

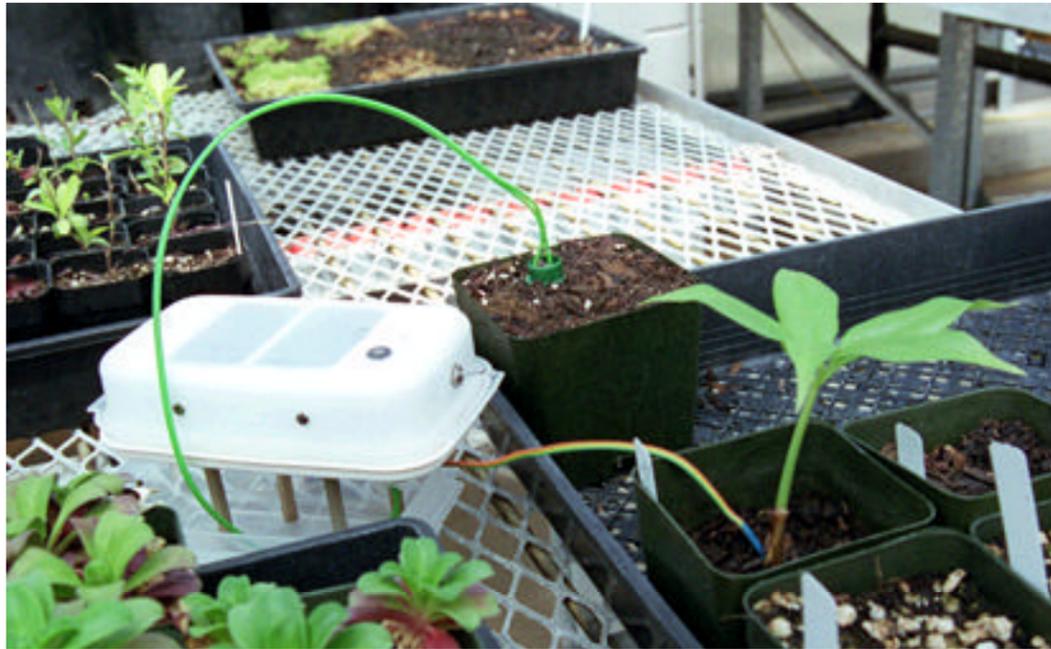
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## Researchers go back to the garden

By Nancy Lovato

*Sensors are housed in plastic sandwich containers within several greenhouses at the Huntington Botanical Gardens in San Marino.*

*Dr. Kevin Delin, below, shows another tiny sensor used to study microclimates.*



Bob Brown / JPL Photo

**Researchers and scientists are one step closer to measuring biological activity on other planets thanks to new sensor web technology studying life here on Earth. The new system, made up of small, wireless sensors, was developed by JPL engineers, and will eventually help establish a virtual presence for solar**

system exploration. Like remote measurements obtained by satellites and telescopes, the webs allow large areas to be monitored. Unlike remote operations, however, sensor webs are placed within the environment—thus making them capable of on-site detection not possible from afar.

The prototype sensor web system, being tested in several greenhouses at the Huntington Botanical Gardens in San Marino, consists of 12 sensor pods, which quantitatively measure a number of environmental factors. The data is “hopped” from pod to pod, finally making it to a primary pod, which is connected to a computer that collects and stores the data.

“The beauty of this system is that the data collected is shared by all the pods,” said Dr. Kevin Delin, leader of JPL’s Sensor Webs Project. The collection of web pods can be looked at as a neural system embedded in the environment, Delin explained. “Just as neural synapses in the brain work off each other to produce intelligence, the collection of pods share information with each other, ultimately resulting in knowledge, rather than a mere collection of data.” He also noted that the individual pods can be upgraded one at a time, increasing the overall performance of the system, while not disturbing the functioning of the web itself.

Each pod, no bigger than the

size of a plastic sandwich container and some as small as a gumball, monitors soil temperature and moisture, light levels, local humidity, air temperature and gases every five minutes. “The pods all take quantitative data at essentially the same moment,” said Shannon Jackson, lead project engineer. Delin added, “It’s quite remarkable that the pods work in a synchronized manner when you realize that they are distributed over a large area and that most can’t communicate directly with each other.”

The pods are battery-powered. The batteries, which charge throughout the day via the solar panels located on the top of the

Pods, support the pods after the sun has set, enabling the system to run 24 hours per day. “I’m very happy with the way we are harvesting energy,” said Jackson. The sensor web has been running continuously for the last month, despite cloudy days and some unseasonal rains.

The environment in which these pods are being tested also appears to be working well. “The botanical gardens is a perfect place with the varied garden environments reflecting different microclimates,” said Delin. The Huntington Gardens house more than 15,000 kinds of plants from all over the world. With time, the project team hopes to “plant” other pods outdoors in the various gardens at the Huntington.

“We are delighted that Kevin included us in this project,” said Jim Folsom, director of the botanical gardens. “I’d like to think this is one way in which we can lift the veil of mystery between us and nature.”

Indeed, many unanswered questions may be addressed with these pods. On Earth, sensor webs may have a wide range of applications—from studying the carbon cycle on a planetary scale in intricate detail to locating, as opposed to just detecting, fires in buildings. The project team also looks forward to developing these sensor webs for extraterrestrial applications, such as detecting biological activity on Mars and studying the ice flow on Europa.

For more information, including pictures and animation, go online to <http://sensorwebs.jpl.nasa.gov>.



## Interstellar sails successfully demonstrated

By Nancy Lovato

*A lightweight sail (at right) that could be used to propel a spacecraft for interstellar exploration is depicted in this frame from an animation, where the sail receives beamed energy from a solar-powered satellite.*

In two breakthrough developments, scientists have beamed microwaves and laser energy to “fill” lightweight sails in laboratory demonstrations of how these technologies might provide propulsion for interstellar exploration.

The sails used in the microwave experiment were actually driven to liftoff and flight, while the laser-driven sails achieved horizontal movement.

“These are really two giant steps forward,” said Henry Harris, task manager for the microwave levitation and laser experiments at JPL. “These results would not have been possible without newly developed ultralight, high-temperature sail materials and beamed-energy propulsion methods.”

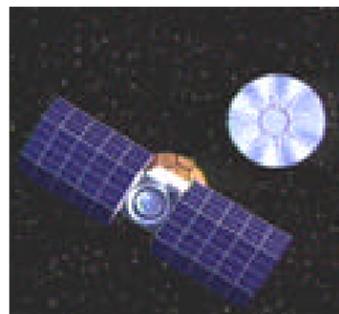
Future spacecraft that explore the depths of space will need to be very lightweight and be propelled by a reliable source of energy. Solar sails and microwave- and laser-beamed sails meet this requirement, with minimal weight since in the first case the “engine” is the Sun, and in the latter two the engine is left at the point of origin. They are driven by photons, particles of energy in which sunlight and other forms of electromagnetic radiation are emitted. By use of a remote laser or microwave source, beamed energy can be directed. In space, the source may be provided by a satellite or other type spacecraft.

The microwave-beamed sail experiment was conducted in a vacuum chamber at JPL, while the laser-driven experiment took place in another vacuum chamber at Wright-Patterson Air Force Base in Ohio. Both of these experiments appear to be firsts.

“Accelerations of several times the force of gravity were observed during the microwave tests,” said Dr. James Benford, project director and president, Microwave Sciences, Inc., Lafayette, Calif. “In one case,

the sail flew two feet in response to the high acceleration.”

About 10 kilowatts of microwave power were beamed to the sails. Analysis of data is underway to isolate the photon pressure effect from other possible causes of sail movement. In the other tests, laser powers



from 7.9 to 13.9 kilowatts were directed to the sails. Photon thrust was calculated from movements of the sails, which were mounted on pendulums. Future research will fine-tune the scientific understanding of flight using photon pressure.

Sails for both experiments were made of a very light but stiff carbon-carbon microtruss fabric that can withstand high temperatures typical of flight-level power densities. “These experiments are the first known measurements of laser photon thrust performance using lightweight sails that are candidates for spaceflight,” noted Dr. Leik Myrabo, associate professor at Rensselaer Polytechnic Institute, Troy, N.Y.

Both Benford and Myrabo are lead authors of papers describing the experiments. “Experimental Investigation of Laser-Pushed Light Sails in A Vacuum,” by Myrabo, was presented June 2 during the Advanced Propulsion Conference at JPL. Benford’s paper, “Microwave Beam-Driven Propulsion Experiments for High-Speed Space Exploration,” was presented at a conference in Scotland May 30-June 2 and also at the JPL conference. Knowles and Harris are among the co-authors on both papers. Harris is also co-investigator on the microwave experiment.

# News Briefs



Michael Devirian

### Devirian to lead Origins Program

MICHAEL DEVIRIAN, former manager of Space Science and Microgravity Flight Experiments, has been appointed as manager of the Origins and Fundamental Physics Program.

Devirian will oversee the projects and technology activities that will seek to answer questions about the formation of the universe, galaxies, stars, planets and life. Devirian will oversee two fundamental physics programs—the Space Science program, including the Laser Interferometer Space Antenna (LISA), and the Microgravity Fundamental Physics Experiment. In addition, he will operate in a supporting role for the Origins theme director at NASA Headquarters.

Devirian received his bachelor's degree in physics from the University of California, Riverside. He joined JPL in 1966 and was a member of the Lunar Surveyor team, Mariner Mars 1969 and Mariner Mars Orbiter 1971 projects. He served as director of flight operations during the development and flight phases of the Voyager Project, through the encounter with Jupiter in 1979. After working for nine years in Washington, D.C. as detailee to NASA Headquarters, he returned to JPL, where he worked on the Wide Field/Planetary Camera-II project for the Hubble Space Telescope.

Devirian received the NASA Medal for Outstanding Leadership for work on Voyager and the Medal for Exceptional Service for work on the Wide Field/Planetary Camera-II.

### Simmons named SESPDP deputy

LARRY SIMMONS has been appointed as the deputy director of JPL's Space and Earth Science Programs Directorate.

As deputy director, Simmons will join in the directorate's responsibilities for all of the Laboratory's initial space flight project activities, except for missions to Mars. In addition, he will share in the responsibilities for all programmatic science activity, all flight instruments made at JPL and for NASA's Earth Science Enterprise flight missions.

Simmons will continue as program manager for the Space Infrared Telescope Facility, due for launch in 2001.

Simmons received his bachelor's degree in physics from UCLA. He has served in managerial expertise at JPL since 1969 on the Atmospheric Trace Molecule Spectroscopy Experiment, the Astrophysics and Microgravity Flight Experiments Office and the Wide Field/ Planetary Camera II. I

### Deep Impact seeks comet observations

The JPL-managed Deep Impact mission, which will seek to hurl a

500-kilogram copper impactor into comet Tempel 1 five years from now, is seeking advanced charge coupled device (CCD) observers to monitor the comet from June through December 2000, when the comet passes through opposition and heads towards Jupiter.

Deep Impact's objective is to send a flyby spacecraft to Tempel 1 in 2004. During the summer of 2005, the spacecraft will launch the impactor toward the nucleus of the comet. The impactor will excavate a 20-meter crater in the nucleus, and the resulting impact will be observed by the spacecraft and by ground-based observatories.

