

universe

Jet Propulsion Laboratory

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SOLAR SYSTEM

Cassini to search for gravity waves

By Guy Webster

The Cassini spacecraft, below, will soon begin an experiment to measure gravity waves, which may give scientists another window into the universe. At right is one of two advanced water vapor radiometers at the Deep Space Network facility in Goldstone that will support the experiment.



BARELY PERCEPTIBLE FLUCTUATIONS *in the speed of a distant JPL spacecraft coasting away from Earth could provide science's first direct detection of gravitational waves, a basic feature of how the universe behaves.*

A 40-day search beginning Nov. 26 will use the Cassini spacecraft and specially upgraded ground facilities of the Deep Space Network. "We've tried this before with other spacecraft, but this time we have new instrumentation on the spacecraft and on the ground that gives us 10 times the sensitivity," said JPL astronomer Dr. John Armstrong. "We're able to measure the relative velocity between Earth and Cassini with exquisite accuracy."

Cassini's speed relative to Earth will vary during the 40 days, but will typically be about what it would take to zip from New York to Chicago in five minutes. In contrast, this experiment aims to measure any speeding up or slowing down by about what it would take to travel the thickness of a nickel in an hour.

Gravitational waves are ripples in the fabric of space and time that are set off by accelerations of massive bodies, such as black holes or supernovas. Albert Einstein theorized they exist, and indirect evidence confirmed his prediction in the 1970s.

"Gravitational waves are at the frontier of astrophysics. There's no question they exist, but they have not yet been detected directly," said Armstrong, leader of an international team that has been preparing for years to do this search.

"Gravity waves can give us another window into the universe, the way Galileo's telescope did in the 17th century and radio telescopes did in

the 1940s," said JPL's Randy Herrera, lead operations engineer. The ability to detect gravitational waves could lead to using them as a way to study black holes and other massive phenomena, he added.

Cassini is in a quiet cruise phase of its mission, 11 months past Jupiter but still more than 30 months from its destination at Saturn. The researchers will use radio transmissions between Cassini and Earth to search for gravitational waves measurably warping space between the two. The transmissions reveal velocity changes by the Doppler effect, the same phenomenon that raises the pitch of an approaching train's whistle or lengthens the light waves from a receding galaxy. If gravitational waves within a particular range of long wavelengths are passing through our solar system, they will alternately stretch and compact space in a way that would rhythmically affect the Earth-to-Cassini distance.

Italian scientists Dr. Bruno Bertotti of the University of Pavia and Dr. Luciano Iess of the University of Rome are co-leaders of the experiment. Italy's national space agency, Agenzia Spaziale Italiana, provided crucial equipment aboard Cassini enabling the gravitational-wave experiment to use higher-frequency radio transmissions than have been used in earlier gravitational-wave searches with JPL's Galileo, Mars Observer, Ulysses and Mars Global Surveyor spacecraft. The higher frequency suppresses noise from the solar wind, allowing more precise measurements of velocity changes.

JPL engineers have carefully instrumented a large dish antenna at the Deep Space Network's Goldstone complex near Barstow, Calif., to send and receive the higher frequencies with unprecedented Doppler sensitivity. The upgrade includes refined pointing capability needed to exploit the higher frequencies, said Sami Asmar, supervisor of JPL's Radio Science Group. Other new equipment at Goldstone will allow researchers to correct for the atmosphere's distortion of radio transmissions and thus improve the search's performance.

The experiment will use links at lower radio frequencies between Cassini and Deep Space Network antennas near Madrid, Spain, and Canberra, Australia. This will enable around-the-clock observations. Taking data with independent equipment at three sites will help discriminate subtle instrumental effects from signals that might be gravitational waves.

The scientific importance of detecting gravitational waves has also prompted ground-based projects, most notably the highly sensitive Laser Interferometer Gravitational Wave Observatory, coordinated by Caltech and the Massachusetts Institute of Technology. The two approaches complement each other because the Cassini experiment is sensitive to million-fold longer wavelengths of gravitational waves than the ground-based laser interferometers are, Armstrong said.

The Cassini experiment is timed so that Earth is on a line between the Sun and the spacecraft, minimizing noises on the radio link. Measurements taken during the 40 days will take several months to analyze. The experiment will be repeated twice more in the next two years when the spacecraft's position will make the measurements sensitive to gravitational waves from different directions in the sky.

Information about the Cassini-Huygens mission is available online at <http://www.jpl.nasa.gov/cassini>.



KSC-977C-1273

Goldin's successor nominated

JPL Director Dr. Charles Elachi informed Laboratory staff Thursday of NASA's announcement that President George W. Bush intends to nominate Office of Management and Budget Deputy Director Sean O'Keefe to be the agency's next administrator.

O'Keefe previously served as professor of Business and Government Policy at Syracuse University. In the early 1990s, he served as



Sean O'Keefe

Secretary of the Navy.

Following this announcement, retiring Administrator Daniel Goldin issued the following statement.

"I would like to offer my congratulations to Sean as he begins the nomination process to become NASA's next Administrator. I look forward to assisting in the transition of my leadership of America's space program to Sean.

