Universe

Jet Propulsion Laboratory

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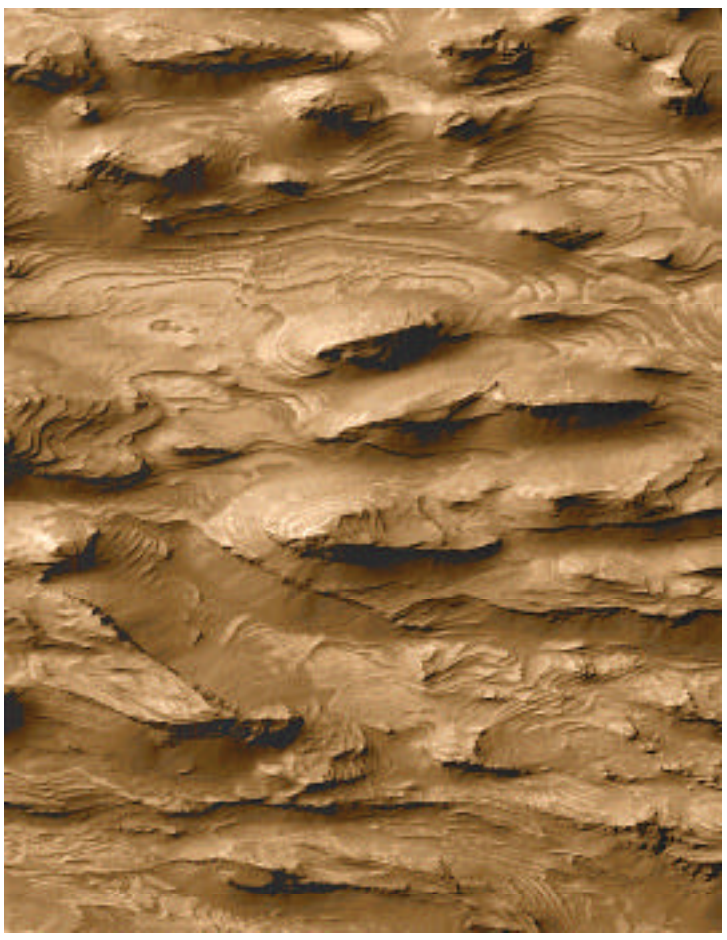
Inside

MGS images suggest ancient lakebeds

By Mary Hardin



PIA 02840

The layered sedimentary rock in this 1.5 kilometer-by-2.9 kilometer area (.9 mile-by-1.8 miles) in Mars' far southwestern Candor Chasma could very well indicate that the materials were deposited in a lake or shallow sea.

In what ultimately may be their most significant discovery yet, Mars scientists say high-resolution pictures showing layers of sedimentary rock paint a portrait of an ancient Mars that long ago may have featured numerous lakes and shallow seas.

"We see distinct, thick layers of rock within craters and other depressions for which a number of lines of evidence indicate that they may have formed in lakes or shallow seas," said Dr. Michael Malin of Malin Space Science Systems in San Diego, principal investigator for the Mars Orbiter Camera on JPL's Mars Global Surveyor spacecraft. "We have never before had this type of irrefutable evidence that sedimentary rocks are widespread on Mars. These images tell us that early Mars was very dynamic and may have been a lot more like Earth than many of us had been thinking."

Such layered rock structures where there were once lakes are common on Earth. The pancake-like layers of sediment compressed and cemented to form a rock record of the planet's history.

The regions of sedimentary layers on Mars are spread out and scattered around the planet. They are most common within impact craters of Western Arabia Terra, the inter-crater plains of northern Terra Meridiani, the chasms of the Valles Marineris, and parts of northeastern Hellas Basin rim. The scientists compare the rock layers on Mars to features seen in the American Southwest, such as Arizona's Grand Canyon and Painted Desert.

"We caution that the Mars images tell us that the story is actually quite complicated, and yet the implications are tremendous. Mars has preserved for us, in its sedimentary rocks, a record of events unlike any that occur on the planet today," said Dr. Ken Edgett, staff scientist at Malin Space Science Systems and co-author of a paper published in the Dec. 8 issue of Science magazine. "This is changing the way we think about the early history of Mars—a time perhaps more than 3.5 billion years ago."

"On Earth, sedimentary rocks preserve the surface history of our planet, and within that history, the fossil record of life. It is reasonable to look for evidence of past life on Mars in these remarkably similar sedimentary layers," Malin said. "What is new in our work is that Mars has shown us that there are many more places in which to look, and that these materials may date back to the earliest times of Martian history."

"The finding of layered sedimentary deposits is something that biologists have been hoping for," said Dr. Ken Nealson, director of the Center for Life Detection at JPL. "Perhaps the favorite sites for biologists to search for fossils or evidence of past life on Earth are layered lake or oceanic sediments such as in these sites Malin and Edgett describe."

Added Malin: "I have not previously been a vocal advocate of the theory that Mars was wet and warm in its early history. But my earlier view of Mars was really shaken when I saw our first high-resolution pictures of Candor Chasma. The nearly identically thick layers would be almost impossible to create without water."