Mission planners seek to develop computer models of the comet to aid mission design, and are looking to gather scientific data about the comet's brightness changes, coma structures and dust activity.

To meet this need for data, the project has established the Small Telescope Science Program, a network of professional and technically advanced amateur astronomers from around the world to make CCD observations of the comet through this December. Coverage of the comet is sought over several days as well as over several months.

To see observing requirements as well as CCD images taken by program observers, go online to <http://www.ss.astro.umd.edu/deepimpact/stsp>.

For more information about Deep Impact, go to <http://deepimpact.jpl.nasa.gov> or <http://www.ss.astro.umd.edu/deepimpact>.

### Astronomical gathering coming up

The annual meeting of the Astronomical Society of the Pacific, to be held at the Pasadena Convention Center July 13-19, will include fun events for the whole family as well as a number of JPL exhibits and scientific presentations.

JPL is a co-sponsor of the event, which will include the Universe 2000 Family Expo, featuring Celestial Cinema, spotlighting popular astronomy videos, and a raffle/silent auction July 15 and 16. Kids in grades kindergarten through 12 can participate in an art contest or discover the wonders of space and science and enjoy hands-on activities at the KidSpace exhibit.

The expo will also include a series of speakers, panel discussions and history sessions. Cassini science advisor ELLIS MINER and astronomer DR. DONALD YEOMANS are scheduled lecturers.

JPL's participation also includes leading four educator workshops.

For prices and other information, go online to <http://www.aspsky.org/meetings.html>.



Larry Simmons

# Special Events Calendar

## Ongoing Support Groups

**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**—Meets the first and third Fridays of the month at noon in Building 111-117. Call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

**Parent Support Group**—Meets the third Thursday of the month at noon in Building 167-111. Call Greg Hickey at ext. 4-0776.

**Senior Caregivers Support Group**—Meets the first Tuesday of each month in Building 167-111. For information, call the Employee Assistance Program at ext. 4-3680.

## Friday, July 7

**In-Situ Age-Dating of Martian Sediments**—Dr. Stephen McKeever of Oklahoma State University will review the principles by which luminescence dating works, provide examples of its use on terrestrial eolian and fluvial deposits, and discuss the challenges to the development of luminescence dating as an in-situ age-dating technique for Mars—including projections for possible instrumentation and platforms (micromissions, landers and rovers). To be held at 1:30 p.m. in Building 306-302.

## Tuesday, July 11

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

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

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

## Wednesday, July 12

**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.

**Music on the Mall**—The Glendale High School Coed Dancers will appear at noon.

## Friday, July 14

**Safety and Mission Assurance Directorate Briefing**—Dr. Neda Fabris, professor of mechanical engineering at Cal State Los Angeles, will deliver a lecture titled "Thermal and Vibrational Analysis of Electronic Packages at 11:30 a.m. in the Building 167 conference room. Sponsored by Section 506. For information, call Rajeshuni Ramesham at ext. 4-7190.

## Tuesday, July 18

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

## Wednesday, July 19

**JPL 2000 Lecture**—"Stardust: Why, How and Where" will be presented by scientific investigator Ray Newburn, who will discuss where the mission stands today, a year and five months after launch, three and a half years before encounter, and five and a half years before Earth return. To be held from 11 a.m. to 12:30 p.m. in von Kármán Auditorium.

**Investment Workshops**—TIAA/CREF will present "Financial Education for Women" at 10 a.m. and "What are Tax Deferred Annuities?" at 2 p.m. Both will be held in Building 180-101.

## Thursday, July 20

**JPL Astronomy Club**—Meeting at noon in Building 198-109.

**Von Kármán Lecture Series**—Robert Manning, who is leading a systems engineering study for the Mars 2003 geological mission, will present a lecture titled "Mars Engineering: Building a Vehicle to Land on Mars" at 7 p.m. in von Kármán Auditorium. Open to the public.

## Friday, July 21

**Von Kármán Lecture Series**—Robert Manning, who is leading a systems engineering study for the Mars 2003 geological mission, will present a lecture titled "Mars Engineering: Building a Vehicle to Land on Mars" at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

# Interns selected for mission architect program

Three JPL researchers have been selected as interns in the Architect Development Program.

Drs. Alberto Behar, Albert Haldemann and Stuart Stephens were appointed by a selection committee to begin the two-year program.

Behar comes from the Robotic Vehicles Group in Section 345, where he has experience as a rover system engineer and camera engineer for the Muses-CN flight project, as

Haldemann comes from the Planetary Radar Group in Section 331 where, as a member of the engineering staff, he has developed planetary radar experiments and Deep Space Network scheduling. He also participated on the Mars Pathfinder science team in the landing site certification process, and in the field integration design and operations (FIDO) Rover instruments task.

Stephens also has a planetary science background and, as a member of the Science System Engineering Group in Section 314, has had recent flight operations experience with Galileo, Mars Polar Lander and Cassini. He is currently helping to plan the first Cassini observations of Jupiter later this year.

In its fifth year, the Architect Development Program is administered by JPL's Center for Space Mission Architecture and Design

The program will be tailored to fit interns' individual needs by having them participate extensively in the planning of their two-year internship. Each intern's plan will take advantage of their expertise and professional interests.

Under the auspices of JPL's Center for Space Mission Architecture and Design, the Architect Development Program aims to iden-

tify, select and train the next generation of mission architects who will design and implement future JPL missions.

The program allows interns to work on a variety of projects in a number of disciplines. Each intern will have the opportunity to work with the Advanced Projects Design Team (Team X), a team comprising representatives from all the major spacecraft and mission subsystems. Interns help develop mission proposals, become familiar with JPL tools in the automated design process, and work with JPL's industrial partners, gaining valuable perspective on how system design is performed. In addition, interns travel to other NASA centers, fill selected project-specific roles, and work within other JPL Centers of Excellence.

Interns will also study areas considered to be crucial to their development as a well-rounded mission architects. Typical of the classes offered are "Introduction to Space Science for Mission Architects," "Politics of Space," "JPL Proposal Preparation," and "Principles of Astrodynamics & Mission Design," to name a few.

Finally, each intern will be paired with a qualified mentor responsible for guiding and counseling that intern through the program.



Alberto Behar



Albert Haldemann



Stuart Stevens

chief engineer on the Antarctic Ice Borehole Probe, and as structural engineer for the Loi'hi underwater volcanic probe.

# Numerous students spend their summer learning the JPL way

By Gia Scafidi

**D**ISTINGUISHED YOUNG ADULTS are one step closer to successful careers, thanks to a variety of student employment programs offered at JPL. While helping students gain real-world, hands-on experience, these programs also assist the Laboratory in recruiting future regular JPL employees.

"The key to these programs is meaningful work experiences," said Dr. Gregor Edwards, of the Staffing and Employment Section. "Both JPL and the students benefit." The Lab presently has seven student employment programs.

Minority students can take part in ALVA (Alliance for Learning and Vision for underrepresented Americans) during the summer before their freshman year in college. Designed to increase minority participation in the engineering and science fields, this program is unique in that it provides its students with calculus and pre-calculus learning skills. JPL currently has eight ALVA students.

While ALVA represents a national minority-serving program focused on college-bound high school students, JPL's Geospace program takes place locally at John Muir High School in Pasadena. Through eight-week internships, students develop good work habits and get an idea of the number of career choices available.

Minority students also participate in JPL's From the Sun to the Star Nations outreach program,

which employs Native American students as interns, and the Minority Initiatives Intern (MII) program.

For eight weeks during the summer, Native American college interns contribute to JPL's technical areas and the Laboratory's communication outreach efforts.

This summer JPL has six Navajo students working at the Lab.

As MII interns, students from historically black colleges and universities and Hispanic and Native American-serving institutions also have the opportunity to work with JPL scientists and engineers on project-specific problems and activities. For 10 weeks, JPL's 18 MII students also attend weekly meetings, participate in a student career fair and present their work at the end of the program.

A presentation of one's work is also required of Summer Undergraduate Research Fellowship students. A Caltech program, SURF offers college students an opportunity to work on research projects with Caltech faculty or JPL technical staff members for 10 weeks during the summer. There are currently 43 students "SURFing"

on Lab.

"These students get an outstanding head start," said Dr. William Whitney, acting deputy manager of the Educational Affairs Office. "Not only do they stand out among their

peers, but they develop a working technical vocabulary while they are here."

In addition to summer work, JPL also hosts year-round programs. The Academic Part-Time (APT) and Cooperative Education programs provide students with the opportunity to prepare for careers with on-the-job training as a supplement to their classroom instruction.

With opportunities for APT employment in almost every area at JPL, this program enables students to apply theories and principles learned in the classroom and develop transferable skills for potential full-time positions.

Presently, JPL has approximately 270 high school,



undergraduate and post-graduate APTs.

The co-op program is primarily for undergraduate students. It allows them to participate in a variety of scientific, technical and administrative assignments, and offers weekly seminars based on student interest. There are currently 87 co-op students on Lab.

While each employment program has unique requirements and qualifications, through hands-on experience and real-world exposure to professional environments, they all prepare JPL's students to make better-informed career decisions about their futures.

For more information on the ALVA, APT or co-op programs, contact the Staffing and Employment Section office at ext. 4-5150. To inquire about the Geospace, MII, From the Sun to the Star Nations or SURF programs, call the Educational Affairs Office at ext. 4-8252.

*Summer co-op students Alfredo Ceja, left, and Michal Brown work on a flight test model of the Athena rover in the Mars Yard.*

# Educator workshops help teachers to better teach science

By Gabrielle Birchak-Birkman

shops at JPL, works with teachers on several reservations to empower educators with state-of-the-art research, supply the teachers with cutting edge resources and change the way in which science is taught. "You begin to see that we do a disservice in teaching science in the way we teach science," said Vosicky. "Science is a way of thinking. It's not just a subject to teach between 1 and 2 p.m. It's a never-ending process to get people to never stop asking questions."

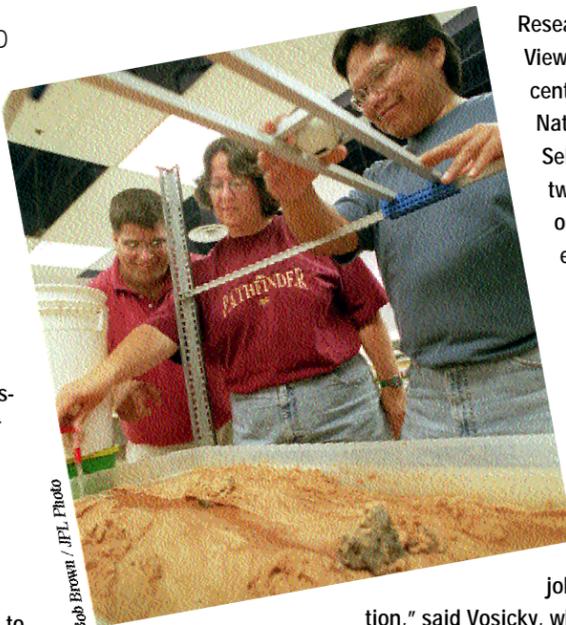
Currently, the JPL workshops are working with tribes such as Pima, White Mountain, Apache, Papago, Navajo, Zuni, San Carlos Apache, Pauma and Pala. Vosicky is working with Arizona State University's Tribal Coalition to develop an action plan with teams of teachers so that they can go back to the reservations with enhanced science, math and technology programs and skills to find community resources. "The first team was so excited that the district in Arizona has funded those people to come back to do more teacher training to continue to broaden out this program," said Vosicky.