"Nearly 10 years ago, I accepted a job that was the fulfillment of a lifelong dream. I'm sure that Sean must feel the same excitement and anticipation I first felt when I was nominated as Administrator.

"I feel blessed to have had the unique opportunity to serve the people of this nation in an area so tied to the hopes and dreams of all

Americans. I hope that Sean will feel equally blessed when he assumes his new job. The President has nominated a man of intelligence, energy and deep integrity. I wish Sean well.

"The President intends to nominate Sean to what I feel is the best job in the world, leading a team made up of the best people I've had the privilege to know. There is no more dedicated group of people serving any agency in the federal government. I am sure NASA's creative and diverse workforce will give Sean the same outstanding support it's given me these many years."

President Bush's statement, as well as more information on O'Keefe, is available online at <http://www.nasa.gov>.

News Briefs



Tom Frascchetti

Genesis begins science mission

JPL's Genesis spacecraft has successfully entered into orbit around the balanced-gravity point Lagrange 1, where it will collect solar wind particles.

On Nov. 16, engineers sent a final command to the spacecraft to begin operating its hydrazine thrusters, putting the spacecraft into its final orbit to begin the particle-gathering phase of the mission. The orbit is at a point where the gravity of Earth and the Sun are balanced.

"The mission operations team did a great job, the orbit insertion went off exactly as planned, and we're in our 30-month science collection orbit," said Project Manager CHET SASAKI. "The spacecraft is in perfect health and we're ready to move into the next phase of its mission."

At the end of this month, Genesis will open its collector arrays and begin to monitor and collect the solar wind ions flowing from the outer layer of the Sun. The samples of solar wind returned by Genesis will help scientists understand how the solar system evolved.

In September 2004, Genesis will return to Earth and release a capsule containing the samples. That capsule will be caught in mid-air by a helicopter.

Fraschetti is new ESD deputy

THOMAS FRASCCHETTI has been appointed deputy director for the Engineering and Science Directorate.

Fraschetti joined JPL in 1983 as deputy task manager for the Airborne Surveillance Sensor Evaluation Testbed. In 1985, he became the supervisor of Division 38's Optics and Integration Group. He was reassigned to the Microwave Observational Systems Section in 1986 and managed the section from 1989-92. Later that year, he became deputy manager for Division 38. Frascchetti then served as division manager from 1995-98 before assuming the role as project manager for the Space Interferometry Mission.

He earned a bachelor's degree in electrical engineering from Cal Poly Pomona and a master's from Cal State Los Angeles.

'Tumbleweed' rover receives honors

The JPL/USC team that developed the "Tumbleweed" inflatable rover has received a "Best of What's New" Award from Popular Science magazine.

The award, in the Aviation & Space category, is profiled in the December 2001 issue of the magazine.

The rover is a large, beachball-like device that holds a central payload by means of a series of tension cords. JPL

is presently conducting both analytical and experimental investigations of the capabilities of Tumbleweed rovers, with emphasis on Martian applications. A quarter-scale model is now being tested for ability to climb over rocks and to determine its speed as a function of wind velocity and inflation pressure. Its ability to climb hills is also being evaluated.

For more on the rover, visit http://www.jpl.nasa.gov/adv_tech/rovers/summary.htm.

Space Place site now en Español

NASA's popular educational Web site, Space Place, has announced a new Spanish-language version for children and their families.

The Web site at <http://spaceplace.jpl.nasa.gov> and its new Spanish companion at <http://spaceplace.jpl.nasa.gov/espanol> serve children 8 to 13 years of age. The site contains approximately 40 activities, including games and "amazing facts" about space, Earth and NASA.

The 2000 census data shows that Spanish is the primary language for more than 27 million people living in the U.S. Of those, nearly 13 million feel they do not speak English very well.

"This Web site is dedicated to reaching that audience," said DR. JEFFREY ROSENTHAL, education and outreach director of NASA's Office of Space Science. "NASA is committed to explaining the results of its programs to the entire American public in all its diversity."

The Space Place site launched in early 1998 and continues to add new activities every month. Its educational value has been recognized by the National Science Teachers Association, the International Technology Education Association, Griffith Observatory in Los Angeles, the Los Angeles Times, USA Today and several children's educational Web sites.

Section 514 hosts workshop

Section 514 will host the Microelectronics Reliability and Qualification Workshop Dec. 11 and 12 at the Hilton Hotel in Pasadena. The purpose of the workshop is to provide a forum for open discussion in all areas of microelectronics reliability and qualification for high reliability and commercial applications.

The format will consist of eight main technical sessions. Two keynote speakers each day will discuss latest results or work in progress in all areas of microelectronics device reliability and qualification methodologies.

For registration and schedules, log on to <http://parts.jpl.nasa.gov>.

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 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. For location, call the Employee Assistance Program at ext. 4-3680.

Senior Caregivers Support Group—Meets the first Thursday of the month at noon. For location, call the Employee Assistance Program at ext. 4-3680.

Wednesday, November 21

Caltech Ballroom Dance Club—The third installment of a five-week series of amateur-taught waltz classes will be held from 7:30 to 9 p.m. in Winnett Lounge, followed by a half-hour practice session. Cost: \$1 per lesson. Contact Megan Knight at knight@its.caltech.edu or visit <http://www.its.caltech.edu/~ballroom>.