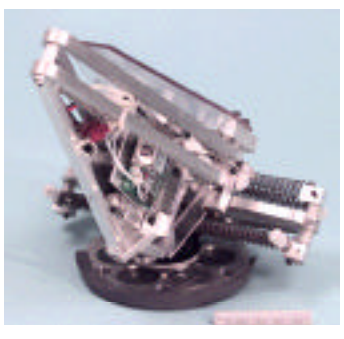
As an alternative to lakes, Malin and Edgett suggest that a denser atmosphere on early Mars could have allowed greater amounts of windborne dust to settle out on the surface in ways that would have created the sedimentary rock.

"We have only solved one little piece of a tremendous puzzle," Malin said. "There is no illustration on the box to show us what it is supposed to look like when it is completed, and we are sure most of the pieces are missing."

Images for this release are available online at *http://www.msss.com/mars_images/moc/dec00_seds.*

Small robot could leap its way around the planets

By Carolina Martinez



The small hopping robot under development by JPL and Caltech may prove more efficient than rovers with wheels.

A small hopping robot with froglike abilities that moves by a combination of rolls and hops to its desired destination may someday hop a ride to an asteroid and leap its way to other planets in the search for water.

The frogbot, under joint development by JPL and Caltech, is featured as the "robot of the month" in the Robot Watch news section of Discover magazine's December issue. The device, which can steer and right itself, weighs in at 1.3 kilograms (3 pounds) and is powered by a single motor. It is equipped with a camera, solar panels, sensors and onboard computer that executes commands autonomously, making the robot ideally suitable for exploration of distant planets, comets and asteroids.

"Hopping is a more efficient form of transportation in low-gravity environments," said Dr. Paolo Fiorini, an engineer in the robotics group in JPL's Autonomy and Control Section. "Our hopping robot performs much like a frog, except that it only has one leg and no tongue. It has a spring between its knees that makes it bend its legs and hop. When the spring releases, the frogbot takes a 1.8-meter (6-foot) hop on Earth, which could become a 6-meter (20-foot) leap under low-gravity conditions on planets like Mars, depending on terrain."

Engineers believe that in low-gravity environments, such as small planets, and in micro-gravity environments, such as asteroids, wheels successfully used on rovers may not be the most efficient form of locomotion. In laboratory experiments, slithering, rolling and hopping have been shown to be alternative methods of propulsion.

In the future, NASA envisions missions involving dozens of small robotic vehicles. "To be effective, a small exploratory robot vehicle must frequently go over obstacles that are many times its body size," said Joel Burdick, the Caltech co-inventor of the robot. "Hopping or leaping motions are some of the few effective ways for small vehicles to overcome such relatively large obstacles."

"Our goal was to come up with a locomotion method and design that would use a minimal number of instruments and that would be small, compact, lightweight and still be able to perform useful scientific study," said Dr. Neville Marzwell, head of JPL's Advanced Projects Office. Researchers at Sandia National Laboratories in Albuquerque, N.M., have also developed a hopping device, with more limited maneuverability.

The frogbot has shown better mobility than rovers on certain terrain. It can be developed to reach canyon walls and other remote areas, be manufactured at a lower cost and multiple numbers of the device can be released onto a planet's surface to cover large distances and communicate with each other. One frogbot could be lost without hindering the whole network.

The hopping robot technology will be ready in about three to five years and could help scientists capture images and collect ground samples. One of the major challenges facing engineers is precision navigation necessary to control the hopping robot. Engineers are also developing a hopper that adheres and climbs vertical walls and are testing prototypes on different ground terrains.

Pictures are available at *ttp://technology.jpl.nasa.gov/gallery/robotics/robot_index.html.*

The Advanced Projects Office of Space Flight at NASA Headquarters is the primary source of funds for this work, which was also sponsored by a National Science Foundation grant through the Center for Neuromorphic Systems Engineering at Caltech.

News Briefs

View this and previous issues of Universe online

http://universe.jpl.nasa.gov

'Most distant object' is now closer

Astronomers have stripped a galaxy near the Big Dipper of its title as "Most Distant Object Known" by using different techniques to make improved estimates of its distance that show it is closer than it first appeared.

The object was first reported last year when a team of scientists identified the faint galaxy in images taken with NASA's Hubble Space Telescope. They inferred a distance of approximately 12.5 billion light years, which would make it the most distant object known. That distance is equivalent to looking back in time to about 600 million years after the Big Bang, just 5 percent of the current age of the universe.

A team of astronomers led by JPL's DR. DANIEL STERN reports that new observations show the galaxy is closer than previously believed, likely about 10 billion light years away, corresponding to 3.3.billion years after the Big Bang. That's about 25 percent of the current age of the universe.

The findings are reported in the Nov. 30 issue of the journal Nature, along with similar findings from the scientist whose team made last year's estimate of the distance.

DR. PETER EISENHARDT of JPL co-authored the paper.