Randii Wessen, supervisor of the Advanced Mission Systems Engineering Group, speaks to the educators and children in these workshops. He said that the way that science is taught is intimidating and stifling, and would like to change that to make science more exciting. "The thing I'm trying to do is give them a sense of awe," he said.

Each of NASA's 10 centers are funded to run two workshops that are focused at teachers in categories for kindergarten through 12th grade. The centers' programs work Native American teachers, rural teachers, urban areas, and educational venues such as museums. JPL and the NASA/Ames

**T**HE WONDERFUL WORLD OF SCIENCE LIVES ON in the impressionable minds of hundreds of Native American children in the southwest, thanks to JPL's participation in NASA Educational Workshops.

Gene Vosicky, administrator of JPL's Educator Resource Center in Pomona and program manager for the work-



Bob Brown / JPL Photo

shop of promoting education," said Vosicky, who wrote the original grant proposal for the program. In the future, plans call for bringing in more tribes from the Grand Canyon area and the northwestern United States.

The importance of these programs, Vosicky said, is to promote analysis and systematic documentation for the students, and teach them how to interpret and communicate data of scientific findings. "As a result of this, you see a difference even in language arts," he said.

The workshops not only give teachers an understanding of what JPL does, but also expose them to subjects such as electricity at California Edison, botany at the Huntington Gardens and astronomy at Mount Wilson Observatory. In addition, scientists and engineers like Wessen visit the schools and speak to the students every chance they get.

Another dividend is the children's excitement and desire to learn about science and space exploration. "What I love is when I'll be walking on Lab and I'll run into someone who will say, 'Remember me? You got me into science!'" said Wessen.

The NASA-sponsored workshops are implemented in cooperation with International Technology Educational Association, National Council of Teachers of Mathematics, and the National Science Teachers Association. For more information, go online to <http://nsta.org/programs/new.htm> or <http://education.nasa.gov/NEW>.

Research Center in Mountain View are the two western centers that work with the Native American workshops. Selected teachers spend two weeks at JPL or Ames where travel expenses, housing and meals are included.

Since 1984, the workshops have enabled local teachers to spend six weeks at JPL. "One of the reasons it continues is because it does a really marvelous

job of promoting educa-

tion," said Vosicky, who wrote the original

*Greg Gorney, left, Barbara Hightower and Melvin Gorman, all instructors at an Arizona Navajo reservation, work on Mars-related experiments at JPL's Educator Resource Center. Hightower releases erosion patterns as Gorman images the surface by manipulating a camera connected to a computer.*

# Bonus awards



JPL's Reward and Recognition Program recently bestowed Bonus Awards for Lab-wide accomplishments that have occurred since October 1999.

The three-tiered Bonus Awards Program was designed to incent and reward accomplishments and behaviors that will ensure future success of the Laboratory; reward outstanding teams and individuals that contribute to achieving JPL's goals and objectives; and increase JPL's competitive advantage through

strategic pay practices that differentiate high performance.

Level A recognizes Lab-wide accomplishments that impact JPL as a whole and

- Achieve one of JPL's significant goals or objectives,
- Enhance JPL's reputation, or
- Advance a field of knowledge.

Payout is \$3,500 per award.

For more information on Bonus Awards, visit <http://hr/compensation/bonusawards.html>.

The following employees received Bonus Awards in May.

**Section 181:** Franklin O'Donnell.

**Section 215:** Sally Hughes.

**Section 222:** Jienming Jou.

**Section 233:** Linda Graham.

**Section 252:** Karen Schlue.

**Section 260:** Randall Taylor.

**Section 311:** Robert Oberto.

**Section 312:** David Seal.

**Element 3235:** Dr. Michael Kobrick.

**Section 331:** F.H. Jim Taylor.

**Section 334:** Mimi Paller.

**Section 341:** Riley Duren, Edward Litty.

**Section 344:** Dr. Nikzad Toomarian.

**Section 345:** Greg Levanas.

**Section 349:** Patricia Westerlund.

**Section 351:** George Wells Jr.

**Section 352:** Donald Bickler, Howard Eisen.

**Section 368:** Christian Hidalgo, Donald Eagles.

**Section 385:** Dr. Thomas Cwik.

**Section 388:** Earl Hansen.

**Section 389:** Thomas Fouser.

**Section 514:** Linda Facto.

**Section 661:** Edward Bohanan.

**Section 662:** Araham Nasoordeen.

**Section 701:** Dr. Fuk Li.

**Section 712:** Gregg Vane.

**Section 756:** Dr. Marc Rayman.

**Section 770:** Dr. Jakob Van Zyl, C.A. Yamarone Jr.

**Section 772:** Moshe Pniel.

**Section 776:** Neil Herman.

**Section 820:** Dr. Barbara Wilson.

**Section 871:** Dr. Lynn Gref.

**Section 900:** Adrian Hooke.

**Section 905:** Wallace Tai.

## Letters

I want to thank the great people in Section 352 and others at the Lab for the support they have given my husband and myself at the passing of my father-in-law. I would also like to thank the ERC for sending the beautiful calla lily.

Terri Scribner

## Retirees

The following JPL employees retired in July:

Richard Mathison, 46 years, Section 900; Donald Johnson, 38 years, Section 344; William Spuck III, 38 years, Section 870; Larry Goforth, 36 years, Section 388; David B. Smith, 29 years, Section 306; Jeanne Stevens, 29 years, Section 369; Philip Stanton, 23 years, Section 333.

## Classifieds

### For Sale

AQUARIUM, 30 gal. w/Eclipse II filter sys., black stand, heater, thermometer, lights (1 white, 1 blue, 1 spare white), freshwater or beginner saltwater, \$300. 626/583-4717, Gabby.

BACKPACK, sm. metal frame, VG cond., \$50. 626/792-8248.

BEDROOM SUITE: 5-piece matching, honey maple, queen/full headboard, blended shades of wood; footboard & bedrails; 2 end tables w/drawers; vanity w/glass top appointment, adjustable full-length mirror, excellent condition, all 5 pieces \$595. 368-9520.

BOOTS, western: Nocona, 9 1/2 D, black/silver-tipped, fancy sides, \$85; Dan Post 9 D, lt. brown, dark fancy sides, \$65; Tony Lama 9D, black, plain, \$50, all exc. shape. 249-0453.

BREASTPUMPS, Medela: Pump-In-Style double, carrying case w/compartments, cold packs, complete w/manual, recent model, clean, exc. cond., \$75; Medela mini-electric single; small but powerful, clean, exc. cond., \$35; CRIB, lg., white wood w/mattress, pad/sheet/bumper guards, coverlet, adj., exc. cond., \$150. 626/285-9103.

CHINA CABINET, mid-20th century, Drexel, gd. cond., \$900. 353-9367.

COMPUTER, IBM 386 PC, 8 MB RAM, 60-MB HD, 13" display, incl. software, \$75; OTTOMAN, '60s style, round/flat top, cream color vinyl w/leather texture, 12"x19"H, \$25; CHAIR, '60s style, straight-back, upholstered, dark olive fabric, walnut base, for office or LR, \$35. 626/289-2795.

CRIB, ChildCraft hardwood standard, innerspring mattress, quilt, knit sheets; all spotless; used only for grandchild visits; \$140. 323/255-3226.

DESK, lg., 30" x 30" x 59", \$100/obo. 626/564-8483, Chris or Nanci H.

DINING ROOM SET, Danish modern teak, 6 chairs, gd. cond., \$500/obo; BUFFET, matching, teak, \$250/obo; BAR, table top, w/light, sliding glass drs., \$50/obo. 790-6491.

DOG, German Shepard, purebred w/papers, \$75. 249-5773.

DRESSER, children's armoire, 6 drawers, closet area & 3 shelves, solid pine, 42"W x 49"H x 16"D, exc. cond., perfect for baby/child's rm., \$350/obo. 626/303-2808.

FURNITURE, Ethan Allen: couch, \$475; love seat, \$375; 2 end tables, 2 & library table, \$150 ea.; coffee table, glass top, \$200; curio cabinet, \$375; other: game table, 4 chairs, \$400; sofa bed, \$150; wedding dress, white satin, cathedral length train, sz.4-6, headpiece incl. \$250; knitting machine, studio, \$75. 626/355-6891.

GOLF CLUBS, Wilson 6, gd. cond., bag, cart, \$75; BIKES, 2, 24", 1-spd. girl's, 3-spd. boy's, Schwinn, old, \$50. 626/792-8248.

GUITAR, Epiphone Riviera, red, arch top, F-hole, bigsby, ohsc, proset rp, 2Hb, mint, easy play, great sound, \$400. 889-3059.

LAWN MOWER, Briggs Stratton, 3.5 hp, 21" rotary. 249-2357.

LUGGAGE, hard-sided, women's American Tourister, red, VG cond., 27", \$40, 24", \$30; Bel-Aire, lt. brown, VG cond., 22", \$20; men's Samsonite, drk. brown, fair cond., 27", \$10; 21", \$5. 626/577-8107.

METAL DETECTOR, Bounty Hunter, top of the line, hardly used, \$350. 248-6062.

MOVING SALE: desk, \$100; tv, \$150, coffee-maker, \$25; vacuum cleaner, \$50; phone, freedom, \$25, phone, reg., \$10; iron, \$10; table, round + extensions, \$200; chairs, 4, rattan, \$120; lamp, table \$15; mattress, queen, \$80; mattresses, 2, twin, \$40/ea.; lamp, desk, \$5. 626/585-1952, Michon H, remicusa@netscape.net.

ORGAN, Yamaha 415 elect. console, 13 pedals, 3 keyboards, 144 rhythm patterns, pd. \$7,500, sacrifice \$3,000; DIET TAPES, Jenny Craig, set of 14, \$50; POWER CONTROL CTR, computer, 5 pwr. + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, \$20; ADAPTERS, sprinkler valve, Lawn Genie, model 756LG 3/4, new, \$10 ea. 790-3899.

SNOWBOARD, Morrow Drive sz. 163, w/bindings; BOOTS, Airwalk all-mountain, men's, sz. 8, \$100 for all. 310/260-1024.

SPA, used, 10 yrs. old, air pump, water pump, filter, heater, solar panels, 80-gal. storage tank. \$500. 626/398-7262.

STOVE, O'Keefe & Merritt, 1950s, white porcelain, mint cond., 35"W, pan storage on left, \$275. 626/351-6551.

WARDROBE, antique English-designed, 2-door, solid wood, original shelving, lining and hardware including key, excellent condition, potentially 20-30's, \$225. 368-9520.

WASHER, Maytag, hvy. duty, 2 spd., lg. capacity, almond finish, VG cond., delivery possible. 248-8636.

