Jet Propulsion Laboratory

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Adventure ahead this year

By Mark Whalen

Lab gears up for Dawn, Phoenix launches in summer


Dawn


Phoenix

Earlier this month JPL celebrated the Mars Exploration Rover Spirit's third anniversary of exploration at the red planet, and on Jan. 24 its twin, Opportunity, also hits the same milestone.

As the rovers continue on with their discoveries, the Lab moves on with more challenges, including an unprecedented journey to two different asteroids as well as the next Mars lander. It will be a hot summer with the launches of Dawn and Phoenix.

The Dawn mission will venture out to the asteroid belt with a spacecraft that will make history in several ways. Set to launch June 20, Dawn will explore Ceres and Vesta, two of the largest asteroids that lie in the vast expanse of space between Mars and Jupiter. This will not only be the first time that a spacecraft will orbit a main-belt asteroid, but Dawn will be the first to ever orbit two targets after leaving Earth.

Also significant is the fact that Dawn will utilize the electric ion propulsion system that proved successful in JPL's Deep Space 1 technology demonstration mission.

"It's cool to take this technology and use it to undertake what a few years ago would be considered science fiction," noted Dr. Marc Rayman, the mission's systems engineer. "It would not have been possible to conduct the Dawn mission without the success of Deep Space 1. The whole point of testing ion propulsion was to do ambitious and important missions like Dawn."

"We showed with Deep Space 1 that the ion propulsion system is quite robust," added Dawn Project Manager Keyur Patel. "I feel very comfortable using it."

Dawn will take eight years from launch to completion of data return. Boosted by a gravity assist from Mars in March 2009, the spacecraft will arrive at Vesta in September 2011, where it will orbit and explore until April 2012, then continue to Ceres for a February 2015 encounter. The mission is scheduled to end in July of that year with Dawn remaining in orbit around Ceres.

The allure of Ceres and Vesta lies in their distinct characteristics. Ceres shows a primitive surface with evidence of water content, indicating that this body is representative of the icy moons of the outer planets, while Vesta appears dry and evolved, with surface features that include a huge crater at the south pole, as well as lava flows. Through their investigations of the contrasts of these different worlds, scientists hope to gain a better understanding of the mysteries of planetary formation.

JPL built Dawn's ion propulsion system and other components of the spacecraft. Flight systems integration has been done by industrial partner Orbital Sciences Corp., which provided the spacecraft. Thermal vacuum testing is underway at the Naval Research Laboratory, where further tests will be completed before Dawn ships to Florida in April for its Kennedy Space Center launch.

JPL is responsible for project management, systems engineering, mission design, navigation, mission operations, mission assurance and science payload management. Two of the science instruments are provided by partners from Germany and Italy.

The mission's principal investigator is Dr. Chris Russell of UCLA.

Phoenix, the first project in NASA's Mars Scout program of openly competed missions, will launch from Kennedy Space Center Aug. 3. After a cruise of about nine months, it will land in May 2008 in Mars' frigid northern hemisphere.

Findings from JPL's Mars Odyssey orbiter have shown that the area above 65 degrees north latitude contains an icy surface layer of about 20 inches, and Phoenix will explore the possibilities of how it got that way by digging into the frozen soil. Science objectives include studying the ice layers, ice and soil textures, and chemical composition. The mission also hopes to answer questions about martian climate cycles and whether they might produce conditions where near-surface water might stay melted.

The spacecraft is undergoing a battery of tests and is scheduled to ship to Kennedy Space Center May 15.

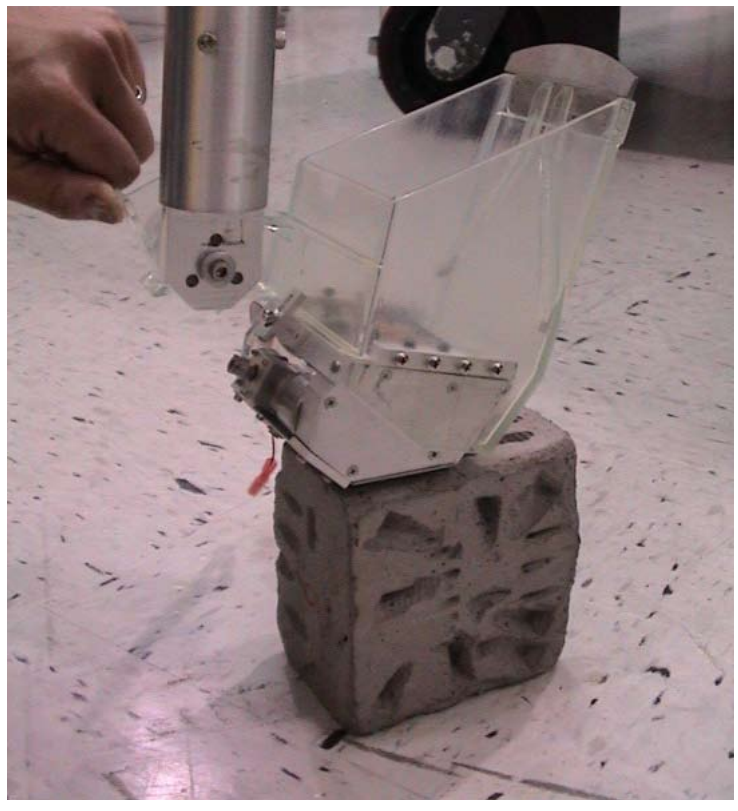
"We're in really good shape," noted Project Manager Barry Goldstein.

