

universe

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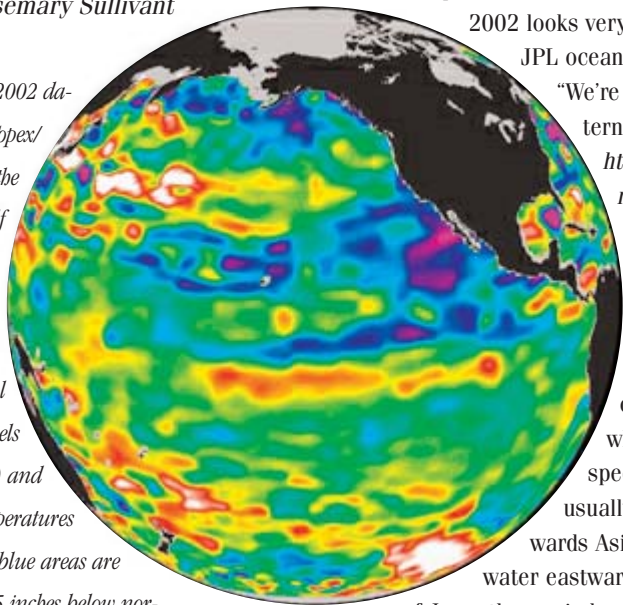
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As summer starts, next El Niño is slow to grow

By Rosemary Sullivant

Data June 14, 2002 data taken by Topex/Poseidon show the Bering Sea, Gulf of Alaska and U.S. West Coast, where lower-than-normal sea-surface levels (blue areas) and cool ocean temperatures continue. The blue areas are between 2 and 5 inches below normal, and the purple areas range from 6 to 7 inches below normal.



The Pacific Ocean doesn't show signs of anything that looks like the whopper El Niño of 1997-98, according to the latest information from the JPL-managed U.S.-French ocean-observing satellite Topex/Poseidon.

The data do show that the mid-equatorial Pacific Ocean has slowly warmed by about 1 degree Celsius (1.8 degrees Fahrenheit) above normal in the past few months. However, the Pacific continues to be dominated by the larger-than-El Niño/La Niña pattern called the Pacific Decadal Oscillation, which may discourage El Niño development. The image is available online at <http://www.jpl.nasa.gov/images/earth/pacificocean>.

"Except for some recent mid-Pacific warming, June 2002 looks very much like June 2001," said JPL oceanographer Dr. William Patzert. "We're still in an El Niño holding pattern." See the June 2001 image at <http://sealevel.jpl.nasa.gov/elnino/20010621.html>.

The ocean warming in the past month can be explained by a relaxation in the equatorial trade winds observed by the JPL-managed Quick Scatterometer (QuikScat) satellite, which measures ocean wind speed and direction. These winds usually blow from the Americas towards Asia, helping push warm water eastward. "For the first two weeks of June, these winds were unusually weak," said QuikScat Project Scientist Dr. Timothy Liu. "But by last week, they had returned to normal. If the weakening continued or intensified, we could have been expecting an El Niño to develop by early fall." "For the past few winters the weather- and moisture-delivering jet

stream has been steered north by the Pacific Decadal Oscillation and other planetary patterns, resulting in a warm winter all across the United States and very dry conditions on the East and West coasts," Patzert added. "A large enough El Niño might provide some relief for the drought-plagued west, southwest and southeast U.S., but it's wishful thinking so far."

The Topex/Poseidon data were taken during a 10-day collection cycle ending June 14, 2002. They show that there hasn't been any fundamental change in the ocean's large-scale patterns for the past three years. The near-equatorial ocean has been very quiet, although sea levels and sea-surface temperatures are near normal or slightly warmer throughout the far western and central tropical Pacific.

The Pacific has settled into a negative phase of the Pacific Decadal Oscillation pattern for the past three years. This long-term ocean feature waxes and wanes approximately every 20 to 30 years. In its present phase, a warm horseshoe pattern of higher-than-normal sea-surface heights connects the north, west and southern Pacific, while a cool wedge of lower-than-normal sea-surface heights is in the eastern equatorial Pacific. More information on the Pacific Decadal Oscillation is available online at <http://topex-www.jpl.nasa.gov/elnino/20000118.html>.

Most recent National Oceanic and Atmospheric Administration sea-surface temperature data also clearly illustrate the warming of the western and central tropical Pacific and the persistence of the basin-wide Pacific Decadal Oscillation pattern. They are available online at <http://psbsgi1.nesdis.noaa.gov:8080/PSB/EPS/SST/climo.html>.

The Topex/Poseidon and follow-on Jason 1 missions are managed by JPL for NASA's Earth Science Enterprise, dedicated to understanding the total Earth system and the effects of natural and human-induced changes on the global environment.

For more information on Topex/Poseidon and Jason 1, visit the Ocean Surface Topography from Space website at <http://sealevel.jpl.nasa.gov/index.html>. More information on QuikScat is available at <http://winds.jpl.nasa.gov/missions/quikscat/quikindex.html>.

Visit the National Oceanic and Atmospheric Administration site at <http://www.noaanews.noaa.gov/stories/s794.htm> for seasonal weather forecasts.

Contour lifts off; JPL team set to navigate



Contour lifts off July 3.

SOLAR SYSTEM

NASA's Comet Nucleus Tour (Contour) spacecraft—set to provide the closest look yet at the "heart" of a comet—successfully launched Wednesday, July 3 at 2:47 a.m. EDT aboard a Delta II rocket from Cape Canaveral Air Force Station, Fla.

