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## Galileo shows Io as a flashback to Earth's volcanic past

By Jane Platt



Brightly glowing lava from volcano Pele—at 1,027 degrees C (1,880 F)—is centered on a large ring of red sulfur that was deposited by Pele's plume and reaches more than 1,300 kilometers (800 miles) in diameter.

**J**upiter's fiery moon Io is providing scientists with a window on volcanic activity and colossal lava flows similar to those that raged on Earth eons ago, thanks to new pictures and data gathered by JPL's Galileo spacecraft.

The sharp images of Io were taken on Oct. 10 during the closest-ever spacecraft flyby of the moon, when Galileo dipped to just 611 kilometers (380 miles) above Io's surface. The new data reveal that Io, the most volcanic body in the solar system, is even more active than previously suspected, with more than 100 erupting volcanoes.

"The latest flyby has shown us gigantic lava flows and lava lakes, and towering, collapsing mountains," said Galileo imaging team member Dr. Alfred McEwen of the University of Arizona, Tucson. "Io makes Dante's Inferno seem like another day in paradise."

Ancient rocks on Earth and other rocky planets show evidence of immense volcanic eruptions. The last comparable lava eruption on Earth occurred 15 million years ago, and it's been more than 2 billion years since lava as hot as that found on Io, reaching 1,482 degrees Celsius or 2,700 degrees Fahrenheit, flowed on Earth.

"Io is the next best thing to traveling back in time to Earth's earlier years," said Dr. Torrence Johnson, Galileo project scientist at JPL. "It gives us an opportunity to watch, in action, phenomena long dead in the rest of the solar system."

The new data focus on three of Io's most active volcanoes—Pele, Loki and Prometheus. The vent region of Pele has an intense high-temperature hot spot that is remarkably steady, unlike lava flows that erupt in pulses, spread out over large areas, and then cool over time. This leads scientists to hypothesize that there must be an extremely active lava lake at Pele that constantly exposes fresh lava. Galileo's camera snapped a close-up picture showing part of the volcano glowing in the dark. Hot lava, at most a few minutes old, forms a thin, curving line more than 10 kilometers (6 miles) long and up to 50 meters (150 feet) wide. Scientists believe this

line is glowing liquid lava exposed as the solidifying crust breaks up along the caldera's walls. This is similar to the behavior of active lava lakes in Hawaii, although Pele's lava lake is 100 times larger.

Loki, the solar system's most powerful volcano, consistently puts out more heat than all of Earth's active volcanoes combined. Galileo's photopolarimeter radiometer and near-infrared mapping spectrometer have provided detailed temperature maps of Loki. "Unlike the active lava lake at Pele, Loki has an enormous caldera that is repeatedly flooded by lava, over an area larger than the state of Maryland," said Dr. Rosaly Lopes-Gautier of JPL, a member of the spectrometer team.

Observations of Prometheus made early in the Galileo mission showed a new lava flow and a plume erupting from a location about 100 kilometers (60 miles) west of the area where the plume was observed in 1979 by JPL's Voyager spacecraft. New Galileo data clarify where lava is erupting, advancing, and producing plumes. The most unexpected result is that the 75-kilometer-tall (50-mile) plume erupts from under a lava flow, far from the main volcano. The plume is fed by vaporized sulfur dioxide-rich snow under the lava flow.

Mountains on Io are much taller than Earth's largest mountains, towering up to 16 kilometers (52,000 feet) high. Paradoxically, they do not appear to be volcanoes. Scientists are not sure how the mountains form, but new Galileo images provide a fascinating picture of how they die. Concentric ridges covering the mountains and surrounding plateaus offer evidence that the mountains generate huge landslides as they collapse under the force of gravity. The ridges bear a striking resemblance to the rugged terrain surrounding giant Olympus Mons on Mars.

Scientists will get an even closer look at Io Nov. 25 when Galileo swoops down to an altitude of only 300 kilometers (186 miles). Because Io's orbit is bathed in intense radiation from Jupiter's radiation belts, there is a risk of radiation damage to spacecraft components. In fact, several spacecraft systems sustained damage during the October flyby. Given these radiation risks, the Io flybys were scheduled near the end of the spacecrafts two-year extended mission.

"Deep Space 2 joins Mars Polar Lander as the first missions to venture to the south pole of Mars, so it's only fitting to name the microprobes after the two explorers who first set foot on Earth's South Pole," said Deep Space 2 Project Manager Sarah Gavit. Withers' winning entry won him a gift certificate for CompUSA merchandise worth \$4,000 and was provided by Lockheed Martin Corp., the Boeing Co. and CompUSA. The top 25 finalists will each receive a copy of a Deep Space 2 poster signed by project team leaders.

## Mars teams prepare for the big day

Nearing the completion of their 11-month journey through space, JPL's Mars Polar Lander and Deep Space 2 spacecraft are just days away from beginning a new chapter in NASA's exploration of the red planet.

Polar Lander is set to land Friday, Dec. 3 at about 12:14 p.m. Pacific time. About 10 minutes before the landing, Deep Space 2's two microprobes will be jettisoned from the mission's cruise stage for a Martian crash landing at 190 meters per second.

Polar Lander's 90-day mission will study the planet's south polar region, probing its layered terrain for signs of climate change. A robotic arm will dig soil at and below the surface and deliver it to a tiny "cooker" onboard, which will detect any carbon dioxide or water vapor. The lander also carries a surface stereo imager and a weather station.

A lidar instrument will use laser pulses to search for atmospheric ice; part of the lidar package includes a microphone, allowing the first sounds to be heard from another planet. Also, a unique camera will take about 10 pictures of the Mars surface as the lander descends.

