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T H E M E E A R T H

RECENT NASA AIRBORNE MEASUREMENTS AND A NEW REVIEW OF SPACE-BASED MEASUREMENTS OF THE THICKNESS OF EARTH'S POLAR ICE SHEETS CONCLUDES THEY ARE CHANGING MUCH MORE RAPIDLY THAN PREVIOUSLY BELIEVED, WITH UNKNOWN CONSEQUENCES FOR GLOBAL SEA LEVELS AND EARTH'S CLIMATE.

Rapid changes seen in Earth's polar ice sheets

By Alan Buis

Airborne measurements allow views of the frozen world on a grander scale

LARGE SECTORS OF ICE in southeast Greenland, the Amundsen Sea Embayment in West Antarctica and the Antarctic Peninsula are changing rapidly by processes not yet well understood, said researchers Dr. Eric Rignot of JPL and Dr. Robert Thomas of EG&G Services at NASA's Wallops Flight Facility, Wallops Island, Va. Their study, published last month in the journal *Science*, reviews progress in measuring changes in ice sheet thickness based upon technical advances and observations made over the past decade.

"Earth's polar ice sheets are changing over relatively short time scales, that is, decades versus thousands of years," Rignot said. Thomas added that today's more precise, widespread measurements tell us rapid changes are common. "These observations run counter to much accepted wisdom about ice sheets, which, lacking modern observational capabilities, was largely based on 'steady-state' assumptions," Thomas said.

"Remote sensing is allowing researchers to look at polar processes on continental scales and in greater detail than before," said Dr. Waleed Abdalati, Cryospheric Program manager at NASA Headquarters. "Closer examination using even broader advanced remote sensing techniques, including NASA's upcoming Ice, Cloud and Land Elevation Satellite, the

Rignot said understanding how polar ice sheets evolve is vital to society. "The Antarctic and Greenland ice sheets together hold enough ice to raise sea level by 70 meters (230 feet)," he said. "Even a small imbalance between snowfall and discharge of ice and melt water from ice sheets into the ocean could be a major contributor to the current sea level rise rate of 1.8 millimeters (0.07 inches) a year and impact ocean circulation and climate. During past periods of rapid deglaciation, ice sheet melting raised sea level orders of magnitude faster than today. This is the real threat of the ice sheets."

Rignot and Thomas' review summarizes current progress for two methods of measuring changes in ice sheet thickness: the mass budget method, which compares losses by melting and ice discharge with total net input from snow accumulation; and measuring elevation changes over time. These methods use various space remote sensing resources, such as laser and radar altimetry, the Global Positioning System and InSAR.

The review reports Greenland's ice sheet is losing 50 cubic kilometers (12 cubic miles) of mass a year due to rapid thinning near its coasts. That's enough to raise sea level 0.13 millimeters (0.005 inches) annually. "Rapid coastal thinning cannot be explained by a few warm summers and is attributed to a dynamic ice sheet response," Rignot said. "A possible contributor to the observed trend is increased lubrication from additional surface melt water reaching glacier beds through crevasses and moulins."

Rignot says the mass balance in Antarctica is much harder to calculate because the ice sheet is far larger, more remote and not well covered by existing key satellites. The researchers calculated net ice gains or losses for 33 Antarctic glaciers, including 25 of the 30 largest ice producers.

The West Antarctic ice sheet was found to be thickening in the west,

thinning rapidly in the north, and probably losing mass overall by roughly 65 cubic kilometers (roughly 15.5 cubic miles) a year, enough to raise sea level by about 0.16 millimeters (0.006 inches) a year. InSAR observations show several major glaciers that are accelerating and contributing to sea level rise. Radar altimetry shows ice shelves in the Amundsen Sea Embayment are rapidly thinning, possibly in reaction to a warmer ocean, as suggested by recent oceanographic data. Melting of ice shelf bottoms is far larger than expected here due to intrusion of warm water on the continental shelf, implying a larger interplay of ice and ocean in ice sheet evolution.

Rignot said little is known about the mass balance of Antarctic Peninsula mountain glaciers, which receive a

"Earth's polar ice sheets are changing over relatively short time scales, that is, decades versus thousands of years"

— Dr. Eric Rignot



quarter of Antarctica's snow accumulation. The peninsula has warmed 2 to 3 degrees Celsius (3.6 to 5.4 degrees Fahrenheit) over the past 50 years, causing rapid thinning, enhanced melting and rapid disintegration of its ice shelves. The peninsula is a unique laboratory to determine whether retreating ice shelves can induce faster ice sheet flow and raise global sea level, a hypothesis formulated decades ago but still disputed. Recent results show large glacier acceleration in response to ice shelf collapse. If ice shelves do buttress glaciers, the Antarctic ice sheet's contribution to sea level rise could be much larger in the future than previously believed.

Illustrations related to this study may be viewed at <http://www.jpl.nasa.gov/images/earth/antarctica>.



