

Mars Climate Orbiter on its way

By DIANE AINSWORTH

One day into the 1998 Mars launch opportunity, NASA's Mars Climate Orbiter blasted off launch pad 17A at Cape Canaveral Air Station, Fla. with the force of 219,000 kilograms (483,000 pounds) of thrust and hurtled skyward on a 9-1/2-month flight to Mars.

Launch occurred Dec. 11 at 1:45 p.m. Eastern Standard Time on the second day of the primary launch period, after a new software program had been loaded to ensure that the spacecraft's battery would operate within its designated limits during the cruise to Mars. The orbiter shot through a breezy, steel-gray mid-afternoon sky, leaving a contrail of billowing, wind-whipped exhaust, before vanishing in an upper deck of rain clouds. The 24-hour delay in launch will not change the spacecraft's arrival date at Mars on Sept. 23, 1999, or alter

its primary mapping mission.

"The performance of the spacecraft equaled, really exceeded, our expectations," said Dr. Sam Thurman, Mars Climate Orbiter flight operations manager. "The spacecraft is in excellent health and we're proceeding now with the first mid-course maneuver on Dec. 21."

Launch events ticked off like clockwork shortly after the 629-kilogram (1,387-pound) orbiter cleared the launch tower. Sixty seconds after liftoff, the four solid-rocket boosters were jettisoned, two at a time, followed by first-stage separation and second-stage engine ignition. The second-stage burn lasted approximately 11 minutes, 22 seconds and propelled the spacecraft onto a low-Earth orbit at about 189 kilometers (117 miles) above Earth's surface.

Third-stage separation occurred at approximately 2:26 p.m. EST, followed by an 88-sec-

MGS altimeter reveals 3-D view of Mars' north pole

Measurements by a laser altimeter instrument orbiting aboard JPL's Mars Global Surveyor spacecraft are providing striking new views of the north pole of the red planet and the processes that have shaped it.

This first three-dimensional picture of Mars' north pole enables scientists to estimate the volume of its water ice cap with unprecedented precision, and to study its surface variations and the heights of clouds in the region for the first time.

The elevation measurements were collected by the Mars Orbiter Laser Altimeter aboard Global Surveyor during the spring and summer of 1998, as the spacecraft orbited Mars in an interim elliptical orbit. The altimeter sends laser pulses toward the planet and measures the precise amount of time before the reflected signals are received back at the instrument. From this data, scientists on the altimeter team, led by Dr. David Smith of Goddard Space Flight Center in Maryland, were able to infer sur-

face and cloud heights.

Approximately 2.6 million of these laser pulse measurements were assembled into a topographic grid of the north pole, with a spatial resolution of 1 kilometer (six-tenths of a mile) and a vertical accuracy of 5 to 30 meters (15 to 90 feet). The topographic map reveals that the ice cap is about 1,200 kilometers (750 miles) across, with a maximum thickness of 3 kilometers (1.8 miles). The cap is cut by canyons and troughs that plunge to as deep as 1 kilometer beneath the surface.

The 3-D visualization was presented at a news briefing at the fall meeting of the American Geophysical Union in San Francisco.

"Similar features do not occur on any glacial or polar terrain on Earth," said co-investigator Dr. Maria Zuber of the Massachusetts Institute of Technology and Goddard Space Flight Center. "They appear to be carved by wind and evaporation of ice."

The altimeter data also revealed that large areas of the ice cap are extremely smooth, with elevations that vary by only a few feet over many miles. In some areas the ice cap is surrounded by large mounds of ice, tens of miles

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KENNEDY SPACE CENTER PHOTO

Mars Climate Orbiter lifts off from Cape Canaveral Air Station in Florida on Dec. 11.

ond burn of the third-stage engine. Once out of Earth's gravitational grasp, after separation from the third stage, the orbiter fired a series of pulses from its onboard thrusters to stop any residual tumbling motion. Four minutes later the spacecraft's solar arrays were unfurled and pointed toward the Sun for power. NASA's Deep Space Network complex near Canberra, Australia, acquired the orbiter's signal at 2:45 p.m. EST.

Now on its way to Mars, Climate Orbiter
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Orbiter

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will rely on its low-gain and medium-gain antennas for communications with Earth during the first half of the journey to Mars. Ground controllers were set to track the spacecraft 24 hours a day through Dec. 17, then reduce tracking time to 12 hours a day using 34-meter (112-foot) antennas of the Deep Space Network.

The first trajectory correction maneuver to remove minor errors in the spacecraft's flight path introduced at the time of launch will be on Dec. 21, Thurman said. The thruster firing itself will be smaller and shorter in duration

than expected, lasting about 2-1/2 minutes and changing the spacecraft's velocity by just 20 meters per second (45 mph). This very slight change in flight course and velocity indicates the degree of accuracy achieved at launch.

Mars Climate Orbiter is currently about 1.8 million kilometers (1.1 million miles) from Earth, traveling at a velocity of about 10,600 kilometers per hour (6,600 mph) relative to Earth. The spacecraft, likened to a weather satellite, will reach Mars on Sept. 23, 1999 to begin a three-month communications and data relay mission for its sister spacecraft, Mars Polar Lander, before embarking on its two-year science mission to monitor Martian weather, climate and current water resources. □



NASA TV

Kennedy Space Center is visible below Mars Climate Orbiter and its Delta II launch vehicle, thanks to a camera attached to the first stage of the rocket.