WASHER/DRYER combo, Kenmore hvy. duty, perfect for sm. spaces, \$600. 626/289-3717.

### Vehicles / Accessories

'93 ACURA Integra RS, 2 dr., black, a/c, Sony am/fm/CD player, rear spoiler, alarm, 103K mi., orig. owner, exc. cond., \$8,200/obo. 790-1419.

'83 CHEVROLET El Camino, blue, V8, 100K mi., \$3,500/obo. 626/284-2025.

'84 DODGE D-50 pickup truck, VG cond, auto, 2.6L, bedliner, shell, new batt. & carburetor, very clean, well maint., all service records, 138K mi., orig owner, \$2,800. 626/332-2682, Steve.

'97 FORD Escort, 4 dr., 5 spd., am/fm, only 12K mi., \$6,950. 626/796-3556.

'97 FORD Taurus station wagon, all pwr., built-in phone, 43K mi., exc. cond., \$10,500/obo. 626/798-8506.

'96 FORD Escort LX, exc. cond., 5 spd., 2 dr., 57K mi., a/c, am/fm/cass., \$6,900/obo. 909/323-3640.

'95 FORD Taurus GL wagon, exc. cond., 48,400 mi., new Michelin tires, V6, 3.0 L, auto, cc, a/c, am/fm/cass., pwr.seat/steer./locks/win., silver paint, gray int., cloth seats, orig. owner, \$8,500. 626/351-1219.

'90 FORD Bronco, 5.8L Eddie Bauer 4x4, loaded, a/c, cc, pwr./llw, 10 disc CD changer in console, well maint., gd. cond., \$5,500 cash. 661/255-6036.

'89 FORD Econoline 250 cargo van, new tires, hitch, s/r, chrome wheels, clean paint, runs great, orig. owner, 100K mi., \$3,000/obo. 248-7097.

'76 FORD Mustang II, 4 spd., 4 cyl. (rebuilt), new carb., primer gray color, black int., \$1,000/obo. 902-0138.

'72 FORD Bronco, tan, V8, 75K mi., dual limited slip differential, \$6,000/obo. 626/284-2025.

'66 FORD Mustang classic 289, V8, auto, all orig., strong engine, alarm, very clean, int. & ext. in exc. cond., must see to appreciate, \$5,200/obo. 626/289-0937, slundeen@pacbell.net.

'96 HONDA Civic, 5 spd., white, exc. cond., 28K mi., \$12,000/obo. 626/791-1245.

'90 HONDA Accord LX 4 dr. p/s/b/w/l, a/c, Kenwood stereo w/6 CD changer, 1 owner, well maint., 5 spd. manual, \$6,300. 248-6762.

'88 HONDA CRX, blue, exc. cond., 140K mi., auto, a/c, am/fm/cass., new tires, runs great, fuel efficient, \$3,500. 909/466-0443.

'98 MAZDA 626 LX, 4 dr., full pwr., 66K mi. (highway), slate blue, assume loan \$332, 34 months remaining. 249-1608.

'84 MILLER tiltbed equip. trailer, completely refurbished, new deck/tires/brakes/elec., 21,000 gross vehicle weight, \$3,995/obo. 626/798-6249.

'97 NISSAN Altima GXE, black, 4 dr., p/w, a/c, exc. cond., 70K mi., \$10,000/obo. 626/441-7384.

'89 NISSAN 240 SX, 5 spd., a/c, am/fm/CD, 127K mi., tinted win., exc. cond., \$2,750. 909/599-3230.

'90 PONTIAC Grand Prix LE coupe, red/silver, V6, auto, air, pwr. everything, tilt wheel, s/r, alloy wheels, new batt./tires, orig. owner, 80K mi., w/ cd. cond., \$3,500. 790-6952.

'99 TOYOTA Corolla LE, near new, scant miles, loaded, a/c, am/fm/cass./stereo, pwr. steering/window locks, extra value pkg., \$12,999/obo. 626/463-1269, x4019.

'90 TOYOTA Camry wagon, full power, roof rack, 111K mi., \$5,225/obo. 626/796-3556.

'85 TOYOTA van LE, dual a/c & sunroof, full pwr., VG cond., \$2,500. 714/527-3273.

'93 VOLVO 940 turbo wagon, mint cond., fully loaded, heated leather seats, s/r, ABS, pwr. everything, side impact protection sys., all service records, super clean, 74K mi. \$12,950. 790-2799, Larry.

'83 VOLVO 240 DL wagon, white, 17K mi., new timing belt & drive belts, \$1,300. 626/798-7339.

### Wanted

CAR, family, trustworthy, reasonable, grand-ma-ish, 4 dr., auto. 626/744-5409.

DOGGIE DAY-CARE, have dog & apt., looking for person w/dog & fenced yard, to increase quality of life for both dogs, no increased expenses. 626/798-5705, Vicky Barlow.

GERMAN SPEAKERS/parents to form play group for toddlers to foster native language development. 249-9093, Petra.

JACKET, JPL Dunbrooke "Plajac", L or XL sz. 848-7072.

LIGHT METER, scale in foot-candles; DISC DRIVE, Jaz, for PC. 909/392-0379.

MAGAZINES, bridal/wedding, for pics only, any cond. 626/345-0681, Susanne.

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

TRUCK, small, pickup, for college student, gd. mech. cond. 626/358-7567, Bobbie.

VAN/CARPOOL, Saugus/JPL, M-F, 8-4:45, somewhat negotiable. 661/297-8108.

VOLLEYBALL PLAYERS, coed, all levels of play, Tues. nts., 8-10, Eagle Rock H.S., \$3/nt. 956-1744, Barbara.

### Free

CAT, gorgeous, black & white "tuxedo", 1 yr. old, F, playful, affectionate, wish we could keep her, spayed, all shots, very clean & healthy, needs to be an only cat. 248-2855, Dave & Kelly.

KITTENS, 4, M, born May 4, need new homes, reserve, see at [www.geocities.com/young\\_j\\_kim/kittensNeedHome.rtf](http://www.geocities.com/young_j_kim/kittensNeedHome.rtf). 249-2889.

STEPPING STONES, concrete, 13, circular (18" dia.), you pick up. 626/351-8643, eves.

### For Rent

ALTADENA condo lease, mins. from JPL, 2 bd., 1 3/4 ba., nice closets w/organizers, f/p, c/a, comm. pool, storage rm., 2-car gar., carport, tile counter & marble flr. in kitchen, lg. patio, landscaped, planters/oriental garden/waterfall/spa, end unit w/wins. on 3 sides, rent by owner, \$1,200. 626/398-1988, Beverly Drane.

ALTADENA, charming 2-bd., 1-ba. house near Christmas Tree Lane, hrdwd. flrs., f/p, appliances, fenced backyard, fruit trees/rose, \$1,500, negotiable, incl. water/gardener/trash, see at [www.alumni.caltech.edu/~chrisc](http://www.alumni.caltech.edu/~chrisc). 626/794-9579.

ALTADENA, lg. furn. rm., cable, also share 3 bd., 3 ba. hilltop house, pool, patios, view (incl. JPL), c/a/h., all amen., kitchen, d/w, laundry rm., priv. off-st. pkg. spot, 11 min. JPL, smoking OK (owner smokes), \$500, incl. all util. + dep. 626/794-1050, Harry, after 7 p.m.

ALTADENA, share charming 2 bd. house in quiet neighborhood, Altadena Estate area, near New York Dr. & Allen, huge yard, patio, off-st. pkg., garage, storage, all privileges, avail. 8/28, all util. pd., \$625. 626/797-3354, bpeterson@huntington.org.

EAST PASADENA studio apt., 1 pkg. spot, incl. water/trash, no smoking/pets, carpet, blinds, stove, \$600 + \$600 sec. dep., avail. 7/1, 1 yr. lease. 949/643-9439.

LA CANADA-FLINTRIDGE, rm., private ba., kitchen, privileges, pool, BBQ, off-street pkg. 790-1280.

LA CRESCENTA, 1-bd. guest house w/private ent./parking, patio, laundry, c/a, quiet neighborhood, no smoke/pets, basic cable & util incl., \$695, avail. Aug 10. 957-2173.

PALM DESERT, exquisite, 2 bd., 2 ba. villa, for rent (or sale), vacations or long term, newly remodeled, skylight, patio, 2 car gar., located across the Living Desert, great private secure resort, tennis, multiple pools/spas, clubhouse facilities, great locality, around 2 top resorts. 909/620-1364.

PASADENA, charming 1920s apt. in 3-unit bldg. nr. Lake Ave. shopping, 2 bd., 2 ba., LR, DR, bonus, 1,450 sq. ft., f/p, hrdwd. flrs., lg. encl. deck, covered pkg./2 cars, W/D on premises, water/trash/gardener pd., \$1,400. 249-3602, 626/398-8865.

### Real Estate

LA CANADA-FLINTRIDGE, view home, 4 bd., 2.5 ba., c/a, 2,778 sq. ft., 2-car gar., lg. driveway, 15-ft. swim spa, LC schools, very quiet st. & neighborhood, 53,954 sq. ft. on 2 lots w/oak forest & creek, 2.5 mi./JPL; see [www.realtor.com](http://www.realtor.com), "La Canada", "Ca", MLS ID=G202353; \$849,500. 952-9654.

LA CRESCENTA, 2 story, 5 bd., 2.75 ba., La Crescenta schools, mtn./city view, hrdwd. flr., marble f/p, 2,196 sq. ft. liv. space, 500 sq. ft. encl. patios for den/family rm, 7,800 sq. ft. lot, yards w/grass, patio, fruit trees, gardens & sprinklers, c/a/h, newer d/w & roof, 2-car gar., reduced, [www.geocities.com/young\\_j\\_kim/house\\_flyer.jpg](http://www.geocities.com/young_j_kim/house_flyer.jpg), \$429K. 249-2889.

PASADENA, delightful 4 bd., 3 ba., Spanish style home in Caltech/So. Lake area, over 2,600 sq. ft., lg. rms., lots of light, f/p, newer kitchen, best price in area, offered by former JPL/Caltech emp., Sec. 336 10+ yrs., 615 S. Mentor, Pas., \$475,000. 626/229-0909, Lowell Hamburg, DBL Realtors.

VALENCIA, by owner, 3+2+ fam. rm., walk to best schools, exc. area, a/c, f/p, in-ground spa, BBQ, covered patio, converted gar. w/ full ba., 27458 Cherry Creek Dr., \$196,500, firm, no realtors, see at <http://photos.yahoo.com/enriquemedina>. 569-2017 pager, 661/297-3933 home, enriquemedina@yahoo.com.

### Vacation Rentals

BIG BEAR cabin, quiet area near village, 2 bd., slps. 8, compl. furn., f/p, TV/VCR, \$75/nt. 249-8515.

BIG BEAR LAKEFRONT, lux. townhome, 2 decks, tennis, pool/spa, beaut. master bd., suite, sleeps 6, 949/786-6548.

CAMBRIA ocean front house, slps. up to 4, exc. view. 248-8853.

HAWAII, Kapa, Kauai, 1 bd, 1 ba., ocean front condo, sleeps 4, full kitch., patio, pool, spa, sauna, BBQ grills, tennis, Oct. 21-28, \$90/nt. 323/296-6641.