Deep Space 2 will bury two bullet-shaped probes up to a meter underground to determine if ice is present in the soil, as well as other experiments. Part of the New Millennium Program, the mission will also demonstrate a number of new technologies.

The Polar Lander team spent last week testing and training for the entry, descent and landing operations of the mission.

A test last week involved a detailed simulation of the landing using the spacecraft simulator at industrial partner Lockheed Martin Astronautics in Denver. Teams at JPL, Lockheed Martin and UCLA have also been practicing for the early surface mission.

The next thruster firing to adjust the spacecraft's flight path is scheduled for Nov. 30. Flight navigators have been using additional tracking data to help them calculate the spacecraft's path as it approaches Mars. The spacecraft remains in good health, and the team is not working any spacecraft problems.

## Deep Space 2 probes named for Antarctic explorers

JPL's Deep Space 2 microprobes have been named Amundsen and Scott in honor of the first explorers to reach the South Pole of Earth.

Paul Withers, a graduate student at the University of Arizona, wrote the winning essay in a public contest to name the mission. His was among a NASA-record 17,000 entries submitted.

Norwegian Roald Amundsen led the first successful expedition to the South Pole, reaching it on Dec. 14, 1911. Robert Falcon Scott led an English team to the South Pole in January 1912, only

to discover the national flag left during Amundsen's earlier arrival. Although blizzards and starvation claimed Scott and his entire team on their return trip, a search party found the team's scientifically valuable diaries and notebooks.

"A century ago, Antarctica was the Earth's only unexplored continent," wrote Withers, who studies the thin upper atmosphere of Mars. "Then expeditions led by Amundsen and Scott landed there, striving to discover its secrets, seeking knowledge, and finding a land of stark beauty."

# News Briefs

## Stone wins Sagan Award

JPL Director DR. EDWARD STONE has received the 1999 Carl Sagan Award from the American Astronautical Society.

The award, presented each year to recognize an individual who has demonstrated leadership in research or policies advancing exploration of the cosmos, was given during the society's national conference Nov. 16 in Pasadena, titled "Mapping a Course for Solar System Exploration." At the conference, Stone delivered an address titled "The Role of Robotic Outposts in Establishing a Permanent Presence in Space."

Earlier recipients of the award were former JPL director DR. BRUCE MURRAY and former NASA associate administrator for space science DR. WESLEY HUNTRESS JR.

## Experience JPL folklore with a story

The JPL Technical Library is sponsoring a "JPL Stories" series, which is expected to begin in February 2000. "Storytelling provides an informal yet personal and insightful look into

the events that shape JPL's past, present, and future," said TERESA BAILEY of the Library. "Sharing stories helps build a strong sense of community in the workplace. As a listener, this is your opportunity to learn about JPL culture first-hand—from the people who create it. As a storyteller, this is an opportunity to share your experiences and reflections about your work at JPL."

All JPL employees, contractors and retirees are invited to participate. The Library plans to hold the series after hours, 4:45 to 6 p.m., in the customer service area of the Library located in the west end of Building 111.

For information, contact Bailey at ext. 4-9233.

## Holiday car show in the works

JPL's annual holiday car show is being planned for Wednesday, Dec. 22. On display will be specialty vehicles, motorcycles, stationary engines and other car-related displays.

The event, which in past years has drawn up to 75 vehicles, will be held from 8 a.m. to 2 p.m. at the Transportation parking area outside Building 284. For participation and other information, call JERRY KALISH at ext. 4-8733.

Due to guest operations and numerous news media visitors, special parking arrangements have been put in place for Friday, Dec. 3. Employees with on-Lab parking privileges who normally park in the blue lot may overflow into any available green decal parking on Lab. Access will be available through all three vehicle gates.

Employees who normally park in the west lot may park in the east lot. Once the east lot is full, employees will be directed to alternate parking at the Flintridge Riding Club or Hahamongna Park. Should each of

these lots overflow, an officer at the park will direct the overflow to a fourth site.

Shuttle buses will transport staff from the east lot and Hahamongna to the Lab. Employee badges will be checked prior to boarding the buses.

In addition, no employee-sponsored personal visits to JPL will be approved by Security for Dec. 3 beyond those already approved for Mars Polar Lander guest services.

For more information, go online to <http://jpl-facilities.jpl.nasa.gov/665/parking/parking.htm>.

The NASA Management Office, JPL Deputy Director Larry Dumas and Security and Protective Services Manager Joseph Charles waived the Lab's "no dogs" rule to permit Durham and Murrill to bring the service dog-in-training to JPL. "Their 'yes' to Kepler's presence at JPL ultimately meant that Mr. Fairo received a new guide dog," said Durham.

Dumas and his wife Roberta joined a JPL contingent attending the ceremony. "If you want to boost your spirits, I recommend attending a guide dog graduation," he said. "The recipients of the guide dogs offer an object lesson in optimism and perseverance, and the donors, trainers and puppy raisers an object lesson in the joy of giving."

Guide Dogs of America provides fully trained service dogs to the blind at no cost to the blind partner.

After the ceremony, Fairo, who was one of 10 graduates in the class, thanked the puppy raisers and the JPL community for preparing Kepler for his work as a guide dog. Kepler's new partner, whose blindness was caused 14 years ago by diabetes, lost his previous guide dog to illness seven months ago. As a new working member of the family, Kepler joins Fairo, his wife and teenage daughter at home with two pet dogs and a pet ferret.



JPL Director Dr. Edward Stone, left, greets former astronaut Neil Armstrong at the American Astronautical Society's national conference last week.

