last

day, calling the mission "the greatest experience anyone could ever hope to have. To the world who watched us, thank you for all your enthusiasm and support."

The Pathfinder team will continue analyzing the data and making it available over the coming months via the Planetary Data System library.

A description of the efforts to reestablish contact with Pathfinder can be found on the World Wide Web at <http://mars.jpl.nasa.gov/readme.html>.

Pathfinder raw images and meteorological raw data are now available online at <http://www.pdsimage.jpl.nasa.gov/PDS/public/MPF/front-page.html>. □

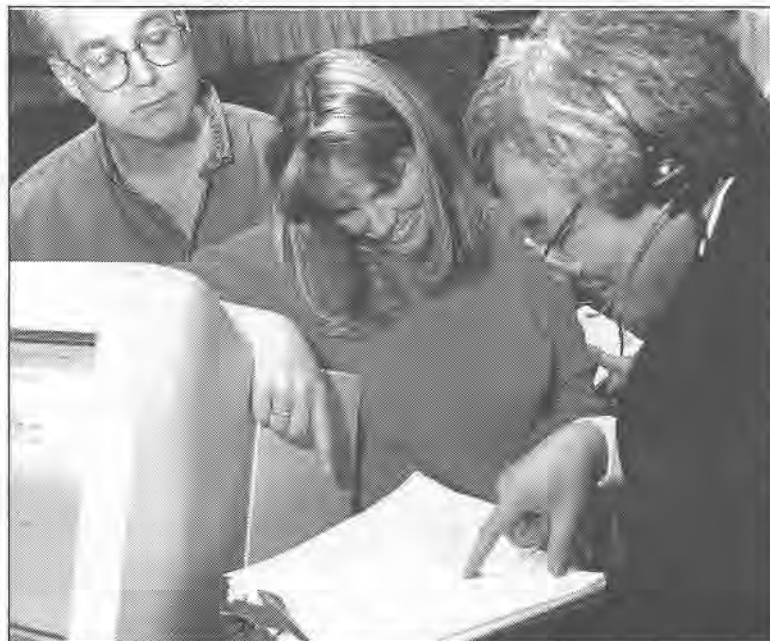


PHOTO BY DUTCH SLAGER / JPL PHOTO LAB

Pathfinder surface mission planner Bill Dias, left, flight director Jennifer Harris and flight controller Ben Toyoshima check out commands to be sent to the lander that, if successful, would have activated its transmitter.

discussions I've had with colleagues around the world, it seems to me that the finest space science in the world is done here at JPL. You've given me moments of great pride, you've given America moments of great pride, and I look forward to many more of them." □

Crater

Continued from page 1

member Jan Smit of Free University, Amsterdam, noted that the Belize tektites were similar to those found in Haiti and northern Mexico. This finding links the stratigraphy of the Belize sites to the more distant Caribbean and Mexican ejecta sites.

Alfred Fischer of USC, Michael Gibson of the University of Tennessee at Martin, and Jaime Urrutia and Francisco Vega of the National Autonomous University of Mexico helped the team collect 400 kilograms (900 pounds) of samples, including drill cores, for paleomagnetic studies. They also collected fossils from the site to help date the deposits and add new pieces to the puzzle of what happened at Chicxulub 65 million years ago.

Impact ejecta is very rare on Earth, but covers much of the surface of Mars because Mars' surface has remained stable and unchanged for billions of years, thus preserving debris from these rare impact events. Also, such fluidized ejecta lobes have never been observed directly on Earth before and can serve as an excellent laboratory for studying the ejecta lobes surrounding many Martian craters.

"The discovery of these new ejecta sites is very exciting," said team co-leader Ocampo. "It is like seeing a bit of Mars on Earth."

The exact nature of these ejecta lobes on Mars remains a mystery, Ocampo noted. Some scientists think they were created by an abundance of water in the Martian crust, which turned the ejecta into a muddy, molasses-like material. Others suggest the fluidized ejecta lobes were enabled by a much thicker atmosphere in Mars' early history. As flying ejecta from an impact event flew through the Martian atmosphere, it was reduced by friction to a very dense, turbulent cloud of debris that also flowed like water. Study of the Chicxulub fluidized ejecta may help settle this debate and shed new light on theories that the Martian surface may once have been more hospitable for life.