HAWAII, Kona, on 166 ft. of ocean front on Keauhou Bay, priv. house & guest house comfortably sleeps 6; 3 bd., 2 ba., rustic, relaxing & beautiful, swimming, snorkeling, fishing, spectac. views, nr. restaurants/golf/other attractions. 626/584-9632.

HAWAII, Maui condo, NW coast, on beach w/ocean view, 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microw., d/w, pool, priv. lanai, slps. 4, 4/15-12/14, \$100/nite/2, 12/15-4/14, \$115/nite/2, \$10/nite add'l. person. 949/348-8047.

LAKE TAHOE, north shore, 2 bd., 2-1/2 ba. condo, slps. 6-7, private sandy beach, pool, great location, all amen., hike/golf/fish, 2 mi. to casinos, JPL disc., summer weekly rate \$650. 626/355-3886, Rosemary or Ed.

LAKE TAHOE, west shore @Homewood in Chamberlands, full amen., assoc pool, tennis, private beach & club, 3 bd. + loft, 2 ba., slps. 8, linens provided, full kitchen & laundry, TV/VCR, wood stove, 2 day min., \$700/wk., \$75 cleaning fee. 626/585-0321, Bob or Nicole.

MAMMOTH, Chamonix condo, 2 bd., 2 full ba., slps. 6, fully equip. elec. kitch. w/microw. & extras, f/p & wood, color TV, VCR, cable, FM stereo, pool & sun area, o/d Jacz., sauna, game, rec. & laundry rms, play & BBQ areas, convenient to hiking, shops, summer events, daily/weekly rates. 249-8524.

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

PACIFIC GROVE house, 3 bd., 2 ba., f/p, cable TV/VCR, stereo/CD, well-eqpd. kitch. w/microw, beaut. furn. close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discnt. 626/441-3265.

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 18-hole golf course 6 mi. away, priv. secure pkg. 626/794-3906.

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## 162 million stars now online

By Jane Platt

**Y**our home computer can become a portal to a wonderland of stars, thanks to a massive release of images from an infrared sky survey sponsored by NASA and the National Science Foundation.

"Any computer with a Web browser can be transformed into a desktop observatory," said Dr. Michael Skrutskie of the University of Massachusetts, principal investigator of the sky survey, which has scanned the nighttime sky and produced an online image potpourri of half a million galaxies and 162 million stars. The images can be seen at <http://www.ipac.caltech.edu/2mass/gallery/second>.

"The general public can see a menagerie of objects in infrared wavelengths that they couldn't see in any other way," said Project Scientist Dr. Roc Cutri of the Infrared Processing Analysis Center at Caltech, which is operated by JPL. The 1.9 million images would fill 6,000 CD-ROMs, equivalent to 4,000 gigabytes or four terabytes of computer hard disk space.

The images were gathered by the Two-Micron All Sky Survey (2MASS), the most thorough census of stars ever made. The survey detects infrared wavelengths that are beyond the red light in the rainbow of visible colors. Infrared light penetrates the gas and dust in our galaxy and is particularly effective for detecting the heat of very cool objects not visible with optical telescopes.

In order to cover the entire sky, the 2MASS survey uses two highly automated, 1.3-meter diameter (51-inch) telescopes, one at Mount Hopkins, Ariz., the other at the NSF Cerro Tololo Inter-American Observatory, Chile.

Operations for 2MASS began in 1997. Its catalogs will contain more than 300 million objects by the time observations are concluded next year. Final processing of the data and release to the public will be complete by 2003.

Already, 2MASS data have uncovered numerous stars with characteristics so unique that astronomers had to revise a century-old classification system of known types of stars.



Astronomers armed with 2MASS data also discovered the coolest brown dwarfs, or failed stars, known to date. They also detected previously unknown star clusters within, and galaxies beyond, our own Milky Way, and have mapped new star-birth regions. In the distant reaches of the universe, 2MASS discovered a new population of dust-obscured active galaxies, quasars and super-massive black holes.

The current release is based on a volume of data several hundred times larger than that contained in the human genome, Skrutskie said. "Astronomers will become cosmic geneticists, searching out patterns in these sky maps to decode the structure and origin of the Milky Way and the surrounding nearby universe."

The 2MASS project is a collaborative effort between the University of Massachusetts, Amherst, and the Infrared Processing and Analysis Center (IPAC).

The University of Massachusetts was responsible for the development and construction of the 2MASS telescopes and cameras and currently manages the collection of survey data.

Part of NASA's Origins Program, 2MASS is funded by NASA's Office of Space Science and the National Science Foundation.

2MASS results will benefit future Origins missions, including the Space Infrared Telescope Facility and the Next Generation Space Telescope, and will also help scientists plan observations for the Hubble Space Telescope and the Stratospheric Observatory for Infrared Astronomy.



Photos: IPAC / University of Massachusetts

Upper right: the Monoceros molecular star-forming region.

Above: the Sombrero Galaxy.

Messier 104.

## Hurricane Carlotta spins in stereo

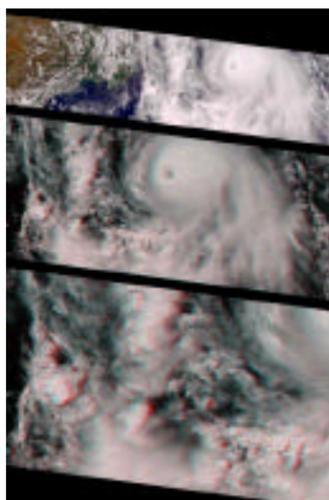
By Rosemary Sullivant

Views of Hurricane Carlotta in the eastern Pacific Ocean, as imaged by MISR's vertical camera.

With winds reaching 250 kilometers per hour (155 mph), this year's Hurricane Carlotta became the second strongest eastern Pacific June hurricane on record. New images from the Multi-Angle Imaging SpectroRadiometer (MISR)—built and managed by JPL—show the hurricane on June 21, the day of its peak intensity. The images are best viewed in color, with 3-D glasses (red filter over the left eye), at <http://www.jpl.nasa.gov/pictures/misr>.

MISR is one of several Earth-observing instruments aboard NASA's Terra satellite, which was launched in December 1999. This set of images has been oriented so that the spacecraft's flight path is from left to right; north is at the left.

The top image is a view from MISR's vertical (nadir) camera,



showing Carlotta's location in the eastern Pacific Ocean, about 500 kilometers (310 miles) south of Puerto Vallarta, Mexico.

The middle image is a stereoscopic anaglyph created using MISR's nadir camera plus one of its aftward-viewing cameras, and

shows a closer view of the area around the hurricane.

Near the center of the storm, the eye is about 25 kilometers (16 miles) in diameter and partially obscured by a thin cloud. About 50 kilometers (31 miles) to the left of the eye, the sharp drop-off from high-level to low-level cloud gives a sense of the vertical extent of the hidden eye wall. The low-level cloud is spiraling counterclockwise into the center of the cyclone. It then rises in the vicinity of the eye wall and emerges with a clockwise rotation at high altitude. Maximum surface winds are found near the eye wall.

The bottom stereo image is a zoomed-in view of convective clouds in the hurricane's spiral arms. The arms are breeding grounds for severe thunderstorms, with associated heavy

rain and flooding, frequent lightning, and tornadoes. Thunderstorms rise in dramatic fashion to about the same altitude as the high cloud near the hurricane's center, and are made up of individual cells that are typically less than 20 kilometers (12 miles) in diameter. This image shows a number of these cells, some fairly isolated, and others connected together. Their three-dimensional structure is clearly apparent in this stereo view.

More information about MISR is available online at <http://www-misr.jpl.nasa.gov>.

MISR scientific data products are available through the Atmospheric Sciences Data Center at NASA's Langley Research Center: <http://eosweb.larc.nasa.gov>

The Terra mission is managed by NASA's Goddard Space Flight Center, Greenbelt, Md.

# News Briefs

## Finding: ocean causes Earth's wobble

The century-old mystery of Earth's "Chandler wobble" has been solved by a JPL scientist. The Chandler wobble, named for its 1891 discoverer, SETH CARLO CHANDLER JR., an American businessman turned astronomer, is one of several wobbling motions exhibited by Earth as it rotates on its axis, much as a top wobbles as it spins.

Scientists have been particularly intrigued by the Chandler wobble, since its cause has remained a mystery even though it has been under observation for more than a century. Its period is about 433 days, or just 1.2 years, meaning that it takes that amount of time to complete one wobble, which amounts to about 6 meters (20 feet) at the North Pole. It has been calculated that the Chandler wobble would be reduced to zero in just 68 years, unless some force were constantly acting to reinvigorate it.

Writing in the Aug. 1 issue of Geophysical Research Letters, JPL geophysicist RICHARD GROSS reports that the principal cause of the wobble is fluctuating pressure on the bottom of the ocean, caused by temperature and salinity changes and wind-driven changes in the circulation of the oceans. He determined this by applying numerical models of the oceans, which have only recently become available through the work of other researchers, to data on the Chandler wobble obtained during the years 1985-95. Gross calculated that two-thirds of the wobble is caused by ocean-bottom pressure changes and the remaining one-third by fluctuations in atmospheric pressure. He says that the effect of atmospheric winds and ocean currents on the wobble was minor.

## Comet LINEAR visible, with help

With the aid of binoculars, amateur astronomers should be able to see Comet C/1999 S4 LINEAR in the northwest night sky through July 26.

The comet, which has been visible since July 19, will be at its brightest when it makes its closest approach to Earth on Sunday, July 23, at about 55 million kilometers (34 million miles), according to JPL astronomer DR. DON YEOMANS.

He said to look for the fireball at the outer rim of the Big Dipper, where it will be traveling eastward from the tip of the "ladle" toward the "handle."

Just three days after its closest approach to Earth, the comet will make its closest approach to the sun and be 114 million kilometers (71 million miles) from Earth.

The comet was named after the computer simulation program that found it, the Lincoln Near Earth Asteroid Research (LINEAR) project, funded by the U.S. Air Force.

## Lab teams complete tough Mojave race

Two teams comprising members of the JPL Running, Bicycle and Amateur Radio clubs participated in the 2000 Mojave 250+ Mile Death Race in June.

A 285-mile team event that features a combined race for runners, road and mountain cyclists in the eastern Mojave Desert in California and Nevada, the race is run relay-style in 21 legs over surfaces ranging from paved roads to desert trails. Each 12-person team completed running and cycling legs of between 6 and 42 miles, with most members competing in two legs.

This is the third consecutive year JPL has entered the race and the first time it fielded two teams. The "Mars Attacks" team finished the race in 24 hours, 31 minutes, placing first in the corporate division and sixth overall out of 18 teams. JPL's co-ed "Mars Needs Women" team finished in 27 hours, 58 minutes and placed second in the mixed division and 14th overall.

For results, photos and other information, go online to <http://www.jplerc.org/running/death.html>.

## Dryden hosting alumni meeting

NASA's Dryden Flight Research Center is hosting an alumni reunion Sept. 14-17 for those who worked at the facility between 1946 and 1958.