Monday, November 26

Caltech Ballroom Dance Club—The fourth in a five-week series of samba classes will be held from 7:30 to 9 p.m. in Winnett Lounge, followed by a half-hour practice session. Cost: \$8 per lesson. Contact Megan Knight at knight@its.caltech.edu or visit <http://www.its.caltech.edu/~ballroom>.

Music of Beethoven and Prokofiev—Deborah Buck, violin, and Robert Theis, piano, will perform a free concert at 8 p.m. in Caltech's Dabney Lounge. For information, call (626) 395-3609.

Tuesday, November 27

"BEAM: A Pioneering Tool for Spacecraft Health Maintenance"—Ryan Mackey of Section 367 will discuss Beacon-based Exception Analysis for Multimissions, an ongoing JPL project designed to provide fault-detection capability to a broad variety of space hardware, from the Deep Space Network to self-directing spacecraft. He will explain how this system is intended to reduce operator workload and downlink requirements, enhance spacecraft safety and science data return, and simplify construction of fault monitors. Held at noon in the Building 167 conference room.

Wednesday, November 28

Caltech Ballroom Dance Club—The fourth installment of a five-week series of amateur-taught waltz classes will be held from 7:30 to 9 p.m. in Winnett Lounge, followed by a half-hour practice session. Cost: \$1 per lesson. Contact Megan Knight at knight@its.caltech.edu or visit <http://www.its.caltech.edu/~ballroom>.

JPL Toastmasters Club—Meeting at 5 p.m. Guests welcome. Call Joy Hodges at ext. 4-7041 for location.

Thursday, November 29

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

JPL Stories—Bill O'Neil, Galileo Science and Mission Design Manager, will present "From Pasadena (uh, La Canada-Flintridge) to Jupiter Against All Odds: A Brief History of the Trajectory of Galileo's Launch Date Moving Through Virtually the Entire Decade of the 1980s" from 4 to 5 p.m. in the Library, Building 111-104. For the flyer, log on to <http://beacon.jpl.nasa.gov/WhatsNew/Stories/ONeil.pdf>. For

questions about the JPL Stories series or participation information, call Teresa Bailey at ext. 4-9233.

Von Kármán Lecture Series—Dr. Charles Beichman, chief scientist of the Origins Program, will present "The Hunt for Earth-like Planets" at 7 p.m. in von Kármán Auditorium. Open to the public. For more information, see <http://www.jpl.nasa.gov/events/lectures/nov01.html>.

Friday, November 30

Von Kármán Lecture Series—Dr. Charles Beichman, chief scientist of the Origins Program, will present "The Hunt for Earth-like Planets" at 7 p.m. in the Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Saturday, December 1

Shirley Jones—A medley of holiday and musical favorites will be presented at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$29, \$25 and \$21. For information, call (626) 395-4652.

Sunday, December 2

Caltech-Occidental Symphony Orchestra—The program is to be announced for this 3:30 p.m. concert in Caltech's Ramo Auditorium. Admission is free. For information, call (626) 395-4652.

The Valencia Trio—Flutist Janice Tipton, oboist Allan Vogel and guitarist Jack Sanders will appear at 3:30 p.m. in Caltech's Dabney Lounge. Admission is free. Call (626) 395-4652.

Monday, December 3

Caltech Ballroom Dance Club—The final class in a five-week series of samba lessons will be held from 7:30 to 9 p.m. in Winnett Lounge, followed by a half-hour practice session. Cost: \$8. Contact Megan Knight at knight@its.caltech.edu or visit <http://www.its.caltech.edu/~ballroom>.

Tuesday, December 4

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

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

Wednesday, December 5

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

Caltech Ballroom Dance Club—The final class in a five-week series of amateur-taught waltz classes will be held from 7:30 to 9 p.m. in Winnett Lounge, followed by a half-hour practice session. Cost: \$1 per lesson. Contact Megan Knight at knight@its.caltech.edu or visit <http://www.its.caltech.edu/~ballroom>.

Thursday, December 6

Caltech Engineering Design Contest—Devices designed and built by teams of undergraduate students will compete at 2 p.m. in Beckman Auditorium. For more information, visit <http://www.design.caltech.edu/courses/ME72>.

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

Fri., Dec. 7-Sat., Dec. 8

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

Monday, December 10

Tax Deferred Annuity Open House—Representatives from TIAA/CRF and Fidelity will be available from 9 a.m. to 3 p.m. in the 167 cafeteria to answer questions.

With JPLers' help, robots battle

More mentors signing on to help high school competition

By Stephenie Lieveuse



Photo by Bob Brown / JPL Photolab

JPLers look on as students compete in a Nov. 7 robotics scrimmage on the mall.

The JPL mall was transformed into a robotics competition playing field Nov. 4, as dozens of JPLers got caught up in the excitement and those who mentored these student-teams were caught up with pride.

The competition pitted students in the 2001 Southern California For Inspiration and Recognition of Science and Technology (FIRST) Southern California regional. Last year, 33 JPL employees served as mentors to competing schools, and the need for mentors in 2002 is even greater.