Volunteers who assisted the Planetary Society and the scientists in the field have posted their photographs of the expedition on the Planetary Society's World Wide Web site at <http://planetary.org>. □

Asteroids

Continued from page 1

position of the telescope as it orbits the Earth. This effect, known as parallax, allowed Evans and Stapelfeldt to determine distances and sizes for the asteroids spied by Hubble. A similar parallax effect is the key to depth perception in human vision: our eyes are set apart so that we can see three-dimensionally.

"Asteroid trails observed by the Hubble telescope are usually curved because the telescope travels in a curved low-Earth orbit," Stapelfeldt said. "By precisely measuring the shape of the trails, we can solve for the distance to each asteroid at the time it was observed. It isn't possible to do this using a stationary telescope on the ground."

Finding asteroids isn't what the two astronomers originally had in mind. As members of the WFPC2 science team, Evans and Stapelfeldt were examining test images of distant stars and galaxies to ensure that the new camera was functioning properly. These were among the first images taken with WFPC2, which had restored sharp focus to Hubble's images when it was installed in late 1993. Stapelfeldt's wife, Deborah Padgett (also an astronomer), pinpointed the first asteroid in 1994 while looking at images on the couple's home computer. Intrigued, Evans and

Stapelfeldt began combing through more than 1,600 of the science team's survey photos, finding 12 more asteroids. This discovery prompted their large-scale search, by eye, of two years' worth of Hubble archival images.

Evans' and Stapelfeldt's initial results are reported in the February 1998 issue of the research journal *Icarus*. □

Yeomans will lead science team for asteroid sample return

Astronomer Dr. Donald Yeomans has been named project scientist for the NASA portion of the joint U.S.-Japanese MUSES-C mission, which will be the first ever to send a lander and robotic rover to an asteroid and return an asteroid sample back to Earth.

Yeomans is a senior research scientist at JPL and supervisor of the Lab's Solar System Dynamics Group, which is responsible for tracking all the planets, natural satellites, comets and asteroids in the solar system. Yeomans will lead the work of the U.S. science team in utilizing

See Yeomans, page 4

March 20, 1998

Passings

Ernest Adams, 83, a retired environmental test specialist from Section 354, died of natural causes Feb. 12 at a nursing home.

Adams worked at the Lab from 1959-78. He is survived by daughters Gloria Kratz and Linda Moore and son Robert Adams.

Services were held at Forest Lawn Memorial Park in the Hollywood Hills. □

Gordon Dillinger, 80, a retired supervisor from the former Section 152, died of a heart attack Feb. 15.

Dillinger, who worked at JPL from 1963-83, is survived by his wife, Jeanette, daughter Linda and son Mark.

Services were held Feb. 28 at United First Methodist Church in Pasadena. □

Daniel Garcia, 72, a retired heavy duty truck driver from Section 643, died of cancer Feb. 16.

Garcia joined the Lab in 1968 and retired in 1982. He is survived by his wife, Ethel, and five children.

Services were held at Mountain View Cemetery in Altadena. □

Elma Davis, 77, a retired data coordinator from Section 661, died of natural causes Feb. 21.

Davis worked at JPL from 1957-83. She is survived by sister

Gwendolyn Frank of Pittsburgh.

Services were held at Mount Lebanon Cemetery in Pittsburgh. □

Douglas Eastwood, 81, a retired test specialist from Section 352, died of cancer March 1 at his home in

Retirees

The following employees retired in March:

Dennis Carpenter, 40 years, Section 349; **Tommy Otoshi**, 37 years, Section 333; **Alan Frandsen**, 36 years, Section 320; **M. Joseph Cork**, 33 years, Section 501; **Marvin Wick**, 33 years, Section 920; **Leo Carls Jr.**, 31 years, Section 324; **Arthur Kiesow**, 30 years, Section

Yeomans

Continued from page 3

the scientific instruments on the tiny book-size rover being built at JPL for the mission. The lander and sample return vehicles are provided by Japan. The U.S. and Japanese science teams will collaborate on the analysis of scientific data returned by the spacecraft, including work on the sample that will be brought back to Earth from Asteroid 4660 Nereus, a small, near-Earth asteroid nearly one

Pasadena.

Eastwood joined JPL in 1957 and retired in 1981. He is survived by his wife, Doris, six children and 14 grandchildren.