Designed and built by the Johns Hopkins University Applied Physics Laboratory in Laurel, Md., the 2,138-pound (970-kilogram) spacecraft was placed into an elliptical Earth orbit 63 minutes after launch. About 19 minutes later the mission operations team acquired a signal from the spacecraft through the Deep Space Network antenna station in Goldstone, Calif., and by 5:45 a.m. EDT Mission Director Dr. Robert Farquhar of the Applied Physics Lab confirmed the craft was operating normally and ready to carry out its early orbit maneuvers.

Contour will rely on JPL's navigation experts to guide the craft on its tricky journey toward two comets to find out how the icy, rocky bodies evolve as they approach the Sun.

The spacecraft is slated for a 15-month journey to Comet Encke followed by a two-and-a-half-year trip to Comet Schwassmann-Wachmann 3. The mission was conceived so that scientists could compare the older, less active Encke to the younger, dust-clouded Schwassmann-Wachmann 3. The different targets pose a challenge to the navigators, too.

"We'll be flying by quickly and close to Comet Encke. There will be just 10 minutes of time to take the science data, and our job is to protect that time," said Tony Taylor, chief of the navigation team at JPL. "On the other hand, Comet Schwassmann-Wachmann 3 has more dust and gas shooting from its inner body. We will fly past it a bit farther away to avoid being hit by a particularly large particle, and we'll have more time to observe the comet."

The navigation team will guide the spacecraft through its complex orbit. After six weeks, the navigators will steer the spacecraft toward the first of the two comets.

"It's like having two launches," said Dr. Bobby Williams, a member of the navigation team and the leader of the JPL navigation team that landed the Near Earth Asteroid Rendezvous spacecraft on the asteroid Eros in February 2001. "We have to fire a rocket to go into orbit around Earth and then about six weeks later fire another rocket to push the spacecraft out of Earth orbit."

The spacecraft will fly by each comet at the peak of its activity as it approaches the Sun. During each encounter, the target comet will be well situated in the night sky for astronomers worldwide to make concurrent observations from the ground. Protected by its dust shield, the spacecraft will fly by each comet nucleus to within a distance of 100 kilometers (62 miles).

The most intensive data-taking will occur within a day or so of each encounter.

The mission's design is flexible so that the spacecraft can be retargeted to intercept an unexpected comet visitor. If a "new" comet passes close enough to Earth's orbit, mission managers at the Applied Physics Laboratory will design a new flight path to take advantage of the opportunity to study the new comet. The JPL navigation team will then calculate the amount of fuel the spacecraft should burn, and for how long, to put it on the right path.

JPL will also provide communications support through the Deep Space Network, the worldwide series of antennas that provide radio communications for all of NASA's interplanetary spacecraft.

"JPL's participation is essential to making the mission happen," said Dr. Joseph Veverka, principal investigator and leader of the mission from Cornell University, Ithaca, N.Y. "We have to get the spacecraft very close to the comets and we have to communicate with the spacecraft—and we couldn't do those things without JPL. And one of the world's experts on comets, Dr. Don Yeomans of JPL, is part of our science team."

Comets may have brought to the forming Earth some of the water in the oceans, some of the gases of our atmosphere and perhaps even the building blocks from which life arose.

News Briefs

Caltech, JPL honored by United Way

Caltech and JPL have received the United Way's Community Landmark Award for the 2001-02 fundraising campaign conducted last fall.

The United Way of Greater Los Angeles chapter honored the campus and Laboratory at ceremonies last month. The organization said the award celebrates "the contributions of visionary companies that have found United Way of Greater Los Angeles to be a friend and messenger of their optimism and hope for the community." The award is given, United Way said, "to an organization that has demonstrated a true commitment to the United Way fundraising campaign and has championed the belief that United Way is the way America cares ... community by community."

JPL staff contributed approximately \$450,000 to the campaign, and Caltech staff added about \$150,000. "We are grateful to be honored in this way by United

Way," said TOM SCHMITT, assistant vice president for Human Resources Administration at Caltech. "All members of the Caltech community are pleased that the United Way would single out Caltech, including JPL, for the award and are only hopeful that we can continue to be as supportive or more so in the future as have been in the past."

NASA Internet sites honored

Two NASA Internet sites were honored last month with Webby Awards, sponsored by the International Academy of Digital Arts and Sciences. The awards recognize Web sites that are both aesthetically exceptional and which utilize technology to help build communities.

One of the awards, the People's Voice Award for Science, was given to the Earth Observatory, an interactive site that highlights news and imagery about NASA's Earth science research.

KAREN YUEN, JPL's Earth outreach theme lead, credited JPL staff members with providing significant contributions to the site. MIKE ABRAMS from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) team contributed image acquisition and caption writing; DAVE DINER and CLARE AVERILL from the Multi-angle Imaging SpectroRadiometer (MISR) team for outreach, and TIM LIU from the Quikscat science team, for providing images and words that keep JPL's role in predicting El Niño in the forefront.

The NASA home page, which serves

as the agency's entryway into its more than 4 million public World Wide Web pages, won the Webby's People's Voice Award in the Government & Law category.

Voters who register through the Webby Awards site select the People's Voice winners. The academy also has panels of judges who select their choice for the top site in each category based on a variety of functional and esthetic criteria.

"We're very pleased that Internet users voted NASA these awards," said GLENN MAHONE, assistant administrator for public affairs. "Since 1994, when people around the world were staying up late to see images of Comet Shoemaker-Levy colliding with Jupiter, the Internet has been an important means of fulfilling NASA's mission to inspire the next generation of explorers in ways that only NASA can."

The Earth Observatory, at <http://earthobservatory.nasa.gov>, is sponsored by the NASA Goddard Space Flight Center, Greenbelt, Md., and the Office of Earth Science at NASA Headquarters.

