Universe

Jet Propulsion Laboratory

Inside

December 16, 2005
Volume 35 Number 24

Rovers continue to explore and amaze

By Guy Webster

This view from the panoramic camera on Opportunity shows an outcrop called "Olympia" along the northwestern margin of "Erebus" crater.

The durable twin Mars rovers have successfully explored the surface of the mysterious red planet for more than a full Martian year (687 Earth days). Opportunity started its second Martian year Dec. 11; Spirit started its new year about a month ago. The rovers' original mission was scheduled for only three months.

"The rovers went through all of the Martian seasons and are back to late summer," said Dr. John Callas of JPL, the deputy rover project manager. "We're preparing for the challenge of surviving another Martian winter."

Both rovers keep finding new variations of bedrock in areas they are exploring on opposite sides of Mars. The geological information they collect increases evidence about ancient Martian environments including periods of wet, possibly habitable, conditions.

Spirit is descending from the top of "Husband Hill" to examine a platform-like structure seen from the summit. It will then hurry south to another hill in time to position itself for maximum solar-cell output during the winter.

"Our speed of travel is driven as much by survival as by discovery, though the geology of Husband Hill continues to fascinate, surprise, puzzle and delight us," said Dr. Steve Squyres of Cornell University, principal investigator for the rover's science instruments. "We've got this dramatic topography covered with sand and loose boulders, then, every so often, a little window into the bedrock underneath."

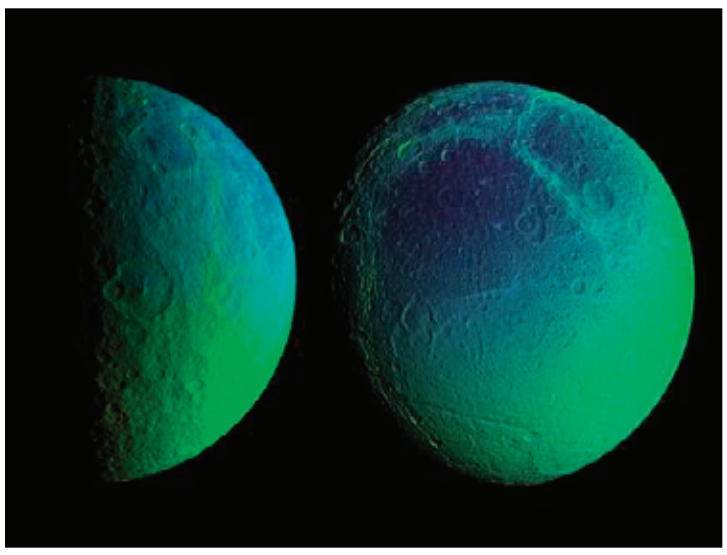
From the composition and texture of more than six different types of rock inspected, scientists deduced what this part of Mars was like long ago. "It was a hot, violent place with volcanic explosions and impacts," Squyres said. "Water was around, perhaps localized hot springs in some cases and trace amounts of water in other cases."

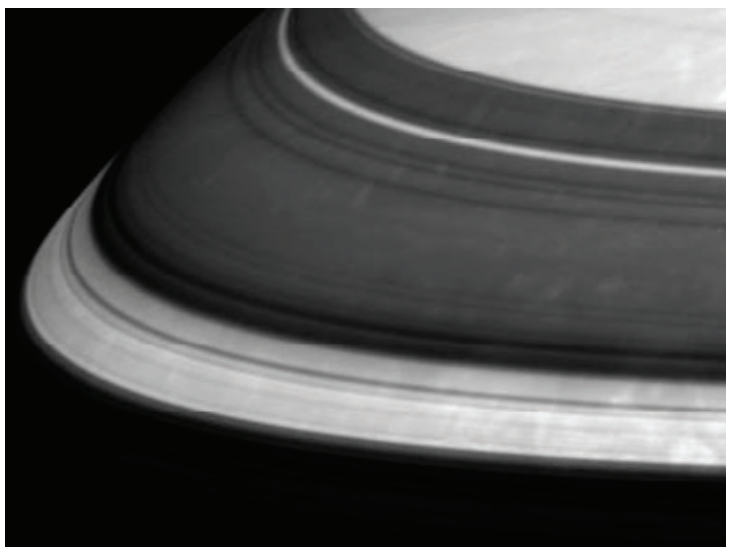
Aided by a good power supply from Spirit's solar cells, researchers have been using the rover at night for astronomical observations. One experiment watched the sky during a meteor shower as Mars passed through the debris trail left by a passage of Halley's comet. "We're taking advantage of a unique opportunity to do some bonus science we never anticipated we would be able to do," said Cornell's Dr. Jim Bell, lead scientist for the rovers' panoramic cameras.

Opportunity is examining bedrock exposures along a route between "Endurance" and "Victoria" craters. It recently reached what appears to be a younger layer of bedrock than examined inside Endurance. In Endurance, the lowest layers of bedrock were deposited as windblown dunes. Some of the upper layers were deposited as underwater sediments, indicating a change from drier to wetter conditions over time.

The bedrock Opportunity began seeing about two-thirds of the way to Victoria appears to lie higher than the upper layers at Endurance, but its texture is more like the lowest layer, petrified sand dunes. This suggests the change from drier to wetter environmental conditions may have been cyclical.

Cassini's photo album from a season of icy moons





Near right: False-color views of Saturn's cratered, icy moons, Rhea and Dione.

Far right: Saturn's rings throw imposing shadows and relegate parts of the planet's northern regions to darkness.

Lower right: Meri, a crater on Saturn's moon Hyperion, blooms in this extreme color-enhanced view.

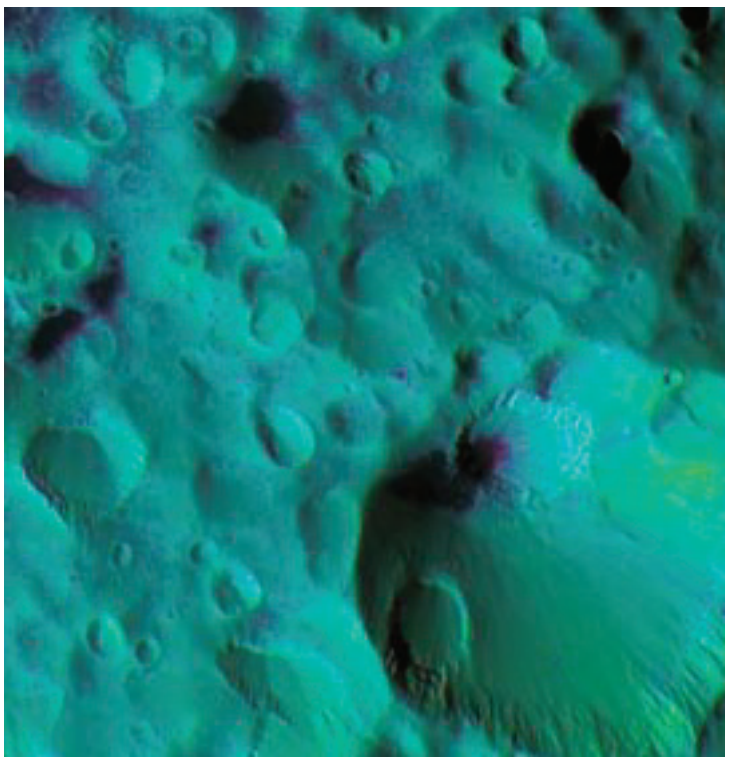
Wrapping up a phenomenally successful year of observing Saturn's icy moons, the Cassini mission is releasing a flood of new views of the moons Enceladus, Dione, Rhea, Hyperion and Iapetus.

The moons and their intricacies were highlighted at a Dec. 6 news briefing at the American Geophysical Union meeting in San Francisco.

Several new images of Rhea, a moon measuring 1,528 kilometers (949 miles) across, were taken during Cassini's most recent close flyby on Nov. 26. During the encounter, Cassini dipped to within 500 kilometers (310 miles) of Rhea's surface.

Additional new images include two "zoomable" mosaics of Rhea and Hyperion at high resolution; false-color views revealing compositional variation on the surfaces of Hyperion, Dione and Rhea; two movies reproducing Cassini's exciting encounters with Iapetus and Hyperion; and dazzling new images of the plumes of Enceladus, including a time-lapse movie.

The image products being released include large mosaics, movies and false-color views. They are available at *http://saturn.jpl.nasa.gov, http://www.nasa.gov/cassini* and *http://ciclops.org.*



News Briefs

Dr. Charles Elachi

Tom Gavin

Elachi, Gavin receive AAS awards

JPL Director DR. CHARLES ELACHI and Associate Director of Flight Projects and Mission Success TOM GAVIN have received major awards from the American Astronautical Society.

Elachi earned the 2005 Space Flight Award. This is the highest award bestowed by the society for "an individual who has contributed the most to the advancement of space flight and space exploration."

Previous recipients include WERNHER VON BRAUN, WILLIAM PICKERING, JOHN CASANI, DAN GOLDIN, ED STONE, NEIL ARMSTRONG, JOHN GLENN and SALLY RIDE.

Elachi, who joined JPL in 1970, has served as Laboratory director since May 2001.

Gavin was selected to receive the 2005 W. Randolph Lovelace II Award, presented annually for "outstanding contributions to space science and technology."

Gavin, who two years ago was honored as a fellow of the society, joined JPL in 1962. He has held numerous engineering and management positions, including mission assurance manager for both the Voyager and Galileo projects, spacecraft system manager for Cassini and deputy director for JPL's space and Earth science programs.