## Special parking plan noted for Dec. 3

## Guide dog puppy raised at JPL is placed with blind partner



David Durham of Section 313, left, who helped raise Kepler, looks on as new owner John Fairo holds the dog during graduation ceremonies.

puppy raisers. "Our job was to socialize Kepler and expose him to as many environments and experiences as possible," said Durham. "From the time he was eight weeks old, we worked with him, teaching him things like how to climb up and down stairs, ignore cats, and how to behave in the workplace, in restaurants and on buses, trains and planes."

# Special Events Calendar

## Ongoing

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

**Codependents Anonymous**—Meeting at noon every Wednesday. Call Occupational Health Services at ext. 4-3319.

**Gay, Lesbian and Bisexual Support Group**—Will meet only once in December, on Friday, Dec. 10 at noon in Building 111-117. Call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

**Parent Support Group**—Meets the fourth Tuesday of the month at noon. For location, call Jayne Dutra at ext. 4-6948.

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

## Wednesday, November 24

**Caltech Ballroom Dance Club**—Beginning rumba will be held from 7:30 to 9 p.m. in Caltech's Winnett Lounge. Student taught; cost: \$1. See [www.caltech.edu/~ballroom](http://www.caltech.edu/~ballroom) or call (626) 791-3103.

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

**JPL Toastmasters Club**—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. Call Mary Sue O'Brien at ext. 4-5090.

## Monday, November 29

"A Scientist Goes to Washington"—Dr. Wesley Huntress Jr., former NASA associate administrator for space science, will receive the Caltech Management Association Excellence in Management Award during a dinner at the Athenaeum. Open to association members (including new members) and guests. Reception at 6 p.m. followed by dinner and program. Call Alice Tangney at ext. 4-4894.

**Caltech Ballroom Dance Club**—Beginning American waltz will be held from 7:30 to 9 p.m. in Caltech's Winnett Lounge. Cost: \$24. See [www.caltech.edu/~ballroom](http://www.caltech.edu/~ballroom) or call (626) 791-3103.

## Tuesday, November 30

**Investment Advice**—A Fidelity representative will be available for individual investment and retirement counseling from 9 a.m. to 3 p.m. To schedule an appointment, call (800) 642-7131.

## Wednesday, December 1

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

**Caltech Ballroom Dance Club**—Beginning rumba will be held from 7:30 to 9 p.m. in Caltech's Winnett Lounge. Student taught; cost: \$1. See [www.caltech.edu/~ballroom](http://www.caltech.edu/~ballroom) or call (626) 791-3103.

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

## Thursday, December 2

**Caltech Engineering Design Contest**—Devices designed and built by undergraduate teams will compete at 2 p.m. in Beckman Auditorium. Free admission. For information, go online to <http://www.design.caltech.edu/Courses/ME72>.

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

## Fri., Dec. 3—Sat., Dec. 4

**Holiday Concert**—The Caltech Men's and Women's Glee Clubs will perform music of the season at 8 p.m. in the campus' Dabney Lounge. Admission is free. Call (626) 395-4652.

## Saturday, December 4

**Conjunto Cespedes**—One of the leading purveyors of the Afro-Cuban musical form known as "son," which has defined the music now known as "salsa," this ensemble will perform at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$22, \$18 and \$14. Call (626) 395-4652.

## Sunday, December 5

**Chamber Music**—The Aulos Ensemble and soprano Julianne Baird will perform at 3:30 p.m. in Caltech's Beckman Auditorium. Tickets are \$25, \$21, \$17 and \$13. Call (626) 395-4652.

## Tuesday, December 7

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

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

## Wednesday, December 8

**AFS Quick Start Session**—Jeff Sachs of Section 366 will provide Windows users with an overview of the benefits of this distributed file system to manage computer files, change passwords, protect data, and more. At noon in Building 180-703C.

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

**JPL Toastmasters Club**—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. Call Mary Sue O'Brien at ext. 4-5090.

## Wed., Dec. 8—Thu., Dec. 9

**Investment Advice**—A TIAA/CRF representative will be available for individual investment and retirement counseling from 9 a.m. to 3 p.m. To schedule an appointment, call (800) 842-2007, ext. 1045.

## Thursday, December 9

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

## Friday, December 10

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

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

**TDA Open House**—During the first week in December, employees will receive their annual 403B tax deferred annuity retirement plan maximum contribution information for year 2000. At today's event, to be held from 9 a.m. to 3 p.m. in the 167 cafeteria, representatives from Fidelity, TIAA/CRF and Prudential will be available to answer questions regarding contribution calculations and investment opportunities.

## Saturday, December 11

**ERC Children's Holiday Party**—To be held at the Pasadena Ice Skating Center from 6:30 to 8:15 p.m. Tickets are on sale at the ERC; the \$2 per person admission includes skates, refreshments and gift.



# RED PLANET, BIG SCIENCE

Science teams prepare for Dec. 3 landing

**M**ARS POLAR LANDER is scheduled to touch down in the south polar region of Mars on Friday, Dec. 3 at 12:14 p.m. Pacific time to begin its 90-day mission. Twenty-five minutes after landing, the spacecraft's medium-gain antenna will point to Earth to begin its first two-way communication. The highest priority of this first afternoon will be assuring that the spacecraft is healthy and that telecommunications are working. If so, highly compressed images of portions of the spacecraft and a glimpse of the surrounding landscape will also be returned. Additional images, including pictures from the Mars Descent Imager, will be transmitted during the next few days.

## Science objectives

The area near the south pole of Mars is the lander's destination because the layered terrain there may contain physical evidence of climate change, whether it be minerals formed in ancient seas elsewhere on the planet or the signature of more recent, repetitive climate change represented by the layers themselves.

The layered terrain in the polar region is one to three kilometers (.6 to 1.8 miles) thick, as shown by altimetry measurements by Mars Global Surveyor's laser altimeter.