The two winning sites are the fourth and fifth NASA sites to be selected for Webby honors during the past six years. Previous winners include JPL's Mars Pathfinder (<http://mars.jpl.nasa.gov/MPF>) which garnered the 1998 People's Voice for Science.

The full list of winners and nominees can be found on at <http://www.webbyawards.com>.

Atlas will launch Mars '05 orbiter

NASA has chosen the Atlas III expendable vehicle offered in a competitive bid by Lockheed Martin Commercial Launch Services Inc. for the launch of JPL's Mars Reconnaissance Orbiter, scheduled in 2005. Lockheed Martin Commercial Launch Services is a division of International Launch Services of McLean, Va.

This is a firm fixed-price task order awarded under the terms of the current NASA Launch Services contract for intermediate-class launch services, for which Lockheed Martin Commercial Launch Services is one of two selected providers.

The prime contractor for the Mars Reconnaissance Orbiter spacecraft is Lockheed Martin Astronautics in Denver, which is responsible for spacecraft design, integration of the science instruments and the support of mission operations.

The Mars Reconnaissance Orbiter spacecraft will weigh approximately 1,975 kilograms (4,355 pounds) and have a 250 by 320 kilometer-high (200 by 155 mile) polar orbit around Mars. The spacecraft's instruments will provide significant improvements in resolution and data volume over previous missions and are being developed by both U.S. and international investigator teams. The spacecraft will also provide telecommunications and navigation support for future Mars missions.

Special Events Calendar

Ongoing Support Groups

Alcoholics Anonymous—Meetings are available. Call the Employee Assistance Program at ext. 4-3680 for time and location.

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

Gay, Lesbian and Bisexual 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.

Caregivers Support Group—Meets the first Thursday of the month at noon in Building 167-111 (The Wellness Place). For more information, call the Employee Assistance Program at ext. 4-3680.

Working Parents Support Group—Meets the third Thursday of the month at noon in Building 167-111 (The Wellness Place). For more information, call the Employee Assistance Program at ext. 4-3680.

Tuesday, July 9

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

Thursday, July 11

Contract Management—The first session of a class that is part of the UCLA Extension/JPL Government Contract and Proposal Management Certificate Program begins in Cafeteria 190 from 5:30 to 8 p.m. Class continues through Sept. 12. Enroll tonight, with credit card or check; fee is \$380. For more details call Dana Edler at ext. 4-5825.

Monday, July 15

"The Odyssey of Odyssey: Why We Could Not Fail"—Mars Odyssey Project Manager Roger Gibbs, Mission Manager Dave Spencer and Project Scientist Steve Saunders will speak at 4:45 p.m. in von Kármán Auditorium. Gibbs will discuss challenges the project faced during the development phase; Spencer will discuss the preparation for and execution of the operations phase; and Saunders will discuss the significance of the first science data return. The talk is sponsored by the Caltech Management Association. For membership information, contact Priscilla Fraschetti at ext. 4-4964, mail stop 264-255.

Tues., July 16-Wed., July 17

Investment Advice—A TIAA/CREF representative will be available for one-on-one counseling in T1720-131. For an appointment, call (877) 209-3140 or visit www.tiaa-cref.org.

Wednesday, July 17

Career Day—Student employees are invited von Kármán Auditorium from 1 to 4 p.m. to learn about the technical

and business divisions' vision and mission, work activities and job listings for new graduates, academic part-time and co-op students. Representatives of JPL's student employment programs will be available. Bring copies of your resume.

Thursday, July 18

JPL Stories—Dr. Ed Stone, Voyager project scientist and former JPL director, will present "Voyager—the Journey of a Lifetime" from 4 to 5 p.m. in the customer services area of the Library, Building 111-104. For information about the story series, call Teresa Bailey at ext. 4-9233.



Social Security—A representative will be on Lab for counseling. For an appointment, call the Benefits Office, ext. 4-3760.

TIAA/CREF Enrollment Meeting—Employees newly eligible for Caltech/JPL retirement plan participation are invited to Building 180-101 from noon to 1 p.m. for help in selecting investment options and completing enrollment forms.

TIAA/CREF Workshop—"Estate Planning," to be held from 10 to 11:30 a.m. in Building 180-101, will focus on gaining a better perspective on planning for your financial future and meeting financial goals. Consultant Julie Thomas will discuss wealth transfer in a tax-effective manner, charitable gift giving, and maximizing the transfer of significant retirement plan assets.

Thurs.,-Fri., July 18-19

Von Kármán Lecture Series—Galileo science team member Dr. Rosaly Lopes-Gautier will present "Jupiter's Moon Io: A World of Great Volcanoes" Thursday in von Kármán Auditorium and Friday at Pasadena City College's Vosloh Forum, 1570 E. Colorado Blvd. Both lectures begin at 7 p.m. For more information, call Public Services at ext. 4-0112 or visit <http://www.jpl.nasa.gov/events/lectures/jul02.html>.

Tuesday, July 23

Investment Advice—A Fidelity representative will be available for one-on-one counseling in T1720-131. For an appointment, call (800) 642-7131.

Ongoing

JPL Tennis Club—A round robin is held Saturdays at 9 a.m. at El Molino School tennis courts, at the corner of Del Mar Boulevard and El Molino Street. Parking is available. For information, call Gordon Blackhall, ext. 4-6981 or Jorge Vazquez, 4-6980.



United Way of Greater Los Angeles

Left to right: Dlorab Gonzales of Caltech's human resources office; Joe Haggerty, president of United Way of Greater Los Angeles; and Angela McGahan, manager of JPL's Internal Communications Office.