Special Events Calendar

Ongoing

Alcoholics Anonymous—Meeting at 11:30 a.m. Mondays, Tuesdays, Thursdays (women only) and Fridays. Call Occupational Health Services at ext. 4-3319.

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

Gay, Lesbian and Bisexual Support Group—Meets the first and third Fridays of the month at noon in Building 111-117. For more information, call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parent Support Group—Meets the fourth Tuesday of the month at noon. For location, call Jayne Dutra at ext. 4-6400.

Senior Caregivers Support Group—Meets the second and fourth Wednesdays of the month at 6:30 p.m. at the Senior Care Network, 837 S. Fair Oaks Ave., Pasadena, conference room #1. For more information, call (626) 397-3110.

Friday, December 18

Award For Excellence Nominations—Due today from JPL personnel in technical organizations (3X, 4X, 5X, 7X, 8X, and 9X) to the Reward & Recognition Administra-

tor. For more information, visit the R&R home page at <http://eis/sec614/reward/excel.htm> or call the R&R program office at ext. 4-3825. Note: Nominations will be accepted from business/administrative organizations (1X, 19X, 2X, and 6X) Jan. 4-22, 1999.

Von Kármán Lecture Series—Galileo Project Manager Jim Erickson will speak on the Galileo Europa Mission at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Wednesday, December 23

Holiday Car Show—The annual event will be held throughout the day at the Transportation parking area, Building 177. The Blues Boys band will perform from 10 a.m. to noon. Vintage vehicles are welcome. For information, call Jerry Kalish at ext. 4-8733.

JPL Drama Club—Meeting at noon in Building 301-127.

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. For more information, contact Mary Sue O'Brien at ext. 4-5090.

Tuesday, January 5

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

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

Wednesday, January 6

JPL Drama Club—Meeting at noon in Building 301-127.

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. For location and further information, call Joyce Wolf at ext. 4-7361.

Thursday, January 7

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

Friday, January 8

Associated Retirees of JPL/Caltech Board—Meeting at 10 a.m. at the JPL Woodbury complex, conference room 601-224, 500 W. Woodbury Rd., Altadena.

JPL Dance Club—Meeting at noon in Building 300-217.

Sunday, January 10

Chamber Music—The Debussy Trio will perform harp, flute and viola at this free concert, to be held at 3:30 p.m. in Caltech's Dabney Lounge. For information, call (626) 395-4652.

MGS

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across and up to half a mile in height. "These structures appear to be remnants of the cap from a time when it was larger than at present," Zuber said. Impact craters surrounding the cap appeared to be filled with ice and dust that was either deposited by wind or condensation or, perhaps, was left over from an earlier period when the ice cap was larger.

Scientists found that the shape of the polar cap appeared to be composed primarily of water ice, with a volume of 1.2 million cubic kilometers (300,000 cubic miles). The cap has an average thickness of 1.03 kilometers (0.64 mile) and covers an area 1.5 times the size of Texas. For comparison, the volume of the Martian north polar cap is less than half that of the Greenland ice cap and about 4 percent of Earth's Antarctic ice sheet.

The estimated volume of the north ice cap is about 10 times less than the minimum volume of an ancient ocean that some scientists believe once existed on Mars, Zuber said.

"If a large body of water once existed on the red planet, the remainder of the water must presently be stored below the surface and in the much smaller south polar cap, or have been lost to space," she said. "But such a large amount of water that is unaccounted for is not easily explained by current models of Martian evolution." □

Galileo shows Europa fault as long as San Andreas

By JANE PLATT

New pictures from JPL's Galileo spacecraft show a closeup view of a fault, or fracture, on Jupiter's icy moon Europa that stretches as long as the California segment of the infamous San Andreas fault.

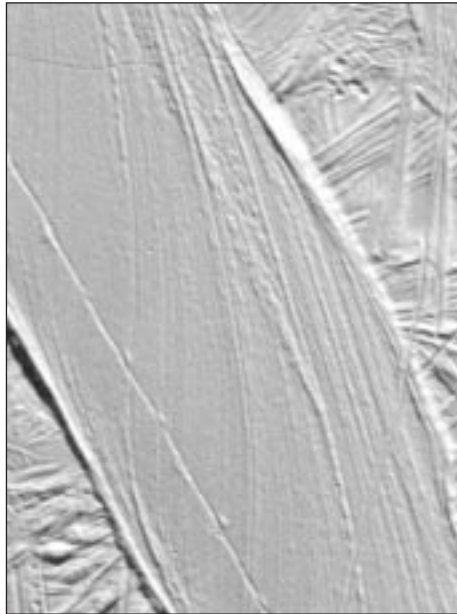
The European fault, known as Astypalaea Linea (pronounced ast-ipp-uh-LAY-uh LINN-ee-uh) was first discovered in 1996 when Dr. Randy Tufts, Galileo imaging team affiliate and research associate at the University of Arizona, reviewed distant images taken years earlier by NASA's Voyager spacecraft. The new mosaic of Galileo images released Dec. 7 captures a 290-kilometer-long (180-mile) portion of the fault in Europa's icy surface. Scientists calculate its full length at about 810 kilometers (more than 500 miles), about the same distance as the part of the San Andreas fault that runs from the California-Mexico border north to the San Francisco Bay.

