As Stardust finds its way home, several other key events are in store for JPL as the new year unfolds. Here's a preview of what's to come in 2006.

JPL's next mission to the red planet, the Mars Reconnaissance Orbiter, is on course to reach Mars on March 10. After gradually adjusting the shape of its orbit for half a year in a process called aerobraking, it will begin its primary science phase in November. From the missions planned science orbit about 300 kilometers (186 miles) above the surface of Mars, the high-resolution camera will be able to discern features as small as 1 meter (1 yard) across.

Launched Aug. 12, 2005, Mars Reconnaissance Orbiter will deliver over the course of its science mission more data about Mars than all previous missions combined. The orbiter's instrument payload will study water distribution—including ice, vapor or liquid—as well as geologic features and minerals. The orbiter will also support future missions to Mars by examining potential landing sites and by providing a high-data-rate relay for communications back to Earth.

Its next scheduled trajectory maneuver, on Feb. 1, and another one 10 days before arrival, will be used, if necessary, for fine tuning. When it reaches Mars it will join several other active missions, including JPL's Mars Exploration Rovers and the orbiters Mars Global Surveyor and Mars Odyssey.

In Earth science, the CloudSat satellite awaits a launch date in 2006. The mission will be the first spacecraft to study clouds on a global basis. The satellite will use an advanced radar to "slice" through clouds to see their vertical structure, providing a completely new observational capability from space (current weather satellites can only image the uppermost layers of clouds). CloudSat's primary goal is to furnish data needed to evaluate and improve the way clouds are represented in global models, thereby contributing to better predictions of clouds and thus to their poorly understood role in climate change and the cloud-climate feedback. It will join nine other active JPL Earth science missions that have satellites or instruments in orbit.

Another mission that has a pending launch date is Dawn. The first spacecraft ever planned to orbit two different bodies after leaving Earth, Dawn will orbit Vesta and Ceres, two of the largest asteroids in the solar system. Pending a current NASA review, the launch could be no sooner than December.

2006 will be a busy year for the Cassini spacecraft at Saturn. After reaching the ringed planet in 2004 and delivering the European Huygens probe to the surface of Saturn's moon Titan early in 2005, the spacecraft spent many of its early orbits visiting several of Saturn's large, icy moons. During 2006 it will focus on Titan, with a total of 13 targeted flybys. The twin Voyagers and Ulysses also remain active.

Peering into deeper space beyond the solar system, the Spitzer Space Telescope and the Galaxy Evolution Explorer observe at different wavelengths in the infrared and ultraviolet, respectively. Both will note their three-year launch anniversaries during 2006.

For more on JPLs missions, visit http://www.jpl.nasa.gov/missions.
Retiree receives Air Force honors, 60 years later

Dr. Fred Hadaegh, special events coordinator at the Air Force’s ROTC detachment at USC, presented honors to Frank Colella.

Fred Hadaegh named AIAA fellow

Dr. Fred Hadaegh, a senior research scientist and technical supervisor for the Guidance and Control Analysis Group, has been elected a fellow of the American Institute of Aeronautics and Astronautics (AIAA). Hadaegh received the honor for "advances in the theory, computation and implementation of autonomous navigation, guidance and control."

Hadaegh, who also is the manager of JPL's Distributed Spacecraft Technology Program, joined the Lab in 1984. His research interests are in the areas of system identification, estimation, controller design and navigation. He has published extensively on mathematical modeling of uncertain systems, parameter identifiability, identification and control of large space structures and autonomous control of formation flying space systems.

In receivces fellow designation

For his contributions to spacecraft atmospheric remote sensing, Dr. EASTWOOD III, radar instrument manager for the Gobalim project and supervisor of the Atmospheric Radar Science and Engineering Group, has been elected a fellow of the Institute of Electrical and Electronics Engineers.

He has extensive experience in spacecraft meteorological radar science and radar design and advanced technology. It was the first instrument architect of the multi-functional radar for the Cassini project (1997-1991), and went on to become the system engineer of that instrument until its launch in 1997.

In has been a member of NASA's Tropical Rainfall Measuring Mission Science Team, the Earth Observing System Aquarius calibration science team and the precipitation measurement mission science team. He is responsible for the studies of advanced radar techniques and algorithms for precipitation and cloud parameter retrieval and calibration. Since 1998, he has been the principal investigator of several NASA studies to develop new radar technologies for future spaceborne atmospheric science missions.