Top: The Larsen B ice shelf, a floating ice mass on the eastern side of the Antarctic.

Above: Sequence shows the break-off of a large tabular iceberg from the Pine Island Glacier in West Antarctica.

Gravity Recovery and Climate Experiment and Europe's planned Cryosat mission—combined with widespread interferometric synthetic aperture radar (InSAR) data, ice thickness surveys and ground-based measurements—will enable us to estimate ice sheet mass balance for Greenland and Antarctica even more precisely."

News Briefs



Mariner 2 team member during maneuvers.

Comets break up far and near

Some comets may break apart over and over again in the farthest reaches of the solar system, challenging a theory that comets break up only occasionally and not too far from the Sun, says JPL senior research scientist DR. ZDENEK SEKANINA.

A system of comets called "sungrazers," named for their orbit that closely brushes the Sun, reveals important clues about how these bodies break up. Most sungrazing comets are tiny—the smallest could be less than 10 meters (30 feet) across—and move in a highway-like formation of comets that pass near the Sun and disintegrate.

Sekanina reports in the Sept. 10 issue of the *Astrophysical Journal* that many sungrazer comets arrive at the Sun in clusters and on parallel paths. He emphasizes that such tiny fragments would have disintegrated if they had come so close to the Sun on an earlier trip. Therefore, the parents of these tiny sungrazers must have broken up after their previous encounter with the Sun and continued to break up far from the Sun on their journey through the solar system.

Sekanina's sungrazer studies challenge an earlier theory that the only place these comets break up is very close to the Sun, as the strong pull of its gravity cracked their loosely piled chunks of dust and ice. The gradual, continuing fragmentation gives birth to all the sungrazers, the most outstanding examples of splitting comets.

"Astronomers never before realized that there could be a fairly orderly pattern in breaking up, so that one comet cascades into large families of smaller comets, and that this process could be an important part of a comet's natural life cycle," Sekanina said.

For more information, log on to http://www.jpl.nasa.gov/releases/2002/release_2002_170.html.

Women's Club offers activities

The Caltech Women's Club is sponsoring a number of get-togethers at Tournament Park that are available to JPL staff.

Preschool Playgroup for children ages 1-4 is held Tuesdays from 10 a.m.

to noon. The group offers crafts, song and story time, free play, and exploratory learning for toddlers and preschoolers, and also offers a supportive environment for parents and caregivers to observe and interact with their child. For information, call JULIA KENNEFICK at (818) 792-7808.

Wednesdays in the Park from 10 a.m. to noon provides conversation and camaraderie for the grownups and playtime for infants thru school-age children. Meet people and share practical information about services and activities available for families. For information, call IRENE LOCHER at (818) 584-5828.

Family Potluck in the Park for new and returning families will be held Sunday, Sept. 29, from 4 to 7 p.m. The club will provide the plates, cups, utensils and drinks; bring your family and a potluck dish. A clown performs at 5 p.m., and a bounce house will be available. For information, contact LAURIE CLARK-KLAVINS at (626) 355-3874 or lcklavins@hotmail.com.

To find out more about the club, plan to attend their first Welcoming Coffee for the 2002-03 year on Friday, Sept. 27, 9 to 10:30 a.m. at Caltech's Winnett Lounge. For information, call TEMA HALPERN at (818) 952-6214.

Calling all Mariner 2 team members

The Public Services Office is trying to locate members of the Mariner 2 project for a special JPL event in December.

Mariner 2, the first spacecraft to fly by another planet, launched in August 1962 and flew by Venus on Dec. 14 of that year. The JPL event will commemorate the Venus encounter.

Mariner 2 team members are asked to call Public Services at (818) 354-0112.

Join the band

JPL staff members interested in joining the Caltech Concert Band or Caltech Jazz Band are invited to contact band director WILLIAM BING at wbing@caltech.edu. The first rehearsal is Thursday, Oct. 3, in Caltech's Beckman Auditorium.

For further information, check out the band's website at www.music.caltech.edu/band-intro.html.

Four JPL employees have been selected to participate in the fiscal year 2003 Software Architect Program.

Administered by the Center for Space Mission Information and Software Systems, the program's new participants are Leonard Charest (Section 368), John Diehl (382) and Yu-Wen Tung (368). Michael Heflin (335) is this year's alternate.

The Software Architect Program is a half-time, one-year paid internship intended to help train JPL's next generation of software architects, system engineers and managers. Participants will receive instruction in concepts, principles, and state-of-the-art methods in software architectures. On-the-job training and mentoring will take place in a variety of organizations to expose participants to software architectures and mission domains at JPL, and to foster communication and cooperation among them.

Charest is a knowledge engineer and the configuration manager for Mars Exploration Rovers' Activity Plan Generation tool (a ground-based science activity planning tool). He earned his bachelor's degree in computer science from Rensselaer Polytechnic Institute and has been at JPL for eight years.