Scientists receive physics grants

Five JPL scientists are among 41 researchers selected by NASA to receive grants to conduct fundamental physics research on Earth and in space. This research will seek knowledge that will expand understanding of space, time and matter.

Sponsored by NASA's Office of Biological and Physical Research, the research grants, totaling more than $15 million over four years, offer investigators the advantage of a low-gravity environment to enhance understanding of physical, biological and chemical processes associated with fundamental physics.

Researchers will use NASA's microgravity research facilities such as drop-tubes, drop-towers, aircraft flying parabolic trajectories and sounding rockets. Flight-definition investigators will work toward experiments on a spaceflight test bed, such as the International Space Station and space shuttle.

The grant recipients at JPL are:

• DR. TALSO CHUI: Heat Current, Q, Effects on the Superfluid Transition (QUEST).

• DR. INSEOB HAHN: Measurement of the Coexistence Curve in 3He near the Liquid-Gas Critical Point in Microgravity.

• DR. MELORA LARSON: Experiments Along Coexistence near Tricriticality (EXACT).

• DR. YUANMING LIU: Effects of Heat Current on the Superfluid Transition in a Low-Gravity Simulator.

• DR. FANG ZHONG: Measurements of the Thermal Conductivity near the Liquid-Vapor Critical Point of Helium-3 and Helium-4.

While Hahn's grant involves a flight definition task, the other four scientists have ground-based tasks.

NASA received 109 proposals in response to its research announcement in this area. These proposals were peer reviewed by scientific and technical experts from academia and government.

A complete list of awardees (by state), their institutions and research titles can be found online at *ftp://ftp.hq.nasa.gov/pub/pao/pressrel/2000/00-183a.txt.*

SIRTF, SIM name their science teams

By Jane Platt

NASA has selected science teams for two Origins Program missions managed by JPL: the Space Infrared Telescope (SIRTF) and the Space Interferometry Mission (SIM).

Six teams of scientists have been selected to participate in SIRTF, which is set for launch in July 2002. The teams will study the formation of galaxies, stars and planet-forming dust disks, will hunt for Earth-sized planets around other stars and provide new insights into the origin and evolution of our galaxy.

The SIRTF teams make up the SIRTF Legacy Science Program, which will involve American-led teams of scientists from around the world. The six projects comprise more than 3,000 hours of observations, or about half of SIRTF's first year of operation.

• Black Holes and Galaxies: Led by Dr. Carol Lonsdale of the Infrared Processing and Analysis Center at Caltech (851 hours of SIRTF observing time).

• Galaxy Birth and Evolution: Led by Dr. Mark Dickinson of the Space Telescope Science Institute in Baltimore (647 hours).

• Unveiling Hidden Stars: Led by Dr. Robert Kennicutt of the University of Arizona (512 hours).

• Inside the Milky Way: Led by Dr. Ed Churchwell of the University of Wisconsin (400 hours).

• From Gas to Stars: Led by Dr. Neal Evans II of the University of Texas (using 400 hours and all three SIRTF instruments).

• Planet Formation: When the Dust Settles: Led by Dr. Michael Meyer of the University of Arizona (350 hours).

Detailed observational planning for these projects will be conducted throughout 2001, and the actual observations will begin a few months after SIRTF is launched. More information is available at *http://sirtf.caltech.edu.*

Scheduled for launch in 2009, SIM will precisely measure the locations and distances of stars throughout our Milky Way Galaxy, and study other celestial objects. The SIM team consists of 10 principal investigators leading key science teams, and five mission specialists.

Three JPL scientists will lead SIM teams:

• Extrasolar Planets Interferometric Survey: Dr. Michael Shao. A search for planets using a large sample of stars, this study addresses one of SIM's primary science goals: taking a census of planetary systems around nearby stars.

• The Search for Young Planetary Systems and the Evolution of Young Stars: Dr. Charles Beichman. A study of the early stages of the formation of planetary systems around young stars that will provide new insight into how planets like Earth might have formed.

• Binary Black Holes, Accretion Disks and Relativistic Jets: Photocenters of Nearby Active Galactic Nuclei and Quasars: Dr. Ann Wehrle. A study of possible motions and changes in active galactic nuclei and quasars.

In addition, Dr. Stuart Shaklan of JPL's Interferometry Systems and Technology Section has been named instrument scientist for SIM.

Light gathered by SIM's multiple telescopes will be combined and processed to yield information that could normally be obtained only with a much larger telescope. SIM will also search for planets beyond our solar system. A critical part of the mission will be to identify potential observing targets for the Terrestrial Planet Finder, which will image planetary systems around other stars and look for chemical signatures that indicate a planet could sustain life.

For a complete list of the investigators and their studies, as well as other mission scientists, go online to *http://sim.jpl.nasa.gov.*

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The Space Infrared Telescope Facility

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.

End of Life Issues and Bereavement—Meets the second Monday of the month at noon in Building 111-117. Call the Employee Assistance Program at ext. 4-3680.

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 meet the first Tuesday of each month in Building 167-111. For information, call the Employee Assistance Program at ext. 4-3680.