Celebrating Heritage Week

Hundreds of JPLers enjoyed the final day of American Heritage Week, which was held June 10-13. At left, a Henna artist draws a tattoo; at right, Tony Saddul (l) and Jean Cheng dance to the Chaffey College/Cal Poly Pomona Latin Jazz Band.



Photos by Dutch Slager / JPL Photolab

As the future of space exploration expands to regions more remote and more hostile than ever explored before, spacecraft of the future will have to live longer and be able to withstand the adverse conditions associated with harsher environments.

BY DEREK BLACKWAY

JPL researcher Adrian Stoica of Section 3445 has dedicated his career to developing technologies for this very goal. He and his six-person team of researchers have been developing and testing evolvable hardware designed to enhance the survivability and versatility of spacecraft in extreme situations.

"Evolvable hardware is a relatively new technology, born at the confluence of automated design, artificial intelligence and reconfigurable hardware," Stoica said. "It addresses hardware that changes/self-configures itself for meeting new requirements or for improving its performance. It is the only proven technique to automatically synthesize (analog) electronic circuits. Moreover, this can be done it on-chip and in-situ."

Evolvable hardware—the first concept of which was proposed in 1994—is based on the same idea as the evolutionary process occurring in the biological world. In a silicon chip about the size of a fingernail, robust search algorithms, called genetic algorithms, seek solutions from a vast search space within seconds. The search spans a variety of candidate solutions or circuits, which are obtained from the genetic code associated to each circuit. The circuit that satisfies the requirement the best is the one chosen as the first solution to fix the problem. The system then builds on itself, reconfiguring stronger solutions.

Genetic algorithms are combined with reconfigurable hardware devices to achieve reconfiguration autonomously, thereby making them self-configurable, which is the next step forward from hardware that is only able to be reconfigured by a human.

"If you are operating in an environment far away," Stoica explained, "you would need the capability of finding electronic solutions to address situations that occur, without the benefit of a human designer. This is a method of getting an on-board way of solving the problem."

"In case of faults or degradation of electronic components, such is often the case with flight hardware, evolvable hardware can find new circuit topologies or chip architectural arrangements that bypass the faults or reuse the components in a different way than the original one, salvaging some part of their capabilities. This leads to a new system that is able to continue and maintain the existing functional-

interested in automated design," Stoica said.

Stoica's supervisor, Anil Thakoor, has been a strong supporter, acting as a lobbyist for the new technology as well as appealing to NASA and the Department of Defense. "Anil had the vision to see the opportunity of this technology at a time when there were no chips and no proofs, only some ideas," said Stoica.

"Adrian and his team get the credit for bringing evolvable hardware to JPL and making NASA and the Department of Defense aware of the technology, championing it for space applications," Thakoor said.

Not long after the initial funding (a Director's Discretionary Fund grant from former Chief Scientist Dr. Moustafa Chahine), Stoica started gathering a team and fabricated the world's first evolvable analog chip.

In choosing his team to bring to JPL, Stoica looked for good old-fashioned experience, hand-picking the best researchers bringing from leading research labs around the world. "I brought Didier Keymeulen from Electrotechnical Lab in Japan, and Ricardo Zebulum from the group at University of Sussex (United Kingdom) that first demonstrated evolvable hardware. Michael Ian Ferguson came from the European Organization for Nuclear Research, on the border between France and Switzerland, just outside Geneva," explained Stoica, referring to key team members. "We are now the best team in the world, as measured by technology demonstrations, publications and references to them, and individual recognition of the team members."

The team also initiated and has been organizing the main event in the field: the NASA/Department of Defense Conference on Evolvable Hardware, which this year will be held in Washington, D.C from July 15 to 18.

The team does its experimental work in the Evolvable Systems Lab, part of JPL's Center for Integrated Space Microsystems facilities. Here the chips are put in environmental chambers in which the temperature can be altered to extreme conditions. The chips self-reconfigure to recover from degradations induced by extreme temperatures.

The team has designed and fabricated three generations of evolvable chips.

"One of the accomplished goals for our latest chip was for it to be able to rapidly perform the testing of hundreds of thousands of circuits that were evaluated in a matter of seconds, and result in an evolved/synthesized circuit solution that satisfied

Hardware EVOLUTION

JPL TEAM WORKING ON WAYS TO GIVE SPACECRAFT LONGER LIFE



ity, although the components are not exactly the same or not in the same arrangement."

Before joining JPL in 1996, Stoica earned his doctorate in robot learning from Victoria University in Melbourne Australia and had been working in the field of adaptive and learning hardware since 1986. He started working in evolvable hardware when he was hired at JPL. "I got into this because I was

the imposed requirements," Stoica said. "It's an excellent result, but we realize there is a long road from laboratory proof-of-concept to insertion of technology in space."

During this long road, Stoica focuses on small goals.

"Part of what makes me happy," he said, "is the emotional reward when you solve a problem, find a solution to a previously unsolved problem, or when you know something that no one else on Earth knows. And for us, that happens on a day-to-day basis. We're exploring totally new ground. Our chips allow us to do unique experiments that no one else in the world can do. We discover many things that wouldn't be possible if we didn't have these chips."

More "material" rewards for Stoica include the JPL Lew Allen Award, as well as other prizes and invitations to deliver keynote addresses and tutorials.

Stoica and his team can often be found working late nights on Lab. "I am fortunate to have a great team," Stoica said. "We are very close. We work hard together, go to conferences together, go to baseball games and ski together. This facilitates inter-communication and keeps our motivation high."

As the workload intensifies, the excitement level of the group remains consistently steady.

"We are excited about our progress, although, as happens all over the world of science, the more you know, the more questions appear, and you realize that there is still a lot of work to be done," Stoica said. "Still, I strongly believe that evolvable hardware concepts will be the very essence of all infrastructures 20 to 30 years from now, and will play an important role in enabling more survivable space hardware."