Services were held March 4 at Live Oak Cemetery in Monrovia. □

391; **Henry Delgado**, 29 years, Section 357; **Julie Delgado**, 28 years, Section 506; **Henry Frank**, 28 years, Section 346; **Joyce Patterson**, 23 years, Section 195; **Carol Miller**, 20 years, Section 389; **Dorothy Robinson**, 20 years, Section 515; **Donald Gennery**, 18 years, Section 345; **Jacqueline Richardson**, 18 years, Section 501; **Thomas Cleary**, 17 years, Section 388; **James Krug**, 17 years, Section 391; **Antonio Gonzales**, 10 years, Section 662. □

mile in diameter.

Scheduled for launch from Japan on a Japanese M5 rocket in January 2002, MUSES-C will be the first space flight demonstration of several new technologies. "MUSES-C" stands for Mu Space Engineering Spacecraft (the "C" signifies that it is the third in a series). It is part of a series of flight technology and science missions managed by the Institute of Space and Astronautical Science of Japan (ISAS). JPL is managing the U.S. portion of the mission. Ross Jones is the project manager at JPL. □

She gives a hoot



DUTCH SLAGER / JPL PHOTO LAB

Many JPLers have recently noted the presence of a family of great horned owls nested just below the rooftop of the south-east corner of Building 198. An adult female protects three babies. These photographs were taken from Building 301.



LETTERS

Thank you ERC and Section 393 for the lovely plant and card that were received upon the recent passing of my father-in-law. Your kind thoughts were greatly appreciated.

Marj Burris

□□□

I would like to thank my friends, co-workers, and the ERC for the cards, condolences, prayers, and beautiful plant upon the recent death of my father.

Bob Warzynski

□□□

A special thank you to my friends who planned my retirement gathering on Feb. 27 and to those who attended. I also appreciate all the good wishes from those who could not attend. I value your friendship throughout the years. Thanks again.

Joyce Patterson

□□□

Thank you so much to my JPL friends and to the ERC for prayers made on my mother's behalf during her illness, and kind expressions of sympathy upon her recent death.

Elly Ponice

FOR SALE

ALARM CLOCK, antique table top, old English; FIGURINES, misc. (no Hummel left); COLLECTOR PLATES, 18 (one Bing and Grunfeld); LAMPS, alabaster, and one marble-based floor lamp. 909/985-7508, Jim.

BABY ITEMS: 2 potties, \$5 each; backpack, Gerry, exc. cond., \$25. 355-9733, after 6 p.m. or leave msg. BED, double, hdbd, w/storage, bedside 2 drawer chest, dresser w/3 lg. attachable mirrors; COUCH, light green, approx. 9' (high quality); DESK, fold-out, w/drawers and top matching hutch cabinet; all furniture avail. in Upland 4/1/98. 909/985-7508, Jim. BEDROOM SET, gd. cond., antique white wood, dresser w/9 drawers, desk & chair, bookcase, 2 nightstands, \$100/obo. 790-4455.

BIKES, men & ladies, \$30 & \$40; boy & girl's 20", \$20 & \$30. 626/289-2688.

BOOKCASES, oak wall unit, 6' x 6', gd. cond., \$100; 4' x 5', gd. cond., \$30; PRINTER, Epson LQ-510. 24 pin, \$50. 909/595-6467.

NOTICE TO ADVERTISERS

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

Universe

Editor
Mark Whalen

Photos
JPL Photo Lab

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

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

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

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

BOOKS, technical, computer, engineering, astro-physics texts; many titles. 240-7253.

BOXES (cardboard), standard sizes w/lids, gd. cond., 3 for \$1. 367-0969.

CHANDELIER, solid brass, two tier with 18 lights, 35" diameter, 31" high; \$50/obo. 626/963-2565.

COFFEE TABLE, oval glass top, 30" x 60", with gold-painted iron base in scroll pattern; exc.; \$150/obo. 249-8088.

COFFEE TABLE, cherrywood, oval with Queen Anne legs, exc. cond., \$85. 957-4722.

COMFORTER, Stevens brand twin, new, red roses on white background, \$25. 626/398-4960.

COMPUTER, AST Notebook, 386 5X/20 Model 43V/2 MB w/bag, exc. cond., \$300/obo. 626/792-2655.

COUCH/FUTON BED, gd. cond., \$120. 714/449-9714.

ENTERTAINMENT CENTER, 2-piece oak, w/lighting feature, exc. cond., \$800/obo. 249-3053, Linda or Dave.