Dr. Fred Hadaegh

In receiving his fellowship, Hadaegh said that Dimotakis' expertise, experience and professional in space and spacecraft control activities.

Hadaegh was selected as the result of a review by the AIAA committee. He has been a member of both the Air Force and the AIAA since 1983. Hadaegh is a fellow of both the American Physical Society and the Optical Society of America.

Dr. Greg Braden

Dr. Greg Braden received Air Force honors, 60 years later

Col. Scott Grundahl, commanding officer at the Air Force's ROTC detachment at USC, presented honors to Frank Colella.

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Topex/Poseidon

COMPLETES ITS MISSION

• Provided the first decade-long global descriptions of seasonal and yearly ocean current changes
• Refined scientists’ estimates of rising global sea level during the past decade
• Developed the most-accurate-ever global ocean tides’ models
• Provided the first global data set to test ocean general circulation model performance
• Demonstrated Global Positioning System measurements in space could determine spacecraft positions with unprecedented accuracy, enabling rapid delivery of data

A remarkable voyage of discovery, Topex/Poseidon, the first great oceanographic research vessel to sail into space, has ended its mission.

A joint mission of NASA and France’s space agency, Centre National d’Etudes Spatiales, Topex/Poseidon lost its ability to maneuver and ceased operations after nearly 62,000 orbits of Earth.

The satellite’s pitch reaction wheel, which helps keep the spacecraft in its proper orbital orientation, stalled on Oct. 9, and ground controllers commanded the wheel not to function, according to the Centre National d’Etudes Spatiales. The satellite remains orbiting 1,336 kilometers (830 miles) above the Earth, posing no threat to the planet.

The end of the mission was announced in a NASA statement this month.

Launched in 1992 to make precise measurements of the ocean surface, Topex/Poseidon was watching in 1997 when the largest El Niño in 100 years changed weather patterns around the world. "Topex/Poseidon didn’t discover El Niño," said Project Scientist Dr. Lee-Luong Fu, a JPL oceanographer, "but it did give us our first global perspective on this and other short-term climate events such as La Niña. It allowed us to follow their evolution and showed that these events weren’t limited just to the tropics. It also gave us evidence of even longer-lasting phenomena."

Topex/Poseidon data have also helped in hurricane forecasting, ocean and climate research, ship routing, offshore industries, fisheries management, marine mammals’ research, modernizing global tide models and ocean debris tracking.

"Topex/Poseidon was built to fly up to five years, but it became history’s longest Earth-orbiting radar mission," Fu said. "It provided, on average, more than 90 percent of the scientific data it was designed to collect in every 10-day measurement cycle, a remarkable achievement."
The mission’s most important achievement was to determine the patterns of ocean circulation—how heat stored in the ocean moves from one place to another. Since the ocean holds most of the Earth’s heat from the sun, ocean circulation is a driving force of climate. "Topex/Poseidon has given us the longest and most complete observations of surface circulation in the deep ocean," Fu said.

Topex/Poseidon made it possible for the first time to compare computer models of ocean circulation with actual global observations and use the data to improve climate predictions.

Another of the mission’s major accomplishments was to map global tides for the first time. "Tides are the most visible changes in the ocean on a daily basis," Fu explained. "They are important for navigation, they have a big role in biological activity and they are the major source of mixing in the ocean. The mixing may be small in scale, but it has a huge effect," he noted. "Before Topex/Poseidon, tides in the open ocean could only be estimated."

Topex/Poseidon was the first mission to demonstrate that the Global Positioning System could be used to determine a spacecraft’s exact location and track it in orbit, knowing the satellite’s precise position, to within 2 centimeters. "This is a key component in making accurate ocean-height measurements possible."

The ocean is a different place now than it was when Topex/Poseidon first set sail. The sea is warmer than it was and is getting warmer faster. "Global sea level is rising. Heat in the tropics is moving northward more slowly. In some regions, some currents are faster while others are slower than in the past," Fu said. "The biggest lesson from Topex/Poseidon is that the ocean is changing all the time."

"Topex/Poseidon was a unique mission that attracted the attention of many oceanographers," Fu said. "Topex/Poseidon was the first mission to demonstrate that the Global Positioning System could be used to determine a spacecraft’s exact location and track it in orbit, knowing the satellite’s precise position, to within 2 centimeters. "This is a key component in making accurate ocean-height measurements possible."