Leonard Charest



John Diehl



Yu-Wen Tung



Michael Heflin

Diehl is the software lead for the imaging science subsystem and visual infrared mapping spectrometer (VIMS) instrument for the Cassini Ground Data System. He is also a systems engineer for the Cassini Multimission Image Processing System. He has a master's degree in mathematics from Pennsylvania State University and 12 years of experience at JPL.

Tung is the acting software chair on the Advanced Projects Design Team (Team X) of the Project Design Center. He has a doctorate in computer engineering from USC and has been with JPL for 10 years.

Heflin has a doctorate in physics from the Massachusetts Institute of Technology and is a co-patent holder of the award-winning GPS-Inferred Positioning System and Orbit Analysis Simulation Software (GPSY) software package developed at JPL. He has been with the Lab for 12 years.

Correction

An article in the Aug. 30 issue of Universe on the third quarter Service Awards indicated an incorrect date for the ceremony. Recipients attended a luncheon in their honor on Sept. 12.

Special Events Calendar

Ongoing Support Groups

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

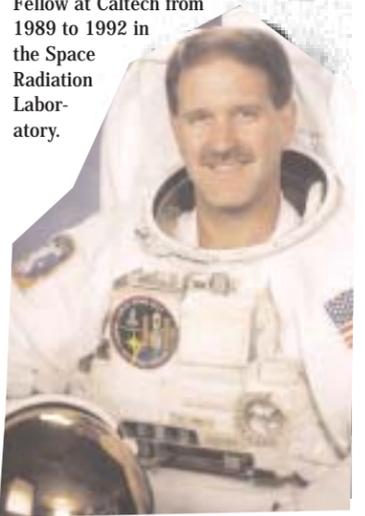
Caregivers Support Group—Meets the first Thursday of the month at noon in Building 167-111 (The Wellness Place). For more information, call the Employee Assistance Program at ext. 4-3680.

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.

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.

"From Caltech to Low Earth Orbit: New Eyes for Hubble"—Astronaut Dr. John Grunsfeld will speak at 11:30 a.m. in von Kármán Auditorium in talk sponsored by the Caltech Management Association and the JPL Space Flight Awareness Program. Grunsfeld, the only Caltech faculty member to have flown in space, was a Senior Research Fellow at Caltech from 1989 to 1992 in the Space Radiation Laboratory.



Saturday, Sept. 21

JPL Family Day—Astronaut Dr. John Grunsfeld will appear in von Kármán Auditorium during morning hours of the event, which runs from 10 a.m. to 3 p.m. Free lunch will be served in the mall, and numerous Lab facilities will be available for touring. Tickets are required of JPL staff and their guests, and must be picked up by Sept. 13. For more information, call Nancy Kapell, ext. 4-9432.

Wednesday, September 18

JPL Fishing Club—A full-day tuna trip is planned aboard the 85-foot Eldorado out of Long Beach Sportfishing. The cost is \$110 per angler. The boat departs 9 p.m. Tuesday, Sept. 17, returning 8 p.m. Wednesday. For reservations or information, call Chris O'Connor at ext. 4-5725.

Thursday, September 19

JPL Stories—Alice Fairhurst, former career development and mentoring coordinator, will present "Careering through JPL" at 4 p.m. in the JPL Library, west end of Building 111. The JPL Stories program, sponsored by the Library, Archives, and Records Section, celebrates the Lab's unique environment and history, and provides an informal way for JPLers to share their stories with each other. For more information, call Teresa Bailey, ext. 4-9233.

Sunday, September 22

The Secret Origins of the Bible—Author Tim Callahan will speak at this Skeptics Society-sponsored event at 2 p.m. in Caltech's Baxter Lecture Hall. Donation: \$8 for members, \$5 for nonmembers. For information, call (626) 395-4552.

Wednesday, September 25

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

JPL Toastmasters Club—Meeting at 5 p.m. in the 167 conference room. Call Roger Carlson at ext. 4-2295 for information.

Thursday, September 26

Estate Planning Workshop—You've have worked hard for what you have, now learn how to preserve as much of your assets as possible. This Fidelity workshop from 10 a.m. to noon in Building 180-101 will cover estate planning tools, implications of beneficiary designations, and how the newest tax legislation can help protect your estate. Seating is limited. For a reservation, call Fidelity at (800) 642-7131.

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

JPL Stories—"The True Story Behind the Mars Pathfinder Success" will be presented by Rob Manning (Pathfinder flight system chief engineer), Brian Muirhead (flight system manager and project manager), and Richard Cook (mission manager), from 4 to 5 p.m. in the Library, Building 111-104. This talk was rescheduled from last month. For questions about the JPL Stories series, call Teresa Bailey at ext. 4-9233.

Friday, September 27

Investment Advice—A TIAA/CREF representative will be available for one-on-one counseling. To schedule an appointment, contact TIAA/CREF online at tiaacref.com or at (877) 209-3140, ext. 2614.