Peter Smith of the University of Arizona is the principal investigator. The university also provided two of the spacecraft's six instruments: the surface stereo

Continued on page 2

One of Dawn's two solar array wings undergoes deployment testing in October. Each solar array wing is 27 feet long and is on a yoke that extends about 37 inches from the spacecraft.

A technician checks on the xenon feed system on the Dawn spacecraft core structure.



The scoop design on Phoenix's robotic arm is tested by the JPL robotics team.

hot summer *Continued from page 1*

imager, which will provide high-resolution images of the landing site and positioning information for the lander's robotic arm; and the thermal evolved gas analyzer, which will heat soil samples dug up from the surface to measure water vapor, carbon dioxide and volatile organic compounds.

The gas analyzer is based on an instrument originally flown on Mars Polar Lander in 1999. And in other ways, Phoenix, like its namesake mythological bird, has risen from the ashes of its predecessors.

Of the other instruments, JPL built the robotic arm, which is based on designs from previous missions—it will be longer than a similar arm JPL created for Mars Polar Lander or a modified version for the 2001 Mars Surveyor lander. The microscopy, electrochemistry and conductivity analyzer—which will measure chemical properties and analyze the soil's minerals and thermal and electrical properties—was built by JPL for 2001 Mars Surveyor. The Mars descent imager, which will guide Phoenix to its landing site, was built by Malin Space Science Systems for 2001 Mars Surveyor.

In addition, a meteorological suite provided by the Canadian Space Agency will monitor various changes in the martian atmosphere.

"The team has been working really hard," said Goldstein. "This has been a great partnership between JPL, the University of Arizona and Lockheed Martin, our primary industrial partner. It's been a challenge at times, but it's a good cross-fertilization of skills and experiences. We're looking forward to the launch campaign."

Also of note for this year will be JPL's annual open house, scheduled for Saturday and Sunday, May 19 and 20. Throughout the year, the Laboratory will observe a number of anniversaries of significant events in its history. Among them are the 35th anniversary of the launch of the Jupiter flyby mission Pioneer 10 (March); the 40th anniversary of the launch of Mariner 5, which flew by Venus (June); the 10th anniversary of Mars Pathfinder's landing (July); and the 30th anniversary of the launches of Voyager 2 (August) and Voyager 1 (September).

Working out export compliance

John Casani, in the Office of the Director, is leading the effort and discusses the initiative's progress.

Photo by Tony Greicius

ITAR! There's an acronym that strikes fear and fury into the hearts of many a JPLer. Many of the Lab's researchers and project managers have been complaining for some time now that the regulations as currently implemented are interfering with efficiently carrying out the fundamental mission of the Laboratory. In response, JPL Director Charles Elachi called for a review of the impact of export compliance regulations on how JPL performs work, with the objective of finding and implementing better ways to carry out its mission, while maintaining full compliance with the law.

So, what's the problem?

The essence of the problem is that JPL has both a mandate to collaborate with international partners and the legal obligation to comply with export regulations when sharing information with foreign nationals. These two requirements frequently operate at cross-purposes, impeding the development and execution of high-quality, low-cost space science missions.

The manner in which the regulations are interpreted and implemented can create impediments to effective international collaboration, to the career progression of some of our scientists and technologists and very importantly to our ability to attract world-class talent.

What are these regulations about, and what are JPL's responsibilities in implementing them?

There are two separate sets of regulations implementing export legislation. One has to do with the export of munitions and other military equipment, the other has to do with export of commercial technology. The first set of regulations, called International Traffic in Arms Regulations (ITAR), is administered by the Department of State. The second set of regulations, known as Export Administration Regulations (EAR), is administered by the Department of Commerce.