Friday, December 8

"Dealing with Holiday Stress for Families"—Steve Degelsmith of JPL's Employee Assistance Program will speak at noon in Building 167-111. Sponsored by JPL's Working Parents Support Group.

Travel Film—*Chile Awaits Your Discovery* will be shown at 8 p.m. in Caltech's Beckman Auditorium. Tickets are $9 and $7. For information, call (626) 395-4652.

Sunday, December 10

Skeptics Society Lecture—Dr. Robert Pennock, author of "Tower of Babel: The Evidence Against The New Creationism," will speak at 2 p.m. in Caltech's Baxter Lecture Hall. Donations: $5 for members, $8 for nonmembers.

Monday, December 11

End of Life Issues and Bereavement—The ongoing discussion group, sponsored by JPL's Employee Assistance Program, will discuss dying and loss and how they affect the workplace. At noon in Building 111-117.

TIAA/CREF Enrollment Meetings—Employees newly eligible to participate in the retirement plan are invited to T1720-137 at 9 a.m. and 1 p.m. Investment options and assistance in the completion of the enrollment form will be offered.

Tuesday, December 12

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

Wednesday, December 13

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

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. Call Jim Raney at ext. 4-6301.

JPL 2000 Talk—Cassini Program Manager Bob Mitchell will present "An International Journey of Discovery," discussing the spacecraft's inflight performance to date, the upcoming Jupiter flyby, and what's to come at Saturn. To be held at 11:45. in von Kármán Auditorium.

Thursday, December 14

Von Kármán Lecture Series—JPL oceanographer Dr. Bill Patzert will present "Earth's Oceans: When the Oceans Speak, We All Listen" at 7 p.m. in von Kármán Auditorium. Open to the public.

Friday, December 15

Retirement Accounts—Today is the deadline for submitting salary reduction agreements for January 2001 contributions to employees' voluntary 403(b) tax-deferred retirement accounts. To increase/decrease or begin contributions, submit a form to the Benefits Office by today or contact the office at ext. 4-3760. Forms are available online at *http://eis.jpl.nasa.gov/hr/benefits/benefits.htm*.

Von Kármán Lecture Series—JPL oceanographer Dr. Bill Patzert will present "Earth's Oceans: When the Oceans Speak, We All Listen" at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Saturday, December 16

Holiday Concert—Gregg Miner will perform on a variety of instruments in featuring his CD "A Christmas Collection" at 8 p.m. in Caltech's Dabney Lounge. Tickets are $12 for adults, $4 for children under 12. For information, call (626) 395-4652.

Tuesday, December 19

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

Wednesday, December 27

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. Call Jim Raney at ext. 4-6301.

Thursday, December 28

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

Tuesday, January 2

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

JPL Genealogy Club—Meeting at noon in Building 301-271.

Wednesday, January 3

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

Thursday, January 4

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

Students will Help Cassini at Jupiter

Goldstone-Apple Valley project will aid the spacecraft's Dec. 30 flyby of ringed planet

By Guy Webster

Students at 25 middle schools and high schools in 13 states are remotely controlling huge radio-telescope dishes in the California desert from their classroom computers this fall and winter.

Their work will aid studies of Jupiter to be made by the Cassini spacecraft's Jupiter Millennium Flyby Dec. 30. The students are using telescopes near Barstow at the Goldstone tracking station of the Deep Space Network, which JPL operates for NASA.

Students' monitoring of natural radio-wave emissions from Jupiter's atmosphere and radiation belts over the next few months will help with the interpretation of measurements that Cassini will take during a few days in early January.

"We know that the radio emission from Jupiter's radiation belts changes over time, and we want to know whether Cassini is looking on a normal day or an unusual day," said JPL physicist Dr. Scott Bolton, a Cassini science team member. "The observations the students collect will be our primary gauge to determine the state of the radiation belts."

The students' data will also be used to calibrate Cassini's radio gear for scientific studies to be conducted after the spacecraft reaches its main destination, Saturn, in 2004.

Courtney Smith, a junior at Redlands East Valley High School, keyed numbers into a classroom computer one recent evening as other students clustered around to watch. Another computer in the room carried a live picture via the Internet of the 34-meter-diameter (112-foot) dish that Smith's commands were steering, about 200 kilometers (about 120 miles) away. She pointed the radio telescope a little to one side of Jupiter, then did a scan across the disc of the planet while other students wrote down measurements of radio-wave intensities the telescope detected at different wavelengths.

The telescope is the Goldstone-Apple Valley Radio Telescope, one of a group of large radio-antenna dishes at the Goldstone tracking station. This antenna was formerly used for communications with NASA spacecraft, the main mission of Deep Space Network stations around the world, but it now is available for schools' use through a partnership of the JPL, NASA and the non-profit Lewis Center for Educational Research, in Apple Valley. The Lewis Center develops lesson plans and conducts teacher training to get maximum educational benefit out of students' use of the telescope. A second 34-meter dish at Goldstone is also being used by students in the project to support Cassini.