The event marks the 54th anniversary of the High Speed Flight Station Muroc Unit, which today is known as Dryden. Founded as a support unit for the X-1 rocket plane supersonic research flights, Dryden has evolved from a small desert outpost into the nation's premiere flight research facility.

The reunion committee seeks names, addresses or telephone numbers for anyone who was employed by the National Advisory Committee for Aeronautics at Edwards between Sept. 15, 1946 and Oct. 1, 1958.

Information can be mailed to NACA Reunion IX, P.O. Box 1589, Lancaster, 93539-1589. Call BETTY LOVE at (661) 265-8049 or PAT KENNER at (805) 995-3430.

# Special Events Calendar

## Ongoing Support Groups

**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 on Wednesdays. 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. Call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

**Parent Support Group**—Meets the third Thursday of the month at noon in Building 167-111. Call Greg Hickey at ext. 4-0776.

**Senior Caregivers Support Group**—Meets the first Tuesday of each month in Building 167-111. For information, call the Employee Assistance Program at ext. 4-3680.

## Friday, July 21

**Von Kármán Lecture Series**—Robert Manning, who is leading a systems engineering study for the Mars 2003 geological mission, will present a lecture titled "Mars Engineering: Building a Vehicle to Land on Mars" at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

## Monday, July 24

**Caltech Ballroom Dance Club**—The first of four successive Monday sessions of salsa will be presented from 7:30 to 9 p.m. in the campus' Dabney Hall. The course costs \$24 and is taught by a professional dance instructor. Refreshments and practice time are provided until 9:30 p.m. See [www.its.caltech.edu/~ballroom](http://www.its.caltech.edu/~ballroom) or call Don at 626/791-3103.

## Tuesday, July 25

**Insurance Plans**—Medical and dental plan representatives will be on Lab for one-on-one meetings with employees to answer questions

about JPL's various spending account plans. To be held from 9 a.m. to 1 p.m. in the Building 167 cafeteria, east side.

**JPL Firewall Requirements Workshop 2**—The JPLNet group, in coordination with JPL Network and Computer Security, will deploy an institutional firewall this calendar year. This workshop will discuss various options for a JPL firewall, including requirements by NASA and JPL users. To be held from noon to 1:30 p.m. in von Kármán Auditorium.

## Wednesday, July 26

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

## Thursday, July 27

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

## Monday, July 31

**JPL 2000 Lecture Series**—Dr. Diane Evans, Dr. Loren Lemmerman and Alfred Zieger will present "Earth Science and Future Missions/Technologies" at 11 a.m. in von Kármán Auditorium.

## Tuesday, August 1

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

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

## Thursday, August 3

**Data Acquisition Fair**—Company representatives will demonstrate hardware- and software-based technical capabilities of their data acquisition and analysis products from 10 a.m. to 3 p.m. in von Kármán Auditorium. Sponsored by the Measurement Technology Center in Section 351. For more information, call Phillip Yates at ext. 3-3705.

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



Comet Observation home page: <http://encke.jpl.nasa.gov>

Comet LINEAR as imaged by the Korea Astronomy Observatory June 28.

# Rescuers of JPL engineer receive special NASA award

By Jane Platt and Mark Whalen



Tom Wynne / JPL Photo

JPL engineer Dr. Len Efron, center, meets with Kazuhito Hachiya, left, and Keiko Asano after the pair received a special NASA Group Achievement Award for their efforts in rescuing him from Japan's Mt. Fuji last fall.

JPL engineer Dr. Len Efron is alive and well today thanks to the heroic efforts displayed by two Japanese mountain climbers who rescued him from almost certain death. Last week, the pair received special recognition from NASA for putting their own lives on the line to help a stranger.

Efron, who works in the Navigation and Mission Design Section 312, was in Japan last November preparing for NASA/JPL meetings with two Japanese national space agencies (NASDA and ISAS). During some down time, Efron hiked to the 3,775-meter (12,400-foot) icy summit of Mt. Fuji.

The ascent took more than six hours to complete, and he rested while eating lunch and

enjoying the view of the summit crater. It was noon when a man and a woman passed Efron on their way to the crater edge.

Efron began his descent a minute later. Moving a bit too quickly, he took a misstep in a steep icy chute and his crampons—steel spikes attached to the soles of his boots—came loose.

He was sliding feet-first on his stomach for the next 20 to 30 seconds, "waiting for the inevitable terminal impact," he recalled. Suddenly, the slide was interrupted by a violent collision with an object he didn't see. The impact left him on a 45-degree slope with a fractured pelvis and broken hands.

Efron had fallen 100 meters (more than 300 feet). Immobilized, he cried for help.

About 10 minutes went by, he said, before help arrived. It was the last pair of hikers that had passed him on their way to the summit.

"From above and behind I heard a woman's voice call, 'Are you all right?'" Efron said. "Then I heard the sweetest words ever spoken: 'It's all right! I have a cellular phone.'"

Keiko Asano and Kazuhito Hachiya not only responded to Efron's cries—they stopped his bleeding, prevented him from falling farther, and called police. Although a blizzard was approaching rapidly, they refused to leave him, endangering their lives and using their own bodies to keep Efron from freezing to death.

During the next seven hours, when teams of rescuers would arrive to transport Efron down the mountain, Asano and Hachiya selflessly protected Efron. They carved a seat for him in the ice, planted their ice axes to provide foot rests, attended to his head wounds and shared

their warm lemonade.

"On several occasions I told Keiko and Kazuhito that as much as I would regret my own dying, I would have more remorse if three died instead of one," Efron said. "Each time, Keiko merely responded, 'Everything is all right.'"

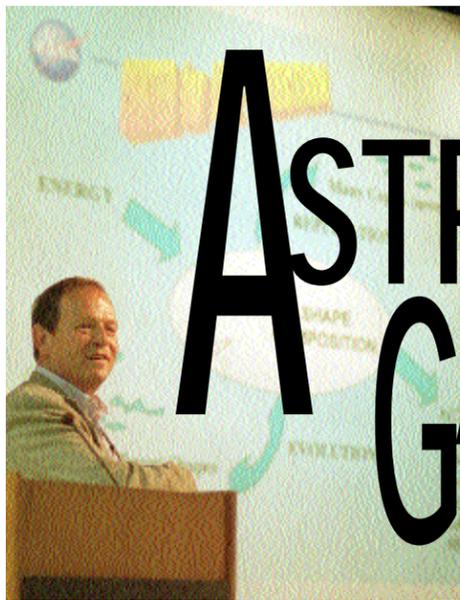
Indeed it was. The trio and rescue teams spent the night in a mountainside shelter cabin, and later that day Efron made it to a hospital at the base of the mountain.

Now fully recovered and back at work, Efron welcomed Asano and Hachiya to California a couple of days before their July 7 visit to JPL. The pair received a special NASA Group Achievement Award and were cited for "heroic, selfless actions, despite an impending winter storm."

A certificate has also been presented to Rich Miller, manager of TMOD Plans and Commitments, who led the working group meeting Efron attended in Japan and who mobilized and coordinated international resources.

Others to be honored in Japan are Gilbert Kirkham, the NASA representative at the U.S. Embassy in Tokyo, who coordinated the rescue efforts, arranged transportation, and interfaced with medical and rescue teams; the Fuji-Yoshida police station and Mikasa Climbing Club, both of which sent volunteer rescue climbers; and the Keio Plaza Hotel for coordination, support and sensitivity during and following the rescue.

"I want to thank the Lab as an institution; they really came through on my behalf," Efron said. "Not until after my return did I learn how many unseen on-Lab individuals were involved in assisting my safe return."



Bob Brown / JPL Photos



By Mark Whalen

**IF ANYONE IS TO EVER FIND AND analyze life outside of the Earth, it will likely be Dr. Ken Neelson and his group in JPL's Center of Excellence for Life**

**Detection. So it was with excitement and anticipation that astrobiologist Neelson heard last month's announcement of the discovery of the possible evidence of water on Mars as imaged by Mars Global Surveyor's camera.**

Neelson shared his views on the implications of the Mars discovery in a July 7 lecture, part of the Director's Topical Seminar Series. The standing-room crowd in von Kármán Auditorium was abuzz with a fervor perhaps not seen since Pathfinder's landing on the red planet three years ago.

Neelson said, referring to an ancient rock found in Antarctica in 1996 that purportedly contained fossils of past Martian life. "The entire supposition for the presence of living forms in the meteorite is based on structural analysis: things that look like they *could* be bacteria."

Neelson contended that unless researchers look at the chemistry of these structures—things such as the abundances of elements of carbon, hydrogen, nitrogen, oxygen and others; the presence of macromolecules; and non-predicted abundances of molecules—"at the spots that are interesting and at the proper size scales, it is not convincing to make an argument for life."

It will be the development of techniques to make such measurements—at the micrometer level—that will allow scientists to see whether or not there is biological activity and tell the difference between life and non-life.

Statistical approaches—such as calcium-to-iron ratios—may also be used to determine life vs. non-life from samples. Finally, scientists will also look for activities such as movement and the weathering of rocks.

Most biologists agree that anyplace with liquid water, organic chemistry and energy is a potential setting for life to arise and prosper. But what about places where liquid water is only occasionally available? What about places where freezing and thawing occur regularly?

Many such environments exist, where the daily temperature fluctuations are such that all life is frozen at night and thawed the next day. To this end, Neelson said it's important to realize that bacteria have the advantage of being so small—"ice crystals are bigger than they are"—that freezing and thawing wouldn't kill them.

The time of analysis can also be very important. "In Antarctic rocks, for example, there may be only one week out of the year when it gets warm enough that there's liquid water, where the temperature gets above zero. If you happen to be there, you can see a lot of biological activity. So time becomes an important factor when making measurements," he said.

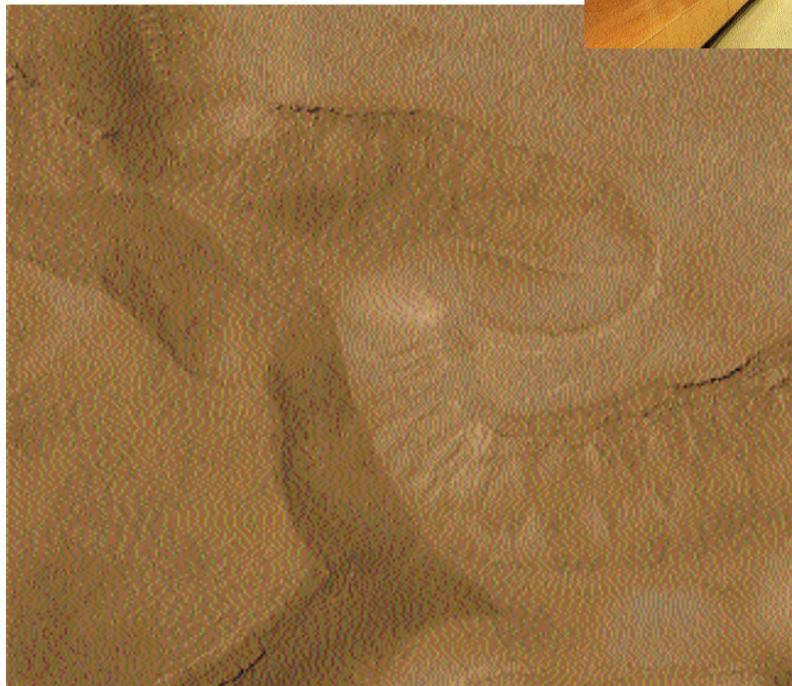
As a final point, Neelson noted that bacteria have highly evolved repair systems, designed for fixing accumulated damage. "If you can make the argument that once every 500,000 to 1 million years you could wake up the system and it could fix itself, then you could argue that there could still be some life there. I didn't care for that argument at all before the recent report, but if indeed there have been episodes of recent liquid water on Mars, it energizes that kind of thinking."