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"Topex/Poseidon revolutionized oceanography by giving us the first global ocean observing system," said Massachusetts Institute of Technology oceanographer Dr. Carl Wunsch, one of the mission’s archivists and early champions. "Oceanographer Dr. Walter Munk, from the Scripps Institution of Oceanography, described the mission as ‘the most successful ocean experiment of all time.’"

Jason, launched in 2001, continues the same observations begun by Topex/Poseidon. For the past three years, the two satellites have flown in tandem, providing twice the coverage of the sea surface. This allowed the study of smaller-scale ocean phenomena like coastal tides, ocean eddies and currents. It also improved understanding of how low-frequency ocean waves transmit signals of climate change.

Jason precisely maps the surface height, wind speed and wave height of 10 percent of Earth’s ice-free oceans every 10 days. The data provide invaluable input for short-term weather forecasting, long-term climate forecasting and prediction models.

A future mission, the Ocean Surface Topography Mission, is planned for 2008. It will continue providing high-precision sea surface height data to the oceanographic science community. After that, scientists propose to make more detailed measurements of ocean surface topography to study critical issues such as sea-level rise.

My family and I would like to thank JPL for so much for the beautiful plant that was sent on the death of my beloved stepfather, who died during the week of the severe weather that caused great devastation. He was a kind and gentle man and still a scholar, studying Chinese language, culture and history. He will be missed.

Sherri Eastman

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Frank Mortelliti

My family and I would like to express our sincerest thanks to all of our friends, coworkers, and JPL, for the beautiful flowers, cards, and plants that were sent after the recent passing of my grandfather, who played an important role in my life. His knowledge and thoughtful guidance helped make the loss easier to bear and turned my grandfather’s beautiful plant into a special place in my garden.

Kelly Soma and family

The illusion of moving water, paid $250, sell for $100; sunglasses, women’s Persol, NIB, with case, $15; tickets, face value $15/ea., now $5/ea. on 1/13, 1/25, 2/1, 2/12, 3/5; Terrace Main. [....] (2 spaces), secure entry, wonderful landlord, close to shops; large LR/DR, lovingly polished woodwork, charcoal ext./gray interior, exceptional care, Blue Book list: $81K. 818/515-2461.

Real Estate

PASADENA house, 4 bd., 1.75 ba., w/’sacred garden area, 2 patios, nice living area (cable ready); central heat, AC, washer/dryer, fridge, sink, toilet, etc.; 1 owner, grt. loc. with over $5,000 monthly income. 541-1074.

ARCADIA apt., 2 bd. + large den, 1 ba., parking for 2 cars, close to shops; large LR, kitchen/living area, a/c, stove, dishwasher; clean, spacious; unfurnished. 626/324-4662.

ALTADENA, room in 2 bd., 1 ba., 1920 Spanish style cottage in very quiet neighborhood; a respectful person who possesses a nice balance of left- and right-brained qualities would be ideal. 818/864-6724.

Cat, 3-year-old neutered male, short hair, no papers, 3 lbs., 15 months old, in need of a loving home. 626/759-5078.

Real Estate

PASADENA house, 1 1/2, 175, m/s/one car garage, in a quiet, well maintained neighborhood; 2 patios, nice living area for 4; centrally located, walking distance to shops, exc. neighborhood; in the heart of it all, large LR, DR, bedrooms, kitchen, a/c, stove, dishwasher; clean, spacious; unfurnished. 626/324-4662.

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Stardust completes journey home

Scientists say samples exceed expectations

JPL's Stardust sample return mission returned safely to Earth when the capsule carrying cometary and interstellar particles successfully touched down at 2:10 a.m. Pacific time on Jan. 15 in the desert salt flats of the U.S. Air Force Utah Test and Training Range. Stardust traveled 2.88 billion miles during its seven-year round-trip odyssey to comet Wild 2. Scientists believe these precious samples will help provide answers to fundamental questions about comets and the origins of the solar system.

"Ten years of planning and seven years of flight operations were realized early this morning when we successfully picked up our return capsule off of the desert floor in Utah," said Tom Duxbury, Stardust project manager at JPL. "The Stardust project has delivered to the international science community material that has been unaltered since the formation of our solar system."

Stardust released its sample return capsule at 9:57 p.m. Pacific time on Jan. 14. The capsule entered the atmosphere about four hours later, followed by the deployment drogue and main parachutes five minutes apart. Helicopters then swooped down to pick up the capsule, which was carried to a temporary cleanroom nearby at the U.S. Army Dugway Proving Ground.