## Instruments

Dr. David Paige of UCLA is the principal investigator for the Mars Volatiles and Climate Surveyor, a suite of four major instruments designed to study the south polar region's surface environment, weather and geology:

- A robotic arm, built at JPL. A scoop at the end of the 2-meter (6 1/2-foot) arm will dig trenches and deliver soil samples to the thermal and evolved gas analyzer on the lander's deck.
- A surface stereo imager—a clone of the Pathfinder camera—and a robotic arm camera located near the digging scoop.

- The thermal evolved gas analyzer, which will "cook" soil samples in order to test for volatiles such as water or carbon dioxide. Soil samples delivered by the robotic arm are heated in a small oven to temperatures up to 1,027 C (1,880 F). The gases generated by heating pass through light from a tiny laser, which detects the presence of water vapor and carbon dioxide. The instrument can perform up to eight soil analyses.

- A meteorology package led by JPL investigators Drs. David Crisp and Randy May. This weather station includes a 1.2-meter (4-foot) mast with a wind speed and direction sensor, temperature sensors and lasers that detect water vapor. A shorter secondary mast will measure wind speed and air temperature close to the ground.

Two other instruments are on the lander:

- A descent imager, which will take a series of pictures as the lander descends toward the planet's surface.
- A lidar instrument, which, like radar, emits pulses of energy and detects their echo as they bounce off dust or ice particles in the atmosphere. But instead of using radio pulses as radar does, the lidar sends out pulses of light from a laser.

The lidar package also includes a small microphone, which may pick up the sounds of mechanical events on the lander, as well as wind and possibly thunder or lightning.

## Communication

Upon completion of the Deep Space 2 mission, Mars Climate Orbiter may utilize Mars Global Surveyor as a communications link. The spacecraft can also link direct to Earth.

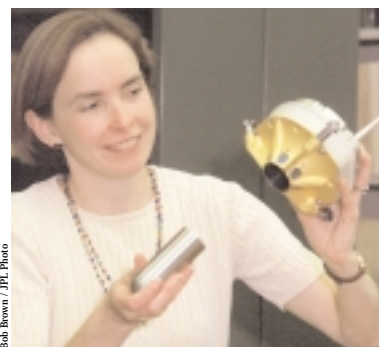
## Timeline

The first pictures may be available from the spacecraft within two hours of landing. The robotic arm is not expected to be operational until the second day of the mission.



Dutch Sager / JPL Photo

**T**WO DEEP SPACE 2 probes, each about the size of a grapefruit and encased inside a basketball-sized aeroshell, have been attached to the Mars Polar Lander cruise stage since launch and will be released about 10 minutes before the lander touches down. Traveling at about 190 meters per second (400 mph), the probes will hit the Martian surface up to 30 seconds before Polar Lander lands, some 60 kilometers (36 miles) away. The probes are expected to land between one and 10 kilometers apart.



Bob Brown / JPL Photo

## Science objectives

Deep Space 2's science goals dovetail with those of Mars Polar Lander, which is focused on understanding Mars' climate.

Deep Space 2 will attempt to determine if ice is present in Mars' subsurface soil; estimate the thermal conductivity of the soil at depth; determine the atmospheric density throughout the probes' descent; and characterize the soil's

hardness and possibly the presence of layering on a scale of tens of centimeters.

Each probe's bullet-shaped forebody will be buried up to about 1 meter (3 feet) underground to search for evidence of water in the soil. A tiny drill will pierce the soil to bring it into a heater cup; heating the soil will drive any water vapor into an analysis chamber, and water will be detected by measuring the difference in light intensity of a laser shining through the vapor. The probes' aftbody will stay above ground and will connect to the forebody below the surface via a flexible cable.

## Technology validation

Deep Space 2 will test technologies that could enable future missions with multiple landers released from a single spacecraft, possibly distributed around an entire planet or other body. Among those technologies are:

- Entry system: The Deep Space 2 aeroshell is not required to be pointed or spin-stabilized when it enters Mars' atmosphere. It uses no parachutes, airbags or retro rockets to slow its descent.

- High G-packaging techniques: The high speed of the probes' impact could produce deceleration levels up to 30,000 Gs in the forebody and 60,000 Gs in the aftbody (one "G" is equivalent to the force of gravity on Earth's surface).

- Micro-telecommunications system: Each probe has a tiny radio transmitter and receiver system weighing less than 50 grams (1 3/4 ounces).

- Ultra-low-temperature lithium battery: To provide power at temperatures as low as minus 80 C (-112 F), each probe carries two new non-rechargeable lithium-thionyl chloride batteries, weighing less than 40 grams (1.4 ounces) each.

- Advanced microcontroller: The probes' spartan computer system uses a low-power chip used in such products as microwave ovens, VCRs and cars. The system operates with a mass of 3.2 grams (1/10 of an ounce) and with a volume of 2.2 cubic centimeters (.13 cubic inches).

## Communication

Each probe's aftbody will transmit data to Mars Global Surveyor, which will temporarily store the data before relaying it to Earth.

## Timeline

The probes are expected to impact Mars at about 12:30 p.m. Dec. 3. The prime mission ends after one Martian day, when the probes transmit data evaluating the project's technologies. That first data set is expected to be relayed to Earth by about 9:30 p.m. Pacific time Dec. 3. At the end of the prime mission, the probes will continue to collect and transmit data until their batteries are depleted.

"Our most challenging experiment will be the soil analysis, which involves several elements of the science payload. There are some new technologies in the system we'll be using, and we want to get samples not only from the surface but from beneath it as well."