Adrian Stoica shows three generations of evolvable chips built at JPL.

The largest one, developed last year, measures about 30 square millimeters.

Passings

AUDREY ADKINS, 75, a retired senior photo lab technician in Section 642, died May 30.

Adkins worked at JPL from 1959-88. Services were private.

HAROLD CONWAY, 81, a retired senior instrumental specialist in Section 375, died June 1.

Conway joined the Lab in 1979 and retired in 1986. He is survived by his wife, Emily, and son Harold.

Services were private.

JOSEPH AUSTIN, 65, a retired maintenance electrician in Section 662, died of lung cancer June 8.

Austin worked at the Lab from 1982-95. Services were private.

JACK DUNN, 70, a retired senior test specialist in Section 357, died of desmin myopathy June 12.

Dunn joined JPL in 1967 and retired in 1995. He is survived by his wife, Margaret, and sons Jack Jr. and Russell.

Private burial was in Dayton, Ohio.

Retirees

The following JPL employees retired in July: Timothy Scheck, 38 years, Section 910; Yi-Chien Wu, 33 years, Section 353; Santosh Srivastava, 27 years, Section 323; Gail Huddleston, 22 years, Section 331; Marilyn Pistoll, 22 years, Section 311; Noel Tibbetts, 16 years, Section 245; Richard Capps, 15 years, Section 700; Robert Van Steenburg, 11 years, Section 813.

Letters

Thanks to the Staffing department and the party committee for the wonderful retirement party held in 167. It was wonderful and the food and gifts were terrific. I will look so good on the golf links. I will miss you all but especially all my co-workers in Human Resources whom I have worked with for over 15 years. I am looking forward to a rewarding retirement, but I will keep in touch and I wish everyone much happiness and prosperity.

Noel Tibbetts

Classifieds

For Sale

AIR CONDITIONER, Sharp Comfort Touch energy saver, model AFT 908X, 110V, 8.500 BTW, \$200/obo; TABLE FANS, misc., \$20/obo, 248-1856, Gordon.

BABY ITEMS: soft front carrier, Evenflo, \$7; car seat w/base, Century, rear-facing, \$40; bathtub carousel, Safety1st, \$7; all in superb cond., prices are obo, 626/791-6101. BED, antique oak & rod iron, queen size w/rails, \$150/obo; SKI SET, used, women's Head, 170s Gala radial & poles, Salomon boots, size 7 + bindings, see pictures @ERC, \$120/obo, 626/744-9064.

BEDS, 1 twin XL, 1 full, both include mattress, box spring, frame, exc. cond., almost new, \$60/ea./obo, 247-3439, Sean. BICYCLE, women's 29", Centurion Comp TA road bike, equipped with Shimano 600 derailleur, etc., terrific cond., \$60, 956-3745, Steve.

CAMERA, Mamiya M645 SLR, A & E prism, 220 back, w/120 & 220 roll film cylinders and inserts, deluxe power motor dr. lenses, 45 mm, 80 mm & 105-210 zoom, Sunpak auto flash, mod. 555, aluminum case, \$2,200, 323/257-7668.

CELL PHONE, Ericsson R280LX, Internet browser, tri-mode, five-line display, two-way text messaging, includes battery, fast charger, earbud headset, and all original manuals and paperwork, used with AT&T Wireless but should work with any service, \$40/obo, mckenn@earthlink.net.

COFFEE MAKERS: Krups, 10-cups, white/gray, like new, \$40/obo; Braun, 10-cups, white/black, like new, \$30/obo, 626/791-6101.

COMPUTER, Compaq, 300 MHz, 128 MB RAM, 3.2 GB hard drive, new 56K modem, new mouse/KB, computer only \$295; 15" monitor, \$65; 17" monitor, \$95, 626/486-0999.

DISNEY WORLD TICKETS, 4, good for any Disney World theme park, valid thru end of 2003, regularly \$48/ea., sell for \$40/ea.

956-1744.

DODGER TICKETS, 2, selected games, Loge (orange) level, aisle 140, row J, seats 1, 2, parking not included, sell at face value, \$23/ticket, 626/296-1253.

FOREIGNER TICKETS, 4, fourth row seats at the Grove in Anaheim, next to the Edison Field in Anaheim, 2 or 4 tickets, will not sell single tickets, \$96/ea, 219-0965.

KITCHEN TABLE & CHAIRS, butcher block style w/white legs, 60" long 33" wide, 6 Windsor style chairs, sturdy, \$175, 952-8455.

MISC ITEMS: receiver, Sony DSS, \$40; TV, Toshiba, 20" color, \$25; car cover, Falcon mid-size, \$10; pictures, framed, dance oriented, 3, 2 x 3ft, \$5/ea.; tablecloth, oval 60 x 84, tan, \$3; rocking chair cushions, tapestry-tie, \$10; pool raft, \$3, 626/447-7584. MOUNTAIN BIKE, specialized Rockhopper, women's model, 15", 2 yrs old, hardly ridden, exc. cond., can e-mail photo, \$350, 626/304-0403.

MOVING SALE: glass top table, \$45; 2 bar stools, \$30, queen mattress + box, \$120; Rock Hopper, \$80; blender, \$10; coffee table, \$10; Mac 603e /200/4GB/60MB+ 17" monitor + 28.8 modem, \$50; futon, 8", \$80; grill, gas w/spare new grate, \$70; glasses, plates, and silverware, \$5/all; bookcase, \$5; sofa, \$20, 3 chairs, \$15; cookie jar, Sagauro, \$5; JGRs, complete set, Viking era, free; toaster, \$5; TV stand, \$10; answering machine, digital, \$20, 352-3777.