Awards were handed out at the society's recent national conference in Houston.

Voyager milestone noted

Voyager team members on Nov. 12 celebrated the 25th year since the venerable Voyager 1 spacecraft's closest approach to Saturn.

Launched in 1977, Voyager 1 and its twin, Voyager 2, were sent on a four-year journey to Jupiter and Saturn.

The Voyager team, from left: Ed Massey, Jefferson Hall, Larry Zottarelli, Tim Hogle, Andrea Angrum, Sun Matsumoto, Roger Ludwig, Sharon Maupin, Steve Howard, Enrique Medina.

Voyager 1 flew under Saturn's south pole, a requirement to get a close look at Titan. Saturn's gravity caused the trajectory to bend northward out of the ecliptic plane, precluding any further planetary encounters. The success of the Titan encounter set the stage for Voyager 2 to continue on to Uranus and Neptune.

Voyager 1 discovered three satellites, a dynamic and complex ring system with ring spokes, shepherding moons and far more ring structure than had been previously imagined. It also paved the way for the Cassini spacecraft to continue the study of the Saturnian system 24 years later.

At its peak, Voyager employed more than 300 people at JPL. The flight team currently has about 10 full-time equivalent personnel. Four of these, JEFFERSON HALL, TIM HOGLE, REGINA WONG and LARRY ZOTTARELLI, were on the team during the Saturn encounter. This small, close-knit group continues a vigorous program of spacecraft monitoring and maintenance, science sequence augmentation and processing received data.

Voyager 1 will pass out of the heliosphere into interstellar space in about 10 years. The spacecraft is healthy enough that it could continue sending data for another 15 or more years.

Accident claims Goldstone personnel

Three contractors at the Goldstone Deep Space Communications Complex died Thursday, Dec. 8, in an auto accident while vanpooling to work.

The deceased were DENNIS BUTCHER, driver of the commuter van, and two passengers, ROGER LANIER and JOHN MASON. The other three passengers, MICHAEL BLACK, GUY KAUFFMAN and DON PAVELKA, were taken to the hospital with moderate to major injuries. The five were employees of ITT Industries, which operates the Goldstone complex under contract to JPL, and a subcontractor company.

According to newspaper reports, the accident occurred when two other vehicles both attempted to pass the van simultaneously. One vehicle hit the van, causing it to leave the road.

"Our heartfelt sympathy goes out to all those affected," said JPL Director DR. CHARLES ELACHI.

Records system established

In response to a federal requirement, NASA has established a system of records that will document foreign access to agency resources including JPL.

The database, called the NASA Foreign National Management System, will include information on non–U.S. citizens, including both foreign nationals and permanent resident aliens, who work at or visit JPL. Information will be entered via an online system and transmitted electronically to NASA.

"This is not a JPL initiative, but rather is a requirement coming from the federal government," said JOSEPH CHARLES, manager of JPL's Office of Protective Services. "It is part of the federal government's efforts to increase the security of federal facilities, and we are contractually obligated to provide this information."

No action is currently required by foreign nationals or others at JPL, said Charles. Personnel will be advised later when their input to the system is required.

A Privacy Act notice giving a general description of the records system was published in the Federal Register on Aug. 23, 2005 and may be viewed at *www.jpl.nasa.gov/dailyplanet/stories/new_foreign_nat.html.*

Special Events Calendar

Ongoing Support Groups

Alcoholics Anonymous—Meets Wednesdays at 11:30 a.m.

Caregivers Support Group—Meets the first Thursday of the month at noon in Building 167-111 (the Wellness Place).

Codependents Anonymous—Meets at noon every Wednesday.

Lambda (Gay, Lesbian, Bisexual and Transgender Networking Group)—Meets the first Friday and third Thursday of the month at noon in Building 111-117. For more information, call Randy Herrera, ext. 3-0664.

Parents Group for Children With Special Needs—Meets the second Thursday of the month at noon in Building 167-111 (the Wellness Place).

For more information on any of the support groups, call the Employee Assistance Program at ext. 4-3680.

Wednesday, December 21

JPL Library Orientation—Stop by Building 111-104 at 11:30 a.m. for an overview of the Library's products and services, and learn how to access numerous electronic resources from your desktop. For more information, call the reference desk, ext. 4-4200.

Thursday, December 22

Holiday Car Show—JPLers' classic vehicles will be displayed from 11 a.m. to 1 p.m. at Transportation Building 177, north side. Event organizer Gerald Kalish requests that all participants have a JPL badge and enter through the south security gate on the day of the event. Participants should park their vehicles on the north side of 177 when they arrive for work the morning of the event. Those planning on showing cars, motorcycles and/or special equipment should contact Kalish at ext. 4-8733 or via e-mail.

Wednesday, December 28

JPL Library Orientation—Stop by Building 111-104 at 11:30 a.m. for an overview of the Library's products and services, and learn how to access numerous electronic resources from your desktop. For more information, call the reference desk, ext. 4-4200.

JPL Toastmasters Club—Meeting at 5 p.m. in conference room 167. Call Dirk Runge, ext. 3-0465, or visit *www.jplcaltechtoastmasters.com.*

Thursday, December 29

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

Tuesday, January 3

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

Wednesday, January 4

Associated Retirees of JPL/Caltech—Meeting at 10 a.m. at La Cañada United Methodist Church, 104 Berkshire Place, La Cañada. Call (626) 794-1698 to leave a message for an ARC board member.

JPL Library Orientation—Stop by Building 111-104 at 11:30 a.m. for an overview of the Library's products and services, and learn how to access numerous electronic resources from your desktop. For more information, call the reference desk, ext. 4-4200.

Thursday, January 5

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

Sunday, January 8

Chamber Music—The Eroica Piano Trio will perform at 3:30 p.m. in Caltech's Beckman Auditorium. Tickets are $29, $25, $21 and $17. For more information, call (626) 395-4652 or visit *www.events.caltech.edu.*

Tuesday, January 10

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

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

Wednesday, January 11

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

JPL Library Orientation—Stop by Building 111-104 at 11:30 a.m. for an overview of the Library's products and services, and learn how to access numerous electronic resources from your desktop. For more information, call the reference desk, ext. 4-4200.

JPL Toastmasters Club—Meeting at 5 p.m. in conference room 167. Call Dirk Runge, ext. 3-0465, or visit *www.jplcaltechtoastmasters.com.*

Tuesday, January 17

"New Neighbor in the Sky: Discovery of the 10th Planet"—Mike Brown, a Caltech professor of planetary astronomy, will deliver this lecture from noon to 1:30 p.m. in Beckman Institute Auditorium. The event is sponsored by the Caltech Management Association.

Wednesday, January 18

"The Coming Revolution in Pharmaceuticals"—Dr. William Goddard, professor of chemistry, materials science and applied physics and director of Caltech's Materials and Process Simulation Center, will speak at 8 p.m. in Caltech's Beckman Auditorium. Free admission. For more information, call (626) 395-4652 or visit *www.events.caltech.edu.*

Chahine participates in Vatican workshop

By Sharon Okonek, AIRS outreach coordinator

When you think of events associated with the Vatican, "science conference" probably isn't one of them. So it may be surprising to learn the Vatican has a tradition of studying what is referred to as "specific natural emergencies," and one of JPL's own was recently invited to participate in a workshop on the state of water resources around the world.

Dr. Moustafa Chahine was one of 15 international participants invited to speak last month at the Pontifical Academy of Sciences' Working Group on Water and the Environment, which took place in Vatican City. The goal of the workshop was to discuss the scientific frontiers of the main environmental issues related to the impact of hydrologic dynamics on sustainable development.

The workshop was organized around the topics of biodiversity, global hydrology, climate change, land–atmosphere interactions, and river basins and hydrologic dynamics. Chahine's talk, "NASA's Measurements of Water From Space," focused on results obtained from instruments like the Atmospheric Infrared Sounder and the Gravity Recovery and Climate Experiment. Beyond the workshop, attendees were invited to a three-hour Sunday mass with Pope Benedict XVI, where they were treated as guests of honor and seated near the altar.

During their stay, attendees were given gold medallions to wear around their necks, which signified their special guest status and allowed them unquestioned access to locations within Vatican City. Their accommodations at the Domus Sanctae Marthae were the same rooms in which the cardinals are secluded when selecting a pope.

How does the experience of representing NASA and JPL at the Vatican measure among a lifetime of achievements? "In all of my career and life, other than the birth of my children, this has been among the greatest experiences I have known," Chahine said.

Inventors are up to the challenge

JPL's Richard Goldstein, above, checks out his winning entry, "Rube Goldstein," in JPL's annual Invention Challenge, the "Strike A Match Contest," held Dec. 2. At right is La Cañada High School's "Disciples of Babylon," which won in the school teams category. Twenty-five school teams and eight JPL teams entered the competition, which required entrants' contraptions to execute three or more sequential actions, each using different forms of energy, to light a small wooden stick match in 20 seconds or less.

The scoring system awarded points for the speed of lighting the match, completing the task without human intervention, creativity, artistry and unusual features. Trophies were awarded for the top three point-getters, with certificates issued for the heaviest, lightest, largest, smallest, most artistic, most unusual and most creative designs.