Export, in the context of the regulations, means providing hardware, technical data or technical assistance to a non-U.S. entity. A non-U.S. entity can be a foreign company or university, or a foreign person. Even if the information is provided in the United States, an export is deemed to have occurred. At JPL, we don't export much hardware, so most of our exports deal with engineering and technology information about our work.

The objective of these laws and regulations is to limit access to, and use of, certain technology data and related services to purposes that serve the foreign policy interests of the United States.

JPL is firmly committed to compliance. The export control regulations, like all federal regulations, carry the force of law and apply to all U.S. entities, including individuals, companies and universities.

Before the mid '90s, spacecraft and all related technologies were treated under the law as commercial technology. At about that time, Congress determined that spacecraft technology, because of its significance to military applications, should be added to the U.S. Munitions List, thereby putting it under the jurisdiction of the State Department rather than the Commerce Department. That seemingly simple change has had a profound effect on the way JPL must conduct business regarding foreign nationals and foreign partners.

You were tasked with this initiative in September. What did you do first?

I felt the most important thing to do at the start was to try to understand the problems and issues as seen by the affected communities at JPL. The method I chose was to engage a broad segment of the community in a series of one- to two-hour interview sessions, mainly from late September through early November. Olga King, the manager of the Office of Export Compliance, and I, assisted by Tom Soderstrom of the Office of the Chief Information Officer, interviewed two or three people at a time. We asked them to tell us about problems or issues they had experienced, to illustrate the problems with supporting anecdotes, to make recommendations on how things could be improved and to suggest metrics we might use to gauge our progress as we move forward.

Altogether we interviewed folks representing about seven projects in different phases of development, several groups of individual science and technology contributors (including the chief scientist), members of the Senior Research Scientists Council and a number of support organizations. At the end of each interview we invited interviewees to go online and edit or expand on our posted interview summaries. We wanted to assure ourselves and the interviewees that we had properly interpreted what they had told us.

We had planned to finish the information gathering in early November and spend the rest of November and December synthesizing the go-forward plans. Actually the interview process went on into late November, but we've managed, at least, a first-order synthesis of our response plans. Implementation started in early January and will continue throughout the year.

Can you describe some of the issues you identified in the course of this process?

Altogether we identified more than a dozen

Continued on page 4

problems and issues. Some reflect the export compliance "facts of life," which we might not be able to solve to everyone's satisfaction. Some are a result of misunderstandings that can be resolved though better communication and training. However, many can be addressed through new and revised practices that will affect both the Office of Export Compliance and the user community, and through improved procedures and information technology tools that we will be introducing over the next several months.

Those who are interested can go online to see the complete list of problems, anecdotes, recommendations and suggested metrics. See *http://wikidev.jpl.nasa.gov/index.php/ITAR*.

One of the more vexing issues has to do with fundamental research. Fundamental research is exempted from the ITAR, provided certain conditions exist. Those conditions exist at Caltech and most universities, but not at JPL. Thus, the research results of a Caltech researcher generally are exempted from the regulations, while similar research conducted by a researcher at JPL is not. The reason has to do with restrictions in the prime contract that apply to all work performed at JPL.

Another problem has to do with what JPL technical content can be included in our proposals for competed work. It was reported to us that so much of the technical content from one of our proposals had to be removed that the proposal evaluation team ruled our proposal not technically competitive. We don't yet see a clear path forward for this problem, but it will likely involve a negotiated agreement with the proposal sponsors, since a major component of the problem has to do with foreign national participation on the proposal evaluation teams.

Yet another problem has to do with the document clearance review process. JPL is obligated to review every document intended for unlimited external release to ensure that it does not contain export-controlled information. Export compliance review is now an integral part of the standard Document Review Services review process. Documents that must be reviewed include conference papers, papers for journal publication, technical data, reports and other material related to JPL work as well as outreach products, educational materials and visitor handouts. Since we release 4,000 to 5,000 documents a year, this has resulted in an enormous backlog of papers requiring clearance review. Up until last summer all of the documents had to be routed to the Office of Export Compliance for compliance review. With only a handful of reviewers, the backlog was up to more than 350 papers, with a lag time of months. To better distribute the workload among knowledgeable reviewers and speed up the reviews, Chief Scientist Dan McCleese recommended that we train line managers, group supervisors and above, to review for export compliance. We've set up a special training course to do this. So far, we have trained more than 180, and expect to train an additional 40 by the end of April. The backlog in the Office of Export Compliance now fluctuates between 25 and 60, and the cycle time for the majority of documents is down to just a matter of weeks rather than months. In addition, with the help of the Office of the Chief Information Officer, we will be rolling out an automated online review system that will improve the efficiency and cycle time even more.