*Dr. Richard Zurek, Mars Polar Lander project scientist, below*

"We've tested the range of speeds with which we'll hit the ground, in a wide range of terrain, from ice at minus 60 degrees to very fine grains of sand. We think these are reasonable facsimiles of what we expect to find on Mars. But it's possible there's something even stranger on Mars we haven't tested for."

*Dr. Suzanne Smrekar, Deep Space 2 project scientist, left*



# NOVA Awards



The following employees were awarded JPL's Notable Organizational Value-Added awards (NOVAs) in October:

**Section 222:** Florencio Cunanan, Aram Yagubian.

**Section 224:** Stephen Canell, Irene Chan, David Fu, Irena Hungerford, Jonathan Kim, Luis Sandoval, Elaine Tang, Alan Tu, James Tu.

## New NOVA vouchers available

Recipients of NOVA awards may now choose a \$100 recognition voucher, which can be redeemed for gift certificates from various retail stores and restaurants. Once the recipient makes their selection of gift certificates, he or she contacts the

**Section 320:** Anthony Grigsby, Deronda Mayes, James Young.

**Section 353:** Hartwell Long, Georg Siebes, Andre Yavrouian.

**Section 509:** Cheryl Allworth, Kristine Asatrian, Eva Bazzarre, Neil Bautista, Terry Bednarczyk, Jeffery Behar, Thomas Boxwell, Pamela Brown, Elaine Cottle, Jeannine Darrett, Mary Gilmore, Julie Jackson, Bill Korver, Ruth LeBlanc, Amy Posner, Patricia Smith-Araki, Bradley Walker, Alison Weisbin, Ronald Yarbrough.

vendor and the gift certificates are mailed directly to the recipient's home. (Applicable tax withholdings apply to the \$100 recognition voucher after the voucher is redeemed.)

For more details on this and other NOVA Awards, visit the Reward & Recognition home page at <http://eis/sec614/reward> and click on "NOVA Award Program."

## Letters

Giovanna and I are sincerely grateful for the outpouring of kindness shown to us following the recent passing of our son Michael. Your support is what helps those of us who have lost loved ones cope with our feelings. The beautiful plant sent to us by ERC reminds us that life continues.

Cecil Brower

I want to express my appreciation to my co-workers at JPL for their support and thoughtfulness during my mother's recent hospitalization and since her passing. I thank them also for the beautiful flowers sent to her funeral, and thank you ERC for the nice plant.

Roger Hickok

## Passings

**MARIE ISABELLE, 84**, a retired senior department clerk in Section 652, died of respiratory illness Oct. 17 at her home in Pasadena.

Isabelle worked at JPL from 1955-79. She is survived by her daughter, Maryann Rushton; two grandchildren and four great-grandchildren.

Services were private.

**WILLIAM BERKLEY, 65**, a retired member of the engineering staff in Section 338, died of cancer Nov. 4. Berkley joined the Lab in 1979 and retired in 1998. He is survived by his wife, Mai Pham, and children Mark and Linda Berkley and Nguyen Ngo. Services were held in Orlando, Fla.

## Retirees

The following employees retired in November: Gerald Hicks, 38 years, Section 642; Thomas Thornton Jr., 38 years, Section 170; Judy Hicks, 37 years, Section 361; Richard Barazza, 34 years, Section 389; Catherine Thornton, 33 years, Section 330; Jeffrey Baker, 23 years, Section 223; Edward Christianson, 22 years, Section 940; Sally Rose, 15 years, Section 214.

## Classifieds

### For Sale

**BASEBALL CARDS.** '95 Tipper Deck complete set, 225 cards, major players & stars. \$20. 200 asst'd. baseball or football cards, specialty favorite teams & players, major stars, rookies, commons, inserts. \$20. 626/914-6083.

**BOMB HOIST,** w/19 vintage, portable, half-ton capacity, lightweight aluminum, gal. size for mounting in a truck bed. \$60. 626/303-1927.

**CHRISTMAS DECORATIONS,** hand made wreaths, centerpieces, floor arrangements, much more, 12/4 & 5, noon-4 p.m., 4411 Dunsmore Ave., La Crescenta. 249-7894, Bev.

**COFFEE MAKER,** restaurant-type, w/2 warming plates, \$50. 909/623-4857, Anita.

**COMPUTER,** laptop, Mac 145B, incl. Stylewriter II printer, carrying case, 14" rgb monitor and XT keyboard, \$200/obo. 790-0264.

**COMPUTER,** Pentium 166 w/math co-processor, 64MB EDO RAM, 2.5 GB disk, 28.8 modem, some software. \$575/obo. 626/795-1902, Seth.

**COMPUTER MONITOR,** Hyundai 14" SVGA, 29 pitch, \$25. 626/398-4960.

**DIAMONDS,** earring studs, 89 ct. \$500; earring jackets, 24 ct. \$250; pendant necktie, 23 ct. \$250. Lladro Christmas bells, \$10 ea. 626/798-2531

**EXERCISE EQUIPMENT** Everying treadmill, like new, orig. price \$1,100, sell \$500/obo, page 323/858-5335 or 909/987-6707, Tania.

**EXERCISE EQUIPMENT,** NordicTrack Skier Pro model, \$250. 909/623-4857, Warren or Anita.

**EXERSAUER,** Graco, for baby, fancy, many activities, used 2 mos., like new, paid \$75, sell for \$40. 909/599-6915

**FIREWOOD,** eucalyptus w/some pine, \$250/cord, pick up in La Canada. 790-6851, Roger or Margaret.

**FIREWOOD,** high quality, 626/449-0102.

**GATES,** chain link, 3 1/2' w x 5' h; 6 w x 5' h; 6 1/2' w x 5' h; 8 w x 5' h; 31/2' w x 4' h. 626/798-2531.

**FISH TANK,** 100 gal. Plexiglas, fully equipped, incl. \$400 worth of fish plus 10 gal. tank, less than a year old. \$875. 909/981-1113.