"I have been waiting for this day since the early 1980s when Deputy Principal Investigator Dr. Peter Tsou of JPL and I designed a mission to collect comet dust," said Dr. Don Brownlee, Stardust principal investigator from the University of Washington. "To see the capsule safely back on its home planet is a thrilling accomplishment."

Two days after landing, the capsule's science canister was transferred to Johnson Space Center in Houston. After opening the canister, scientists confirmed that samples from the comet and interstellar dust had indeed been embedded in the capsule's aerogel-laden grid.

Tsou, who invented the technique of intact capture of hypervelocity particles for just such a mission as Stardust, said researchers were ecstatic with the collection of the cometary and solar materials from outer space. "Stardust is the realization of a 25-year dream to capture and return samples from a comet," he said.

"The collection of cometary particles has exceeded our grandest expectations," said Brownlee. "We were absolutely thrilled to see thousands of impacts on the aerogel."

Above: Investigators get their first look at the aerogel grid holding cometary samples.

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Inside the capsule, a tennis racket-like sample tray holds the particles captured in a gel as the spacecraft flew within 149 miles of comet Wild 2 in January 2004. An opposite side of the tray holds interstellar dust particles caught streaming through the solar system by Stardust during its seven-year journey. The team is analyzing the particle capture cells and removing individual grains of comet and interstellar dust.

Dr. Michael Zolensky, Stardust co-investigator and curator, said the samples would be distributed to more than 150 scientists worldwide for study. He said areas of analysis would include isotopes, bulk composition, mineralogy and petrology, optical and spectroscopic properties, organics, small impactors and interstellar grains.

JPL celebrated the two-year anniversary of the Opportunity rover's landing on Mars on Jan. 24. This month also marked the first full martian year on the planet for Opportunity and its twin, Spirit. Among the festivities, clockwise from top left: NASA Administrator Mike Griffin offers a video tribute to the rover team; Congressman David Dreier receives a gift of thanks from Lab Director Dr. Charles Elachi for Dreier's ongoing support; Mars Science Laboratory Project Manager Richard Cook gives a preview of that mission, launching in 2009; and La Cañada-Flintridge Mayor Anthony Portantino (left) presents a city proclamation to former Mars Exploration Rover Project Manager Pete Theisinger. To see the celebration online, visit http://dailyplanet.jpl.nasa.gov/multimedia.php.

Rovers' 2-year anniversary marked

Comet particles are shown embedded in Stardust's aerogel collector.
First joint faculty appointment named to JPL

JPL Director Dr. Charles Elachi joins the recipients of NASA Space Act Awards.

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Legislators hear from experts about how to better interest students, improve standards and hire and keep quality teachers

By Mark Whalen

From left: State senators Gloria Romers and Jack Scott, Assemblywoman Carol Liu, before Ryndell Brown, left, and Sara Munshin, both representing the California Math Council, testify at the hearing.

Making science fun and interesting for students, more flexible curriculum policies, and improved teacher recruitment and retention were the key themes discussed in a JPL-hosted joint State Senate-Assembly hearing on the future of math and science education on Jan. 20.

Organized by JPL's Office of Legislative Affairs and Education Office, the event was led by State Senator Jack Scott, chair of the Senate Education Committee, and Assemblywoman Carol Liu, chair of the Assembly Higher Education Committee. JPL lies in the district of both legislators. State Senators Gloria Romers and Tom Torlakson were also in attendance.

Scott, the former president of Pasadena City College, expressed concern about a recent study showing that 11 countries outperformed American fourth-graders in math. He also noted that China is graduating four times as many engineers as the United States. And he said the teacher workforce is getting older, with 97,000 teachers needing to be replaced in the next 10 years.

He called the problem not just one of education, but also of economics. "I think America's competitiveness is at stake," he said.

Angela Diaz, from NASA's Office of Education, began the testimony, noting that "NASA can inspire students in STEM (science, technology, engineering and math) as few organizations can." She added that "California is an ideal partner to help us achieve our goals."

Former astronaut Sally Ride testified that students' interest in math and science drop significantly during the middle- and high-school years, particularly among girls. She said that only 11 percent of engineers and 20 percent of scientists are women.

"We have to make science interesting and cool, and fuel that enthusiasm to help girls through middle school," Ride said. She added the importance of introducing girls to female role models.

Witnesses spoke about how they believe state education policies create obstacles for teachers. "They are told not to teach science in the early grades, particularly in grades K–3," said Dean Gilbert, president of the board of trustees of the California Science Teachers Association. He added that teaching standards ought to focus on students' critical thinking and problem solving, rather than memorizing content.