To date, more than 60 teams have signed up to compete in the event. All mentors who helped last year have committed to be involved again, and 19 more JPLers signed up at the scrimmage to work with local teams to conceive, develop and build a functioning robot that can achieve specific tasks. In the spring the teams will compete against other regional schools that will lead to spots in the national finals.

Chuck Bergh, a member of the JPL technical staff who mentored the Archer School for Girls, found that mentoring is a rewarding and positive experience. "I make time for this because I know I'm getting back so much more than I'm giving," he said. Added Ayanna Howard, who mentored the King Drew Magnet team, "I was able to watch kids get excited about engineering to the extent that one of our senior team members decided not to go to a community college, but to go to a University of California campus, and major in mechanical engineering. I feel like I had something to do with that."

If you're interested in volunteering, e-mail Joe Bishop, call him at ext. 4-9539 or attend an information meeting Nov. 30 at 10 a.m. in von Kármán Auditorium. You can also sign up online at <http://first-robotics>.

1981



By Enrico Piazza and Annie Richardson

Birth of a Geological Tool
 Researchers in 1981 gained the first indication of ancient river channels beneath the sands of the Sahara Desert without the use of picks or shovels. Amazingly, nobody even had to walk on the sand of the hot African desert. Instead, the channels were found by researchers analyzing data from a radar instrument on the then-new technological wonder, the Space Shuttle Columbia.

Launched Nov. 12, 1981, the Shuttle Imaging Radar-A flew as an idea and an assemblage of spare parts from the 1978 SeaSat Synthetic Aperture Radar (SeaSat SAR), the first ever Earth-orbiting satellite designed for remote sensing of Earth's ocean.

"It was just a fluke," recalls JPL Director Dr. Charles Elachi, who was SIR-A principal investigator.

The radar onboard the shuttle was comprised of a single-frequency, single-polarization antenna capable of acquiring imagery at only one angle. Yet, the results were proof that certain radar frequencies could actually take images from as deep as 3 meters (9 feet) below the sand.

Also onboard the same payload as SIR-A was the JPL-developed Shuttle Multi-Spectral Infrared Reflective Radiometer, which detected hydrothermally altered rocks from space. The success of this instrument proved a boon to the field of imaging spectroscopy, leading to the development of such instruments as the Near-Infrared Mapping spectrometer on Galileo, the Visible and Infrared Mapping Spectrometer on Cassini and the Airborne Visible InfraRed Imaging Spectrometer.

Building a Better Radar

The success of the SIR-A mission paved the way for a follow on, SIR-B. In designing it, scientists tried to improve the quality of the images by building an instrument capable of collecting data at more than one angle. Scientists were aware of a relationship between the intensity of the image and the incidence angle of the radar at the surface of Earth.

Comparing data collected by SIR-A and SeaSat SAR, it was clear that not all terrains were easily mapped with just one angle. To address the problem, the SIR-B antenna was designed to be mechanically tilted. SIR-B launched Oct. 5, 1984, aboard the Space Shuttle Challenger for an eight-day mission. An international team of investigators led by Elachi conducted experiments in geology, oceanography, calibration techniques and other scientific areas.

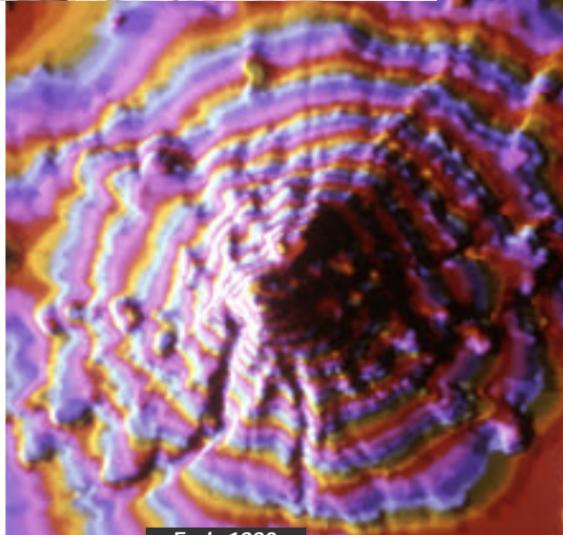
The antenna design allowed images to be acquired at several different angles. Multiangle images could be used to generate perspective views such as these of Mt. Shasta in California.

Because of technical issues involving communication malfunctions, NASA granted another go to the team. However, after the 1986 Challenger disaster, a planned re-flight of SIR-B was aborted and the entire shuttle program placed on hold.

Back on the Space Shuttle

By the time the shuttle program resumed operations in 1988, JPL had developed a third set of instruments in the Shuttle Imaging Radar series. A cooperative project of NASA, the German Space Agency and the Italian Space Agency, SIR-C/X-SAR was the third radar to be flown on a space shuttle.

This radar had an impressive list of characteristics. For the first time, the synthetic aperture radar on board was fully polarimetric—that is, capable of collecting information at any polarization, vertical or horizontal. In addition, the antenna was electronically steerable and operated at three frequencies.



Early 1980s

NASA rewarded the team with two flights in 1994, one in April and one in October. This allowed investigation into the radar's response to seasonal changes.