"I've found that students who participate in this really show a lot of interest in science, and it whets their appetites," said Joe Monaco, Earth sciences teacher for the Redlands students.

Brian Dansereau, a Redlands East Valley junior writing down measurements of Jupiter's radio emissions, said he likes the unpredictablilty of this real research, compared with textbook learning. "It inspires you to go on and do more in science," he said.

Other schools participating in the project range from Sanford Middle School in Opelika, Ala., to University Public School in Detroit.

The research helps students understand that visible light is not the only way to see the universe. "In visible light, we see Jupiter's atmosphere, its clouds, its Great Red Spot," said Dr. Michael Klein, manager of the Deep Space Network's science office. "At some radio frequencies, we see deeper into the atmosphere and measure its temperature. At longer radio wavelengths, the students are measuring emissions from the radiation belt around Jupiter that you can't see with your eyes, but that is being generated by electrons and protons zipping around Jupiter at close to the speed of light."

Cassini is a cooperative project of NASA, the European Space Agency and the Italian Space Agency.

Further information about students' use of the Goldstone telescopes and about Cassini's Jupiter flyby is available online at *http://www.jpl.nasa.gov/jupiterflyby.*

For more information on the Goldstone-Apple Valley Radio Telescope, log on to *http://deepspace.jpl.nasa.gov/dsn/applevalley/index.html.*

On its way to Saturn, the Cassini spacecraft will make its closest approach to Jupiter on Dec. 30. Students throughout the country will make observations on Cassini's activities using an antenna at Goldstone.

Stone Helps Eliot Kids Make The Grade

By Gia Scafidi

Stressing the importance of astronomy and scientific experimentation, JPL Director Dr. Edward Stone spent a half-day with budding young scientists at Eliot Middle School in Altadena last Tuesday.

As part of the National Science Foundation's nationwide "Scientists and Engineers in the Schools" program, Stone provided eighth-graders with insight into the world of space missions, answered deep space questions and assisted with a scientific project in progress.

"This is great for the students," said David Thesenga, eighth-grade science teacher. "Eighth-graders are already starting to think about jobs, and when they see that [Dr. Stone] is an astrophysicist and a normal guy, it makes this field a possibility."

"Visits from distinguished guests have always been real positive," added Irma Hernandez-Conrad, assistant principal. "Not only does it put the students on their best behavior, but it brings the world to the kids, showing them that we're not isolated."

During Stone's visit, Cherise Hoskins' eighth-grade science students watched while Thesenga dropped their launch modules, carrying raw eggs, from the school's tower. Inspiring teamwork, the experiment demonstrated the students' group design and construction of a parachute-like vehicle, made out of a plastic bag, string, tape and tennis ball halves.

"The key thing is to test," Stone told the students. "Build it, test it and test it some more. Because once it's gone, it's too late."

Bob Brown / JPL photos

Stone noted the similarity of the classroom and JPL. "The students are learning how to do things they've never done before, and that's exactly what we do."

The day was a nice change of scenery, Stone said. He remembered the time he spent at Eliot Middle School back in the 70s, when his two daughters attended the school.

"This was a great day," said Issis Navaro, 13. She said Stone's question-and-answer session helped her better understand aspects of astronomy she had learned in class.

Above left: Dr. Edward Stone helps (from left) Donald Oliver, Chris Graves and Robert Lewis create "launch modules" made from tennis balls. Center: Jennifer Torgersen (left) and Bonnie Estrada work with the director on making a parachute. Above: Stone and eighth-grade science students watch as a parachute falls to the ground from the school's tower.

Engineers sought to help students in robot challenge

JPL engineers are sought to help inspire local high school kids in the art of robotics.

The Lab is sponsoring the For Inspiration and Recognition of Science and Technology (FIRST) Southern California regional competition to be held at the Los Angeles Memorial Coliseum, March 15-17, and engineers are needed with expertise and skills in engineering, machine shop, mechanical, electrical, software development, CAD-CAM drawing, or similar expertise to help students build their own robot. More than 20 schools have signed up so far, increasing JPL's chances of placing in the regional and possibly taking JPL to the finals at Walt Disney World's EPCOT Center, Florida, in April 2001.

The time commitment varies from a few hours to a few days depending on the engineer's time. Additionally, there are limited funds available to cover the time JPLers work with the students during school hours. Those not available to provide one-to-one contact but who still wish to participate can do so via their computer by simply reviewing a team's plans via e-mail.

The competition challenges students to build their own robot and make it perform a specific task. FIRST aims to inspire students, provide hands-on activities, foster teamwork and give students the opportunity to work with the country's leading engineers.

Students and engineers work together to brainstorm, design, construct and test their "champion" robot. The teams then compete in a spirited, no-holds-barred tournament complete with referees, cheerleaders and time clocks. "The result is a fun, exciting and stimulating environment in which all participants discover the important connection between classroom lessons and real-world applications," noted Alice Wessen, JPL's technology theme lead.

If you can spare some time to join the competition, call Wessen at ext. 4-4930 or Rob Steele at ext. 4-4847.