Thurs.-Fri., Sept. 19-20

Von Kármán Lecture Series—Senior research scientist Dr. Lute Maleki will present "A Unified View of the Universe" 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. Maleki will discuss how various developments in the arts have contributed to the field of physics. For more information, see <http://www.jpl.nasa.gov/events/lectures/sep02b.html> or call Public Services at ext. 4-0112.

Friday, September 20

British Invasion—Fairport Convention, which combines rock and roll with British traditional music, and British folk music band Equation at 8 p.m. in Caltech's Ramo Auditorium. Tickets are \$18 for adults, \$10 for youth. For information, call (626) 395-4552.

Lab proposals selected for development

Five chosen in Earth science technology

Five proposals from JPL were among those selected last month by NASA for the component technology development program in support of the Earth Science Enterprise. The Advanced Component Technology Program will provide core component and subsystem technology developments that will enable new science measurements and visionary concepts.

The Office of Earth Science awarded 14 proposals, for a total value over a three-year period of approximately \$13 million, through the Earth Science Technology Office at Goddard Space Flight Center, Greenbelt, Md. The five JPL investigators and their proposals are:

Tien-Hsin Chao (Electro-Optic Imaging Fourier Transform Spectrometer); Wendy Edelstein (Ultra-High Efficiency L-Band Transmit/Receive Modules for Large Aperture Scanning Antennas); Lute Maleki (Quantum Gravity Gradiometer for Sub-Surface Mapping); Alina Moussessian (T/R Membranes for Large Aperture Scanning Antennas); and Simon Yueh (Compact, Lightweight Dual-Frequency Microstrip Antenna Feed for Future Soil Moisture and Sea Surface Salinity Missions).

The objectives of the Advanced Component Technology Program are to identify, develop and demonstrate component and subsystem technologies that reduce the risk, cost, size and development time for Earth-observing instruments, platforms and information systems, and enable new Earth-observation measurements. Critical to this design is the relationship between the various technology development programs that the Earth Science Enterprise has available to enable missions. Within this development environment, the Advanced Component Technology Program is complementary to the Instrument Incubator Program for instruments and the New Millennium Program for space flight validation. The overall program is designed to bring components and subsystems to a demonstrated technology readiness level for infusion into a future science mission.

For more information, log on to http://research.hq.nasa.gov/code_y/nra/current/NRA-02-OES-01/winners.html#Top.

Three awarded for in-space propulsion

In the future, NASA's fleet of robotic spacecraft might cruise among the planets like sailboats in space, or perhaps they will be propelled from planet to planet by advanced ion engines.

NASA's Office of Space Science announced in late August that those technologies and other advanced propulsion ideas have been selected for development as part of a suite of in-space propulsion technologies. Development of these technologies will provide giant steps in capability for NASA to conduct future planetary missions, especially to the outer planets of Jupiter and beyond.

Three principal investigators from JPL were among those chosen by NASA: James Polk (Development of a 65 cm, 20 kW, Xenon Ion Thruster); Jack Mondt (Segmented Thermoelectric Multicouple Space Reactor Power System); and Bobby Williams, (Development of an Integrated Set of Solar Sail Simulation Tools).

The awards, part of the In-Space Propulsion Program, cover four propulsion technology areas: aerocapture, high-power electric propulsion for nuclear systems, power conversion technologies for nuclear electric propulsion, and solar sails.

Beginning in fiscal year 2003, the propulsion technologies unique to nuclear power systems will be managed under NASA's Nuclear Systems Initiative, including the high-power electric propulsion and power conversion technologies.

The total anticipated budget for high-power electric propulsion and power conversion in fiscal 2002 is \$1 million, \$16 million in fiscal 2003, and \$16 million in fiscal 2004, contingent on budget approval. Total anticipated budget for proposed work in the aerocapture and solar sail areas under the In-Space Propulsion Program in fiscal 2002 is \$2 million, \$17 million in fiscal 2003, and \$18 million in fiscal 2004, contingent on budget approval.

For more information about these technologies, visit <http://spacescience.nasa.gov/news/index.htm>

LAST MONTH, after meeting with the California Department of Fish and Game concerning the deer population on Lab property, JPL management made a commitment to better inform the JPL community about co-existing with wildlife on Lab.

Encounters between humans and wildlife are usually due to changes in wildlife habitat, which have often been rapid and continual. Replacement of forest lands with commercial and residential areas creates an "edge" habitat for deer and other wildlife. The Laboratory is one such area where humans have to learn to share the land with the deer. Each year in the U.S., however, an estimated 200 people are killed and 29,000 injured in deer-vehicle collisions.