"Comparisons between this European fault and faults on Earth may generate ideas we can use in studying earth movements here on our planet," said Tufts. "In addition, Astypalaea Linea is simply a beautiful structure."

The new Galileo images show that about 50 kilometers (more than 30 miles) of movement, or "displacement," has taken place along the fault, which is located near Europa's South Pole. Bends in the fault have allowed the surface to be pulled apart as this movement took place along Astypalaea Linea, which is the largest known strike-slip fault on Europa and one of the largest strike-slip faults known to exist anywhere. A strike-slip fault is one in which two crustal blocks move horizontally past one another, somewhat like two opposing traffic lanes.

This pulling-apart along the fault's bends created openings through which warmer, softer ice from below Europa's brittle ice shell surface, or frozen water from a possible subsurface ocean, could reach the surface. This upwelling of material formed large areas of new ice within the boundaries of the original fault. A similar pulling-apart phenomenon can be observed in the geological trough surrounding California's Salton Sea, and in Death Valley and the Dead Sea. However, in those cases, the pulled-apart regions can include upwelled materials, but may be mostly composed of sedimentary and erosional material deposited from above.

Tufts believes Astypalaea Linea is probably no longer active, because large ridges formed more recently crosscut it without interruption. Opposite sides of the fault can be reconstructed in puzzle-like fashion, matching the shape of its sides as well as individual older lined areas that had been broken by its movements. The overall motion along the fault seems to have followed a continuous narrow break along the entire length of the feature, with a path resembling steps on a staircase crossing the pulled-



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This view of Europa's south polar region shows part of a gray band that formed as plates on the icy surface separated and material filled in the widening gap. In the center of the image, a gently curving linear crack runs north to south and appears to be the location where the fault originally opened. Successive layers, like tree rings, form as material enters the gap periodically from below and hardens.

apart zones. Between the zones, this break coincides with ridges that separate them.

Tufts and fellow University of Arizona researchers, in a group led by Dr. Richard Greenberg, suspect that the fault motion is induced by the pull of variable daily tides generated by Jupiter's gravitational tug on Europa's icy crust. This tidal effect produces a phenomenon they call "walking."

"In walking, tidal tension opens the fault, subsequent tidal stress causes it to move lengthwise in one direction, and then the tidal forces close the fault up again. This prevents the area from moving back to its original position; it may move forward with the next daily tidal cycle," Tufts explained. "The walking analogy describes perfectly what we think happens at the fault, resulting in a steady accumulation of these lengthwise offset motions. Walking may explain the appearance of many other faults and areas of cracks and ridges on Europa."

Unlike Europa, here on Earth, large strike-slip faults such as the San Andreas are set in motion by plate tectonic forces from the planet's mantle. Based on the Europa findings, Tufts said, "The data may teach us more about the detailed structure that develops at bends in Earth's faults, including the San Andreas."

The latest Galileo images of Astypalaea Linea are available on the Internet at <http://photojournal.jpl.nasa.gov>. □

TOPEX finds global sea level change during El Niño event

By MARY HARDIN

The 1997-98 El Niño event may have been a major contributor in the average global sea level rising about 2 centimeters (0.8 of an inch) before it returned to normal levels, according to scientists studying TOPEX/Poseidon satellite measurements of sea surface height.

"This is the first time we have been able to identify that El Niño may cause a change in average global sea level," said Dr. R. Steven Nerem, a TOPEX/Poseidon science team member at the Center for Space Research at the University of Texas at Austin. "Understanding these short-term variations is important for understanding and detecting long-term variations caused by climate change."

"TOPEX/Poseidon measures average global sea level at 10-day intervals with a precision of 0.4 centimeters (0.16 inches), so detecting the 2-centimeter (0.8-inch) change associated with the El Niño was relatively easy," Nerem said. "However, these results tell us that detecting sea level variations caused by climate change will be more difficult because such changes are significantly smaller than the variations we have observed during the El Niño."

Nerem and his colleagues presented their findings at the American Geophysical Union's fall meeting in San Francisco Dec. 7.

Key to understanding the changes in the ocean are the global maps made by TOPEX/Poseidon. The sea level rise was not confined to the tropical Pacific, but also was observed in the Indian Ocean and the southern Pacific. Nerem's team then calculated the average global sea level.

"These six years of satellite data are a good start, but we really need a decade or more of continuous measurements before we can accurately detect any climate-induced change," said Dr. Lee-Lueng Fu, the TOPEX/Poseidon project scientist at JPL. "We need sustained observation records to understand the variations in the ocean."

Global mean sea level change on seasonal and inter-annual time scales is a measure of the changing heat content of the ocean. The 2-centimeter rise during the El Niño implies that, on average, the global ocean may be gaining heat.