MOVING SALE: TV, Sony 27" Trinitron, like new, \$200; TV, Sharp 17", vg condition, \$30; vacuum, good condition, \$20; Grill, Kenmore, \$20; microwave, Sharp, \$15, swinging chair \$5; 2 chairs, very sturdy, leather/wood, \$5; dining table, glass/wood, \$5, 626/577-9278.

PET DOOR, for sliding glass door, clear glass w/black aluminum frame, for cats up to 15 lbs or dogs up to 7 lbs., w/installation instructions, cost \$160, sell for \$60, 548-5656.

PIANO, Clavinova digital, Yamaha CLP 411, exc. cond., black, with bench, \$1,300/obo, 626-475-5790.

PLAYPEN, can also be used as portable crib, \$20, 626/797-3310, eves & weekends.

RANGE, electric, Tappan stove top and bottom oven, \$200/obo, 626/963-8288.

REFRIGERATOR, off-white, 18 cu. ft., Kenmore Coldspot, less than 1 year old w/1 year of warranty remaining, avail. August, \$400/obo, 626/289-6359.

SLIDE RULES, 2, log/tog duplex, Decitrig, and Doric pocket, make offer, 352-3588. SOFA/LOVESEAT, Broyhill, camel back, green, great condition, \$500/obo; COFFEE TABLE, and end tables, cherry, Queen Anne style, \$100/obo, 626/319-7234.

SOFA SLEEPER, makes into queen bed, abstract black, blue and mauve design, good cond., \$300; BICYCLES, 4, children's, \$15/ea.; PICNIC TABLE, 2 benches, \$20, 626/357-8210.

STEAM BUGGY, a better way to clean, without harsh chemicals, moved to small apt., no room to store, like new, pd. \$150, will sell for \$50, 248-3414.

TREADMILL, Perform, bought from Sears for \$623, used less than 15 times, moving sale, \$190, ah19_99@yahoo.com or 626/237-1256, eve.

TV CART, solid oak, on casters, 36 w x 23 d x 30 h, pull-out shelves for videos-DVDs behind door, location for VCR-DVD player behind glass panel door; large storage area with double doors, exc. cond., \$125, 626/398-8702.

Vehicles/Accessories

'91 ACURA Integra GS, red, 167K mi., new tires, brakes, stereo w/12 CD changer, must sell, \$3,700, 805/522-2721.

'00 BMW 323i, silver on black leather interior, premium sport pkg, includes: wood trim, moon roof, xenon headlights, steptronic automatic trans, and Harmon Kardon premium sound, Lo-Jack, 35,000 mi., great cond., Kelly Blue Book \$29,810, sell \$28,500/obo, 909/452-7594.

'95 CHEVROLET Camaro, silver, T-tops, V6, 5 spd, manual, 80K, exc. cond., \$8,000, 352-2380.

'95 EAGLE Summit wagon (twin of Mitsub. Expo), 85K, SUV space w/car-like ride, efficiency; auto, all pwr., a/c, good mileage, clean, new timing belt, tires, seals, all belts, etc.; needs trans. work; \$1,950/obo, 661/424-1420.

'01 FORD Escape, 3.0 V6, 4 w/d, 26K mi., loaded, premium sound, 6 CD, towing package, auto trans., mocha int./ext., 2 new tires, exc. cond., \$19,950, 626/296-4082, Ted.

'96 FORD Aspire, red, stick shift, new CD player/speakers, new tires, brand new fuel pump, good cond., only 70K mi., \$1,000/obo, 626/351-4606.

'96 FORD Escort LX, 2 dr, hatchback, stick shift, a/c, stereo, only 60K mi., great commuter car, exc. cond., \$4,350, 909/985-6806.

'95 HONDA Civic, white, 4 dr., automatic, 96K, a/c, cruise control, am/fm cass., pwr. steering/window/door locks, ABS brakes, dual airbags, exc. cond., 1 owner, \$6,000, 626/577-9278.

'90 FORD Taurus L, 4-door sedan, 3 liter V6, automatic, cruise, a/c, power locks, radio/cassette, 101K mi., gd cond., drives well, \$1,850, 323/845-9340.

'67 FORD Mustang 390, 4-speed S Code coupe, Ford Blue exterior, new interior, great condition, must see, \$6,500/obo, 626/339-9353, Greg.

'91 JEEP Laredo, 4 dr., 2/4 w/d, 4.0 I/6 cyl., air, tilt wtl., crs cont., r/r/k, AM/FM, power everything, \$3,500/obo, 323/256-6634, Mary.

'90 LODESTAR inflatable boat, 10', 20 HP max, 6 person max, oars, bench seats, rmvbl floor, great for sea, rivers & lakes, \$600, 909/237-8808.

'79 MCI M65C, 39 passenger coach with toilet, 35 foot with automatic trans, V6, air, new generator, starter, tires, great motor home conversion, \$12,000, 626/728-2375.

'97 MERCURY Villager GS minivan, 7

passen-ger, CD player, very good cond.,

\$7,900, 661/286-1038. '91 NISSAN Stanza XE, exc. cond. inside and out, power steering/brakes, automatic, a/c, everything works, very well maintained, one owner, \$3,000/obo, 626/577-0778.

'89 NISSAN Maxima GXE, auto, very good cond., orig. owner, all service records, 175K mi., a/c, power sunroof/windows/doors/seats, Bose stereo, \$1,950, 248-6263.

'96 SAAB 900S, dark green with beige interior, 80M, orig. owner, exc. cond., all maintenance records, 5 spd., a/c, factory stereo, alloy wheels, \$7,900/obo, 310/306-7319, Mike.