Here are some tips to be used at the Lab—and at home—to avoid hitting a deer:



Photo courtesy of Nigel Angold

- Be aware that there is wildlife on Lab at all times.
- Watch for deer and other wildlife at dawn, dusk, and the first few hours of darkness.
- Be particularly cautious in mid-to-late-fall, as this is deer-breeding season.
- Heed "deer crossing" warning signs and reduce speed.
- If you see one deer cross, expect others.
- At night, watch for reflection from headlights when driving a car. Headlights reflect in the eyes of the deer, often appearing to be glowing red orbs.
- If a deer "freezes" in the headlights of your car, stop and try turning your lights off and on.
- The speed limit on Lab for cars and bicycles is 20 mph on the site and 10 mph in the parking lots.

Deer are responding to changes in their environment initiated by human beings by adapting to live in the human environment. It is our responsibility to understand this and realize they are a part of the JPL environment.



Photos by Tom Wynne / JPL Photolab

Deer are very often seen on the mall (top) and in the hills, but can sometimes be seen in the most unexpected places on Lab, such as the stairs (above) or roof (bottom) of Building 111.



LAB · ORATORY

SEPTEMBER

1962

"Joyce Anderson and Joanne McMaster (r) are introduced to Lab by Fred Vogel, Supervisor, Automotive Repair Shop and Dispatch Office. The distaff additions to Transportation alternate driving "Joyce Anderson and Joanne McMaster (r) are introduced to Lab by Fred Vogel, Supervisor, Automotive Repair Shop and Dispatch Office. The distaff additions to Transportation alternate driving the Visitor Bus, which shuttles visitors from the parking lot to the main gate, and chauffeuring, making 'short haul' deliveries and pickups on Lab. The girls, making a neat appearance in their JPL uniforms, are a welcome addition to the Lab."

40 years ago...

Lab hosts Japanese minister

JPL Deputy Director Eugene Tattini presents a gift to Takashi Aoyama during the latter's visit to JPL Aug. 30.

Takashi Aoyama, senior vice minister of the Japanese Ministry of Education, Culture, Sports, Science & Technology, dropped by JPL last month during a visit to Los Angeles.

The request for the visit came from the Los Angeles Office of the National Space Development Agency (NASDA) of Japan and from the ministry through NASA Headquarters. The ministry supervises NASDA and provides most of their funds. Aoyama's responsibilities include science and technology issues, including space issues. He is in charge of the merger of three space-related institutes in Japan; the merger is expected next year.

While at JPL, Aoyama received an overview of the Lab from JPL Deputy Director Eugene Tattini and discussed Earth science with Earth and Science and Technology Director Dr. Diane Evans. The minister also had a close-up look at the Lab's scatterometer projects, Mars Exploration Rover, Microdevices Laboratory, Life Detection Science and Technology Program, and Space Flight Operations Facility.



Photo by Bob Brown / JPL PhotoLab

DailyPlanet

Online for the JPL community

Classified ads will be available the day before Universe is published, at <http://dailyplanet> JPL's online news source

View this and previous issues of Universe online <http://universe.jpl.nasa.gov>

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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 JPL Store 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 all of my friends and colleagues once again for the present of a cruise when I retired as Director last year. Alice and I have just returned from exploring Alaska's inside passage. It was even more beautiful and relaxing than we imagined. I look forward to seeing many of you during my continuing visits to JPL as Voyager continues its journey toward interstellar space. Again, thank you.

Ed Stone

I would like to thank my co-workers and the ERC for the kindness expressed at the recent passing of my father. You've helped my family and me through a tough time.

Leo Bister

Classifieds

For Sale

AMPLIFIER for bass guitar, Sunn Beta Bass (stage amp), good condition, with foot-pedal remote, \$150. 626/798-0226.

BARBECUE GRILL, George Foreman's, indoor/outdoor electric, brand new, never used; 17.5" cooking surface, nonstick, coated for quick easy clean-up, fat drain tray; \$60. 502-0768.

BATTERY BACKUP, for PC, brand new APC ES Series, model no. BE350U, \$28. 956-3745, Steve.

BIKE TRAILER, 2 kids size, excellent cond., bought in summer 2001, \$80. 626/584-1164.

BIKES: boy's \$45, girl's \$15, both vg cond.; COLLECTOR PLATES, 20 - 25, porcelain, \$50 for the set. 626/359-7666.

BUNK BED: white, metal; with 2 twin mattresses, excellent condition, \$175/obo. 957-8463.

CAMERA EQUIPMENT, Canon, AE-1 program body - black, assorted lenses (fd series) and accessories, exc. cond. 626/355-0944.

CHAIRS, kitchen, vg cond., \$8. 248-4647.

CLARINET, Yamaha YCL-20 resinite, good playable condition, \$300/obo, list \$600;

CASUAL DINING TABLE (60" by 30") and 6 chairs, all sturdy, \$120. 952-8455.

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

CONCERT TICKETS: Jimmy Buffett, Thurs., Oct. 3, Verizon Amphitheater, Loge 8, Row LL, Seats 835 & 836, \$73/ea. 661/254-6445.

CONTRACTOR EXAM TAPES, w/manual; for C5, C6 & B1; Calif. licenses in woodworking, law and gen. contractor, \$150. 249-6071.