The multi-parameter images were combined and enhanced to produce some of the most spectacular radar images ever seen.

Ultimate Mapping Machine

But JPL scientists and engineers were not quite done in their search for the ultimate mapping machine. Since radar's ability to image day or night and through cloud covers had been well proven, to make an even better mapping tool they build the longest rigid structure ever to fly in space: a 60-meter (200-foot) boom. In February 2000, the Shuttle Radar Topography Mission circled Earth for 10 days mapping 80 percent of the world's land area. The resulting high-resolution, 3-dimensional topographic map will further our understanding of our planet and has a host of Earth science applications.

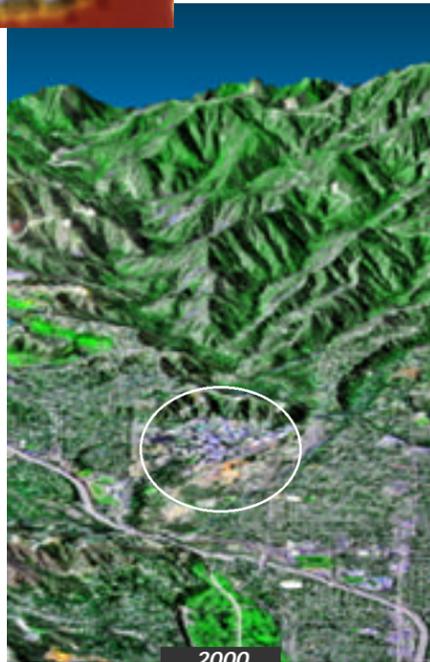
"From a geological point of view, the ability to compare the 3-dimensional shapes of mountain ranges throughout the world will lead to a quantum leap in our understanding of how mountains grow and are eroded," said Dr. Tom Farr, SRTM deputy project scientist. "There are several active San Andreas-size fault zones throughout the world that have never been mapped and we know very little about."

The greatest benefits to be gained from SRTM data lie in the facts that, for the first time, the same instrument has mapped the whole planet, and in a short period of time—thus increasing the accuracy of the results.

"SRTM data will be a base map for all sorts of applications, not the least of which will be monitoring the earth's crust for motions related to earthquake and volcanic activity and subsidence," Farr said.

For more information, visit the Shuttle Radar Topography Mission website at <http://www.jpl.nasa.gov/srtm>

or go to the imaging radar site at <http://southport.jpl.nasa.gov>



2000

1981

The SIR-A team from 20 years ago. JPL Director Dr. Charles Elachi, then the principal investigator of the mission, is shown to the left of center, holding model.

Early 1980s

Early 1980s simulated radar interferogram of Mt. Shasta, by Dr. Michael Kozbrick.

2000

The San Gabriel Valley is shown in this SRTM image taken in February 2000. JPL is circled.

20 years of SHUTTLE IMAGING RADAR

Senior research scientists named

From left: Chief Scientist Dr. Tom Prince, Larry Matthies, Ronald Pogorzelski, Eugene Serabyn, Colin Williams, JPL Director Dr. Charles Elachi.



Dr. Colin Williams (367) was honored in recognition of his research in quantum computing, quantum information theory, artificial intelligence and computer science. The senior research scientist title was established to give special recognition and promotion of outstanding individual research achievers. Eligibility is established by

the demonstrated ability to meet the research requirements typical for appointment as full professor at a leading university, as evidenced by outside peer review, and also depends upon the individual's active participation in programs related to JPL's research and institutional goals.

Passings

JAMES INGOLDSBY, 89, retired from JPL's Procurement Division, died Aug. 21 at his Texas home.

Ingoldsby retired in 1974 after working for the Lab for nine years. He is survived by his wife, Joan.

Letters

Thanks to all of those folks who participated in my retirement events. Especially to the Division 32 and 387 and other folks who put on swell events. Dave Norris

I would like to thank my friends and coworkers for their support and expressions of sympathy following the recent passing of my mother. Also, thanks to the ERC for the plant sent to my home. Darrell Davidson

Retirees

The following JPL employees retired in November: Wayne Arens, 46 years, Section 344; Marshall Gram, 44 years, Section 352; Edith Huang, 35 years, Section 366; Francis Mathur, 31 years, Section 341; Claude Hildebrandt Jr., 30 years, Section 312; Michael Martin, 28 years, Section 389; Richard McKinney, 26 years, Section 387; Sverre Eng, 21 years, Section 340; John Genofsky, 17 years, Section 387; Belinda Wilkison, 16 years, Section 369; Larry Ruple, 13 years, Section 357.