These are all legitimate issues of concern. However, some problems can result from the extensions of practices that served us well in the past to the current environment. For example, one employee who was planning on giving a lecture to an elementary school class was understandably annoyed (to put it mildly) because his presentation would now be subject to export compliance. For many years the rule has been that all educational outreach products—independent of complexity of content—were subject to the full clearance process, which now includes export compliance review. We are now in the process of changing the way outreach products are handled, so that all such products will from now on be cleared by the Office of Communications and Education, rather than having to go through the full clearance review process. This will shift more of the review burden to that office, but will further reduce the cycle time for documents requiring the full clearance process.

On March 21 we will brief interested JPLers in von Kármán Auditorium on the specifics of the plans for 2007. My hope is to get feedback through an interactive Q & A session. I'm looking forward to a good turnout.

Who at JPL ensures that we are following the rules?

The Office of Export Compliance supports JPL's mission of exploring space in collaboration with international partners by facilitating the exchange of scientific and technical information to the extent allowed under the laws and regulations of the U.S. government. That office, in consultation with the Office of the General Counsel and other interested organizations, is responsible for developing the processes and procedures required to implement a system of export compliance. The Office of Export Compliance also conducts audits as needed to ensure compliance, but export compliance is a shared responsibility. All of us need to do our part to ensure that the rules are followed. Most people follow the rules if they know about them, and understand the need and purpose. One of our major findings had to do with just that. Many people just don't know about or understand the rules. That will be a major thrust behind our new program of communication.

Where do things stand now?

I think we've made good progress. We have a strong collection of problems, recommendations and metrics, and we have achieved early buy-in from many of the stakeholders. We are developing both short- and long-term solutions involving training, better planning, better use of information technology and continuous communication with employees.

Will there be a huge restructuring of how export compliance will be done at JPL?

Not exactly—the organizational structure will be the same. The Office of Export Compliance (OEC) will continue to work with the program offices, flight projects and directorates to determine the need to review material for export compliance, and to assign export technical representatives to facilitate document review. They will continue to assist in obtaining any required export licenses. However, with the introduction of trained line managers to do the first-order compliance review, OEC will no longer have to function as the primary in-line reviewers of every document. They will still do in-line reviews, but only at the request of the line reviewers or Document Review Services, allowing the OEC to focus on auditing the process, which will ensure that the line reviewer training has been adequate and that the reviewers are properly implementing the training.

Document Review Services will continue to provide the traditional review services, but they too will now rely on the trained line managers for the first level of export compliance review. Document Review Services will only forward documents to the Office of Export Compliance for compliance review on an exceptional basis.

However, there will be many changes to how we communicate and how we do business, including an improved set of tools. We've planned a number of actions as we move forward. There will be a new training program with new courses and new delivery methods; a new set of rules to ensure alignment with the Office of Export Compliance; a communications program to build trust and understanding and promote a culture of shared responsibility; and the development of guidelines to promote uniformity and consistency, both in authoring and reviewing documents, and in interpretation and application of the rules.

On March 21 we will brief interested JPLers in von Kármán Auditorium on the specifics of the plans for 2007. My hope is to get feedback through an interactive Q & A session. I'm looking forward to a good turnout.

Will the new training affect all employees?

Yes, but in different ways. We received a lot of feedback about training, much of it recommending that the training should be geared to job function, rather than by a one-size-fits-all-approach.

There will be new training modules, including an introductory compliance course for all employees, which is a modification to the current online course. We will continue the ITAR-EAR review course I spoke of earlier for line and program managers. There is also an orientation module for project managers and staff; an export technical liaison course for technical members of a project or task having an export license; several short online modules specialized for cognizant engineers, shipping and receiving staff, and foreign national hosts; subject matter expert courses for Office of Export

Compliance staff; and an annual JPL Executive Council seminar.

In addition, each 3X and 5X organization that authors documents intended for unlimited external release must have at least one technical manager trained to review documents for export compliance. Training will typically be required for group supervisors and section managers.

Besides the training, will there be other policies and practices put in place to help people get the job done?

Yes. Throughout the project life cycle, at least one dedicated export technical liaison will be required in each project office that requires a technical assistance agreement or any other export license. In addition, one export technical liaison will be required for each program office and programmatic directorate that has a project or program with an export license.