"Average global sea level began rising in late March 1997, peaked at 2 centimeters above normal in early November 1997, and then began falling back to normal by the end of July 1998," according to Nerem. "Sea surface temperature changes began rising in late October 1996, peaked at 0.4 degrees C (0.7 degrees F) in late December 1997, and fell back to 0.1 degrees C (0.2 degrees F) at present." □

Cassini fires engine, is on course for Venus

By MARY BETH MURRILL

JPL's Cassini spacecraft successfully completed a long-planned 90-minute firing of its onboard engine Dec. 2, setting the spacecraft on course for a second flyby of Venus—the next major milestone on Cassini's long trajectory to Saturn.

The main engine firing started at 10:06 p.m. Pacific time and ended at 11:36 p.m. for the so-called "deep space maneuver" that put the spacecraft on course for its next planetary gravity-assist—a flyby of Venus next June.

"The performance of the spacecraft and the team in performing this maneuver was just perfect, we couldn't have asked for anything bet-

ter," said Bob Mitchell, Cassini program manager at JPL. Since its flawless launch Oct. 15, 1997, Cassini's flight has been characterized by excellent performance and extraordinary accuracy in navigation.

Telecommunications with Cassini throughout the maneuver were conducted through NASA's Deep Space Network complex near Madrid, Spain. Mission engineers said the engine firing went exactly as planned, slowing the spacecraft by close to 450 meters per second (about 1,006 mph) relative to the Sun.

Cassini's speed went from 67,860 kilometers per hour (42,168 mph) at the start of the maneuver to 66,240 kilometers per hour (41,161 mph) at the

end of the engine firing. The maneuver adjusted the angle of the spacecraft's flight path relative to Venus' orbit so that Cassini will achieve the maximum velocity boost from Venus' gravity during the June flyby of that planet.

The Dec. 2 engine firing is one of two long burns of the engine over the entire course of the mission; when Cassini reaches Saturn in July 2004, the engine will burn for about the same amount of time to brake the spacecraft into orbit around the ringed planet.

All of Cassini's systems remain in excellent condition. The spacecraft has flown more than 1.055 billion kilometers (655.5 million miles) since launch. □

NASA to have access to Intel's radiation-hardened Pentium chip

By JOHN G. WATSON

NASA and other federal agencies will soon have access to the technology for a radiation-hardened version of Intel's Pentium chip for use in future missions.

Intel Corp. announced Dec. 8 that it will provide a royalty-free license for its Pentium processor design to the Department of Energy for the development of custom-made microprocessors for space and defense purposes. The agreement provides the government with a ten-fold increase in processing power over the highest-performing currently available radiation-hardened chips.

Radiation hardening is required to shield systems and applications from radiation, such as cosmic rays, which affect the reliability of conventional electronics.

"The successful development of this new chip will bring advanced computing capability to

our missions in deep space where the radiation environment is much too severe for commercial devices," said JPL Director Dr. Edward Stone.

NASA's Deep Space Systems Technology Development Program, known as X2000, will serve as one of several Department of Energy partners to develop chip applications, in this case applications specific to future NASA missions. The program is intended to develop and deliver advanced spacecraft systems and avionics technologies to missions bound for different destinations in the solar system and beyond.

"High-performance radiation-hardened processors will enable many future space missions, both deep space and Earth-orbiting," said Dr. Leon Alkalai, head of JPL's Center for Integrated Space Microsystems, an element of the X2000 program. "This technology is cross-cutting within all of NASA's enterprises, including space science, Earth science, aero-

nautics, and human exploration and development of space."

In a ceremony at Intel's headquarters in Santa Clara, Intel said it would license the chip design to Sandia National Laboratories, the U.S. Department of Energy's lead facility for microelectronics research and development. Sandia will develop a custom radiation-hardened version of the Pentium processor for use in satellites, space vehicles and defense systems. A key goal of the agreement is the eventual transition of the technology into the commercial radiation-hardened semiconductor fabrication industry.

The Pentium processor redesign effort will involve several government agencies and laboratories that are expected to use the increased computing power for a variety of applications. JPL, the Department of Energy, the Air Force Research Laboratory and the National Reconnaissance Office are the initial institutions with applications for future use. Among those applications will be Earth satellites, space probes, radiation environments on Earth, missile defense and advanced military systems. □

New JPL-affiliated toys fulfill needs vital to space travelers

By JOHN G. WATSON

Shelter, sustenance, communications and exploration gear—in short, all the needs vital to a space traveler—are provided by a new toy line developed in collaboration with engineers and scientists from JPL.

The educational product line, "Mars and Beyond Science Exploration System," from Uncle Milton Industries Inc. of Westlake Village, features a domed tent, a drink dispenser, walkie-talkies and a robotic arm that extends to collect rocks and other objects.

The toys, which will eventually be augmented by additional exploration gear and biological, geological and chemical sampling test kits, are designed to enthuse and

teach youngsters about the space program. They have just begun to hit specialty toy store shelves in recent weeks.