**FURNITURE,** sofa & low seat, sleek, lt. gray leather. \$150; coffee table, oak w/smoked glass inserts & storage shelf, 2 matching end tables, all \$100; TV cart w/covered storage, \$30. 790-4553, after 6 p.m.

**MAGAZINES,** National Geographic, 40+ yrs, plus maps, indexes, over 500 issues, \$250/obo. 213/880-7805.

**MATRESS,** full size, exec. cond., must move. 762-7298.

**MISC.** bed, cal King, Italian lacquer, white, matching dresser & 2 night stands w/mirror, \$300/obo; Sit and Ride Huffy bike trailer, holds 2 kids, \$90; Swedish baby buggy, dr. blue, white wheels, \$250/obo. 548-5082.

**MISC.** beta cam, incl. access & batt., \$274; beta tapes, new & used; bicycles, hi rise, \$78 ea.; Sony Cam F-8, 8mm, access & batt., \$249; weight bench, Legacy Fitness, \$93; weight set, Olympic, \$93. 805/582-9494.

**MISC.** entertainment center, oak bedroom set w/head & footboard; nightstand; dresser; mattress set, queen; dinette set w/leaf, oak, seats 6; chairs, 4, southwestern; rollout desk, oak, small, more, everything must go. 951-5107.

**MISC.** entertainment center, \$50/obo; wall unit, solid teak, must sell, \$300; baby crib, car, never used \$80; baby swing, Graco, open top, battery op. \$20. 323/722-4412.

**MISC.** lamp shade, leaded glass, hanging, 19" across, diff. colors of glass in butterfly patter. \$95; sign, Burgermeister beer, old embossed copper tray w/logo, \$30; newspapers, WWII era, \$5 ea.; buffalo skull, large, mounted, \$145; clock, mantle, old Seth Thomas, \$100. 248-5282.

**MISC.** piano, Marshall & Wendell Ampico player and bench, orig. bill of sale 12/12/30, refurh. '72, 70 orig. paper rolls, incl. 1830s sheet music; needs tuning & some work, \$3,200; dining set, 6 cane chairs, 2 captain & 4 straightback, two 18" leaves, expands from 68" to 104" x 44" w table pads, some needs refinishing, \$550; stereo console, Fisher FM radio, Sony reel-to-reel tape deck, dual 1019 recorder, 2 speaker cabinets, \$1,800; camera, 35mm SLR, Olympus OM-2T 1.5, 50 mm Zuiko lens, winder, accessory case, Vivitar series-1 1.3, 5.7, 20-210mm macro focus, auto zoom lens w/case & shoulder strap, Vivitar model 123 auto thyristor flash, orig. box & instr. books, mirror sys. needs work, \$375. 249-1892.

**MISC.** sofa & love seat, contemp., synthetic/wool off-white, seat cushions w/zippers, exec. cond., \$450; bed frame, metal w/casters, \$10. 626/798-2925.

**MODEM CARD** for laptop, 33.3 kbps, w/o wire, used twice, \$19; ZIP disks, \$7. Publisher '97. \$19; Macafee Anti Virus Security Suite, free updates, \$19, orig. \$79; New Application Bible CD, \$9, orig. \$59; Greenleaf CD, \$4; Premier Ed. Draw Print Studio, \$10, orig. \$49; Jeopardy, \$9, Photo Studio SE, \$7. 366-6134.

**PIANO,** Wurliizer spinet, w/bench, looks nice, \$875/obo. 952-8455.

**POOL TABLE,** 4.5 x 9', all accessories incl., \$1,000. 626/398-3649.

**RANGE,** Whirlpool, gas, almond, 30" self-clean oven, like new, must see, \$350. 626/337-6130.

**REFRIGERATORS,** GE, 18 1/2" w x 17 1/2" d, 18 1/2" h, \$40; 18 3/4" w x 18 1/4" d, \$34, \$5. 952-1256.

**SHAKE,** boa, red-tail, almost 1 year old, likes to be held, nice coloring, \$100. 952-8455.

**SNOW BOOTS,** women's, size 8, tan, only used once, \$25. 714/903-8888.

**SPEAKERS,** stereo, 1 pr., Definitive Technology BP-20, bi-polar, orig. \$1,600, sell \$500/obo. 626/291-2990.

**TELEVISION,** Sony Trinitron, color, 20", model KV-20M40, practically new, super clean, perfect work, cond. orig. box w/remote, 181-20, auto preset tuner, on-screen menu, speed surf, sleep timer, channel block, XDS, caption vision, many more features, under 1 yr. part, 2-yr. CRT warr., bought Feb. '99, \$200. 626/683-0706.

**WASHER/DRYER,** GE, electric, exec. cond., free dry, within 20 mi., both \$238/obo. 805/582-9494.

## Vehicles / Accessories

'95 ACURA Legend LS Coupe 2D, black, auto, 104,000 mi., mint cond., leather, sunroof, heated seats, alloy wheels, CD changer, remote keyless entry, \$19,000/obo. 626/ 568-8298.

'96 CHEVROLET Cavalier, 4 cyl., 4 dr., green, auto, A/C, CD, cruise, P.D. ABS, 79K, \$77,000/obo. 626/946-0323, Brian.

'95 CHEVROLET Camaro, V6, dark green ext., a/c, cc, AM/FM, Alpine CD player, pwr. locks & win., keyless entry, kill switch, new tires, alloy wheels, only 60,000 mi., great cond., \$12,000/obo. 626/235-6588, Mayuko.