Goldstein edged out a guest team from Elsinore called "Firebolts" that competed alongside JPL entrants, 96 points to 94. Audrey Doran of JPL and her "Li'l Stinker 6" tied with Elsinore's second team, "Santa's Little Match Lighters," for third with 82 points each. "Firebolts" won a certificate for most unusual entry.

La Cañada's win was also a tight one: 98 points to 96 for Jordan High School's "Destroyers." Crescenta Valley High School of La Crescenta and Granite Hills High School of Apple Valley were close behind with 94 points each. In addition to their overall win, La Cañada's entry also won certificates for largest and most creative entry.

Tom Wynne / JPL Photolab

Readers' feedback sought on JPL internal communications

How effective is Universe as a communication vehicle? Or the Daily Planet? Are you getting too many, not enough, or just the right amount of all-hands e-mails?

JPLers are invited to express their thoughts as part of a review of the Laboratory's internal communications channels—and changes may be on the way soon.

According to Frank O'Donnell, manager of the Institutional Communications Office, the idea is to see what's working and what may have outlived its usefulness.

"Some of our communications channels were created long ago in a very different era," said O'Donnell. "For example, the Lab newspaper, Universe, was born in the 1950s when a weekly or biweekly newspaper was the way most employees could get their most up-to-date news on JPL missions. Today, the Internet is a far faster way of accessing breaking news."

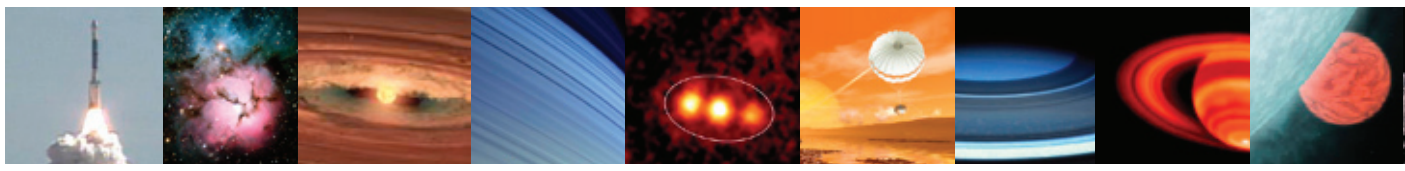
One proposal being considered is to change Universe from a biweekly to a monthly publication. "Instead of publishing mission news that employees probably saw on the Web weeks earlier, as a monthly Universe might have more of a 'feature' focus emphasizing stories on our people behind the missions," said O'Donnell.

The internal communications team is also interested in employee feedback on the Daily Planet. "We'd like this to be the first place that employees and contractors turn to for information about what's going on at the Lab," said O'Donnell. "Is it working? Is there anything we can do to improve it?"

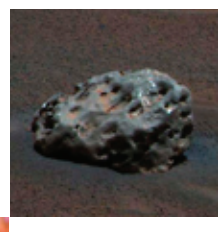
All-hands e-mails are another area that many JPLers have strong feelings about. "Some people feel they get too many all-hands e-mails, but there are some things that we're obligated to communicate to the workforce," said O'Donnell. "But there might be different ways to do this. I don't think we can let people unsubscribe from all-hands e-mails entirely, but it might be possible to split it into different lists—some with the mandatory information that needs to go out to everyone, and others with optional messages that people can choose to subscribe to by topic."

O'Donnell invited any JPLers with opinions on these or other internal communications topics to e-mail him at *fod@jpl.nasa.gov.* Changes to the communications channels may begin to be rolled out during the first few months in 2006.

2005 in review

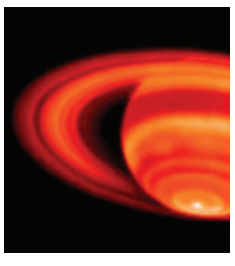


JANUARY



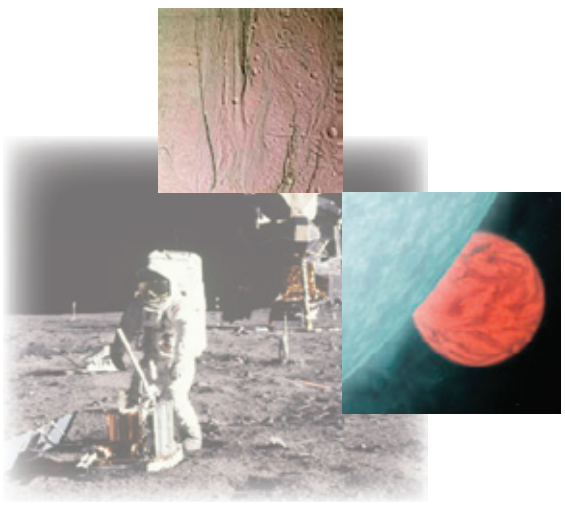
Culminating more than four years of processing data, NASA and the National Geospatial-Intelligence Agency completed Earth's most extensive global topographic map. The data, extensive enough to fill the U.S. Library of Congress, were gathered during JPL's Shuttle Radar Topography Mission, which flew in February 2000 on Space Shuttle Endeavour. … The JPL-managed Spitzer Space Telescope saw the dusty aftermath of the probable collisions of objects, perhaps as big as the planet Pluto, up to 2,000 kilometers (about 1,200 miles) in diameter. The dusty disc swirling around the nearby star Vega, 25 light-years away, is bigger than earlier thought. Astronomers think embryonic planets smashed together, shattered into pieces and repeatedly crashed into other fragments to create ever-finer debris. Vega's light heated the debris, and Spitzer's infrared telescope detected the radiation. … Scientists including Dr. Richard Gross of JPL, using data from the magnitude 9 earthquake southwest of Sumatra on Dec. 26, 2004, calculated that the temblor affected Earth's rotation, decreased the length of day, slightly changed the planet's shape, and shifted the North Pole by centimeters. … Imagery from three NASA instruments shed valuable insights into the tsunami that resulted from the earthquake. The data acquired by the Multi-angle Imaging SpectroRadiometer and the Advanced Spaceborne Thermal Emission and Reflection Radiometer instruments on NASA's Terra spacecraft, as well as from the Shuttle Radar Topography Mission, will be used to assist with disaster recovery, mitigate the effects of future natural hazards and increase our understanding of how and why tsunamis strike. … The Deep Impact spacecraft began its 431 million kilometer (268 million mile) journey to comet Tempel 1 on Jan. 12. … The Mars Exploration Rover Opportunity found an iron meteorite, the first meteorite of any type ever identified on another planet. …

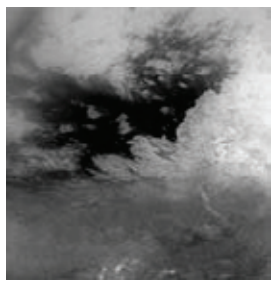
FEBRUARY



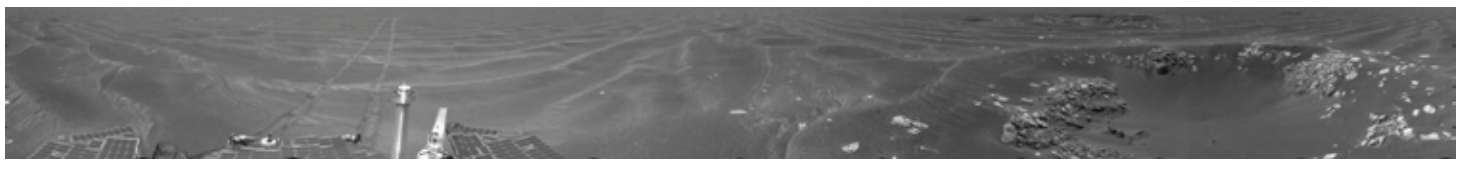
Spitzer spotted a dusty disc of planet-building material around an extraordinarily low-mass brown dwarf, or "failed star." The brown dwarf, called OTS 44, is only 15 times the mass of Jupiter. The finding will ultimately help astronomers better understand how and where planets form, including rocky ones resembling our own … Earth-based radio telescopes indicated that strong winds of up to about 400 kilometers per hour (250 mph) buffeted the Huygens probe as it descended through Titan's upper atmosphere in January. An estimate of the wind variations down to the surface was recovered by a joint team of researchers from JPL, the Huygens Doppler wind experiment team and the ground-based European Very Long Baseline Interferometry team. … The Spirit rover found a new class of water-affected rock, dubbed "Peace," an exposure of bedrock in the Columbia Hills. The hills are in Gusev Crater, where Spirit landed 13 months before. "This gives us even more compelling evidence for water playing a major role for altering the rocks here," said Dr. Steve Squyres, principal investigator for the rovers. … Dr. Firouz Naderi, manager of NASA's Mars Exploration Program, was named the Laboratory's associate director for programs, project formulation and strategy. Naderi's new duties include long-term strategic planning for JPL and coordinating advance studies, acquisition of new missions and development of projects early in their life cycle. … Dr. Gerard Holzmann, who leads JPL's Laboratory for Reliable Software, achieved the rare and prestigious honor of election to the National Academy of Engineering. …