Uncle Milton Industries licensed the JPL logo and received technical advice through the JPL Technology Affiliates Program, which enables businesses to form strategic alliances with JPL to license intellectual property and gain access to JPL's engineers and scientists to help solve technological problems. To date, more than 120 companies, large and small, have used the program to solve upwards of 200 specific technology challenges.

"Educational toys can be a wonderful and creative way of

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Through JPL's Technology Affiliates Program, Uncle Milton Industries Inc. has developed the "Mars and Beyond Science Exploration System," a new toy line developed in collaboration with JPL engineers and scientists.

Contest to name DS2's two microprobes

By JOHN G. WATSON

NASA has announced the start of a contest to name its Deep Space 2 mission's two microprobes, scheduled to be launched next month on a journey to Mars.

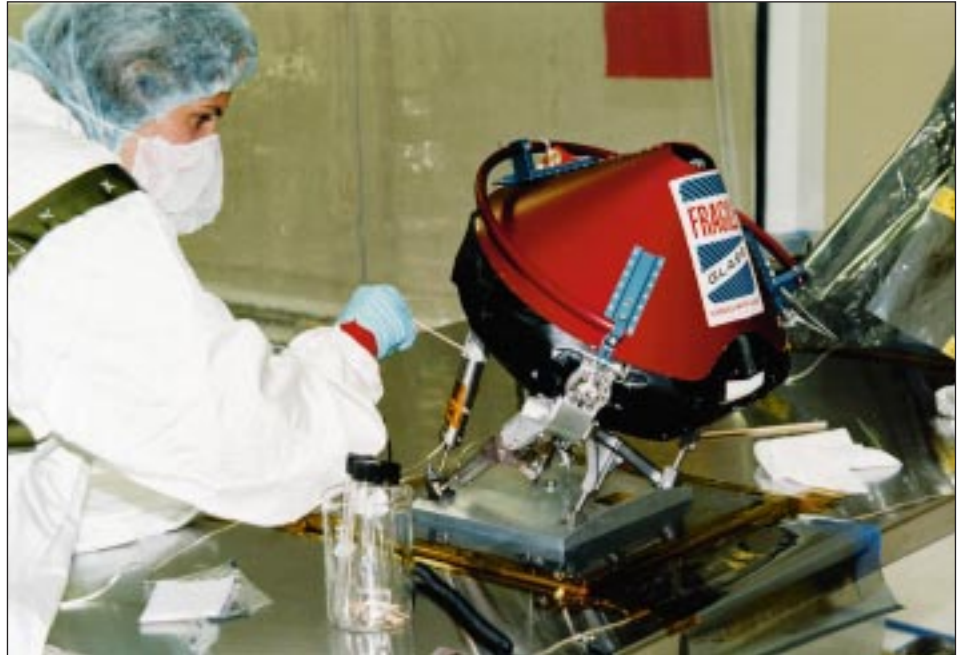
"Just as Mars Pathfinder's Sojourner rover received its name through a contest, we would like to invite the public to become involved in helping to name Deep Space 2's twin probes," said Project Manager Sarah Gavit of JPL. "What better way to involve school children and parents alike in this exciting, one-of-a-kind mission?"

Deep Space 2, launching with the Mars Polar Lander on Jan. 3, will send its two microprobes to impact and penetrate the surface of Mars in December 1999.

Each of its two entry systems consists of a basketball-sized aeroshell with a softball-sized probe inside. Released from the cruise stage of the Mars Polar Lander, the probes will dive toward the surface of Mars. Upon impact, the forebody of each probe will bury itself up to about 1 meter (3 feet) underground, while the aftbody remains on the surface to transmit data through the orbiting Mars Global Surveyor spacecraft back to Earth.

Unlike any spacecraft before, the Deep Space 2 probes will smash into the planet at speeds of up to 200 meters per second (400 mph). The mission's main purpose is to flight-test new technologies to enable future science missions—demonstrating innovative approaches to entering a planet's atmosphere, surviving a crash-impact and penetrating below a planet's surface. As a secondary goal, the probes will search for water ice under Mars' surface.

Participants in the probe naming contest can choose either two people from history, mythol-



KENNEDY SPACE CENTER PHOTO

In Kennedy Space Center's Spacecraft Assembly and Encapsulation Facility-2, a worker prepares one of the two Deep Space 2 microprobes that will hitchhike to Mars attached to the cruise stage of the Mars Polar Lander. Launch is scheduled for Jan. 3.

ogy or fiction (not living) or two places or things that are in some way associated with each other, or a combination. Their choices should be accompanied by a short written composition of up to 100 words explaining why their entries would make good names for the miniature probes.

"The names should symbolize our exploration of the universe, embodying the spirit of

risk-taking pioneers breaking barriers," explained Gavit. Complete details, along with online entry forms and further information about Deep Space 2, are available at <http://nmp.jpl.nasa.gov/ds2/>.

The deadline is April 30, 1999, and winners will be announced the following November. Finalists will receive one copy each of a Deep Space 2 poster signed by the project team. □

Cunningham named MED deputy

Mars Global Surveyor Project Manager Glenn E. Cunningham has been named deputy director for the Mars Exploration Directorate.