Neelson pointed to the findings of 250-million-year-old salt deposits, which can be dissolved to find viable bacteria. "The amount of time that life can survive keeps moving back. So people are asking questions today they wouldn't have even thought of 20 years ago, because we didn't think it was possible."

Indeed, astrobiology has gained lots of attention of NASA Headquarters. In attendance at the talk was Dr. Kathie Olson, who joined NASA last year as the agency's chief scientist. JPL Director Dr. Edward Stone noted that Olson is a strong advocate of research at NASA and has a great interest in the detection of life.

"I am the first biologist to be chosen chief scientist at NASA, and this is (Administrator Daniel) Goldin's way of making a statement that he believes that biology is going to be important to our future in terms of the search for life," she said.

Ten years ago, Olson noted, NASA allocated 31 percent of its budget for research and development. Next year, it will be 41 percent, and five years from now, 51 percent. "And at JPL, where you combine the engineering, the science, the technology and the missions, you are primed for the future."



PA01033

*Gullies proposed to have been formed by seeping ground water emanate from a specific layer near the tops of trough walls in Mars' Gorgonum Chaos region, as imaged by Mars Global Surveyor's camera.*

Neelson heads a staff of about 20 people, including six staff scientists. Organizationally, JPL's Astrobiology Group (Research Element 3251) is part of NASA's overall Astrobiology Institute, and also works on one of JPL's Grand Challenge initiatives, "the in-situ detection of life."

"Life detection cuts across many factors that are integral to the JPL community and NASA—missions, planetary protection, extreme environments and the origin and detection of life," Neelson told the audience.

Neelson provided a cautionary note: "As some of you know, I'm not a big fan of life on Mars until we actually prove it's true." But he also pointed out that if NASA's Mars strategy is "follow the water," we can now do it. If [Global Surveyor's discovery] is real, it could potentially change the entire Mars strategy. And it should, because we would have a place to go, a place to look where the organic carbon might be, and if we're lucky, where life might still be preserved."

The step-by-step approach to detecting life will include the following components:

- Physical and chemical measurements of shapes, structures and metabolic activities in the environment
- The use of multiple measurements: Except for obvious life, no single indicator will be sufficient
- A strong contribution of statistics and data mining
- The use of remote and in-situ measurements for life detection and in selection of samples for return to Earth

"We want to first define life," Neelson said, noting that researchers need to develop non-Earth-centric biosignatures for life detection methods "that do not require Earthly molecules like DNA or RNA, but which would never miss Earthly life when encountered." Test methods would need to be developed for Earthly environments, the best of which, he said, would be "extreme environments"—frozen sites, freshly formed lava, and hot or cold deserts. On Earth, areas with small amounts of liquid water support little active life; i.e., the signals are subtle.

"We know from studying extreme environments on Earth that when things get tough, the smart organisms move into the rocks and the dumb ones die. So when you go to these extreme environments, like Antarctica, you don't find any dumb living things. You find smart living things."

But to find life in the rocks will require new approaches. For example, Neelson's group built an ultraviolet imaging detection system that allows them to study surfaces of exposed rocks for the presence of carbon-based molecules and organisms. "This allows you to reduce the search space, then go to a spot that's interesting," he said. "If it's made up of something organic, it'll jump out at you."

Once likely structures are found, they must be further analyzed for their physical and chemical properties in order to verify the presence of past or current life.

"Some of you may know of my arguments with my colleagues at Johnson Space Center about the nanobacteria on the Martian meteorite,"

**"If [Global Surveyor's discovery] is real, it could potentially change the entire Mars strategy."**

— Dr. Ken Neelson  
Lead scientist,  
Astrobiology Research Element

## New space stamps unveiled

The Postal Service's first pentagonal stamps were issued to commemorate solar system exploration.



JPL participated in a ceremony earlier this month held by the U.S. Postal Service to dedicate a new series of stamps commemorating space.

The Postal Service's dedication of its Space Achievement and Exploration issue took place at the World Stamp Expo, held in Anaheim. Five stamp panes, each showing a different aspect of the exploration and study of space, provided several firsts for the Postal Service: the first hologram stamps, the first circular stamp and the first pentagonal stamps.

JPL Deputy Director Larry Dumas represented the Laboratory for the first-day issue ceremony for the five pentagonal \$1 stamps, together named "Exploring the Solar System."

These stamps showed different views of the sun based on NASA images.

Other NASA themes that were part of the new stamp issue included "Landing on the Moon," "Probing the Vastness of Space" and "Escaping the Gravity of Earth." In addition, "Stampin' The Future," four stamps based on designs by American children in a national stamp design contest, were also released.

JPL provided exhibits at the expo, as did Johnson Space Center and the International Space Station.

For pictures of the new stamps and more information, go online to <http://www.worldstampexpo.com>.

## Letters

My thanks to my many friends at JPL for their kind support at the passing of my father. Their wishes and the peace lily plant from the ERC were much appreciated.

Gary Kunstmann

My family and I would like to express our appreciation to our many friends at JPL for their comforting expressions of sympathy on the recent passing of my wife's father, Joseph Forcier. I would also like to thank those involved with sending the nice plant from the ERC; it was a very kind sentiment.

Don Potter and family

Thank you to my dear friends and co-workers, and especially to Al Williams and Steve Silverman, for my wonderful retirement send-off. I will never forget my 29 years at JPL and will miss all of you.

Jeanne Stevens

Rod and I want to thank all our friends and co-workers for their condolences, concern and cards upon the passing of my father. The support of our JPL family means a lot and we are very appreciative. The Section 388 plant arrangement and the ERC plants add a special touch to our home.

Carol and Rod Stanley

## Passings

CARLO FEA Jr., 77, a retired senior environmental test specialist in Section 357, died of congestive heart failure June 24 at his home in Los Angeles.

Fea worked at the Lab from 1962 to 1991. He is survived by son Gregory and daughters Donna and Janet. Services were private.

WILLIAM VAN DE WETERING, 77, a retired maintenance electrician in Section 662, died of cardiac arrest July 5 at his home in Monrovia.

Van de Wetering joined JPL in 1967 and retired in 1989. He is survived by his wife, Nanda, two sons and four grandchildren.

Services were private.

## Classifieds

### For Sale

AIR CONDITIONER, Amana, 9600 BTU, win., energy saver modes, 1 yr. old, hardly used, like new; \$250. 626/792-7753 after 6pm.

APPLIANCES: Westinghouse refrigerator, frost-free, white, top freezer, 19 cu. ft., \$120/obo; GE washer, extra lg. cap., \$30/obo. 626/301-1538.

BICYCLE RACK, Thule, holds 2 bikes, fits most cars & trucks w/raingutters, \$150. 626/797-5804.

BICYCLES, 10 spd., recent refurb., 27" & 24" wheels, 5 min. from JPL, \$25 ea. 952-8803, Don.

BINOCULARS, Explorer 750, Orion, BAK 4 prism, field 6.8, 365 ft., 1,000 yd., \$100 negotiable. 323/665-2684.

COFFEE TABLE, glass top, square, marble base, \$40/obo. 626/791-9049, Suzi or Paul.

COMPUTER, Mac 7100-66 with L2 cache, 66 MHz 601 PowerPC, 32 MB RAM, 1 GB HD, 33.3 KHz modem, 13" monitor, software, \$400. 773-9571.

CLAY POTS, lg. round, 2'dia., \$50 ea./obo, 3' dia., \$60 ea./obo. 626/398-3480.

DRESS, evening, Alan Schwartz designer, brand new, stunning, black w/spaghetti straps, sz. 2-4, tag, \$235, sell \$130. 241-8208, after 9 p.m., Irena.

FILE CABINET, 5 drawer, vertical, lock, gray/green, incl. 150 hang-file folders, gd. cond., \$100. 909/593-4046, vivdavies@starquest.net.

GARAGE SALE, Sat. & Sun., July 22 & 23, 4808 Matley Rd., La Canada, directional signs at Foothill Blvd. & Ocean View. 248-4790.

GOLF CLUBS, Ping Black Eye, 2 thru PW, gd. cond., \$250. 541-9493.

LAWN EDGER, McLean, gas, like new, \$100. 909/593-4991.

LAWN EDGER, pwr., McLane 3 HP, 8" dia. blade, exc. cond., 10 yrs. old but less than 2 hrs. use, 5 min. from JPL, \$35; MOWER; pwr., King-O-Lawn, 3 HP, 21" reel, clutch-type drive, old but reliable, \$25. 952-8803, Don.

MATTRESS, full sz., never used, Sealy Posturpedic, cushion firm, pd. \$400, sacrifice \$200. 323/665-3439.

MICROWAVE, Sharp Carousel II/convector oven, 800W, turntable & tons of special functions, \$65/obo; LAWNMOWER, Poulan, "weed-eater", 4 HP, Quattro Briggs & Stratton motor, mulch capable, 1 yr. old, \$75/obo. 362-7542.

MONITOR, Sony Triniton, 15", \$99; BATTERIES: for Nokia cell 5100 or 6100 series, \$20; new Nokia, vibrating, \$59; for Sony Camcorder, \$10; new Sony Mavica, \$30; COVER PLATE, new, Disney's Goofy for Nokia 5100 series phone, \$15; MOUSE, new, Logitech, Web scrolling, \$15; AUTO SWITCH, new, 4:1, Belkin, \$35; DVD MOVIES, new, orig., \$22-\$30, sell \$15. 366-6134.

ORGAN, Yamaha 415 elect. console, 13 pedals, 3 keyboards, 144 rhythm patterns, pd. \$7,500, sacrifice \$3,000; DIET TAPES, Jenny Craig, set of 14, \$50; POWER CONTROL CTR, computer, 5 pwr. + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, \$20; ADAPTERS, Lawn Genie sprinkler valve, model 756LG 3/4, new, \$10 ea.; CD CASES, 50, jewel, \$10. 790-3899.

OVEN, convection, by Décor, self-clean, white, wall mount, \$250/obo. 626/584-9632.

ROUTER, Makita 1.5 HP, D-handle, 1/2" collet, \$90; SPRAY FINISHER, Wagner, fine coat, low overspray finisher, for water-based finishing only, both in exc. cond., new \$180, sacrifice \$90. 626/303-0988, eves.

SKI BOOTS, Salomon, men's size 11, worn only 5 times, in original box, \$35. 236 4869, eves.

SOFA & CHAIR, matching, gray/multi-colored pattern, \$100/obo. 626/301-2481.