MARCH

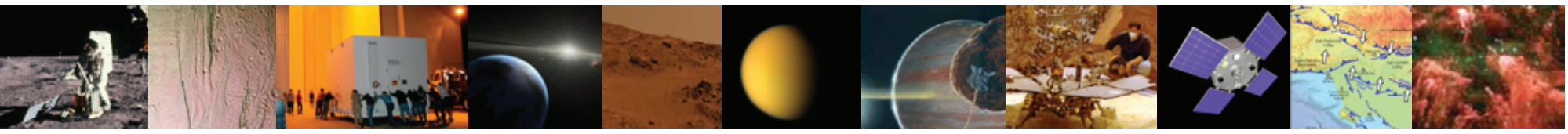




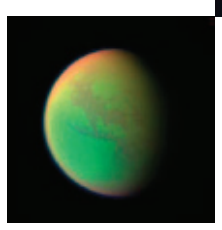
Spitzer saw through cosmic dust to uncover a hidden population of monstrously bright galaxies approximately 11 billion light-years away. "We are seeing galaxies that are essentially invisible," said Dr. Dan Weedman of Cornell University, co-author of the study detailing the discovery. "We had to wait for Spitzer to peer far enough into the distant universe to find these." … Thirty-five years after astronauts placed special reflectors on the lunar surface, scientists used these devices to test Albert Einstein's general theory of relativity to unprecedented accuracy. The lunar laser ranging experiment confirmed that the moon and Earth "fall toward" the Sun at the same rate, even though Earth has a large iron core below its rocky mantle, while the moon is mostly rocky with a much smaller core. The findings were made by JPLers Drs. James Williams, Slava Turyshev and Dale Boggs. … Cassini images showed that Saturn's largest moon, the hazy Titan, has a surface shaped largely by Earth-like processes of tectonics, erosion, winds and perhaps volcanism. Titan, long held to be a frozen analog of early Earth, has liquid methane on its cold surface, unlike the water found on our home planet. Among the new discoveries is what may be a river, roughly 1,500 kilometers (930 miles) long . … A NASA-funded study of marine pollution in Southern California concluded space-based synthetic aperture radar can be a vital observational tool for assessing and monitoring ocean hazards in urbanized coastal regions. … Spitzer, for the first time, captured the light from two known planets orbiting stars other than our sun. The findings marked the beginning of a new age of planetary science, in which extrasolar planets can be directly measured and compared. …



As 2005 comes to a close, we're reminded about a bit of déjà vu. In January JPL observed the Mars Exploration Rovers' full year of studying the Red Planet. And now, once again, Spirit and Opportunity celebrate another 12 months under their belts on their extended missions. The pair will continue to make their presence felt among JPL's flotilla of more than two dozen active spacecraft, instruments and major experiments underway throughout the solar system. Here are some highlights from 2005.

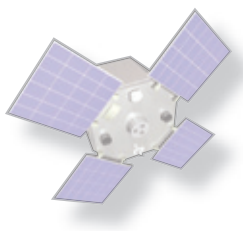


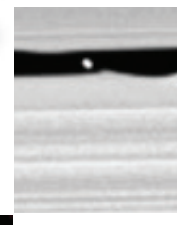
APRIL

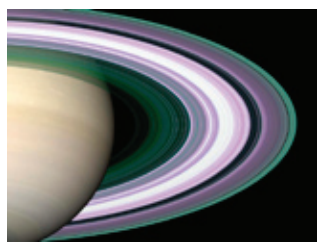


NASA approved up to 18 more months of operations for the Mars Exploration Rovers, Spirit and Opportunity. … Spitzer spotted what may be the dusty spray of asteroids banging together in a belt that orbits a star like our sun. The discovery offers astronomers a rare glimpse at a distant star system that resembles our home, and may represent a significant step toward learning if and where other Earths form. … During its closest flyby of Saturn's moon Titan on April 16, Cassini found that the outer layer of the thick, hazy atmosphere is brimming with complex hydrocarbons. Scientists believe that Titan's atmosphere may be a laboratory for studying the organic chemistry that preceded life and provided the building blocks for life on Earth. … Cassini captured an image of Saturn's small moon Epimetheus in the closest view ever taken of the pockmarked body. Epimetheus is irregularly shaped and dotted with soft-edged craters. The many large, softened craters on Epimetheus indicate a surface that is several billion years old. …

MAY

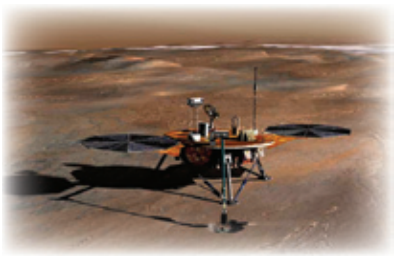


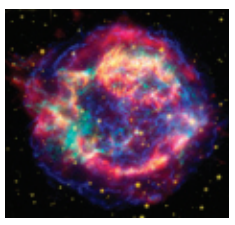


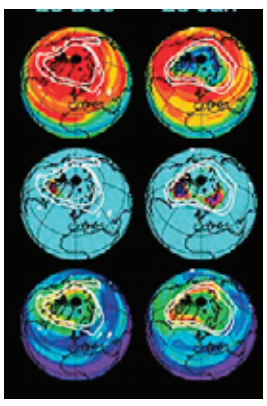


An estimated 40,000 people took in JPL's annual Open House May 14–15. … Scientists concluded that Saturn's battered little moon Phoebe is an interloper to the Saturn system from the deep outer solar system. "Phoebe did not form at Saturn," said JPL's Dr. Torrence Johnson, a Cassini imaging team member. "It was captured by Saturn's gravitational field and has been waiting eons for Cassini to come along." … Research confirmed that northern metropolitan Los Angeles is being squeezed at a rate of 5 millimeters (0.2 inch) a year. A team led by Dr. Donald Argus of JPL set out to distinguish between motions induced by human activity and those generated by movements of Earth's tectonic plates. The results indicated the human-caused motions are very slow and could not account for the significant ground shift observed in northern Los Angeles. … A satellite that measures the variability in the amount of the sun's energy that reaches Earth's atmosphere and impacts our winds, land and oceans successfully accomplished its five-year primary mission. The Active Cavity Radiometer Irradiance Monitor satellite, or AcrimSat, carries the Acrim III instrument, the third in a series of solar-monitoring tools built by JPL and launched over the past 25 years. The goal is to study the Sun–Earth connection by measuring solar irradiance, the sun's energy that reaches our planet. "The satellite's measurements of total solar irradiance have been the most precise ever collected," said Roger Helizon, AcrimSat project manager/scientist at JPL. … Cassini obtained the most detailed look ever at Saturn's rings, including the B ring, which has eluded previous robotic explorers. Its structure seems remarkably different from its two neighbors, rings A and C. During a radio experiment, Cassini mapped this structure with clarity never before available. This was the first of many such observations Cassini would conduct over the summer. … JPL's Voyager 1 spacecraft entered the solar system's final frontier—a vast, turbulent expanse called the termination shock, where the sun's influence ends and the solar wind crashes into the thin gas between stars. The most persuasive evidence that Voyager 1 crossed the termination shock is its measurement of a sudden increase in the strength of the magnetic field carried by the solar wind, combined with an inferred decrease in its speed. This happens whenever the solar wind slows down. … Scientists studying data from JPL's Galileo spacecraft found that Jupiter's moon Amalthea is a pile of icy rubble less dense than water. Scientists expected moons closer to the planet to be rocky and not icy. The finding shakes up long-held theories of how moons form around giant planets. "This gives us important information on how Jupiter formed, and by implication, how the solar system formed," said JPL astronomer Dr. John D. Anderson. …

JUNE

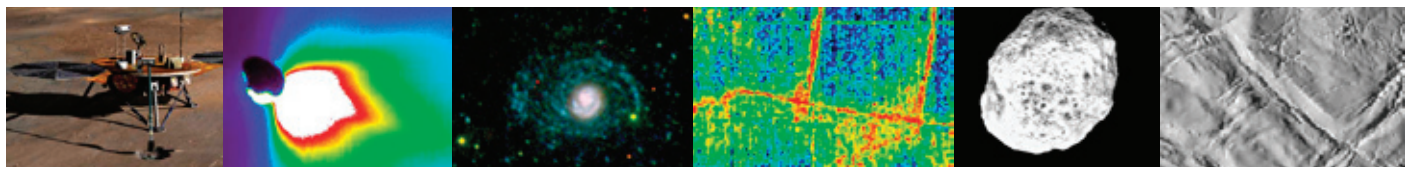






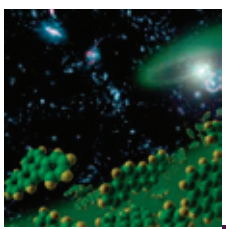
NASA announced that the Juno mission to Jupiter will proceed to a preliminary design phase. Juno is the second in NASA's New Frontiers Program. The selected New Frontiers science mission must be ready for launch no later than June 30, 2010, within a mission cost cap of $700 million. JPL would provide mission project management. … NASA gave the green light to a project to send a high-latitude lander to Mars and deploy its robotic arm and dig trenches up to half a meter (1.6 feet) into the layers of water ice. The Phoenix project—the first in NASA's Mars Scout Program—is designed to examine the site for potential habitats for water ice and to look for possible indicators of life, past or present. Launch is scheduled for August 2007. … Mars Exploration Rover mission team members cheered when images confirmed Opportunity had successfully escaped from a sand trap. The rover team at JPL had worked diligently for nearly five weeks to extricate the rover. The long-distance roadside assistance was a painstaking operation to free all six wheels of the rover, which were mired up to their rims in the soft sand of a small martian dune. … A Cassini flyby of Titan revealed evidence of a possible volcano, which could be a source of methane in the moon's atmosphere. "Before Cassini–Huygens, the most widely accepted explanation for the presence of methane in Titan's atmosphere was the presence of a methane-rich hydrocarbon ocean," said Dr. Christophe Sotin, distinguished visiting scientist at JPL. "The suite of instruments onboard Cassini and the observations at the Huygens landing site reveal that a global ocean is not present." … Cassini captured a series of images showing a dark, lake-like feature—about the size of Lake Ontario—with smooth, shore-like boundaries unlike any seen previously on Titan. "This is definitely the best candidate we've seen so far for a liquid hydrocarbon lake on Titan," said Cassini imaging team member Dr. Alfred McEwen. …