Classifieds

For Sale

BABY ITEMS, like new, Graco 2-spd swing, \$40; Cosco pack-&-go playard w/ent, \$40; baby monitor with 2 receivers, \$20; plus numerous infant toys. 626/351-9117.
BED, queen-size box spring and mattress, Simmons Beautyrest, exc. cond., \$200. 626/355-3886, Rosemary and Ed.
BED FRAMES, dbl, \$20; CA King bed frame, \$35. 909/305-1512, Heather.
BIKE, 1991 Allez, large carbon fiber frame, Suntour 12-speed shifters, very light and stiff, both triathlon and standard drop bars, Look pedals, \$300. 626/794-0886, Ted.
BREAST PUMP, new Medela Pump N' Style, travelers style, attachments still in plastic, bought for \$277, sell \$145. 909/946-6723, call before 8 p.m.
CD PLAYER, virtually unused Akai model CD-A70, single CD, with 3-beam laser pick-up, random play, repeat memory, skip search, full-function remote control, \$65. 353-6369, eves.
CHINA CABINET, 1950s Drexel mahogany, lelson@altavista.com for photo, \$600 cash and carry. 353-9367
COMPUTER, 1.1 GHz, Athlon Tbird, ATX 300 case, Windows NT/98, ATI Rage Pro 32MB, TV tuner card, 3com LAN, DVD, Super disk 120MB floppy, 30GB HD, can load Windows ME/2000, very fast and new, \$700/obo. 249-6786.
COOLERS, Coleman, two, 25" x 36", good cond., \$15/ea.; SHOVELS, six, compact, square point, \$5/ea.; FIREPLACE SCREEN/ACCESSORIES, black, \$50/all; CARPET SHAM-POOER, manual brush and handle, never used, \$5; BICYCLES, four, children's, \$15/ea. 626/357-8210.
DESK, solid oak, roll top, like new, 52" long x 46" high x 20" deep, best offer. 790-0297.
DESK, executive size, walnut finish, \$75; SWIVEL CHAIR, \$15; FILE CABINET, five-drawer, steel, \$60. 626/351-8198.
EXERCISE EQUIPMENT, Tunturi stationary

bike, exc. cond., \$50. 626/449-6799, after 8 p.m., Bob.
FUTON, with rosewood frame, queen size, by Ikea, \$100; TV/VCR STAND, rosewood, with glass doors, good cond., \$30. 626/351-9117.
GARDEN HOSE HOLDERS, new, black ironwork, holds up to 100-ft hose, \$60/obo; new, aluminum, holds up to 75-ft hose, \$50/obo. 626/791-6101.
LOVESEAT, quaint, camel back, pastel yellow with blue pinstripes, two matching pillows and armrest covers. \$50. 626/798-0329.
PERSONAL ORGANIZER, new Handspring Visor Deluxe, \$129; accessories: camera, new, \$49; expansion card, new, backup for Visor, \$29; stylus, pack of 10 extra deluxe, multi-colored metal, Visor or Palm, \$9.99; case, new deluxe leather case for Palm or Visor, \$19.99; cradle, extra USB, for Visor, \$19.99; PHONE, deluxe Nokia 6100 series for AT&T network, free case, \$129; batteries, for Nokia phones, save over 1/2, \$19. 366-6134.
PLANTS, two 6-ft.-high purple Wisteria vines in 5-gal plastic pots, \$15 ea/obo; two 6-ft-high Wisteria vines in 25-gal plastic pots, \$20 ea/obo; two orange Pansies in 1-ft ceramic bowls, \$5 ea/obo; two Jasmine bushes in 5-gal plastic pots, \$10 ea/obo, two red Banana plants in 5-gal plastic pots, \$15 ea/obo. 626/791-6101.
PRINTER, Apple LaserWriter Select 310, complete with software, manual and cables, good cond., \$60. 790-5012.
REFRIGERATORS, G.E., one is beige, 17 yrs. old, side by side, \$100, other is white, 15 yrs. old, \$100; DINING ROOM TABLE, w/ leaf, cherry wood tops, black legs, gd cond., \$150; SOFA/SLEEPER, makes into queen size bed, abstract black, blue and mauve design, good cond., \$300. 626/357-8210.
SATELLITE SYSTEM, complete, big backyard dish, General Instrument 2650R, receiver, video cipher II, digital audio plus remote control and G.I. 2000 PS antenna positioner power supply, \$650/obo. 626/794-0577.
TABLE, dining, round, 36" diam., oak finish, pedestal type, matcher ladder back chairs, \$75; BAR STOOLS, set all wood with swivel seats, \$50/pair. 899-6248, leave msg.
TABLE, dining, beautiful, rectangular, wood, oval/rounded corners, w/extension leaf & 6 matching chairs, black with cherry top, seats six comfortably even without leaf, almost new, immaculate condition, bought 2 years ago for \$1,300, sell \$500. 626/683-0706.
TABLES, three, dark walnut, exc. cond., one small octagonal end table, one medium square end table and one large octagonal coffee table, \$325/obo; BENCH, oak, w/tapestry seat, \$30/obo. 248-7097.
TOOLS, Shopsmith table saw, drill press, band saw, lathe in 1 compact unit, incl. accessories and manuals, \$400. 626/852-9731.
WASHING MACHINE & DRYER, both work fine, must pickup near Allen/Walnut in Pasadena, \$40/obo each. 626/584-1933.
WEDDING GOWN, Mori Lee Designer, scalloped neckline, short capped sleeve, satin bodice overlaid with lace and embroli-dered appliques, trimmed with sequins, pearls, deep V-back meets satin bow at waist, no train, pic: http://www.morileeinc.com/catalog/C2001S5pix1.html, purchased late 2000, worn once, clean, size 12, fits 5' 8" or smaller, \$199/obo. 241-3779.
WHEELCHAIR, power, Everest & Jennings, exc. cond., easy-to-use joystick, foot rest, removable battery for travel. 626/798-0033.