Cunningham had most recently served as manager of the Mars Surveyor Operations Project, and has been project manager of the Mars Global Surveyor Project since its inception in 1994.

He joined JPL in 1966 as an engineer in the Spacecraft System Design and Integration Section and has worked on a variety of spacecraft missions, including the 1969 Mariner spacecraft to Mars and the 1977 Voyager spacecraft to the outer planets of the solar system. Cunningham has also led studies for robotic precursor missions in support of eventual human exploration of Mars.

He was named spacecraft team chief of the Voyager mission in early 1978 and served in that position through the Jupiter encounters in

1979. After several other spacecraft system engineering management positions, he became deputy manager in 1987 of the Mars Rover Sample Return Development Flight Project,



Glenn Cunningham

deputy manager of the Mars Observer Project in 1990 and Mars Observer project manager at its launch in 1992. □

Toys

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bringing the excitement of America's space exploration program to children of all ages," explained Merle McKenzie, manager of JPL's Commercial Technology and Regional Development Program. Each autumn, the program hosts an annual Toys, Games and Multimedia Workshop at JPL to inform the toy, entertainment and multimedia industries about space program licensing opportunities. The 1999 event is in the works for next October.

The four components of Uncle Milton's Mars and Beyond product line are an HM4Terra-Colony Habitation Module (domed tent), NM8 Hydropak Drink Unit (dispenser), CM5 Mission Communicators (walkie talkies) and the Em3 Robotic Extender Arm (specimen collector).

Further details about the Technology Affiliates Program are available from JPL's Commercial Technology Program web site at <http://techtrans.jpl.nasa.gov/tu.html>. □

ARC keeps retirees in touch

JPL employees planning retirement in the near or even distant future may join an organization geared to their social interests and desire to maintain contact with their fellow senior employees: the Associated Retirees of Caltech/JPL (ARC).

Approximately 750 ARC members and spouses have joined the club since it was formed in 1984 by Lab retirees Herman Bank and Joe Koukol.

ARC is an ERC subclub, responsible to Caltech's Human Resources Office and the JPL Benefits Office. The ARC Light newsletter, published monthly and distributed to members, JPL and Caltech organizations and associate members, is a key communications link for retirees to keep informed about members' doings, upcoming ARC social events and

other JPL activities.

The group includes the following nine committees, headed and staffed by volunteers:

- ARC Light publication;
- Financial—an advisory group dealing with matters affecting retired persons' savings, income and investments;
- Hospitality—members who assist other members in need;
- Membership—recruits and aids new members;
- Public Relations—promotes ARC activities;
- Science and Technology—operates the Volunteer Professionals for the Medical Advancement project, whose members have adopted space-related technology for medical research;
- Social—plans and organizes social events and parties for each month of the year and handles

arrangements for extended land trips, tours and cruises;

- Social Security and Health Care—reviews current legislation, developments and trends affecting member concerns regarding Social Security, Medicare and insurance programs;

- Volunteer—members who lend their time and abilities by supporting ARC programs and outside charitable organizations.

Besides annual events such as the picnic at Caltech and December holiday party at the Athanaeum, members have visited the Getty Center, the new Aquarium of the Pacific, Edwards and Vandenberg Air Force bases, Mount Wilson and Palomar observatories and Lawrence Welk Theater. Members have been a part of tours to Spain, Portugal and Nova Scotia. In spring 1999, members will travel to England, Scotland, Ireland and Wales.

VPMA has received national

recognition for winning the Public Service Excellence Award and other members have been cited by their communities for exceptional volunteer service.

Officers for 1999 are Phil Neuheuser, president; Pat Guernsey, vice president; Bob Steinbacher, treasurer; and Pat McLeod, secretary.

Annual dues for retired JPL and Caltech employees and their spouses are \$6; for pre-retirees, \$3.

For more information, call Lila Moore at (818) 790-5893. □

Retirees

The following employees retired in December:

Takeshi Sato, 41 years, Section 334; **David Conklin**, 38 years, Section 394; **David Juergens**, 16 years, Section 387; **Edward Brown**, 10 years, Section 662. □

Celebrating 40 years of service



JPL PHOTO LAB

JPL employees celebrating their 40th anniversary with the Laboratory gathered earlier this month. From left are Tom Sorenson, Section 340; James Hix, Section 351; Don Starkey, Section 313; Earl Cherniack, Section 510; Neil Herman, Section 776; Bob Tausworthe, Section 360; Dean Pruitt, Section 330; and George Ladner Jr., Section 601.

TOPEX wins Pecora award

The TOPEX/Poseidon Team has won the William T. Pecora Award, sponsored jointly by the Department of the Interior and NASA and presented annually to recognize outstanding contributions of individuals or groups who study the Earth with remote sensing.

NASA Administrator Daniel Goldin presented the award at the conclusion of his keynote address at the American Geophysical Union fall meeting in San Francisco Dec. 6.

Charles Yamarone, the TOPEX/Poseidon project manager at JPL, and Jean Louis Fellous, assistant director of the Earth Science and Applications Programme Directorate from the French space agency Centre National d'Etudes Spatiales (CNES), accepted the award on behalf of the TOPEX/Poseidon Team.