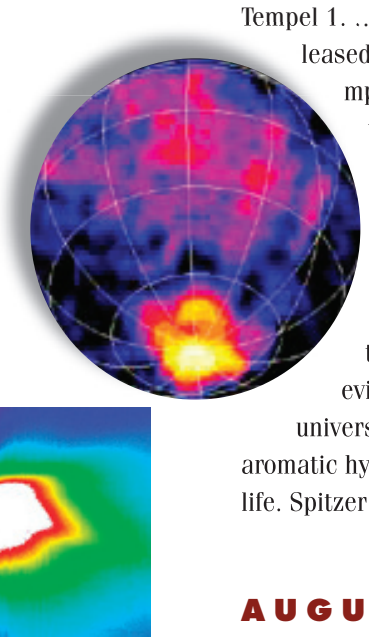
2005 con't d



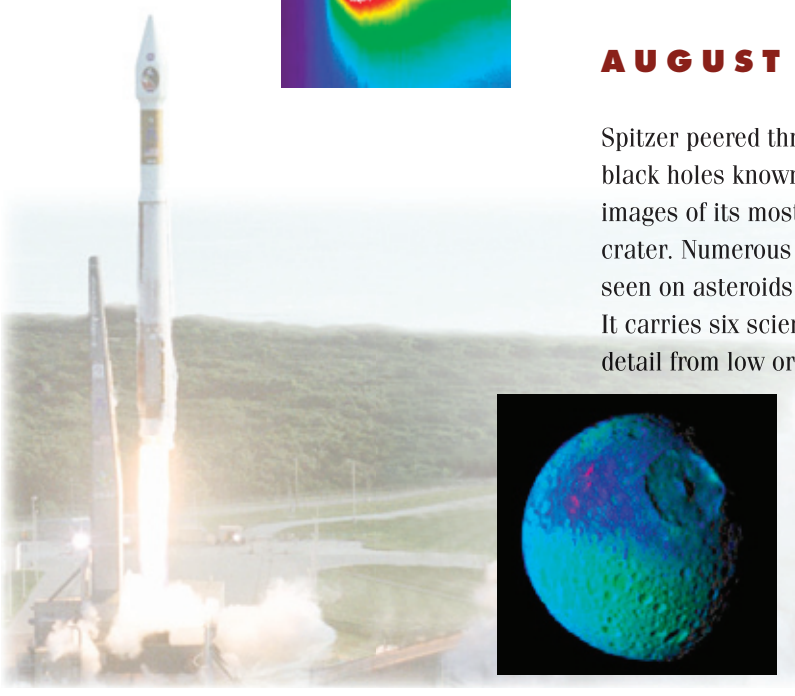
JULY

Deep Impact provided deep-space fireworks to kick off the fourth of July with its spectacular impact with comet Tempel 1. … Data from Deep Impact's instruments indicated an immense cloud of fine powdery material was released when the probe slammed into the nucleus of comet Tempel 1 at about 10 kilometers per second (23,000 mph). … A new image from the JPL-managed Galaxy Evolution Explorer showed that a galaxy once thought to be rather plain and old is actually endowed with a gorgeous set of young spiral arms. The unusual galaxy, called NGC 4625, is a remarkable find because it is relatively nearby. Until now, astronomers had thought that this kind of youthful glow in galaxies was a thing of the past. … During its July 14 flyby, Cassini obtained new, detailed images of the south polar region of Saturn's icy moon Enceladus. The data reveal distinctive geological features and the most youthful terrain seen on the moon. These findings point to a very complex evolutionary history for Saturn's brightest, whitest satellite. … Further studies of the flyby data showed that Enceladus, which ought to be cold and dead, instead displays evidence for active ice volcanism. … Spitzer scientists detected organic molecules in galaxies when our universe was one-fourth of its current age of about 14 billion years. These large molecules, known as polycyclic aromatic hydrocarbons, are composed of carbon and hydrogen and are considered to be among the building blocks of life. Spitzer is the first telescope to see these molecules so far back in time. …





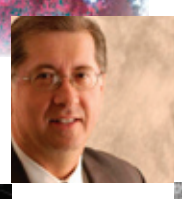
AUGUST

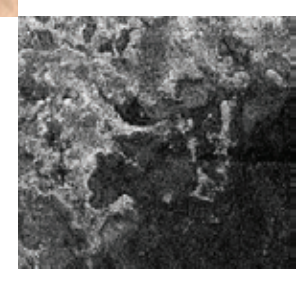


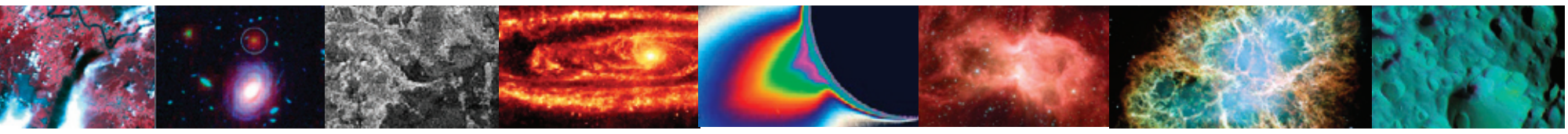
Spitzer peered through walls of galactic dust to uncover what may be the long-sought missing population of hungry black holes known as quasars. … Cassini's Aug. 2 flyby of Saturn's "Death Star" moon Mimas returned eye-catching images of its most distinctive feature, the spectacular 140-kilometer (87-mile) diameter landslide-filled Herschel crater. Numerous rounded and worn-out craters, craters within other craters and long grooves reminiscent of those seen on asteroids were also seen. …JPL's Mars Reconnaissance Orbiter began a seven-month flight to Mars Aug. 12. It carries six scientific instruments for examining the surface, atmosphere and subsurface of Mars in unprecedented detail from low orbit. … NASA and the National Oceanic and Atmospheric Administration outlined research that has helped to improve the accuracy of medium-range weather forecasts in the northern hemisphere. Scientists worked with experimental data from the JPL-managed Atmospheric Infrared Sounder instrument on NASA's Aqua satellite and found incorporating the instrument's data into numerical weather prediction models improves the accuracy range of experimental six-day weather forecasts by up to six hours, a 4 percent increase. … Working atop a range of martian hills, the Spirit rover rewarded researchers with tempting scenes filled with evidence of past planet environments. The summit sits 82 meters (269 feet) above the edge of the surrounding plains, 106 meters (348 feet) higher than the site where Spirit landed nearly 20 months before. …

SEPTEMBER

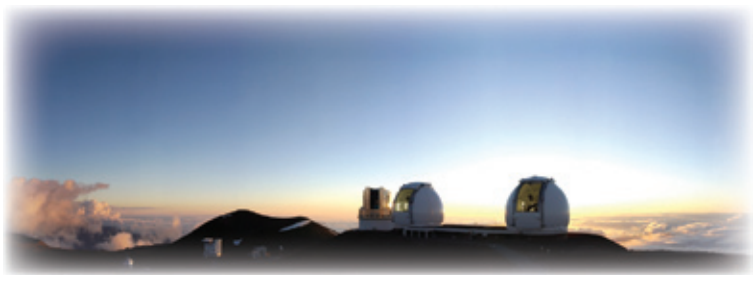
NASA science instruments and Earth-orbiting satellites helped to provide government agencies with detailed insight about the environmental impact caused by Hurricane Katrina. Among them were JPL's Advanced Spaceborne Thermal Emission and Reflection Radiometer, onboard the Terra spacecraft, and the QuikScat satellite. … Astronomers using data from Spitzer and Deep Impact analyzed ingredients of our solar system's primordial "soup" and began to come up with a recipe for what makes planets, comets and other bodies in the solar system. "The Deep Impact experiment worked," said Dr. Carey Lisse of Johns Hopkins University's Applied Physics Laboratory. "We are assembling a list of comet ingredients that will be used by other scientists for years to come." … Software developed by a team of JPL engineers was selected to receive NASA's Software of the Year Award. The Autonomous Sciencecraft Experiment software helps scientists monitor environmental events on Earth, such as changes in the cryosphere (the section of Earth that is frozen), volcanic eruptions, floods and wildfires. Instead of relying on commands from the ground, it allows a spacecraft to respond autonomously to detected science events. The software has been successfully used on NASA's Earth Observing One mission to acquire more than 3,000 images. … James Rinaldi was appointed JPL's chief information officer. Rinaldi will have direct management responsibility over JPL's Institutional Computing and Information Services Office and will work closely with information technology management, supporting end users of the engineering, interplanetary network and finance/business operations. … Images returned during a Cassini flyby of Titan showed captivating evidence of what appears to be a large shoreline dividing a distinct bright and dark region about 1,700 kilometers long by 170 kilometers wide (1,060 by 106 miles). Hints that this area was once wet, or currently has liquid present, are evident. "This radar data is among the most telling evidence so far for a shoreline," said JPL's Steve Wall, the radar deputy team leader. … New gullies that did not exist in mid-2002 appeared on a martian sand dune, one of the surprising discoveries that resulted from the extend-