'96 SAAB 900SE turbo convertible, 5 spd., red/black, leather interior, CD changer, all options; exc. condition, 43K miles, \$15,900/obo, 249-1749

'99 SATURN SCZ coupe, 5 spd., a/c, power steering, windows and door locks, tilt wheel, cruise control, am/fm stereo w/CD, premium sound, dual front air bags, leather interior, rear spoiler, 43K mi., 6 yr/75K extended warranty is transferable, \$10,500/obo, 686-8117 or 426-1121.

'93 SATURN SL2 DOHC, 5 speed, green, beige interior, 199K mi. mostly freeway, 4 dr, 30 mpg, clean inside/out, new clutch, new tires, a/c, ps, pb, am/fm cass., orig. owner, spider spikes for snow, split fold down rear seat, new sheepskin driver seat cover, \$3,500/obo, 626/395-0455.

'94 SEADOO GTX, 2, both are 3 seaters, new upholstery, pre-mix required, 1 has new '94 engine, other has new top end, lake tuned, vg cond., includes 2000 Ziena trailer, \$6,500, 626/359-7666.

'86 SUZUKI GSX-R 750 motorcycle, 21K mi., very clean and in great shape, CVK carbs, KN filters, Kerker K2 pipe, degreed cams, lots of spares and extras, \$2,500, 640-7479, Greg.

'96 TOYOTA Corolla DX, 4 dr., all pwr., dual a/b, a/c, am/fm, cass, CD, new tires, exc. cond., 137K mi., \$5,900, 248-6440.

'96 TOYOTA Corolla DX, 4 dr., all pwr., dual A/B, a/c, am/fm, cass, CD, new tires, exc. cond., 137K mi., \$5,900, 760/246-3825.

'88 TOYOTA Camry LE, automatic, sunroof, am/fm cassette, power windows, extra set of hubcaps, runs well but needs work, 181K mi., \$1,350/firm, 626/237-1275.

'84 TOYOTA Corolla, 5-speed, hatchback, black, 135K miles, strong engine, needs some work, but runs, good student car, \$500, 352-3777, Scott.

'01 VOLKSWAGEN Beetle GLS, silver/black leatherette, 5 spd., pwr. locks, windows and mirrors, cruise, alloys, am/fm cass., CD changer, fog lights, ABS, remote keyless entry, 8K mi., \$16,800, 626/449-0997, after July 24.

'66 VOLKSWAGEN Bug, refurbished inside/out, good engine, must see to appreciate, \$2,500, 626/355-7961.

'92 VOLVO 940GL, 4 dr., 117K mi., black, leather int., exc. cond., loaded, must see, \$6,500, 626/422-8332.

Wanted

AUTO ENGINE, any kind or condition, will pick up but can't pay anything, 626/357-7770.

GUEST HOUSE close to JPL for a married couple, no kids, no pets, non-smoker, 310/370-6905, Frank.

PLAY STRUCTURE, used, to buy, plastic mini-structure with small slide, steps, doors, etc., for toddler 1-3 yr. old, 626/351-8643.

ROOM, single male teacher seeks rent in Pas., SGV, Pomona for less than \$500; clean, quiet, responsible, Scuddy717@yahoo.com.

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

VANPOOL RIDER, Caltech vanpool #2 has open seats for new passenger, permanent or occasional, from Rialto, Fontana, San Bernardino, Cucamonga, Upland, La Verne and San Dimas; vanpool arrives at Caltech at 7:45, departs at 4 p.m. 626/395-6598, Jose.

For Rent

ALTADENA, condo for lease, minutes from JPL, 2 bd., 1.75 ba., nice closets w/organizers, fireplace, central a/c, community pool, storage room, 2-car garage/carport, tile counter top and marble floor in kitchen, large patio with landscape, planters and oriental garden with waterfall and spa; an end unit with windows on three sides, cable on, for rent by owner, \$1,200, 626/398-1988.

ALTADENA house, 3 bd, new kitchen, new ba., shaded yard, .5 mi. east of JPL, water & trash paid, non-smokers, \$1,500, 382-4751.

ARCADIA apt., spacious 2 bd., + den, 1ba., 2nd floor in 3-unit building, new paint, remodeled kitchen, pkg. washer/dryer in unit, a/c, walking distance to shops, bus stops, nice neighbor-hood, good schools, \$1,250, 626/576-7333.

LA CRESENTA, apt. to share, 2 bd., 1 ba, washer/dryer, 15 mins./JPL, no smoking or pets, female preferred, \$425 + 1/2 util, 249-9739.

LA CRESENTA house, 3 bd., 2 ba., 3 yrs. old, large yard, quiet wooded neighborhood, \$2,400, 249-2990.

MONROVIA HILLS, charming 2nd level of house w/a view, 2 bd., 1.5 ba., kitchen w/refrigerator & electric stove, dining rm., living rm, master bd. w/walk-in closet, laundry rm. area, \$1,200 w/2-car garage or \$1,000 w/out garage, 626/256-0015.

MT. WASHINGTON, room in newly remodeled, large home in tranquil, bucolic setting, private bd. with full bath, 15 min. to JPL, includes basic utilities, washer/dryer, satellite TV, off-street parking, \$900 + security dep. 323/478-1853, Priscilla.

PASADENA, nice Southeast area, cute 2 bd., 1 ba., house to share, furnished with hardwood floors, yard, laundry and 2-car garage, no smoking, I have a very friendly dog who stays at doggie day care M-F, only nights and weekends at home, \$800 + \$600 security deposit, 626/792-1330.