Next Universe
January 5, 2001

Due to JPL holidays at year's end, this issue of Universe will be the last one published in 2000.

The deadline to submit classified ads for the Jan. 5 issue has been extended to Tuesday, Dec. 12 at 2 p.m.

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For change of address, contact your section office (on-Lab personnel) or Xerox Business Services at (626) 844-4102 (for JPL retirees and others).

Notice to Advertisers

Advertising is available for JPL and Caltech employees, contractors and retirees and their families. No more than two ads of up to 60 words each will be published for each advertiser. Items may be combined within one submission.

Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 186-118, or via e-mail to universe@jpl.nasa.gov.

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

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

Letters

I would like to thank my friends and coworkers at JPL for their expressions of sympathy and support on the recent death of my mother. I would especially like to thank the TMOD community for their support, the beautiful plant, and the donation to the American Diabetes Association they provided in memory of my mother. I would also like to thank the ERC for the lovely plant they sent to my home.

Wayne Sible

To the Acquisition Division: Thank you so much for the tremendous support shown in the recent loss of my grandmother and grandfather. Your words of comfort, cards and prayers made this difficult time a lot more bearable. Thank you also to ERC for the beautiful plant.

Wendie Donahue

I would like to thank my friends and coworkers at JPL, especially in Section 312, for the kindness and support extended to me and my family on the death of my father in October. I would also like to thank ERC for the beautiful plant. My Dad, who was part of the early manned space program and who proudly displayed Voyager images on his own office walls, always was interested in what was going on here and would have appreciated the tribute from JPL.

Aron Wolf

My family and I would like to thank the ERC for the beautiful plant and our friends at JPL for their expressions of sympathy on the recent death of my mother.

Dayton Jones

My family and I would like to thank my friends and co-workers at JPL for their incredible love, support and expressions of sympathy at the passing of my Dad. Your meals, flowers, cards, comfort and support during this period were deeply appreciated. The money that was raised will go to feeding some needy families in our local area. Thank you ERC for the beautiful plant. I have always known what wonderful people I work with but now, so does my family. God bless all of you.

Nancy Curran

My wife and I would like to thank the JPL community and Section 352 family for their sympathy and support on the recent passing of my stepdaughter, Kristina. Thanks, too, to the ERC for the beautiful plant that will remain a living tribute to her memory.

Ken Jewett

Retirees

The following employees retired in December: John Schlue, 39 years, Section 515; Angus McRonald, 35 years, Section 312; Harvey Horiuchi, 34 years, Section 344; C. Don Hagood, 31 years, Section 351; Richard Stoller, 29 years, Section 313; Robert Richter, 22 years, Section 353.

Passings

ROBERT HANSEN, 73, a retired senior photographer in Section 642, died of pneumonia Oct. 31 at a hospital near his home in Utah.

Hansen joined JPL in 1961 and retired in 1993.He is survived by his wife, Lila; children Robert, Richard, Robyn, Raylee and Renell; and 10 grandchildren.

Services were held Nov. 3.

STEPHEN PAINE, 64, a retired member of the technical staff in the Electromechanical Support Group, Section 440, died of cancer Nov. 22.

Paine joined JPL in 1958 and retired in June of this year as a contractor. He is survived by sons Mark and Michael, daughter Sharon Miller, and six grandchildren.

Services were held Nov. 29 at Douglass & Zook Mortuary in Monrovia.

Classifieds

For Sale

BABY ITEMS: high chair, very good cond., $50/obo; bassinet, as new, $90/obo; stroller, very good cond., $20/obo; changing table, as new, light salmon pine wood, $90/obo. 626/296-8348, Muriel.

BABY ITEMS: 2 Evenflo infant car seats with luggage style handles, Looney Tunes characters, $30 each; one baby crib, Italia, with mattress, $250, all items hardly used and in excellent condition; PRINTING CARTRIDGES, Brother, PC-201, 2, new, for use with fax 1010/1020/1030, 1170/1270/1570MC, MFC-1770/1970, $10 each. 626/443-9774.

BED, youth, w/mattress, Scandinavian style, $80. 952-1303.

BEDROOM FURNITURE: dresser w/mirror and 2 matching nightstands, dresser is 70" wide by 30" high with 9 drawers, nightstands are 26" wide by 23" high with 2 drawers, all for $225/obo. 626/914-7853.

BICYCLE TRAILER, for 2 child., as new, $150/obo. 626/296-8348, Muriel.

CAR SEATS, Century 5000, booster, excellent condition, $50 each or $85 for 2. 661/274-7954.

CLAY POTS, round, large (2-ft and 3-ft diameter), $50 each 2" obo, $60 each 3"/obo. 626/398-3480.

COMPUTER DESK, office quality, with 24" pullout keyboard tray, very sturdy, excellent condition, $70. 626/445-2616.

COUCH, 8 1/2 ft., brown, vinyl, $100. 952-1518.

DESK, perfect for home office, new, never used, see www.bushfurniture.com/html/desks_29.htm for picture, $175/obo. 626/403-9002.