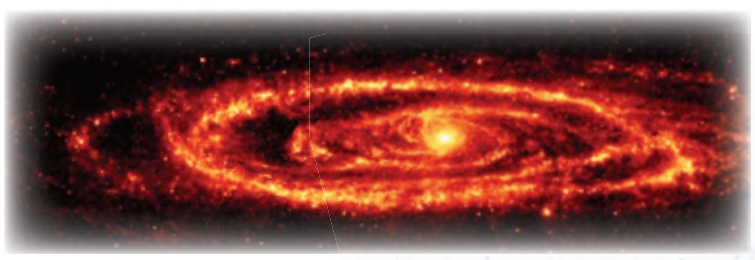




ed life of Mars Global Surveyor, which began its ninth year in martian orbit. Boulders tumbling down a slope left tracks that weren't there two years ago. New impact craters formed since the 1970s suggest changes to age-estimating models. And for three Mars summers in a row, deposits of frozen carbon dioxide near Mars' south pole have shrunk from the previous year's size, suggesting a climate change in progress. … Engineers operating the JPL-managed Keck Interferometer at Hawaii's Keck Observatory in Mauna Kea successfully suppressed the blinding light of three stars, including the well-known Vega, by 100 times. This breakthrough was achieved by adding an instrument called a "nuller," which may eventually help scientists select targets for NASA's envisioned Terrestrial Planet Finder missions. …



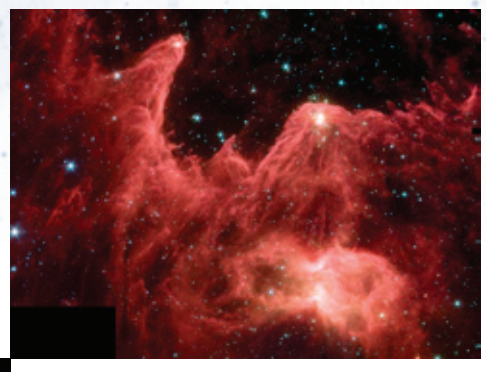
OCTOBER

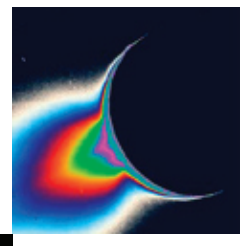


Spitzer captured a stunning infrared view of Messier 31, the famous spiral galaxy also known as Andromeda. New features were detected, including bright, aging stars and a spiral arc in the center of the galaxy. Approximately 2.5 million light-years away, Andromeda is the closest spiral galaxy and is the only one visible to the naked eye. … Spitzer spotted the very beginnings of what might become planets around the puniest of celestial orbs: brown dwarfs, or "failed stars." For the first time it detected clumps of microscopic dust grains and tiny crystals orbiting five brown dwarfs. These clumps and crystals are thought to collide and further lump together to eventually make planets. …

NOVEMBER

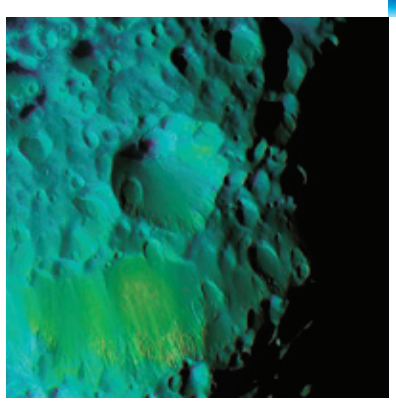
Orbital Sciences Corp. of Dulles, Va., was awarded a $27 million contract to design, develop and build the next satellite in NASA's New Millennium Program, which is managed by JPL. The Space Technology 8 satellite, scheduled for launch in 2009, will validate four advanced technologies in space for possible use in future NASA science missions. Its payload experiments: a large flexible solar array; a 40-meter (131-foot) deployable boom; high radiation environment electronics; and a spacecraft thermal control device. … A Spitzer image revealed billowing mountains of dust ablaze with the fires of stellar youth. The majestic image resembles the iconic "Pillars of Creation" picture taken of the Eagle Nebula in visible light by Hubble in 1995. Both views feature star-forming clouds of cool gas and dust that have been sculpted into pillars by radiation and winds from hot, massive stars. The Spitzer image shows the eastern edge of W5, in the Cassiopeia constellation 7,000 light-years away. The largest of the pillars observed by Spitzer entombs hundreds of never-before-seen embryonic stars, and the second largest contains dozens. …





DECEMBER

The largest image ever taken with JPL's Wide Field and Planetary Camera 2, onboard NASA's Hubble Space Telescope, showed the most detailed view ever of the Crab Nebula, one of astronomy's most studied objects. … Jets of fine, icy particles streaming from Enceladus were captured in images from Cassini. The images provide unambiguous visual evidence that the moon is geologically active and clearly show multiple jets emanating from the moon's south polar region. Based on earlier data, scientists strongly suspected these jets arise from warm fractures in the region. The fractures, informally dubbed "tiger stripes," are viewed essentially broadside in the new images.



Next Universe

January 13

This is the final issue of Universe for 2005. The next issue will be distributed Friday, Jan. 13. The ad deadline is Tuesday, Jan. 3.

JPL'S ONLINE NEWS SOURCE

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E-mail us at

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Universe

Editor
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Design + Layout
David Hinkle, Audrey Steffan/ Design Services

Photography
JPL Photo Lab

Universe is published every other Friday by the Office of Communications and Education of the Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109.

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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 via e-mail to universe@jpl.nasa.gov *and 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.

Passings

Retiree **HARRY NORTON,** 83, died Dec. 5.

Norton's 20-year career at JPL began in 1967. He contributed to the Mariner Mars and Voyager projects, and worked in Advanced Studies, proposing new ideas for solar system exploration. His specialization was measurement transducers.

Norton is survived by his sister, Susan Apt; former wife Henrietta Wahl; children, Cynthia, Andy and Paul; and grandchildren Nicholas, Neal and Linnea.

Services were held Dec. 9 at Mountain View Cemetery in Altadena.

G. EDWARD DANIELSON, JR., retired from Division 38, died Dec. 10.

Danielson worked at JPL and Caltech from 1967 to 2004. His noted accomplishments include the discovery of the 14th satellite around Jupiter (1979) and the early detection of Halley's Comet using the 200-inch telescope at the Palomar Observatory (1982).

He is survived by his wife Judy, children Kris, Eric, Noelle and Holly, and eight grandchildren.

Letters

Dear JPL friends: I wish to let you know that I am retiring after approximately 45 years at JPL. I want to wish my friends at JPL, along with my very close retired friends, many more years of happiness and good health. I came to work at JPL on the Ranger project, which was sent to the moon in preparation for the Apollo program and the landing of the astronauts on the moon. Following were the Mariners, which were launched to Venus, Mercury and Mars. Then came Viking, which was the first soft landing on Mars and was very successful. Voyager and Galileo stand out the most for me. There are far too many projects to name; however, I am proud to have been a part of each of them. The JPL era that I worked in has been very important to the community and NASA. These accomplishments will be very hard to duplicate in the future and I wish JPL/NASA much success. I shall miss you all and thank you for all your support. I bid you all farewell and God bless!!

Fred Tomey
fatomey@dslextreme.com

I wish to thank my JPL friends for their sympathy on the passing of my wife, Terri. The beautiful plant has a special place in the garden. My family and I also appreciate your donations to the Ovarian Cancer Research Fund. Thank you for all of your prayers and support.

Al Nakata

Retirees

The following JPL employees retired in December:

Frank Ott, 42 years, Section 337D; Gerhard Klose, 35 years, Section 352; Richard Cowley, 31 years, Section 353; Bonnie Cantrell, 29 years; Charles Presley, 26 years, Section 3454; Mary Sue O'Brien, 25 years, Section 2745; Edwin Dobokowski, 21 years, Section 5150; Linda Moore, 19 years, Section 2131; Robert Barrett, 17 years, Section 3458; Josephine Soliz, 15 years, Section 2141; Charles Boles, 13 years, Section 2032; Raymond Lin, 11 years, Section 3863; Nancy Feagans, 10 years, Section 372D.

Classifieds

For Sale

BABY CRIB, including mattress, can be converted to a day bed, bought 2 years ago, excellent cond., value $250, will sell for $100. 626/574-7431.

BABY ITEMS: Little Tykes tugboat sandbox, excellent cond., $35; Little Tykes tugboat with steering wheels, like new, $10; Step 2 townhouse climber and slide, excellent cond., $75; Spiderman skates, size 12, excellent cond., $10. 909/598-0065.

BACKPACK CARRYING CASE for notebook computer, Dell, brand new, large, $35/obo. 362-2003, Derek.

BASSINET, Pottery Barn Kids, used for 6 months, vg condition, with green bumper, skirt, sheets and mattress, $150. 951-3532, Andrea.

BBQ, Broil King propane, grill is 22" x 14," cover and propane tank included, good cond., $50. 626/296-1537.

BICYCLE, boys 20" GT Dyno, excellent condition, $65. 626/798-1839.

CHAISE SECTIONAL, white, excellent cond., 117" x 68", $150. 909/598-0065.

DANCE TICKETS (2) for Alvin Ailey American Dance, Dorothy Chandler Pavilion, Feb. 22, 7:30, seats in founders circle, $100 for pair. 790-8523.