The award was established in 1974 in memory of Dr. William Pecora, former director of the U.S. Geological Survey and Undersecretary, Department of the Interior. Pecora was a motivating force behind the establishment of a program for civil remote sensing of the Earth from space. His early vision and support helped establish what is known today as the Landsat satellite program.

See Award, page 7

Passings

Len Carter, 76, known to many JPL employees through his work with the British Interplanetary Society and as editor of the organization's Spaceflight magazine, died unexpectedly Nov. 12 in Sutton, England, after minor surgery.

Carter, who served as executive secretary of the society, commissioned articles and columns authored by JPLers over the past two decades. □

Justin (J.R.) Hall, 70, a retired technical manager in the former Section 410, died of leukemia

Nov. 13 at Verdugo Hills Hospital. Hall worked at the Laboratory from 1959-94. He is survived by his wife, Rahla.

Memorial services were held Nov. 20 at Church of the Lighted Window in La Cañada, followed by cremation at sea. □

Warren Rachwitz, 78, a retired engineering test associate from Section 326, died of cancer Nov. 15 at his Glendora home.

Rachwitz joined JPL in 1956 and retired in 1986. He is survived by his wife, Louise, seven children, 11 grandchildren and five great-grandchildren.

Memorial services were held Nov. 19 at Oakdale Memorial Park and Cemetery in Glendora. □

Duncan Griffith, 78, a retired senior engineering associate in Section 313, died of cancer Nov. 17 at his Lancaster home.

Griffith worked at JPL from 1959-84. He is survived by his wife, Ann Mae, son Robert and daughter Kathleen Crampton.

Memorial services were held Nov. 21 at Valley Bible Church in Lancaster; burial was private. □

Roy Brereton, 77, a retired member of the technical staff, died of cancer Nov. 18 at his home in Victorville.

Brereton joined the Laboratory in 1961 and retired in 1981. He is survived by his wife, Mary; daughters Pamela, Patti and Penny; and son David.

Memorial services were held at March Air Force Base in Redlands. □

Ernest Fehlings, 93, a retired JPL employee, died of natural causes Nov. 19 at a North Carolina nursing home.

Fehlings worked at JPL from 1951-69. He is survived by sons Donald and William.

Private services were held in Pennsylvania. □

John Koenig, 67, a senior engineer in Section 352, died of cancer Nov. 22 at his Glendora home.

Koenig had worked at the Lab since 1979. He is survived by his daughter Bonnie and brother Robert.

Memorial services were held Nov. 25 at Hope Lutheran Church in Glendora. Private burial was in Wisconsin. □

Tony Federico, 85, a retired engineering liaison representative from Section 820, died of heart failure Dec. 2 at a convalescent home.

Federico joined the Lab in 1942 and retired in 1976. He is survived by his wife, Anette, and son Gary. Services were private. □

Award

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The TOPEX/Poseidon satellite uses an altimeter to bounce radar signals off the ocean's surface to get precise measurements of the distance between the satellite and the sea surface. These data are combined with measurements from other instruments that pinpoint the satellite's exact location in space. Every 10 days, scientists produce a complete map of global ocean topography, the barely perceptible hills and valleys found on the sea surface. Launched in August 1992, TOPEX/Poseidon's measurements are accurate to within 4.2 centimeters (1.7 inches). □

Volunteers sought to decorate float

Volunteers are sought to help decorate The La Cañada Flintridge Tournament of Roses' entry in the 1999 Rose Parade, which honors JPL's Mars Pathfinder mission.

From Dec. 26 to 31, two daily shifts of volunteer decorators will help prepare the "Martian Mischief" float under the 210 Freeway at the corner of Hampton Road and Foothill Boulevard. Shifts are 8 a.m. to 2:45 p.m. and 3:45 p.m. to 10 p.m.

Organizer Bob Ferber of Section 386 said families are welcome and decorators must be at least 13 years of age. Hot meals at lunch and dinner, as well as beverages and snacks, will be available to volunteers.

For more information or volunteer forms, call Ferber at ext. 4-3463. □

Next Universe: Jan. 8 Ad deadline: Dec. 21

LETTERS

On behalf of my family and myself, I would like to thank my JPL family for the cards, beautiful flowers and plants and support during my father's illness and recent death. Thanks also to ERC for the exquisite plant. I am truly blessed to have so many "earth angels."

Barbara "Cookie" Kotulla and family
□□□

Special thanks to the JPL ERC for the lovely plant and kind expression of sympathy in the recent loss of my Dad.

Joyce Pulliam, Section 900
□□□

Heartfelt thanks to co-workers and friends in Divisions 23, 21 and elsewhere for your many kindnesses to me during my father's recent illness and passing. Your visits and written expressions of support really mattered. Thanks also to the ERC for the lovely ficus.

Aubyn Miller

FOR SALE

AIRLINE TICKET, R/T, anywhere American flies, \$425, with free hotel voucher and 1 day free rental car; ENTERTAINMENT CENTER, large 3-piece, lighted (\$99); COMPUTER, new Pentium 166 laptop with \$1,600 12.1 active matrix screen/modem (\$849); FRIDGE, huge frost free (\$59); FICUS, huge fake, looks very real (\$35); FAN, standing, (\$15); FLOOR LAMPS, tall black halogen (\$9); SOFTWARE, Word 97 upgrade (\$19), Adobe Photodelux (\$15); SOFA/chair/loveseat, beige (just cleaned/Scotchguarded), \$325 for all. 366-6134.