DESK TOP, white, 5 ft., which sets on two 2-drawer file cabinets, makes a great workspace, $20; DESK, white, 3-drawer, $15, COMPUTER TABLE, with adjustable keyboard, excellent cond., $15. 626/ 445-2616.

EXERCISE BIKE, Turnturi, $150; KICK BAG, water filled, $10; BAND SAW, $150. 790-7079, 9 a.m.- 6 p.m.

EXERCISE MACHINE, DP 8200 Gympac, weights on pulley system, bench press and leg press, like new, good for beginners and intermediates, $95. 909/278-1870.

EXERCISE MACHINE, NordicTrack Pro, hardwood skis, speedometer, good condition, $100/obo. 952-2581.

FAX, plain paper, Sharp U1100, programmable, $75; MICROWAVE OVEN, large 1.2 cu.ft. w/rotating base, Goldstar, $50. 248-6263.

FURNITURE, oak: computer desk, 2-piece, L-shape w/butcher block top, keyboard drawer, 5 drawers, 2 for files, 1 w/lock; file cabinet, vertical, 4 drawers, 1 w/lock; shelf unit w/8 shelves 50w x 60h x 12d, all in very good condition, all for $500/obo. 626/791-6101.

HIKING BOOTS, Vasquez, women's size 7, new, orig. $150, sell $75; JACKET, new, black leather, western style, $150; INFANT EXERSAUCER, $25; MISC.: reasonably priced assorted brand name infant girl/toddler dresses, outfits, shoes and tricycles. 626/798-6248.

METAL DETECTOR, Bounty Hunter Landstar, a perfect Christmas gift to teach kids about science, top of the line, only used twice, $250. 248-6062.

MIXER, Kitchen Aid, 5 qt, heavy duty, 325w, blue, exc. cond., $260. 909/624-0564.

MODEL RAILROAD MAGAZINES, BOOKS & JOURNALS, all types, various dates btw 12/93 and 9/99, $1 each or $50 for all. 626/358-1786, Dave.

MONITOR for 15" Macintosh, keyboard, mouse, La Cie 24X cd drive, La Cie hard drive, $150 or sold separately. 790-5012.

PEDAL CAR, Oscar Mayer, only 3,000 made, $165; COMPUTER, vintage K-Pro portable, still works, $25; DOOR KNOBS, vintage ('20s) glass, $10/pr.; RECORDS, old 78 RPM, $.50 each. 248-5282.

PIANO, Yamaha, ebony, 48" upright model U1, good to excellent condition, $3,000/obo. 310/828-1997.

PRINTER, Canon 5500, color, fax, scanner and copier, new in box with manuals, used 2 times, $200/obo. 626/359-7608.

REFRIGERATOR, 16.5 cu., almond, w/icemaker, new, excellent condition, $275, available after Dec. 12. 909/596-8117.

SKATES, Microblade by Rollerblade, youth size 1 & 2, two boot sizes for the skates, black, hardly used, $70. 952-8455.

STOVES: gas, $25; electric, $180; TV, large console, $20; HIGH CHAIR, $5; ROUTER TABLE, $40. 790-7079, 9 a.m-6 p.m.

TABLE dinette, square glass top 5'x5' w/metal feet and 4 matching chairs, $800/obo; BAR STOOLS, four matching, metal frame, all in superb condition, $400/obo. 626/398-3480.

TELEVISION, Panasonic, 25" diagonal, wooden cabinet, remote control, 8 yrs. old, $150/obo. 626/398-3480.

Vehicles/Accessories

'90 ACURA Integra LS, 2 dr. hatchback, white, automatic, 147k mi., excellent condition, orig. owners, a/c, am/fm/cass., pwr. steering, sunroof, tilt wheel, cruise control, 27 mpg, $4,500/obo. 626/303-6064.

'99 DODGE truck, 1500 quad, 2X2, blk., V8, exc. cond., a/c, pwr. doors and windows, back window, tilt wheel, cruise control, 35k miles, $19,000. 626/447-3993.

'98 DODGE Durango SLT+, 4X4, loaded, 23k miles, must see to appreciate, $22,995. 661/255-5645.

'97 FORD Explorer XLT, only 26,000 miles, new tires, excellent condition, am/fm/cass., gold color, $18,000/obo. 626/355-5631 after 6 p.m.

'94 FORD Club Wagon XLT, 12-passenger van, 5.8 L, V8, 76k miles, a/c, power everything, ABS, alarm, AM/FM cass., premium sound, tow package, recent tires, front brakes, shocks, excellent condition, $13,500. 790-3217.

'89 FORD Tempo GL, 4 dr, ps/pb, a/c, new paint, new brakes, new tires, looks great, runs good, 175,000 miles, alloy wheels, power locks, cruise, original owner, $2,300/obo. 626/966-2904.

'89 HONDA Pilot ATV, sand tires, spare drive belt, shop manual, OEM tires, $4,500. 353-1851.

'92 LEXUS SC400, loaded, white with beige leather, Nakamichi stereo, factory phone, 104k miles, tags paid to 5/01, $13,000. 952-1538.