DESK: very nice executive office desk/workstation, curved L-shape/corner design, approx. 71" x 71"x 29," pullout keyboard tray, 2 drawers (1 for files), cabinet with lock, curved shelves, cherry color with black top, $150. 626/798-0329.

ENTERTAINMENT CENTER, wood, with shelves + a cabinet with doors, $100/obo. 957-8614, Mina, after 5 p.m.

FURNITURE: brown leather recliner, $500; TV stand, black, $25; TV stand, oak, $75; captian's bed, oak, $200; leather sleeper sofa, $100; see photos at colorado4wheel.com/sale. 626/794-1827.

HALL TREE, oak, with storage ($125) and matching picture table ($75) obo; great condition. 244-4565.

HANDBAG, new, Kenneth Cole New York leather "fold still" large tote, retail price $300, sale for $140. 653-9037.

HEADSET for cell phone, Motorola Bluetooth, like new, $40. 687-8627, Alberto.

JEWELRY: diamond anniversary ring (1 CT) w/gift box, $750/obo; diamond ring (chip), 10K YG, w/gift box, $99; Suunto S6 wristop computer, great gift for the winter sports enthusiast, $250/obo. 364-1283, Valerie.

MATTRESS, queen size, w/boxspring and frame, pillowtop (one sided), used 2 years, spotless, $80. 626/794-0073.

MISC.: Compaq Presario 7595 desktop computer w/Pentium III processor for parts, $15; Viewsonic flatscreen monitor, $10; Palm Handspring, $5; books, 25 cents-$5; clothing, 50 cents–$10; misc. items, 50 cents–$10. 626/449-7895.

MISC.: fishing pole (saltwater), $25; baseball glove (small, left handed) + conditioner, good cond., $10; landscape oil painting, autumn tones, $75; red wig, shoulder length, never used, $20; home gym, $75. 626/357-8210, Kathy Little.

MISC.: fax cartridge (model pc-102rf) for Brother machines, brand new, $20; Jenny Craig diet tapes, set of 14, $25; computer power control center, 5 power switches + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, $20. 790-3899.

MODEL TRAIN, HO scale (Lionel), slot car (Aurora vibrator), and Disneyland monorail with vintage '60s train table, 4 x 8 ft., make offer. 951-5952, Dave.

MOUNTAIN BIKE, Haro Escape, 21 spd., Shimano gears, neon orange, $150/obo. 909/319-8338, Paul.

MOVING SALE: love seat, blue, $90/obo; coffee maker, $5; toaster ovens (2), $6/ea.; parquet coffee table, $25; parquet end table, $25; spice jar lamp, $20; student bedroom furniture set: desk, 2 end tables, 2 chests of drawers, $200; full bed, $100; small wooden dresser, $20; computer work stand, $20; blender, $5; sofa, blue, $100; wooden desk chair, swivel, $15; typing table, $10; lawn spreader, $5; electric hedge shears, $8. 626/282-5815.

MUSIC PLAYER, iPOD video/mini/nano/photo; new and used. 213/447-0725, Yian.

ORGAN, Yamaha 415 electronic console w/13 pedals, 3 keyboards, 144 rhythm patterns, pd. $7,500, sacrifice for $2,000. 790-3899.

PATIO SET, table (72 x 42) & 6 chairs w/mesh backing, good cond., $125. 626/296-1537.

PEARLS, Jackie Kennedy's three-strand necklace, Franklin Mint reproduction in box, never worn, see at www/franklinmint.com, $100. 626/744-9145.

PERSIAN RUGS, handmade in Iran, various sizes and designs, many are pure silk, some are wool and blend, must sell, make offer for any or all. 790-2179.

PICTURE, Paradise Waterfall, 46" x 29", moving water & bird sounds (volume control), creates the illusion of moving water, $120. 653-9037.

PILLOW, high-quality memory foam, standard size, 3" height for small necks, barely used, $40/obo. 626/840-0955.

PINBALL MACHINE, children's version by Monopoly, removable legs for table-top or free-standing use, 16" wide x 29" long, $35. 626/303-1927.

PLAY SET, redwood Playwell, 2 swings and trapeze bar, monkey bars, fort with slide, refinished last year, $1,500 includes delivery and setup by Playwell. 790-6491.

PRINTER, Lexmark Z715 Photo Jetprinter, brand new, $79.95 list, sell at $50. 687-8627, Alberto.

PRINTER, Epson C88 inkjet, unopened, $75. 661/297-8533.

SHOES, pair of women's Audley designer, brown, made in Spain, European size 37 1/2 = U.S. size 7; very smart, stylish, well-made; looks good with skirts or pants; love them, but bought wrong size; paid over $125, sell for $30. 626/289-2795.

SKIS, 170 centimeter Rossignol Equipe straight cut w/Salomon 626 bindings, good cond., $45. 626/304-0737.

SOFA, black leather, vg cond., $250; e-mail for pic: stsimpson@charter.net. 626/256-0302, Steve.

SOFA BED, full size, vg condition, neutral colors in subtle chevron pattern, $50; pick up in Altadena. 626/791-2784.

STEREO SPEAKERS, Infinity RSb, 3 way, 10" woofer, floor-standing or bookshelf, $100 for pair. 951-5952, Dave.

TELESCOPE, Celestron 9-1/4" Schmidt Cassegrain, a few years old, good condition, comes with German equatorial mount, tripod, 27mm eyepiece, carrying case, dual-axis drives for photography, finder scope, 2" star-diagonal, make offer. 714/553-5793, Bill.

TONER CARTRIDGE, HP LaserJet series 4-5, 92298A; just opened, wrong cartridge, was $100, now $50. 458-0524, Tim.

TROPICAL PLANTS, plumerias, variety of colors and sizes; shell gingers. 626/444-6156.

WASHER/DRYER, Kenmore, approx. 2.5 years old, exc. cond., $200 ea./obo; REFRIGERATOR, Kenmore side-by-side, exc. cond., $400/obo. 626/351-9641 or Bettyrs@earthlink.net.

Vehicles / Accessories

CANVAS SHELL, CanBack (black) for a Ford Super Duty truck, $200. 909/319-8338, Paul.

DIESEL PUSHER motor home, Class 'A,' 37 ft., Caterpillar 325 HP eng., too many extras to list. 928/474-0832, Stan Jones, buckjones@npgcable.com.

'99 DODGE Intrepid, good condition, 128K mi., orig. owner, $4,000/obo. 661/254-4464, Fred.

'92 DODGE Dakota LE, 160K, very clean, camper shell and carpet kit, new tires and battery, call for pix, $2,500/obo. 909/590-1276.

'64 DODGE Dart 270 Classic (Dodge 50th anniv. year), exc. cond., 4 dr., gold, auto trans, pwr. steering, slant 6, new tires, 140,700 mi. (70,000 on rebuilt motor; 15,893 at purchase in 1965), have all maint. receipts + owner's manual, $3,100/obo. 626/449-6698, Kathie.

'02 FORD Escape XLS, 5-speed manual, a/c, roof rack, 51K mi., white, new tires/brakes, vg condition, 100% dealer servicing, $9,450 (below pp blue book value). 626/836-6729, Tim, eves/weekends.

'97 FORD Escort, 4-door, stick shift, 129K mi., should get 30 mpg, $2,200. 248-8711, Dennis.

'88 FORD E350 Econoline campervan, full power, dual fuel tanks, towing pkg., custom top w/6'2"head rm.; delux equipped: gas range, 12V/120V fridge, sink, toilet, etc.; 1 owner, great cond., only 48K miles, death forces sale, $6,000/obo. 310/823-7716, careyson@webtv.net.

'96 HARLEY Custom Rigid, rigid frame by Atlas, 80CI S&S, 3" drivebelt, 5-spd. trans, 180 rear tire, 21" front wheel, custom forward controls, a great bike, lots of att'n, is registered and I have pink, $13,000/obo. 626/ 497-9591, Gene or guido576@yahoo.com.

'04 HONDA Pilot EX-L, vg cond., 24.5K miles, a/c, am/fm/cd/cassette, ABS, privacy glass, heated seat, charcoal green ext./gray leather interior, $26,120/obo. 259-0832.

'88 HONDA Civic DX hatchback, silver, 5-sp. manual, CD, a/c, 216K mi., vg mech. cond., new tires and batt., just passed smog w/o problems, 30+ mpg; perfect low-budget commuter and fun to drive; no reasonable or interesting offer refused; Blue Book says $960; would trade for guitar or motorcycle of comp. value. 626/794-7343, Lee.

'95 LAND ROVER Range Rover SE V8 4.0 L, auto, 4WD, 138K, tan, leather seats, CD, ps, pw, dual airbags, moonroof, runs great, good condition, $6,100/obo. 626/296-9073 or 818/515-2461.

'02 LEXUS IS 300, loaded, auto, 6-CD changer, GPS navigation, everything power, moonroof, leather power seats, spoiler, 37K miles, $20,995. 909/599-3230.

'96 MACGREGOR 26X sailboat, sloop, 50 hp Nissan, trailer, at Channel Islands Harbor, $13K. 661/382-2679, Ted.

'85 MERCEDES 380 SL, Sahara beige exterior/Palomino interior, 94K orig. miles, 2nd owner, California car, exc. cond., radio upgrade w/6-CD changer, orig. radio avail., hard and soft tops, car cover & windscreen, alarm system, $10,500. 949/248- 2711 or 626/695-9250.

'02 NISSAN Sentra GXE, 4 doors, 60K miles, automatic, radium gray with matching spoiler, intermittent wipers, passenger airbag, power brakes/mirrors/steering, rear defrost, cruise control, great car for commuting, $9,800. 626/963-7227, evenings.