PASADENA guest house, above Eaton Canyon golf course, in a beautiful setting,

about 1,000 sq. ft., washer & dryer, ideal for one person with a very quiet lifestyle, \$895 + utilities, 626/798-4056.

PASADENA, spacious 2-story condo, 3 bd., 2.5 ba., prestigious community, beaut. inter., bright kitch., prof. landscape, ctrl. air & heat, close to shop., cozy l/r w/FP, end unit, frml. d/r, hdwd. flrs., immac. cond., close to schls, \$1,750, 626/396-9024.

PASADENA, cottage house, 1 bd., near JPL/Rose Bowl, washer & dryer, stove and refrigerator, gardener/auto sprinklers, carport, small, private yard, paid utilities, asking \$950, 626/794-8517, Art.

PASADENA, near Caltech, very nice, large, 2 bd., 2.5 ba. townhouse, w/hardwood, floors, fireplace, patio, A/C, washer/dryer, refrig., stove, new carpet, 2 car parking, \$1,600, 626/441-6955.

PASADENA, 3 bd., unfurn., 107 S. El Molino Ave., utilities paid except for gas and electricity, hardwood floors, stove, and laundry hook-up, parking for two cars, 1st and last month's rent, \$200 security dep. to move in, \$1,300, 626/793-8001 or jaywatkins@earthlink.net.

PASADENA apt. to share, 2 bd., 1 ba., 5 min./ JPL, on Del Mar, 2 blocks so. of Colorado, fireplace, porch, gym, sauna, pool, Jacuzzi, cent. air, secured parking & building, avail. 8/15, \$725, 626/683-8864.

SAN MARINO house, 3 bd., 2 ba., 2-car garage with automatic opener, newly painted, remod-eled kitchen, dishwasher, a/c, laundry hookups, spacious family room overlooking yard, living rm. w/fireplace, gardener included, close to bus, exc. neighborhood & school district, \$2,850, 626/576-7333.

Real Estate

ALTADENA, 3 bd., 1 ba., 1,108 sq. ft., 7,668 sq. ft. lot, 2-car detached garage w/laundry facilities, by owner, \$285,000 or make offer, 800/836-8750, ext. 10020.

DUARTE, 4 bd., 2 ba., 2,019 sq. ft. home, 3-car garage, living room w/fireplace, vaulted wood ceiling family room w/fireplace and wall-to-wall built-in bookcase and kitchen bar, 7,500 sq. ft. lot, mountain view, \$379,000, 626/305-1919.

GLENDALE, 4 bd., 2.75 ba., 2,410 sq. ft. home, in pristine move-in cond., convenient 10 min. from JPL, in wooded Glenoaks Cyn. setting & wonderful neighborhood, bay-windowed living rm w/fpl, formal dining rm, large fam rm w/wet bar, & remod. oak-cab kit, spacious front porch w/cyn view, incl. kitchen & laundry appl., new carpet, paint, lighting, furnace, dbl-pane windows, Cu plumbing, \$529K, 323/937-9349.

LA VERNE/CLAREMONT--area townhouse, 2 master bd., 2.5 ba., approx 1,400 sq. ft., attached 2-car garage w/washer and dryer hookups, private yard and streets, \$205,000, 909/596-5774.

Vacation Rentals

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

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

HAWAII, Kona, ocean front on Keauhou Bay, house and guest house comfortably sleep 6, 3 bd., 2 ba., rustic, relaxing and beautiful, swimming, snorkeling, fishing, spectacular view, near restaurants, golf and other attractions, 626/584-9632.

HAWAII, Maui condo, NW coast, ocean front view, 25 ft. fr. surf, 1 bd, w/loft, compl. furn. phone, color TV, VCR, microwave, d/w, pool, priv. lanai, slips 4, laundry fac., 4/15-12/14 \$105/nite/2, 12/15-4/14 \$120/nite/2, \$15/nite/add'l person, 949/348-8047, jackandrandy@cox.net.

LAKE TAHOE, North Shore, condo, 2 bd., 2.5 ba., sleeps 6, pool, private beach, all amenities, convenient location, two miles to casinos, available by the week only, special JPL discount, \$650/week includes tax and cleaning, 626/355-3886, Rosemary/Ed.

MAMMOTH, Courchevel, fully equipped unit, 2 bd., 2 ba., sleeps 6, a short walk to Canyon Lodge and ski lifts, 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.

MAMMOTH townhouse, sleeps 8; pool, Jacuzzi, sauna, game room; newly decorated; 3rd night free, 626/794-6860 eves.

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

OCEANSIDE condo, fully furnished, 2 bd., 2 ba., fireplace, full kitchen, quiet, relaxing, in beautiful setting, located at beachside, with barbecue, pool, spa, game room, and great ocean view, easy walk to pier and restaurants, sleeps 8, available weekly or monthly, 909/981-7492 or dhauge@yahoo.com, Darlene.

PARK REGENCY, Park City, Utah, December 17-24, 2002, 1 bd., sleeps 4, all units have cooking facilities and are well furnished, many have gyms, pools, Jacuzzis, a tourist desk and some have daily family activities, \$550, 897-1203.

PUERTO VALLARTA, Villa del Mar, lg. studio, sleeps 4 max, rooms have microwave, kitchen, phones, cable TV, private patio, 3 pools, 3 restaurants, spa, private beach, charming town, top rated resort, avail only 12/28/02 - 1/4/03, on-site New Year's Eve Fiesta, see at http://www.myvuc.com/puerto_vallarta.shtm, 541-1340.

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 parking, 626/794-3906.

TIMESHARE, 1 week, anywhere in the world, for the flexible traveler, based on availability, 1 bd., expires Aug. 25, 2002, sleeps 4, \$500, 897-1203.

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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.

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