'93 CHEVROLET Corvette, 40th anniv. ed., 350, auto, leather, flame red w/black int., near new tires & brakes, chrome wheels, all options except glass top, 59K mi., \$18,750. 909/598-0844.

'92 CHEVROLET S10 pickup, 2.5L auto, A/C, cass./radio, 65K mi., 1 owner, vg cond., complete maint. records, \$3,000/obo. 626/443-9774.

'77 DATSUN 280Z, new Firelli tires, batt. alt. and voltage regulator, rebuilt gear box, stereo, strong engine, runs exc., \$1,600. 626/683-3140.

CAMPER SHELL for Ford pickup, blue, incl. 4-pc. carpeted storage boxes, \$300/obo. 626/797-5387.

'97 FORD Mustang GT, 4.6L SOHC V8, 5 spd., 17" alloy wheels, ABS, a/c, 12K mi., \$16,595/obo. 626/796-5216.

'96 FORD Escort, 4 dr., air, AM/FM cass., 5 speed, alarm, custom wheels, extended warranty, 60,000 mi., very clean, no damage, \$4,900. 353-4725, after 3:30 p.m.

'94 FORD 4-Runner 4 x 4, SR5, V6, cass. CD, tow, sunroof, p/w/101k mi., exec. cond., silver/grey, \$12,000. 562/425-8403.

'86 HONDA Shadow VT 1100, black, 26K mi., windshield, bags, backrest, extremely clean, \$3,100. 626/441-2150.

'91 INFINITI G20, good cond., 107K mi., 4-dr. sedan, 5-sp man., moorf. A/C, pwr. win., leather seats, cc, orig. owner, \$5,700/obo. 790-2558, eves.

'95 KAWASAKI Vulcan, 800cc, 16,000 mi., wind screen, backrest, leather saddle bags, \$3,500. 951-6534.

MANUALS, '86 Honda Accord (shop); '70 Datsun 240Z (service); 952-8455.

'80 MERCEDES 240 D, gd. cond., exec. engine, A/C, AM/FM w/cass., sunroof, \$3,000. 626/797-9406, Clemmie or Gerald Phillips.

'93 MERCURY Villager GS, exc. cond., AC, AM/FM cass., pwr. win., holds up to 7 comfactors, car phone, \$7,500. 626/797-9406, Clemmie or Gerald Phillips.

'89 MILLER equipment trailer, tilt, new deck, new tires, brakes & electrical, will support 21,000 lbs., \$5,000. 626/798-6249.

'91 NISSAN 300ZX 2+2, 5-sp., pearl white w/mant leather, 79K, Bose, 2-tops, CD, alarm, climate, new tires, air bag, maint. records, car cover, clean & pampered, \$11,700/obo. 550-7555, Rob.

'84 NOMAD travel trailer, slps 6, air heater, stereo, refrig., new tires, \$2,000. 626/798-6249.

'85 PINNACLE motor home, 31 ft., 33K mi., 6.5 kW generator, dual rear A/C, custom 7 ft. bed, hydraulic ladders, microwave, loaded, exc. cond., \$13,000/obo. 949/470-0484.

SNOW TIRES, orig. for Ford Ranger, never used, \$20. 626/798-7339.

'88 TOYOTA Camry, white, 4-cyl., 25,000 mi., must sell, \$15,000 higher than low Blue Book. 323/722-4412.

'94 TOYOTA 4-Runner, 38,000 mi., loaded, 2WD, exc. cond., all records, must move in 3 weeks, \$15,500. 626/643-9769, Dave.

'83 TOYOTA Supra, white w/blue int., 6 cyl., cruise, sunroof, CD, pwr. win./dtrs., alarm, locks & runs good, \$1,500/obo. 353-1907.

'86 YAMAHA SRX6 super single, 600cc, exec. cond., dealer maintained, cafe racer bike, \$2,100. 562/423-2224, Fred.

## Wanted

CHRISTMAS CARDS and picture calendars, used, 548-5656.

EXERCISE BIKE w/easily adj. seat; jr. golf clubs for 8 yr. old boy. 363-6446.

PORTA-CRIB, Graco, gd. cond. 310/828-1997, Terry.

PRE-SCHOOL bikes, tricycles, outdoor riding vehicles, 626/797-5387.

SINGERS, bass & tenor, to sing w/ capella jazz vocal ensemble w/style similar to Manhattan Transfer, able to read music & hold harmony part against others, exper. pref., audition req., rehearsal Mon. eves. after work, 249-6731, Carol.

SNOWBOARD w/bindings, boots, gloves for child about 5'4" tall, shoe sz. 3. 952-8455.

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

VOLLEYBALL PLAYERS, coed, all levels of play, Tue. nts., 8-10:00, Eagle Rock High School, \$3/nt. 956-1744, Barbara.

## Free

DOC, rescued black Chow/Box mix, 2 yrs. old, male, beautiful, needs loving home, well behaved, knows basic commands, healthy, shots, neutered, 661/257-5817.

## Reminders: Award for Excellence

New eligibility date

The eligibility period for the year 2000 award cycle for JPL's Award for Excellence has changed since an article was published in the Nov. 12 Universe. Accomplishments considered for the award must have occurred between Dec. 1, 1998 and Dec. 10, 1999.

Award for Excellence nominations begin Nov. 29 for the 3x, 5x, 7x, 8x, and 9x organizations.

DOGS, Alaskan Malamutes, to good home AKC, 1-5 yrs. old, beautiful, wonderful temperament. 626/798-7339.

KITTENS, 2 black, semi-long-haired, weaned, sweet & sleek, neutered & shots. 353-4705.