ARTWORK, Indian, Southwest, wildlife; limited edition prints, all custom framed, \$35 to \$500; Marty Bell limited edition print, English country cottages, \$250; set of 8 collector plates, \$280/set/obo. 626/797-8776.

BABY ITEMS, like-new Graco battery-operated baby swing, \$50;

Century Bassinet w/linens, \$35; diaper genie, \$10. 957-5502.
BEDROOM SET, Thomasville, qn.-sz. sleigh bed, lg. 6-ft. dresser w/mirror, nightstand, light wood, mattress and pad included, exc. cond., 1 yr. old, \$2,000. 888-3292.

BEDROOM SET, Italian, white lacquer, cal king bed, 2 matching night stands, matching dresser w/6 drawers, w/2 mirrors, \$500. 548-5082.

BIKE, Fuji 12-speed, medium size, good condition, aluminum wheels, Suntour shifters, \$90 firm. 626/794-0886, Ted.

BIRD CAGE, for big bird, 2' x 3' x 4' high, like new, \$340. 341-1798.

BLOUSES/DRESSES, sz. 10, some designer labels, blouses \$10, dresses \$20. 888-3292.

BOOKS, computer, new, 40-70% off list price; published by New Riders, QUE, SAMS, Ventana, Microsoft Press, Waite Group/Prentice Hall, and others; subjects: HTML, Internet, Macintosh & Internet, Visual FoxPro3, Microsoft Network, Microsoft Intranets, Windows NT, Web publishing using Word, Windows 95, Novell's NetWare 4.x, applied C programming, and MCSE study guides. 626/292-0373.

CHINA, six Noritake 5-piece place settings, Rothschild design, \$120. 626/403-9002.

COMPUTER, Mac II-FX w/Apple color RGB monitor, Global Village Teleport 33.6 fax modem, Connor HD, 1.4M + 0.7 HD, best offer, 541-0062.

COMPUTER, Compaq 2010C series handheld PC (brand new, won as a prize); 20 MB RAM, 640 X 240 LCD color screen, 33.6 KBPS built-in modem, external speaker and quick-access microphone; complete bundle of Windows-based CE applications with pocket versions of MS Office software; for more details see www.compaq.com/products/handhelds/2010/index.html; retail value \$699; sell \$450/obo. 626/797-9057.

COMPUTER ACCESSORY, Mac Geoport telecom adapter, Global Village fax modem for Power Mac, best offer. 541-0062.

COUCH/LOVE SEAT, beautiful white bamboo, pastel tropical print cushions, 1 year old, exc. cond., \$600 for both. 888-3292.

DARKROOM, complete Omega C760 enlarger system w/Dichroic Lamphouse 24mm lens, 16 x 20" base, 35mm and slide film carriers, electronic timer, print holder, 16 x 20" and 8 x 10" developing drums, automatic drum roller, measuring jars, thermometers, more, \$950. 805/523-1832, Ken.

DESK, perfect for home office, new, never used, \$200. 626/403-9002.

DIET TAPES, Jenny Craig, set of 14, \$50. 790-3899.

DISHES, full set, Pfaltzgraff, no chips, no cracks, exc. cond.; matching green glass salad bowls and glasses, exc. cond., used once, \$80/obo. 888-3292.

DOGS, beautiful boxer puppies, AKC champion lines; tails and claws done, 1st set of shots; 8 weeks on 12/17/98; good homes only; \$400. 951-9372L, Iv. message.

EXERCISE EQUIPMENT, Body by Jake hip & thigh machine, \$40/obo; ab & back machine, \$50/obo; both w/instructional video & orig. literature. 367-0969.

EXERCISE MACHINE, NordicTrack Achiever, w/Fitwatch, exc. cond., \$350. 805/255-5645.

FISH TANK, brand new 100-gallon, Plexiglas with black back, white Formica with brass stand and canopy, comes with fluorescent lights, wet/dry filtration, bioskimmer, and ozonizer, \$1,000/obo. 626/796-9011.

FOOTBALL CARDS, unopened box of '97 Ecalibur, 24 packs, major stars and rookies, \$40; BASEBALL CARDS, set of 201 '98 Leaf cards, major stars and many rookies, Beckett value \$200, sell \$60. 626/914-6083.

FURNITURE: redwood dining set, 6 chairs w/extension \$300; Oakwood entertainment center, glass doors, \$300; 3-piece wall unit, wood with upper glass doors, gd cond., \$300. 244-0931.

FURNITURE: sofa/loveseat, cust. made, 7 months new, cream color, w/matching chest, dining set w/6 chairs, exc. cond., \$800/obo. 243-7107, Lana or Shant.

FURNISHINGS, merging two households, solid oak roll top desk, solid oak bar w/brass rail and 4 stools, 5 cu. ft. freezer, brass

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