'92 MITSUBISHI Expo SP, 7-passenger minivan, a/c, sport package, 5-speed stick, cruise control, tilt wheel, roof rack, cassette, orig. owner, 115k miles, very good condition, new car on way, must sell, $4,000. 909/861-4202 after 6 p.m.

'90 SKAMPER camper trailer, pop-up, sleeps 5, electrical hook-ups included, very easy to tow, great condition, $1,500. 626/358-1786, Dave.

'98 TOYOTA Sienna LE, loaded, with captain chairs, approx. 35k miles, earth tone in color, very clean, well maintained, excellent condition, original owner, $21,000. 626/850-4378 daytime or 909/598-0065 after 7 p.m.

Wanted

CAT TREE, tall; bookcases of various shapes and sizes; display cases to hold lots of CDs, VHS & audio cassettes; computer desk; computer chair; laser printer stand. 626/397-7224, Charlie.

CO-OP looking for a place to live from Jan-April/May. gte164@prism.gatech.edu, 404/206-4224.

ICE SKATES, for figure skating, women's size 8 or 8 1/2. 626/683-9177, Laurence.

PASADENA JAYCEES seek new members to have fun, meet people and do great things for the community; mixer the third Wed. of every month at 7 p.m. 626/792-5146.

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

TO RENT 1-bd. rear house, guest house or duplex in Altadena, La Crescenta, Montrose or La Canada area/vicinity; for quiet, non-smoking female (7+ years Caltech employee). 626/577-5133 eves/wknds, Doreen.

Free

COMPUTER PARTS, power supplies, desktop cases, old parts for hobbyists. 626/794-9579.

PLAYHOUSE, sturdy plastic, outdoor, red and white. 952-2581.

SOFA, 2 pieces, good condition, you pick up. 626/443-9774.

For Rent

ALTADENA, 2 bd., 2 ba., hardwood floors, living room w/fireplace, dining room, attached 2-car garage w/laundry hook-up, fenced yard, water, garbage and gardener included, on private cul-de-sac. 626/798-3640.

GLENDALE, exclusive house and location, large room avail., central courtyard, running fountain, deck w/gazebo, complete house privileges, no drinking/smoking, 20 min. to JPL, $700. 246-4750.

LA CRESCENTA apt., 1 bd. w/dinette, 10 min. from JPL, $675. 626/445-0884.

PASADENA, room available in a 2-bd. house, short term (1 year), nice quiet neighborhood, close to PCC, Caltech and Old Town, 10 minutes from JPL, very clean home, no drugs or alcohol, full kitchen, washer and dryer privileges, female preferred, have to be non-smoker and clean, $425 plus 1/2 utilities. 626/399-6961.

PASADENA apt. to share, 2 bd., 1.5 ba., fully furn., laundry, carport, 2 mi. to Caltech, gd. for co-ops, avail. Dec. 23, $575 + util. 626/351-9641.

Real Estate

PRESCOTT, Arizona, 1/2 acre lot, Timber Ridge Subdivision location, one of Prescott's finest, in the Ponderosa Pines, located at end of a cul-de-sac, includes underground utilities, indoor/outdoor pools and tennis courts, lot ref. #MLS-357840, $65,000. 626/798-2440, evenings, Tim Parker at Prescott Pines Realty, 888/540-7355.

VALLEY VILLAGE townhouse/condo, large (1,485 sq. ft.), 2 bd., 2 1/2 ba., 20 min./JPL, exc. layout. 626/798-6588.

Vacation Rentals

BIG BEAR cabin, quiet area near village, 2 bd., sleeps 8, completely furnished, f/p, TV/VCR, $75/night. 249-8515.

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

CAMBRIA, ocean front house, sleeps up to 4, excellent view. 248-8853.

HAWAII, Maui condo, NW coast, on beach w/ocean view, 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, mcrowv., 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 ARROWHEAD house, 4 bd., 2 1/2 ba., sleeps 10, quiet, secluded, relaxing, woodsy area of Cedar Glen, http://www.highcountryrents.com/cedar_run.html for pictures/rates, already booked for New Year's, JPLers who book directly with owner get 2 for 1 + cleaning fee. 626/403-0446.

MAMMOTH condo in Chamonix, at lifts 7, 8, 16, 17, walk to warming hut, 2 bd., 2 ba., sleeps 6, fully equipped elec. kitchen, incl. microwave & extras, fireplace and wood, color TV, cable, fm stereo, o/d Jacuzzis, sauna; game, rec., & laundry rooms; conv. to lifts, shops, special events; daily/weekly rates, special midweek rates. 249-8524.

MAMMOTH, Courchevel, walking distance to Canyon Lodge and lifts, 2 bd., 2 ba., sleeps 6, fully equipped unit. 661/255-7958.

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft, sleeps 6-8, fully equipped kitchen incl. microwave, D/W, cable TV, VCR, phone, balcony w/view to mtns., Jacuzzi, sauna, streams, fishponds, close to Mammoth Creek, JPL discount. 626/798-9222 or 626/794-0455.

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