'96 NISSAN Maxima SE, 132K mi., runs great, looks gd., a/c, alloy wheels, new tires/brakes/front struts, beige, $4,100. 626/533-2125.

'95 NISSAN Maxima GLE, dk. emerald grn., runs perf., new brakes/shocks/tires, moonroof, orig. owner, $4,495. 886-8174, Nick.

'02 PORSCHE Carrera 4S, excellent cond., under dealer warranty, used as a weekend car, automatic everything, premium wheels, less than 25,000 miles, silver outside, two-door, $61,000. 626/826-1441, John.

'98 TOYOTA Corolla LX, white, manual trans., 49K miles, perfect condition, 1 owner, no accidents; alarm, power windows/locks, a/c, cruise, daytime running lights, front/side airbags; can e-mail pics; $6,500/obo. 272-1994, Max or mvozoff@hotmail.com.

'91 TOYOTA Camry, 4-door sedan, automatic, single owner, a/c, body in good condition, ~150K miles, almond beige, $2,500/obo. 626/357-2519, Ram.

Lost & Found

Found: Men's gray sweater in Building 601-120. Ext. 4-9550, Barbara Mochrie.

Wanted

CALCULATOR, Curta Type II, in good working condition. 626/798-9648, Andy.

HOUSE TO RENT, 2 bd., in Pasadena/South Pasadena/Monrovia area. 626/796-3093.

HOUSING RENTAL, mature JPL couple, prefer biking distance to JPL, less than $2K per month. 235-4015.

MATH TUTOR, jr. & sr. high school level classes (geometry, pre-algebra, algebra I & II, SAT math, etc.), eves and/or weekends, also Eng. tutors. 888/784-1639, David, lv msg.

REFRIGERATOR, small, to replace one in our JPL suite recently expired (if used for food only, please). 626/289-2795, Debbie.

SPACE INFORMATION/memorabilia from U.S. & other countries, past & present, for personal use. mrayman@alumni.princeton. edu. 790-8523, Marc Rayman.

TUTOR for 6th-grade student; math, science, study skills. 249-3677, Joanne.

VANPOOL RIDERS, Lancaster/Palmdale/Littlerock/Acton area, van leaves Angeles Forest Pk. & Ride @5:45 a.m., leaves JPL 4 p.m., cost $180 or $10/day. Ext. 3-0505, Frank Shanklin.

Free

CLEAN FILL DIRT, 12 cu yds. avail., haul as much as you like, near Los Robles/Jackson, Pasadena. 626/791-3103, dtrask6@its.caltech.edu.

HAMSTERS, babies, Siberian Dwarf variety, white and dark gray, to good homes, healthy, active, friendly. 626/821-0487.

KITTENS (2), black w/white paws and chest, and white with black patches; very cute and playful; lovely mother cat, very affectionate and beautiful. 626/440-1955.

OSCILLOSCOPE, 35 MHz dual-trace, Heath-kit model 10-4235, appears to work but offered "as is;" Electronic Design Experimenter kit and test parts & experiment notebooks, Heathkit model ET-3100A, works; both come with full documentation; will be given to randomly selected person from all requests received. 790-3367.

TUTORING, coupon for college-level math/physics/finance study help, exp. 12/31/05, send questions to email@1800iTutors.com.

For Rent

ALTADENA foothills, room in a cute 3 bd., 2 ba. house, close to hiking/biking trails, perfect for nature lovers, nice views of the mountains from spacious backyard, bedrooms are decent size w/nice closets, looking for a professional or student who is respectful and responsible, animal lovers only. 626/798-4907.

ALTADENA, comprehensively furn. extended-stay sabbatical house: 3 bd., study, boundary Angeles Nat'l Forest, 3 mi. from JPL, trail access, view, fireplace, oak floors, antiques; furniture, beds, dinnerware, utensils, pots/pans, all linens & towels, fine soaps, necessities included; just bring toothbrush & clothes; TV/DVD/VHS, Dish satellite, wireless DSL; garden, fruit trees, patio, garage; private, immaculate; available February. 626/798-3235.

ALTADENA, room w/all necessities furnished; laundry, sheets, towels, dishes, TV, VCR; parking & small patio enclosed; close to JPL, very nice area, next to Christmas Tree Lane; very quiet & clean; $600. 626/798-4821.

ALTADENA guest house, fully furn. 1 bd., 1 ba., ideal for 1 person, hardwood floors, TV/DVD/CD, dinnerware, utensils, pots/pans, bed linens, towels; utilities incl. (electrical, gas, water, trash); street parking, no smoking, no pets; mo.-to-mo. lease, $1,200. 626/791-0317.

ALTADENA, awesome cityview home, great location, 2 bd., 2 ba. + den, master suite, new carpet, hardwood floors, tiled bathroom, laundry hookups, upgraded kitchen, 5 parking spaces, 1191 E. Loma Alta Drive, $2,300. 626/676-6387, 213/910-1072.

ALHAMBRA house, 2,000 sq. ft., 2 bd., 2 ba., exc. cond., quiet neighborhood, 20/min./JPL, $1,800 including utilities. 626/297-5412.

GLENDALE home, 2 bd., 1 bd., 1100 Vincent Ave near Adams Hill, do not disturb tenants, 1-year lease at $1,500. 661/254-4464, Fred or Marian.

LA CRESCENTA, charming 2 bd., 1 ba. home w/bonus room, built 1924, fireplace, all hrdwd, central HVAC, rdwd. deck, $1,800. 248-5068, 970-5047, Vanetta.

LONG BEACH, 3 bd., 1.75 ba. house in the desirable quiet Plaza neighborhood, near Cal State LB; 2-car garage, front and back yard; no pets/no smoking; $1,749. 562/420-2313.

MONROVIA, 2-story duplex: 2 small studio units, 2 blocks from Old Town; downstairs unit: completely renovated, immaculate; new stove, refrigerator, tile, carpet, cabinets, windows; small garage for storage; share 1/2 utilities; $850; upstairs unit: remodeled, clean; new stove, refrigerator, tile; share 1/2 utilities, $750; fenced yard area. 626/914-2775 or 626/818-9111 (cell).

MONTROSE apartment, large 1 bedroom, 10 minutes from JPL, $950. 653-1687, Gary.

N.E. PASADENA, 3 bd., 2 1/2 ba., den or office, laundry rm., fireplace, hardwood flrs., 2-car gar. 626/794-3906.

PASADENA townhome, 2 bd., 2.5 ba. + bonus room, oven, microwave, dishwasher, washer/dryer in unit, a/c, garage, sky lights, $2,100. 909/225-2323.

Real Estate

ALTADENA, in the Meadows overlooking JPL, 3 bd., 3 ba., LR, DR, family room, 2 fpl, pool, attached garage, view, privacy. 626/797-7905.

PASADENA house, 4 bd., 1.75 ba., w/'sacred views,' wood floors and crown moldings throughout, solar hot water, newish HVAC and roof, freshly painted inside and out, landscaped with roses, birds of paradise, etc.; large fenced pool, 2 patios, garage; great for family and entertaining, good schools, safe neighborhood, close to shops; large LR/DR, lovingly polished and renovated kitchen and bathrooms; must see; $919K. 626/351-8336.

Vacation Rentals

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

COSTA RICA condo, Quepos area, 2 bd., 2 ba., a/c, kitchen, fully furn., pools, tennis court, tv cable, relaxing setting, near beach, 15 min. to Manuel Antonio park, next to monkey tour, JPL rates. CostaRicamycondo.com, luisalfaro@earthlink.net, 760/723-8522.

FLORIDA condo, beautifully furn. 2 bd., 2 ba., 2nd floor, on the surf of New Smyrna Beach, half-hour to Cape Canaveral, 90 min. to Disney World; enjoy all the comforts of home, quiet, relaxing, overlooks beach, BBQ/pool/ game rm., easy walk to stores & restaurants. 760/439-7821, Darlene, dfhauge@yahoo.com.

GRAND TETON / YELLOWSTONE Nat'l Parks, visit in style, 2 bd. + loft townhome, totally outfitted, stunning Teton view, sleeps 6, cable, microwave, etc., borders Grand Teton. conniematt@sbcglobal.net.

HAWAII, Maui condo, NW coast, ocean front view, 25 ft. fr. surf, 1 bd w/loft, compl. furn. phone, color TV, VCR, microwave, d/w, pool, priv. lanai, slps 4, laundry fac., $145/nite/2, $20/nite/add'l person. 949/348-8047, jackandrandy@cox.net.

MAMMOTH, Meadow Ridge, 2 bd., 2 ba. + loft, sleeps 8; great family unit and location; walking distance to Eagle Lodge; incl. fully equipped kitchen: microwave, new dishwasher/oven; cable TVs, VCR, DVD, CD/cassette stereo, free wireless internet access; close to pool, Jacuzzi, spa; JPL discount. 240-8763 or anahid@KazEng.com.

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft, slps. 6-8, fully equip'd kitchen incl. microwv., D/W, cable TV, VCR, phone, balcony w/mtn. vw., Jacz., sauna, streams, fishponds, close to Mammoth Creek, JPL disc'nt. 626/798-9222, 626/794-0455 or valeriee@caltech.edu.

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

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, tennis, short walk to beach on priv. rd., 18-hole golf course 6 mi. away, private secure parking. 626/794-3906.