Gilbert also stressed the need to retain quality teachers, urging the legislature to work to improve science teachers' professional development programs, which he claimed have recently been replaced by an umbrella program to work to improve science teachers' professional development programs, which he claimed have recently been replaced by an umbrella program to focus on language arts and math.

"We have world-class standards, and we need the legislation to back that up," he said.

Sara Munshin, past president of the California Math Council, said processes for selecting the state's curriculum content review panels "need to be more open and fair." Liu acknowledged "complaints" about the curriculum commission and said that new legislation has been submitted to limit terms of commission members.

David Marsh, an associate dean of education at USC, urged legislators to update "out of balance" state teaching standards that are focused too much on tests. He added that incentives are needed to help students go into teaching, suggesting scholarships as better options than student loans.

Several educators testified about how California can interest, train and retain more qualified science and math teachers.

Beverly Young, assistant vice chancellor of the California State University system, discussed the Mathematics and Science Teacher Initiative, whose goal is to at least double the production of math and science teachers in the next five years. That would mean 1,500 new teachers in these fields.

To help achieve teacher quality and retention, Young noted a collaboration between the California State University and NASA that offers workshops and courses for CSU faculty, K–12 teachers and community college instructors. The partnership includes a JPL program of in-service professional development that promotes the importance of math and science and motivates teachers to stay in the field, including paid summer internships for math and science teachers.

Dr. France Cordova, former NASA chief scientist and current chancellor of the University of California, Riverside, testified that the University of California's California Teach program has the goal of quadrupling the number of graduates who go on to teach K–12 science and math by 2010, annually providing the state with more than 1,000 additional highly qualified math and science teachers.

"Legislation can help launch a new era of enthusiasm in science among students, through support of the UC and CSU programs, funding to prepare under-represented students and tax incentives for university partners," she told the panel.

The panel heard about an alternate route to teacher recruitment. Layla Avila, representing the nonprofit New Teacher Project, testified that the organization targets mid-career professionals who are inspired to switch careers. The New Teacher Project selects, trains and finds jobs for candidates, and prepares them for state certification.

Avila said the average age of program applicants is 32, about 25 percent of which have already completed a graduate degree. Participants undergo an intensive two-week math immersion program and seven weeks of in-service training.

"There are thousands out there who want to teach," she said, telling the panel that the program recently helped New York City hire 6,000 new teachers in high-need subject areas, half of which teach science and math.

Currently, an Oakland school district is participating in the program. Scott expressed interest in pursuing further study.

Liu called the 3:1/2-hour hearing "informative and thought provoking," adding that the testimony may help shape future legislation. Scott said the panel "will go away from the hearing with a resolve to improve."

High winds blow through Lab

Even the deer found the footing treacherous on Monday, Jan. 23, following heavy winds in the area. Facilities Division Manager Robert Develle said most of the damage resulted from toppled outdoor furniture and debris from broken tree branches. Though the Lab shut down for most of Monday, Develle said it suffered no structural damage and no power outages.
For Rent

MILPEA Heights, 3 bd. & 2 ba., 1,400 sf. for $2,100. 661/297-8533.

LA CANADA CFO house, JPL disc’nt. 626/798-9222, Mammoth Creek, JPL disc’nt. 626/798-9222, 790-2179.


HAWAII, Maui condo, NW coast, oceanfront 2nd floor, on the surf of New Smyrna Beach, w/fireplace and secluded balcony, 2 spacious bedrooms, 2.5 ba., Pergo hardwood flooring downstairs, central air and heating, $2,750. 653-9159.

LA CANADA studio guest house, kitchenette, 1 bath, large deck, fruit trees, patio, garage; private, immaculate; just bring toothbrush & clothes; utilities included; $975/mo. 626/204-1354.

10/210 fwys., no pets, $1,599. 626/576-7333.

760/439-7821, Darlene, dfhauge@yahoo.com.

710 North 3rd St., 4 bd., 2 ba. (1,500 sf). 818/468-6868, 626/204-1354.

WANTED

Western Union for food vending unit. 626/924-0214.

FOR SALE: 4-cyl. 4-speed high school class car or go-kart; ex-good conf. and shape. $1,800 obo. 626/793-4310.

3-TURN signalers; 4-TURN signalers; 3-TURN, 6-TURN track signalers. 308/227-1012.

356/462-6666.

FOR SALE: 600 or more lbs. of various sizes of decorative new concrete, used in construction for outdoor living area. 434/768-0602.

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