## For Rent

ALTADENA condo, minutes from JPL. 2 bd., 1 3/4 ba., nice closets w/organizers, f/p, cent. A/C, pool, storage rm., 2 car gar., carpet, tile counters & marble floor in kit., lg. patio w/landscape, planters & oriental garden, waterfall, spa, end unit w/windows on 3 sides, rent by owner, \$1,200. 626/398-1988.

ALTADENA house, 3 bd., 1 ba., close to JPL, fenced yd., 2car gar., quiet neighborhood, \$1,050 + \$1,000 deposit. 626/839-2061.

ARCADIA, 2 rms. in 5-bd. Immac. hse., great location, full privileges, pool, lg. yd., quiet setting, no smoking/pets, \$800. 626/836-5734.

GLENDALE house, exclusive, to share w/1 person, 20 min. from JPL, courtyard w/fountain, deck w/gazebo, ha, w/garden view, util./cable incl., no smoking/drinking, \$626/mo. 246-4750, Emma.

PASADENA, 2 bd., 2 ba. apt., very nice, sublet beginning of Dec., \$850. 626/396-9027.

PASADENA, room in 3-bd. apt. to share w/2 others, pool, parking, a/c, washer/dryer, \$460 + 1/3 util. 626/564-1078.

SOUTH PASADENA, fully furnished studio apt., nice area at 1718 Huntington Dr. btwn. Marengo & Milan Sts., car space, laundry facilities on premises, utilities paid, non-smoker, no pets, \$565/mo. 626/792-9053, Marilyn.

## Real Estate

PASADENA, 3 bed, 2.5-ba townhome built '98, nr Rose Bowl, 3.5 mi JPL, gated, 1,440 sq. ft. cent. heat/air, 2-car att. garage, prof. organized closets, tiled fl., alarm, dbl. glass windows, covered balcony off master, wood flrs everywhere. Corian counters, lg. incl. backyard fully landscaped w/water sprinklers, palm fruit trees, fountain, community pool/Jazz, basketball court, \$249,500/obo. 626/568-8298.

SPAR HEIGHTS, 2 br., 1 1/2 ba., 1,470 sq. ft., 9,950 sq. ft. lot, walk to Montrose & school, 6 mi. to JPL, 2 f/p, wood floors, ceiling fans, frame/stucco const., new paint, re-plumbed w/copper, attached 2-car gar. w/washer & dryer, C/A & heat, auto sprinklers, dog run, spa, 3 storage sheds, fenced yard, 200 amp elec. serv., \$349,000. 249-1892.

## Vacation Rentals

BIG BEAR cabin, nr. village, 2 bd., sleeps 8, completely furnished, f/p, TV/VCR, \$75/nt. 249-8515.

BIG BEAR LAKE cabin, nr. ski area, lake, shops, village, forest, 2 bd., sleeps up to 6, f/p, TV, VCR, phone, microwave, BBQ & more. JPL disc. from \$65/night. 909/522-9874.

BIG BEAR LAKEFRONT, lux. townhome, indoor pool/spa, full kitchen, full bathroom, master bd. suite, sleeps 6. 949/786-6548.

CAMBRIA ocean front house, sleeps up to 4, exec. view, 248-8835.

HAWAII, Maui cond., NW coast, on beach w/ocean view, 25 mi. fr. surf, 1 bd. w/loft, comp. furn., phone, color TV, VCR, microwave, dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate, \$85/nt/2e, 12/15-4/14 rate \$110/nt/2e, \$10/nt/4d+1 night. 949/348-8047.

MAMMOTH, Chamonix cond., at lifts 7, 8, 16, 17, walk to Warming Hut, 2 bd., 2 full ba., sleeps 6, fully equip. elec. kit., microw. & extras, f/p & wood, color TV, VCR, cable, FM stereo, w/d furnace, sauna, game, rec. & laundry rms, walk to shops, lifts, special midweek rates, 249-8524.

MAMMOTH cond., studio + loft, 2 ba., f/p w/wood, Jacuzzi, sauna, game rm., color CB, TV/VCR, full kit, w/microw., terrace, view, amen. 714/870-1872.

MAMMOTH, Snowcrest, 2 bd., 2 ba., + loft, sleeps 6-8, fully equipped kit, incl. microw., DW, cable TV, VCR, phone, balcony w/mtn. view, Jacuzzi, sauna, streams, fishponds, close to Mammoth Creek, JPL disc. 626/798-9222 or 626/794-0455.

OCEANSIDE, on the sand, charming 1-bd. cond., panoramic view, walk to pier, harbor, pool/spa, game rm., sleeps 4. 949/786-6548.

PACIFIC GROVE house, 3 bd., 2 ba., f/p, cable TV, stereo, CD, well-eqpd. kit, incl. w/microw, beaut. furn. close to golf, beaches, 17 Mile Dr. Aquar., Camery Row, JPL disc. 626/411-3265.

ROSARIO BEACH cond., 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 18-hole golf course w/6 mi. away, private security parking. 626/794-3906.

LAKE TAHOE KEYS waterfront, 4 bd., 3 ba., 1 bd. & 1 rm. upstairs, hgt. acc. access, flrs 12+ ft., fireplaces, decks overlook priv. deck & ski lifts, gourmet kitchen, bikes, boats, 4 color TVs, VCR, stereo w/tape & disk, indoor/outdoor pools, hot tub & beach, tennis, 10 min. skiing, casinos, golf, 1 hr. w/in county 3-day min., \$1,195/wk high season (June 1 to 15 Sept; 22 Nov to 1 April), \$595/week low seas., + \$90 cleaning fee. 949/515-5812.

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Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 188-118, or via e-mail to [universe@jpl.nasa.gov](mailto:universe@jpl.nasa.gov).

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