'87 ACURA Integra LS hatchback coupe, 2D, 153K miles, good cond., 5-speed manual, moon roof, a/c, cassette deck, graphic equalizer, \$1,900. 249-8735.
'95 BMW 325is, automatic, gray mtic w/blk. lthr. interior, sunroof, brd. computer, factory alarm sys. and keyless entry., 72K, 1 owner, exc. cond., \$17,800/obo. 626/584-9503.
'83 BMW 633csi, black, orig. paint, well maintained, good records, \$5,000. 626/836-3931.
'95 DODGE Grand Caravan LE, white, vg cond., orig. owner, \$5,400/obo. 626/449-5821.
'99 FORD Mustang, white, exc. cond., 40K mi., orig. owner, leather interior, CD, cruise control, 100K bumper to bumper, like new, \$13K. 909/971-9405, eve.
'93 FORD Escort LX Wagon, white, V4 1.9L, 5 spd., a/c, pwr. steering, AM/FM/cassette, roof rack, 1st owner, well maintained, 99.5K miles, exc. cond., \$3,500. 790-8760, Kevin.
'91 FORD Explorer XLT, 4 w/d, 4 dr., a/c, 2-year-old transmission, exc. cond., \$4,500. 952-5626.
'90 FORD F150 XLT Lariat, 4 X 4, extended cab, 85,000 miles, 5.8, V8, auto, a/c, loaded with many extras, \$6,950. 626/963-3704.
'86 FORD E150 van, 125,000 mi., queen bed, sink, icebox, closet, captain's chairs, V8, a/c, all power, trailer tow (never used), good cond.,

Vehicles/Accessories

well maintained, orig. owner, \$3,300. 805/376-2873.
'97 HONDA Accord coupe, pearl black, auto, a/c, power, everything in perfect cond., orig. I owner, prem. Alpine sound syst. w/2 amplifiers & dual 12" JL audio sub, new 17" chrome Italian wheels, top-of-the-line alarm/auto engine start, many other extras, super clean interior, owner holds title, orig. stock wheels and tires included, see to believe, \$14,000/obo. 714/325-0658, Steven, lv. msg.
'99 HONDA Civic EX, exc. cond., loaded, moonroof, AM/FM CD, a/c, cruise, power windows/door locks, keyless entry, dual air-bags, ABS, 89K mi., all fwy, maintained continuously, new transmission, runs great, great mileage, \$13,500. 661/400-4434, Wendy.
'97 HONDA Accord EX coupe, 2 dr., automatic, 4 cyl., 2.2. L vtec, 73,200 mi., drk grn, tan interior, a/c, p/s, p/w, pdl, tilt whl, cruise cont., am/fm, CD, dual airbags, ABS 4 wheel, sliding sunroof, alloy whls., very economical, good cond., \$10,895/obo. 909/305-1111, Victoria.
'91 HONDA Civic DX, 4-dr sedan, 120K mi., orig. owner, white w/blue interior, gd. cond., automatic, a/c, power-assisted steering, AM/FM stereo, \$3,500. 626/969-2134, eve.
'99 JEEP Wrangler, black, soft top, 23K mi., exc. cond., \$12,000/firm. 957-7742.
'90 NISSAN 240SX SE Fastback, red, 5 speed, flip-up/removable sunroof, power steering, tilt wheel, cruise, AM/FM stereo, single owner, all records, 100K mi., good cond., \$3,500/obo. 323/467-4742.
'84 NISSAN pickup, deluxe heavy duty long bed, lt. blue, V4, 5 speed, a/c, power steering/tilt, AM/FM/cassette, shell, bed liner, 81.7K miles, well-maintained, good cond., \$1,700. 790-8760, Kevin.
'94 SATURN, 5 sp., 140K mi., \$2,950. 957-3675.
'96 SAAB 900S, dark green with beige interior, 75M, orig. owner, exc. cond., all maint. records, 5 spd., a/c, factory stereo, alloy wheels, \$12,000/obo. 310/306-7319, Mike.
'73 PONTIAC Lemans, 30K miles on new engine, new paint, new interior, gd cond., orig. owner, exc. transportation car, \$1,000/obo. 626/966-2904, after 6 p.m., weekdays.
'91 RANGE ROVER County Limited Edition, ABS, 4 w/d, must sell, \$7,500/obo. 626/799-9347, Maria@mail.pacificnet.net.
'95 TOYOTA Previa LE S/C, ABS, dual air bags, power locks/windows/steering, a/c, CD player, seats 7, must sell, \$10,000/obo. 626/799-9347, or Maria@mail.pacificnet.net.
'93 TOYOTA Tercel, 37,000 mi., 2-dr sedan, a/c, 4 brand new Michelin tires, single owner, perfect running cond., \$6,000/obo. 626/794-4921.
'90 TOYOTA Camry, 165K mi., gd cond., 1 owner, air, auto, white, \$1,750/firm. 790-3802.
'88 TOYOTA Camry, 254K mi., 5 spd. manual, 4 dr. sedan, a/c, cruise control, am/fm, good cond., runs well, \$1,350. 626/821-1001.
'87 TOYOTA Corolla, 2-dr. sedan, a/c, sun-roof, pwr steering, tilt wheel, cruise, 4 brand new Michelin tires, single owner, perfect running cond., \$1,500/obo. 626/794-4921.
'91 VOLVO 740, blue sedan, 132,500 miles, \$4,900/obo. 957-7382, Eric.
'01 VOLKSWAGEN Jetta GL, 23K mi., auto, CD changer, a/c, exc. cond., silver/black, \$13,500. 909/599-3230.
'00 VOLKSWAGEN Jetta, like new, must sell, silver, 5 sp., pwr everything, keyless entry w/alarm, moonroof, prem.sound syst., 8 speakers, cruise cont., dual airbags, ABS brakes, black interior, new brakes & tires, \$16,500. 661/273-4074, Joy or Steve.