CRIB, Childcraft, oak, with mattress; drawers under bed; detachable headboard/storage unit allows simple conversion into regular bed; exc. cond., \$150. 952-3130.

DRYER, electric, GE "Profile," 3-wire 204 or 280 volts, never used, \$100. 541-9646, Stacy.

DRYER, Kenmore electric, requires 220v outlet, series 70 Super Capacity Plus, 3 years old, exc. cond., retails for \$400, sell for \$195. 626/301-0010.

ENTERTAINMENT BOOKS, 2003 San Gabriel Valley, \$20; other areas available; proceeds donated to a non-profit organization to help supply needs for low-income families. 626/797-1310, leave message.

FURNITURE: 1 large entertainment unit, solid oak, good cond., size 60"W x 60"H x 20"D, \$250/obo; 1 set of hutches, two pieces with glass windows, mirror and lights, great for china display and storage, size 41"W x 75"H x 17"D for \$250/ obo; 1 recliner, blue color, hardly used, in excellent cond., 36"W x 36"H x 43"D, for \$150/firm. rabinina@att.net for picture. 248-8179.

HEALTH EQUIPMENT, electric scooter, 4 wheel, slightly used, looks new, rt. and left side controls, can disassemble to fit in trunk, orig. \$2,200, sell \$800. 790-6060.

KITCHEN DOORS, 2, from So. Pas. mansion, solid wood, elaborate decoration, beveled glass, no finish on wood, \$1,200/obo. 626/287-9433.

KITCHEN TABLE, ceramic top with oak legs and solid oak chairs (6), barely used, \$250. 541-9646, Stacy.

MISC.: bed frame / mattress set, twin, \$15; push mower, manual, \$25; lawn chairs (2), \$3/ea.; air mattress, \$2; headboard, maple,

\$5; men's golf and dress shoes, sz. 12-13, \$3/ea. 248-4647.

PIANO, electric, excellent condition, Technics, short keyboard, three voices, floor model with bench, good spring action, MIDI in/out/thru, built-in amplifier and speakers, \$450. 626/798-0226.

RADIATOR, Delonghi, oil filled, almost new timer control with 96 settings, automatic room-monitoring thermostat, 3 variable heat settings for energy efficiency, \$40; VACUUM CLEANER, Kenmore \$90; MONITOR, almost-new Smile, 15 inches, flat screen color, non-interlaced, power saving, outstanding condition, 1280-1024 high resolution, micro-processor user control, \$80; BED, queen sz., \$175. 626/304-0207; e-mail: popescu@ociw.edu.

REFRIGERATOR, GE, 17 yrs. old, beige, side by side, \$75; SOFA, makes into queen sz. bed, abstract black/blue/mauve design, gd. cond., \$300; LADDER, \$50; BIKES, 4, children's, need TLC, \$15/ea. 626/357-8210.

REFRIGERATOR, GE, works perfectly, off white, \$80/obo. 626/287-9433.

SCANNER, brand new Visioneer OneTouch 5800 USB 48-bit color, 600 x 1200 dpi, supports Windows 98/2000/Millennium/XP, \$37. 956-3745, Steve.

SHIRTS: new men's long sleeve, 17 neck, 34.5 sleeve, \$7, Hawaiian, L & XL, \$8/ea.; SLACKS, 42 & 44, \$10; SPORTCOATS, 44 & 46, \$10-\$15/ea.; COFFEE TABLE, 52" x 23," black onyx on brass frame, \$30/obo. 790-6060.

SOFA, off-white cotton, 6 sectional plus ottoman, good condition, \$450. 790-7982.

SUBWOOFERS & AMP, pair of MTX TS82 truck/car 8" subwoofers and Road Gear 80W 2Ch. amp, mint cond., \$100/obo. 626/296-9186.

SWIVEL CHAIR + COMPUTER DESK (L: 32.5," W: 19.5," H: 29.5") with pull-out keyboard and integrated shelf, brand new, \$40. 626/564-8483, Chris Dumas.

TABLE SAW, Black & Decker 8", powerful 1 HP induction motor, cuts 2x4 at 45 degrees and 90 degrees, owner's manual and book, \$100. 323/256-0535, Lucia.

TREES: fish tail, 6' tall, \$80/obo; ficus, braided, in 30" plastic pot, >10' tall, \$250/obo; ceramic bowl, gray, 2' diameter with planted geraniums, \$40/obo. 626/791-6101.

VACATION CLUB MEMBERSHIP, Silverlakes, Calif., resort, golfer's dream, 4 weeks free golf anytime each year at private PGA-rated course with driving range and putting greens, 2 bd. condo for up to 6 people, two lakes, many amenities, less than 2 hours from Pasadena, exchange rights with 3,000 resorts, reduced to sell due to illness, \$15,000. 805/967-7725.

YARD SALE, multi-family, 900 E. Poppyfields Dr., Altadena; Sat. Sept. 14, 8 a.m.-2 p.m., lots of good stuff.