STEREO SYSTEM, Cerwin Vega D-9 speakers, Numark graphic equalizer, full display, Onkyo receiver, bad pwr. switch but working remote, \$250/obo. 626/798-8369.

TABLE, oak, library w/drawer, c. 1900, George III taste, 29.5"Hx26"Wx47"L, \$400/obo. 626/345-0681.

TABLE TOP, laboratory, 2.5'x5', all steel, strong frame & black coated surface, \$20. 323/255-3226.

TELEVISION, Panasonic, 25" diagonal, wood cab. remote, 8 yrs. old., \$150/obo. 626/398-3480.

WASHER/DRYER, Whirlpool, lg. cap., exc. cond., 2 yrs old, \$180 ea. 241-8208, after 9 p.m., Irena.

### Vehicles / Accessories

'93 ACURA Integra RS, black, 5-spd. manual, a/c, full pwr., stereo/CD/cass., alarm, rear spoiler, orig. owner, 103K mi., exc. cond., \$8,200/obo. 790-1419.

'95 BUICK Skylark custom sedan, 4 dr., auto, air, cass., air bags & more, exc. cond., 110K mi., \$5,400. 661/252-8470.

'92 BUICK Le Sabre, fully equipped, exc. cond., white ext., blue leather seats, \$5,400. 892-9824.

'83 CHEVROLET El Camino, blue, V8, 100K mi., \$3,500/obo. 626/284-2025.

'93 CHRYSLER Le Baron conv., blue/white top, auto, a/c, clean, new tires, trans., 130K mi., gd. cond., \$4,500/obo. 352-5666.

'84 DODGE D-50 pickup truck, VG cond, auto, 2.6L, bedliner, shell, new batt. & carb., very clean, well maint., all service records, 138K mi, orig. owner, \$2,800. 626/332-2682, Steve.

'96 FORD Escort LX, exc. cond., 5 spd., 2 dr., 57K mi., a/c, am/fm/cass., \$6,900/obo. 909/323-3640.

'95 FORD Mustang, 3.8L V6, 5 spd manual, 53K mi, silver, a/c, power everything, cc, stereo/CD/cass., dual air bags, no scratches/dents, \$7,400/obo. 249-0038.

'95 FORD Taurus GL wagon, exc. cond., 48,400 mi., new Michelin tires, V6 3.0L, auto, cc, a/c, am/fm/cass., pwr. seat/steering/locks/windows, silver paint, gray int., cloth seats, orig. owner, \$7,900. 626/351-1219.

'90 FORD Ranger Supercab, 4.0L V6, 4X2, auto, a/c, pwr./win./locks, cc, am/fm cass., camper shell, 67K mi., \$5,000. 248-2480.

'72 FORD Bronco, tan, V8, 75K mi., dual limited slip differential, \$6,000/obo. 626/284-2025.

'96 GEO Prizm, 4 dr., green, 1.6L, only 38K mi., exc. mech. cond., new tires at 33K mi., 28 city/38 hwy. MPG, gray int., 5-spd. manual, a/c, Alpine stereo w/Polk speakers, \$8,000/obo. 626/398-0483, Pat Huber.

'95 HONDA Civic EX sedan, 5 spd, a/c, cc, am/fm/CD, s/r, pwr./win./locks, black w/dark gray int., recent tires, dealer maintained, 81K mi., exc. cond., \$9,100/obo. 626/462-9110.

'91 HYUNDAI Excel, low mi., less than 63K, new tires/brakes/muffler, looks gd., runs better, \$1,950. 679-1471.

'93 PACE ARROW motor home, 30', exc. cond., only 23K mi., basement model, levelers, safetyplus steering, TV, microw., a/c, much more, \$39K/obo. 249-0939.

'84 MILLER Tiltbed equip. trailer, completely refurbished, new deck/tires/brakes/elec., Pinto hitch, 21,000 gross vehicle weight, \$3,995/obo. 626/798-6249.

'77 PLYMOUTH Voyager 15-passenger van, gd. cond., \$2,500/obo. 626/571-2052.

'96 SAAB 9000 Aero, high-output turbo eng., 225 HP, 252 lb. ft. of torque, 5-spd., 20.5K mi., silver/black leather, loaded, one owner, very clean, exc. cond., \$3,270 below Kelley Blue Book at \$22,500. 626/794-2965, leave msg.

'98 SATURN, wagon SW-2, white, mint/spotless cond., extended bumper-bumper warranty 6 yr/75,000 mi., all papers incl. proof of oil changes, dual airbags, auto, keyless entry, cc, CD, tinted wins., 19K mi., \$12,800/obo. 661/294-0712, Brad.

'95 SUBARU Legacy, 4-dr. sedan, 56K, single owner, exc. cond., dark green, AWD, ABDS, auto, pwr. sunroof/locks/windows, a/c, am/fm/cass., c/c, alloy wheels, \$10,500. 626/355-5662.

'89 TOYOTA Camry, exc. cond. auto, a/c, pwr./win./locks, 96K mi., \$4,999. 626/579-7403.

'97 VOLKSWAGEN Jetta GT sedan, red, exc. cond., auto, 42K mi., tinted wins., am/fm stereo/cass., alloy wheels, rear spoiler, dual airbags, pwr. steer., new tires, \$14,500/obo. 626/359-5200.

### Wanted

GERMAN SPEAKERS/parents to form play group for toddlers to foster native language development. 249-9093, Petra.

MAGAZINES, bridal/wedding, for pics. only, any cond., 626/345-0681, Susanne.

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

VOLLEYBALL PLAYERS, coed, all levels of play, Tues. nights, 8-10, Eagle Rock H.S., \$3/nt. 956-1744, Barbara.

### Free

KITTEN, charcoal gray, born April 17, to a good home. 626/448-5957.

TABLE TENNIS TABLE and paddles, good condition, needs net. 249-1749.

### For Rent

ALTADENA, lg. furn. rm., cable, also share 3 bd., 3 ba. quiet hilltop house, pool, patios, view (incl. JPL), c/a/h., all amen., kitch., d/w, laundry, priv. off-st. pkg. spot, 11 min./JPL, smoking OK (owner smokes), \$500, incl. all util. + dep. 626/795-1050, Harry, after 7 p.m.

ALTADENA condo lease, mins. from JPL, 2 bd., 1 3/4 ba., nice closets w/organizers, f/p, c/a, comm. pool, storage rm., 2-car gar.,

carport, tile counter & marble flr. in kitch., lg. patio, landscaped, planters/oriental garden/ waterfall/spa, end unit w/wins. on 3 sides, rent by owner, \$1,200. 626/398-1988, Beverly Drane.

SOUTH PASADENA, fully furn. 1 1/4-bd. apt., nice area at 1718 Huntington Dr., betw. Marengo & Milan Sts, laundry facilities on premises, util. pd. except elec., no smoke/pets, \$1,000 + \$1,000 sec. dep. 626/792-9053, Marilyn.

### Real Estate

LA CANADA-FLINTRIDGE, view home, 4 bd., 2.5 ba., c/a, 2,778 sq. ft., 2-car gar., lg. driveway, 15-ft. swim spa, LC schools, very quiet street/neighborhd., 53,954 sq. ft. on 2 lots w/oak forest & creek, 2.5 mi./JPL; see [www.realtor.com](http://www.realtor.com), "La Canada", "Ca", MLS ID=G202353, \$849,500. 952-9654.

PASADENA, beaut. spacious Spanish style 1922 vintage home loc. in desirable "Bungalow Heaven" area, 3 bd., 1 ba., 1,600 sq. ft., lg. lot & much more, \$349,000. 679-1471.

PASADENA executive condo, next to Caltech, total remodel, 2 bd., 1 3/4 ba., 1,200 sq. ft., newly refinished hrwd. flrs. in dining rm., newer appliances, carpet & paint, top floor unit in park-like setting, walk to Caltech & S. Lake Ave., nice pool & spa. 626/585-9048.

### Vacation Rentals

BIG BEAR cabin, quiet area near village, 2 bd., slps. 8, compl. furn., f/p, TV/VCR, \$75/nt. 760/246-7754.

BIG BEAR LAKEFRONT, lux. townhome, 2 decks, tennis, pool/spa, beaut. master bd., suite, sleeps 6. 949/786-6548.

BIG BEAR LAKE cabin, near lake, shops, village, forest trails; 2 bd., sleeps up to 6, f/p, TV, VCR, phone, microw., BBQ & more, JPL disc. from \$65/nt. 909/210-9182.

CAMBRIA ocean front house, slps. up to 4, exc. view. 248-8853.

HAWAII, Kapa, Kauai, 1 bd., 1 ba., ocean front condo, sleeps 4, full kitch., patio, pool, spa, sauna, BBQ grills, tennis, Oct. 21-28, \$90/nt. 323/296-6641.

HAWAII, Kona, on 166 ft. of ocean front on Keahou Bay, priv. house & guest house comfortably sleeps 6; 3 bd., 2 ba., rustic, relaxing & beautiful, swim/snorkel/fish, spectacular views, near restaurants/golf/other attractions. 626/584-9632.

HAWAII, Maui condo, NW coast, on beach w/ocean view, 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microw., d/w, pool, priv. lanai, slps. 4, 4/15-12/14, \$100/nt./2, 12/15-4/14, \$115/nt./2, \$10/nt. add'l. person. 949/348-8047.

LAKE TAHOE, north shore, 2 bd., 2-1/2 ba. condo, slps. 6-7, private sandy beach, pool, great loc., all amens., hike/golf/fish, 2 mi. to casinos, JPL disc. summer wkly. rate, \$650. 626/355-3886, Rosemary or Ed.

LAKE TAHOE, west shore @ Homewood in Chamberlands, full amen., assoc pool, tennis, private beach & club, 3 bd. + loft, 2 ba., slps. 8, linens provided, full kitch. & laundry, TV/VCR, wood stove, 2-day min., \$700/wk., \$75 cleaning fee. 626/585-0321, Bob or Nicole.

MAMMOTH, Chamonix condo, 2 bd., 2 full ba., slps. 6, fully equip. elec. kitch. w/ microw. & extras, f/p & wood, color TV, VCR, cable, FM stereo, pool & sun area, o/d Jacuzzi, sauna, game, rec. & laundry rms., play & BBQ areas, convenient to hiking, shops, summer events, daily/weekly rates. 249-8524.

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft, sleeps 6-8, fully equip. kitch. incl. microw., d/w, cable TV, VCR, phone, balcony w/view to mtns., Jacuzzi, sauna, streams, fishponds, close to Mammoth Creek, JPL disc. 626/798-9222 or 626/794-0455.

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

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on private rd., 18-hole golf course 6 mi. away, private security pkg. 626/794-3906.

SOUTH LAKE TAHOE KEYS waterfront, 4 bd., 3 ba., 1 bd. + liv. rm. upstairs, hcp. access fair, slps. 12+, f/p/s, decks, gourmet kitch., boats, TV's, VCR, stereo, assn. in & o/d pools, bch., tennis/ski/casinos/golf, 3-day min., \$1,195/wk. [1 June-15 Sept; 22 Nov-1 April], \$595/wk. low seas., + \$90 clean fee. 949/515-5812.

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