ALTADENA, room, share bath and kitchen; pool; utility included; \$375 + \$100 deposit. 626/402-9775, pager.
LA CANADA/FLINTRIDGE, separate sm. rm. with bathroom, walking distance to JPL, gated separate entrance, a/c, micro-wave, fridge, partially furnished, temporary OK, very private, all util. pd, \$650. 790-1893.
LAKE VIEW TERRACE townhouse, 2 bd., 2.5 ba., enclosed 2-car garage, large complex, avail. after Jan. 1, can see with appointment, quick access to freeway, 20 min. from Lab, \$1,350. 899-6248.
MONTROSE apt., charming, 2 bd., 1 ba., a/c, garden, off-st. pkgng., Indry., trash/wtr./grdnr. pd., 10 min. JPL, walking dist. to Montrose Mall, \$925. 248-4637.
PASADENA townhouse, 290 S. Morengo Ave., near Old Town, like new, 3 bd., 2 1/2 ba., 1,700 sq. feet, 2-car attached garage, private patio, pool and spa for the complex, \$2,200. 213/680-0337, Ken.
PASADENA, spacious 2-story condo, 3 beds, 2.5 baths, 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.
PASADENA apt. to share, fully furnished, 4 bd., 2 ba., .5 mi. to Caltech, laundry, parking, \$495 + util. 626/351-9641.
SIERRA MADRE, 2 bd., 1 ba., quiet, 6-unit bldg, walk to village, lower unit, \$850. 626/355-7318.
SOUTH PASADENA, studio apt, 1718 Hunt-ington Dr. betw. Marengo & Milan Sts, fully furnished, utilities paid, car space, laundry, no pets, non-smoker, \$750. 626/792-9053, Marilyn or Ray.
SPARR HIGHTS, single furn. guesthouse, man pref., 10 min. to JPL, util. paid, clean, quiet, no pets, no smoking; stove, ref., microwave; \$525. 248-0869, 8-10 a.m. or 5-8 p.m.

Real Estate
COVINA condo, Stonebridge Community, 4900 N. Grand Ave., 2 bd., 2 full ba., walk-in closets, split level, separate dining area, fireplace, high ceilings, newer flooring & carpet, lots of windows w/treatments, patio open to lush landscape, big complex w/2 community pools/spas/waterfalls & streams, includes washer & dryer, built-in security system & microwave, \$148,000. 626/966-5892, Max Hoagland.
MAMMOTH LAKES condo unit, 1 bd. + loft, 2 ba., exc. cond, newly redecorated & return., floor-to-ceiling fireplace in lv. rm, balcony offers superb view of Mammoth Mtn., all elec. kitchen, desirable location in complex, close to Canyon Lodge, rental income potential, \$189,500. 249-8524.

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, excellent view. 248-8853.
HAWAII, Kona, ocean front on Keauhou Bay; house & guest house comfortably slp 6; 3 bd., 2 ba.; rustic, relaxing & beautiful; swimming, snorkeling, fishing, spectac. view; nr. restaur., golf, other attractions. 626/584-9632.
HAWAII, Maui condo, NW coast, on beach w/ocean view, 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, micro-wave, d/w, pool, priv. lanai, slps. 4, 4/15-12/14 \$105/nite/2, 12/15-4/14 \$120/nite/2, \$15/nite/add'l person. 949/348-8047.
MAMMOTH, Chamonix condo; 2 full ba., slps 6; newly return., fully equipped elec. ktch., w/micro-wave & extras, fp/w/wood, color TV, cable, FM stereo, VCR; o/d Jacz., game, rec. & Indry rms.; conv. to Canyon Lodge, shops, lifts, special events; daily/ weekly rates, special midweek rates. 249-8524.
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 eqpd kitchen incl. microwave, DW, 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 & harbor, pool/spa, game rm., sleeps 4. 949/786-6548.
PACIFIC GROVE hse, 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd ktch w/microw, beaut. furn, close to golf, bches, 17 Mile Dr., Aquarium, Cannery Row, JPL discont. 626/441-3265.
ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 28-hold golf course 6 mi. away, priv. secure parking. 626/794-3906.

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