ENTERTAINMENT CENTER, dark oak; L-shaped cabinet w/beveled glass door; holds TV, VCR, stereo components w/storage for CDs, tapes, records, etc.; top lifts for turntable or top loader access; small, perfect for apt. or small house; must sell ASAP; exc. cond.; \$150/obo. 626/791-7645, Bob/Sharon.

FREEZER, 20 cu. ft., Kenmore upright, manual defrost, vg cond., \$200. 790-1649.

JET SKI, standup, '87 Kawasaki, good shape, \$1,000. 310/518-9216, Audrey.

MARS ROVERS: Hot Wheels, 1 for \$15, 2 for \$25, or 3 for \$30; remote control (battery operated, approx. 4" tall x 8 1/2" long, "climbs" with mock rocker bogie), \$25 each. 626/398-9984.

RANGE, gas, 36" Caloric, double oven, self-cleaning, gd. cond., \$150/obo. 768-4436.

REFRIGERATOR, 17 cu. ft., GE, gd. cond., \$150/obo. 714/449-9714.

ROLLTOP DESK, oak, w/chair, like new; \$380. 626/813-9959, Paul.

SKI RACK, Yakima Buttendown 6 ski rack accessory, still in box. \$70. 352-6778.

SKIS, Autier w/Marker II titanium bindings, 194 cm, \$75; SKI BOOTS, Lange 55, M size 12, \$75; SUITCASE, women's 27", w/wheels and extra shoe compartments, green, soft cover, exc. cond., \$60. 626/793-3561.

SOFA, slightly curved, off-white w/subtle floral pattern, vg cond., \$150. 626/797-3156.

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

TELEVISION, RCA 25" console, swivel base and casters, works fine, good picture, no remote; \$50/obo. 626/963-2565.

TICKETS (2) for Penn & Teller, Sat., April 4, 8 p.m.; orch. row F, seats 1 & 3 (left ctr. aisle, right in back of the break), \$50 ea./obo. 805/255-0149.

TRAILER, 2 wheel, 6' x 6', all steel, Model T black pickup bed style, \$190. 562/464-0446.

TRICYCLE, adult 2-seater, side by side, tandem, 3 spd.; with trailer, 4' x 8', collapsible; both in exc. cond.; \$495 total. 805/251-7616 Ben, after 6 p.m.

TROPHY INVENTORY, complete, \$75/obo. 626/797-6406.

TYPEWRITER, antique Smith Corona, w/carry case, mint cond., never used, \$50; BASEBALL CARDS, '65 Topps embossed, gold inserts of major stars of the '60s, \$200-\$10 ea. 626/914-6083.

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

WASHER/DRYER, Maytag stack, large cap. washer, full-size gas dryer; vg cond., \$250. 790-1649.

WATERBED, qn, 12 drawers, new 30-year waveless mattress, new heater, mirror hdbd, w/shelves, perfect pecan wood, \$1,000. 249-6615.

WHEELS, 1995-97 style for Miata, alum. alloy stock, make offer. 626/914-1195.

WRITING DESK, compact w/2 bookshelves below, middle drawer and partitioned space inside desk, 27L x 42H x 9 3/4D, key, vg cond., \$125. 626/793-3561.

AUTOS / RVs / MOTORCYCLES

'87 BUICK Park Avenue, 4 dr., burgundy, auto., recent motor; must sell (too many cars); \$3,200/obo. 626/795-1687.

'89 CADILLAC Sedan DeVille, dark blue in/out, loaded, digital dash, leather, 66K mi., orig. owner, \$8,500. 790-4028.

'89 CHEVROLET Cavalier Z-24 convertible, white w/blue top; low mi., exc. cond.; just pd. tags & license; immediate sale, \$6,000. Altadena area: 626/398-1988.

'89 CHEVROLET Celebrity station wagon, V6, low mi., \$3,000. 626/794-1623.

'89 CHEVROLET S10 Blazer, sport trim, 2 WD, V6, ps, pb, a/c, cass., tilt, cd, rack, auto., white/tan, 158K, \$2,500. 805/254-6134.

'71 CHEVROLET 1/2 ton pickup; 307 V8, 3 spd.,

shell; clean; low mi.; \$1,900/obo. 626/449-9385.

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

'89 DODGE Caravan, 4 cyl., turbo, white/blue int.; new: tires, brakes, head job, smog, reg.; \$3,300/obo. 240-2104.