Vehicles / Accessories

BRAKE PRESSURE BLEEDER, 2-gal. capacity, tool & adapter tray w/casters, includes adapter to cast iron master cyl., VW/Honda, exc. cond., \$180. 249-6071.

CAMPER SHELL for Chevy S10 or similar, gray, 7-ft. bed, good condition, needs painting, \$150/obo. 626/798-0432.

'93 CHEVY 1/4 ton pick-up, teal green, 2-door, extended cab, short bed; Duratrunk and liner, towing and 5th wheel ready; good cond., 70,000 mi., \$8,000. 661/297-8544.

'88 CHEVY Suburban Silverado 4X4, white, dual a/c, vg cond., bought 9 yrs. ago from orig owner, power windows, cruise control, 10 CD changer, \$5,000. 626/577-2882.

'01 FORD Escape XLT, 4x4, 3.0L V6, all options except side step bars, mocha int/ext, 2 new tires, service contract, 28K mi., exc. cond., \$18,500/obo. 626/584-3841.

'99 FORD Taurus wagon, metallic silver, great spacious family car, 12-valve V6 3.0L engine, 79K miles, exc. cond., \$8,300/obo. 626/584-1164.

'97 FORD Explorer XLT, only 41K miles, exc. cond., new tires/brakes, garage parked, am/fm/cassette, a/c, power seats/windows, all dealer servicing, very clean, gold color, \$10,500. 626/355-5631, Tim O'Donnell, after 5:30 p.m.

'95 FORD Clubwagon, 5.7L, 167K mi., 4 speed auto with overdrive, loaded, tow package, meticulously serviced, very clean, \$8,000/obo. 909/593-8950.

'95 FORD Taurus GL, V6, 3.0, only 66,000 miles, dual airbags, automatic, a/c, am/fm cassette, power windows, power mirrors, cruise control, keyless entry, tinted glass, exc. cond., Carfax report available, \$3,600/obo. 818/248-6919 or 323/442-6672, mktameesh@yahoo.com.

'68 FORD Mustang Classic Calif. Special GT/CS, hi-perf. 302 cid, 75K orig. miles, auto, fac. a/c, ps, am radio, metallic gold paint, black interior, GT hood, trunk, fogs and wheels, no rust, turns heads, \$13,250/obo. 626/963-5727.

'65 FORD 250 pickup, custom cab camper

special, in running cond. but needs work, orig. owners manual, \$1,000/obo. 626/798-0432.

'00 HONDA Odyssey 2000 LX, beige, auto, a/c, 44,800 miles, exc. cond., \$19,000. 626/447-0466.

'91 HONDA Civic DX, 5-speed man., air, am/fm stereo/cassette, org. paint/int., new tires, new catalytic converter, \$4,000/obo. 213/229-2980, Hunaid.

'97 INFINITI J30t, exc. condition, 58K miles, \$15,900. 562/498-1097.

'94 INFINITI J-30, orig. owner, 110,000K, recent full maintenance, inc. major tune-up, timing belts, seals, water pump, trans. service, etc.; full power, loaded w options, air, leather, sunroof, ABS, alarm, AM/FM/CD/tape, \$9,000/obo. 661/424-1420.

'01 ISUZU Rodeo LS, 4x4, V6, PS, PW, PD, dark green, gray interior, 25,000 miles, factory warranty, \$23,000/obo. 626/304-0279, Vince or vink@ociw.edu.

'99 JEEP Cherokee, Laredo package, 4x4, blue exterior, beige int., 149,041 mi., 4.0L straight 6, pwr. windows/doorlocks/seats/mirrors, cruise contr., tinted windows, tow pkg., alarm, AM/FM CD player w/removable face & premium sound, Smittybilt running boards, alloy wheels, 3" Rancho suspension lift w/shocks, borla exhaust header, roof rack, new battery; very well maint. w/maint. records; see to appreciate, photo: <http://www.alumni.caltech.edu/~tracy/jeep.jpg>, \$4,500/obo. 626/798-3566.

'88 MAZDA Protégé LX, silver, 52K mi., manual trans., 10-disc CD changer, dual airbags, pull-down back seats, a/c power windows/locks, runs perfect, all maint. documents avail. 626/683-9951, Caroline.

'95 MERCEDES-BENZ C-280, exc. cond., automatic, ABS, a/c, power locks/windows/mirrors/seats, AM/FM/cassette/CD, white, 54,000 mi., \$17,500/obo. 323/254-5685.

'00 SATURN SC2, 32,500 miles, ps, a/c, CD, pd, pl, alarm, auto, exc. cond., Kelley book retail \$12,005, wholesale \$10,045, sell \$10,995. 909/596-3501, Donna.

'94 SATURN, 4 dr. SL1 sedan, dk. green color, outstanding cond. (service only at Saturn dealer), car history provided, smog check performed, mileage 128K, a/c, airbag, 4 cyl. 1.9L, 5-spd. transmission, am/fm stereo, 85 HP, EPA mileage (city/hwy): 28 mpg/37 mpg. \$2,900. 626/304-0207, popescu@ociw.edu.