'87 FERRARI, 3.2 Mondial Quattrovalvole Cpe, blk./blk., sunroof, CD changer, cell phone, alarm; 50K mi., recent service, exc. cond.; \$29,000. 626/351-0097.

'94 FORD Explorer XLT, 2 WD, ps, auto., air, cruise ctrl., tow pkg., 45K mi., \$14,000. 626/357-7347.

'92 FORD E350 van, white, previous vanpool vehicle, 11 reclining seats, 129K, 460 eng., power, low, exc. cond., \$8,000. 805/285-9572.

'90 FORD Tempo, 4 dr., 91K, a/c, exc. body and mechanical cond., clean, white, \$3,100/obo. 626/441-1496.

'88 FORD Mustang convertible LX; runs well, looks good; no scratches/dents; all power, air cond., stereo cass.; 107 K; 2.3L; \$2,300/obo. 683-0631.

'77 FORD Granada, 53K mi. (orig. mi.), V8, 2 dr., brand new maint.-free battery, copper color, immac. cond.; \$1,500. 626/335-6354, Jay.

'91 GEO Storm, 60K mi., vg cond., Alpine CD player, a/c, 5 spd., recent tune up, sporty, fun to drive; \$3,900/obo. 626/303-3880.

'88 GMC Suburban, 307 ci V8, 3 spd. manual w/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.

'98 HONDA Accord LX, silver, brand new, exc. cond., 4K mi., 4 cyl., full elec. pkg., backseat access to trunk; divorce/distress sale; take over 2-yr., closed-end lease at \$387.84/mo., 15K mi. yearly; can sell or purchase 11/3/98. 626/796-2010.

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

'89 HONDA CRX 2 dr. hatchback, 5 spd., AM/FM/cass. w/removable faceplate, exc. cond., serviced regularly; good in snow; \$2,500 incl. chains. 626/821-0130.

'92 HUSQVARN 610, 4 stroke dirt bike; \$2,500. 626/813-9959, Paul.

'90 KAWASAKI Ninja 750R motorcycle, 4K mi., Corbin seat, burglar alarm, new Metzlers, like new; \$3,000/obo. 790-1649.

'89 MAZDA MX-6 GT Turbo, gray ext./burg. int., fast car, moonroof, ABS, pwr. everything, trailer hitch, AM/FM/cass./10 CD, 75K mi., \$5,000. 213/259-8604.

'77 MERCEDES 280 SE, mint cond. & well-maintained, runs like new; charcoal gray, 4 dr. w/sunroof; \$4,500/obo. 213/669-5705, Mary.

'94 TETON Atlanta 5th wheel trailer, 40', w/Teton Series upgrade; 3 slide outs, mint cond. NS, loaded; 2 AC/furn/hyd fans, storm windows, new tires, Onan gen., hyd. jacks, awnings, sbs trig. w/ice; \$70,000. 760/345-3713.

'96 TOYOTA Previa S/C van, sport pkg., rear spoiler, dual sunroofs, CD player, dk. green w/interior, tinted windows, a/c, cruise ctrl., pwr. windows & locks, tilt wheel, alarm, 27K mi.; moving, need to sell ASAP, \$22,000/obo. 541-0131.

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

'89 TOYOTA Corolla DX, gd. cond., a/c, cass. deck, manual trans., runs well, \$1,900. 909/465-1713.

'70 VW Bug, rebuilt engine; new: seats, chrome wheels, tires, battery; needs wiring; as is, \$950/obo. 626/309-9716.

'91 VOLVO 240, exc. cond., elec. windows & door locks, a/c, radio w/cass., 127K mi., serviced regularly, \$9,500/obo. 895-2866.

WANTED

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

HOUSEKEEPER (or service), need recommendations. 626/284-9424.

HOUSEKEEPER, 8 hrs., 1 day a month; dusting, vacuuming, and ironing, 353-2463.

RECORDING FOR THE BLIND & DYSLIXIC needs people w/backgrounds in the sciences, law, medicine and languages, to transcribe textbooks from the printed page to audio cassettes, Mon.-Sat., incl. evens; daytime office help also needed. 226-6055, San Fernando Valley; 213/664-5525, Hollywood; 310/414-6506, South Bay.

SPACE INFORMATION & memorabilia from U.S. &

other countries from past & present. 790-8523, Marc.