'99 SUBARU Outback 4-dr. red wagon; all-whl drv., 5 spd., 33K mi. a/c, cruise, CD, roof rack, tow hitch; \$15,500. 626/447-6655, eves/wkends.

'02 TOYOTA Camry DLX, 4 cyl., 4 dr., front side & curtin airbags, 4 whl. ABS disk brakes, sunrf, 6 CD chgr, A/C, 2K miles, \$24,100/obo. 626/794-0073.

'00 TOYOTA Camry LE, 4-dr. sedan, 4 cyl., 2.2L, auto, 35K miles, a/c, c/c, power everything, am/fm/CD/cass., pwr. driver seat, tilt wheel, runs great, beautiful, see pictures at ERC, \$14,500 firm. 626/536-9500.

'99 TOYOTA Solara SLE V6, 2 dr., black interior/ext., sunroof, spoiler, lthr bucket seats, a/c, am/fm/stereo/cass./CD, power windows/locks/mirrors/seats, cruise control, tilt whl., driver & pasngr airbags, anti-lock brakes, 86,000 mi., immac. cond., \$15,500/obo. 626/967-3200.

'96 TOYOTA Corolla DX, auto, 23K mi., power windows/locks, spoiler, a/c, exc. cond., \$5,000. 909/599-3230.

'95 TOYOTA Camry LE, white, beautiful condition, well maint., new tires, one owner, kept in garage, 93K miles, \$7,000 firm. 547-4522.

'88 TOYOTA Corolla, exc. cond., auto, new battery/tires/smog, stereo, \$2,600. 626/379-3503.

'74 VESPA moped, 2 stroke, street legal, running cond., \$1,200/obo. 661/250-7849.

'01 VW Beetle GLS, silver/black leatherette, 5 spd, pwr locks/windows/mirrors, cruise, alloys, am/fm cass., CD changer, fog lights, ABS, remote keyless entry, 10K miles, \$16,800. 626/449-0997.

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50-plus, leave phone no., address for mailing, 626/403-6312, Marilyn.

FITNESS STEP, for step aerobics; large Reebok or equivalent. 626/345-0681.

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

VOLLEYBALL PLAYERS, coed, no beginners please, Tuesday nights 8 - 10:00 at Eagle Rock High School, \$3/night. 956-1744, Barbara.

For Rent

ALTADENA condo for lease, minutes from JPL, 2 bd., 1 3/4 ba., nice closets with organizers, fireplace, central a/c & heat, community pool, storage room, and 2-car garage (carport), tile counter top and marble floor in kitchen, large patio with landscape, planters and oriental garden with waterfall and spa, end unit (with windows on three sides), cable on; by owner, \$1,200. 626/398-1988.

ALTADENA house, 3 bd., 1 ba.; living, dining, kitchen, laundry, fireplace, wood floors, large fenced yard, attractive Swiss-cottage style, 2-car garage, back yard patio enclosure, \$1,700. 323/871-1043, Kathy.

ALTADENA, 1940s bungalow house, unfurnished, 3 bd., one full & two 1/2-baths, living room and detached office, venting skylights in kitchen and office, refrigerator, stove, dishwasher, clothes washer and dryer included, wood-burning fireplace, quiet neighborhood next to mountains and hiking trails, less than 10 minutes from JPL, \$1,850, flexible lease. 323/309-8953, Marcia.

PASADENA, room in a beautiful house above Eaton Canyon Golf Course, ideal for a very quiet and neat lady; private bedroom, private beautifully remodeled bathroom, private entrance and kitchenette; access to washer, dryer, and treadmill; \$595. 626/798-4056.

PASADENA, near Colorado and Madison, 2 bd., 2 patios, new appliances, washer & dryer, pool, \$1,695. 626/798-3969.

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

SUNLAND, fully furnished room in condo; share kitchen, bath and laundry; garage parking, A/C, fireplace, pool, Jacuzzi, tennis court; 10 miles to JPL; prefer upper classman/grad student, non-smoking; security deposit + references, must like dogs; \$450. 352-3112.

PASADENA, room in a beautiful house above Eaton Canyon Golf Course, ideal for a very quiet and neat lady; private bedroom, private beautifully remodeled bathroom, private entrance and kitchenette; access to washer, dryer, and treadmill; \$595. 626/798-4056.

PASADENA, near Colorado and Madison, 2 bd., 2 patios, new appliances, washer & dryer, pool, \$1,695. 626/798-3969.

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

SUNLAND, fully furnished room in condo; share kitchen, bath and laundry; garage parking, A/C, fireplace, pool, Jacuzzi, tennis court; 10 miles to JPL; prefer upper classman/grad student, non-smoking; security deposit + references, must like dogs; \$450. 352-3112.

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