STUDENT EXCHANGE, 17-year-old daughter of a colleague at the European Space Agency in Germany interested in arranging a private student exchange (visits of several weeks to each other's home) to improve language skills and cultural exposure. 626/335-5564, Michael.

TEMPORARY LODGING: desperately seeking asylum May 1-Aug. 15; quiet, responsible, non-smoker; has cat, will house sit or willing to pay full rate for furnished or unfurn. apt. or home near JPL (5-7 miles) + cleaning and readvertising fee. 626/398-7712, Kathleen.

VANPOOL RIDERS, full- and part-time for van #20, w/stops in Northridge and Granada Hills. 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, w/silver feather charm on top, has fringe and leather cord, approx. 3" long x 1 1/2" wide, sentimental value. 805/250-8066.

FREE

CATS, good homes needed for 3 lovable felines: female gray tabby, 2 yrs.; female black long hair, 4 yrs.; male orange tabby, 1 1/2 yrs.; all shots, spayed/neutered; good w/children. 952-8465, Alex. DOG, 3 1/2 yr. old German shepherd; very friendly, good w/children. 957-6821.

FOR RENT

ALTADENA ranch house, 2 bd., 1 1/2 ba., lg. liv. rm., plus den w/lp, lg. kitchen w/area for dining rm., area for washer/dryer, double garage, lg. yd. 445-0123 x210, Romie.

WALK/JPL, fenced yd., pets OK w/dp., Indry, kitch., clean & quiet, \$425 + part utils. 626/357-0252.

ALTADENA, partially furn. rm. in 3-bd. house, 3 mi./JPL, share kitch., laundry, fireplace, hdbd. floors, quiet neighbor'd, \$380 + 1/3 utils. 626/798-4492.

GLENDAL, light & airy, 700 sq. ft., 2 bd., 1 ba., apt. over garage & studio apt.; stove, refrig., garage pkg. for 1 car; 15-20 min./JPL; \$650 incl. gas & water. 249-3602.

GLENDAL, townhouse style 2-story, c/a, 2 bd., 2.5 ba., kit./btl.-ins, built in '87, \$725. 240-1523, mgr.

LA CANADA house, 3 bd., 1 1/2 ba., dbl. gar., nice yd., close to JPL, water pd., \$1,800. 790-6382.

LA CANADA house, 3 bd., 2 ba., liv. rm., fam. rm., den, 1,750 sq. ft., lg. fenced yd. (10,000 sq. ft.), fruit trees, walk to JPL, 4532 Viro Rd. 790-8216.

MONTCLAIR, 3 bd. condo/townhouse, 2-car attached garage w/Indry. hookups, small yd., cent. air, 1,300 sq. ft., pool & Jacuzzi, \$875. 909/465-1713.

PASADENA end-unit townhouse, 1 bd., 1 ba. w/attached private garage, laundry hkups., patio; very quiet complex at corner of Magnolia/Alpine, 5 min./UIT & 10 min./JPL, pool/Jacuzzi/sauna; avail. 4/98, water/trash/gardener incl., \$975 + sec. dep. 626/568-8298, eves.

ROOM in lg. home, shared bath/lum.; non-smoker, clean person; \$425 + 1/3 util. 626/797-5570.

ROOM w/view and priv. ba. in lovely sgl.-fam. house, quiet area on hills; use of kitch., washer/dryer, garage, pool; 7 mi./JPL; monthly maid serv. and utils. pd.; non-smoker; \$400. 213/256-0535.

SIERRA MADRE CANYON cottage; quiet, charming, secluded; 1 bd. & office, 1 ba.; + recently remod. kitch. & ba.; covered laundry area w/washer/dryer; \$895, incl. parking spot. 626/564-9607, Diana deNoyelles; or ddenoyel@co.la.ca.us.

SOUTH PASADENA townhouse, 3 bd., 2.5 ba., 2-car att. gar. w/laundry hookups; mg/dw./mw.; no pets; quiet rear unit; 1037 Arroyo Verde Rd #C; \$1,100 incl. water & trash. 548-3671.

SOUTH PASADENA, 1718 Huntington Drive, good area, east of Marengo; fully furn. bungalow studio apt., carport, laundry facil., a/c & heat, non-smoker; utils. pd., \$565. 626/792-9053, Marilyn.

SUNLAND townhouse, 3 bd., 2 1/2 ba., kit./btl.-ins + laundry hookups, c/a, liv. rm./trpl., lg. patio off din. rm., dir. access dbl. gar.,