In addition, final export control management plans will be required at end of Phase A, rather than at end of Phase B; however, these will be streamlined and slimmed down from what we have now. Also, Step-1 proposal teams will be required to draft their technical assistance agreements before disbanding, and project managers and key staff will be required to take in-office training at the time of project formation.

Are you confident that the Laboratory can successfully address all of the export compliance issues?

Yes, to a degree. One way to look at it is to compare the situation to airline security. Prior to Sept. 11, 2001, travelers could show up shortly before departure time and carry just about anything on an airplane. After 9/11, things changed quickly and dramatically with new carry-on restrictions and other security procedures. Travelers were angry at the inconvenience, the need to arrive at the airport a lot earlier and the restrictions about what they could carry on. But more recently, the inspectors and their inspection procedures and equipment have gotten a lot better, and the traveling public now understands the rules, knows what the carry-on restrictions are and has adjusted their travel plans accordingly. No more showing up at the terminal 20 or 30 minutes before departure time and no more carrying Swiss Army knives or more than a few ounces of liquid.

Likewise, our export compliance tools and procedures—just like the airline inspectors and equipment—will get better, and the user community—just like the traveling public—will learn to plan a bit differently, but there's no going back to the pre-9/11 security rules.

So, yes, I'm confident that we will successfully address all of the issues, but things will be different—and there'll be no going back to the pre-ITAR days here either.

We need to recognize what's behind this: the foreign policy interests of the country. Export compliance requires informed planning. It does take more time and cost more money, but let's recognize it—this is now part of the price of doing business. The problems can be mitigated if we plan for them.

TREES
making a comeback

By Mark Whalen

Although a number of trees were lost due to the start of construction of JPL's new Flight Projects Center, many more are now on their way.

The first in a three-phase project to restore the trees—indeed, to far surpass the number of trees removed—has been completed.

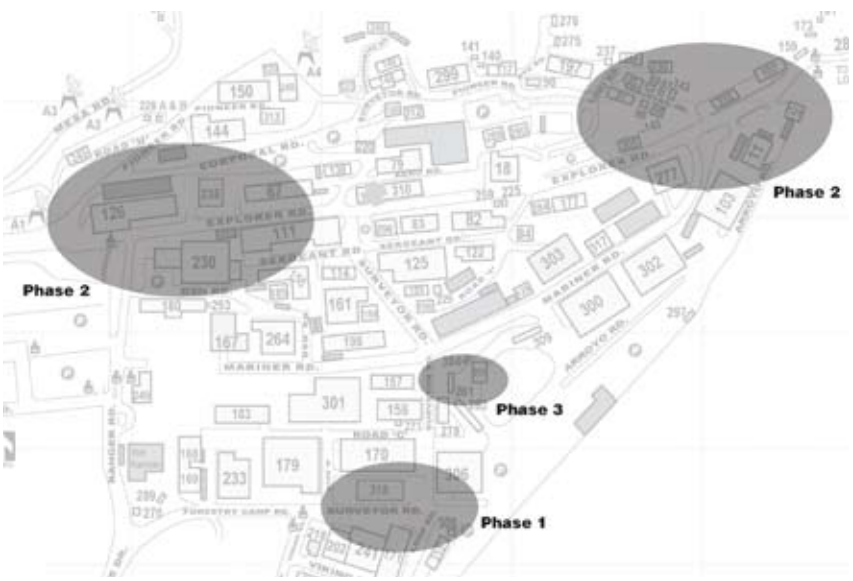
Mark Gutheinz, manager of the Facilities Engineering and Construction Section, noted that about 35 trees have been planted in the southern sector of the Laboratory. By the end of 2007, he said, most of the northern end will have new trees planted.

The final phase of replanting will take place as part of the building's construction. Groundbreaking is scheduled for May 7. About 90 trees will be planted near the structure.

At least 175 new trees—18 different types—are to be planted on Lab, about five times as many trees as were removed.

Dutch Sleger/JPL Photolab

Jason Castro (left) and Joe Lewis of Phoenix Construction begin the tree replanting effort in November. Looking on is Mark Gutheinz, manager of the Facilities Engineering and Construction Section.



About 35 trees have been planted in the Lab's southern section in the first phase of replanting.

Lab gets go-ahead to develop Mars life-detection instrument

By Mark Whalen

JPL will develop a life-detection instrument that could be flown to Mars in the next decade, one of two proposals selected for technology development studies by NASA this month.

Known as the Urey Mars Organic and Oxidant Detector, the instrument would investigate organics and oxidant materials on Mars using three complementary detection systems. The instrument, to be built and managed at JPL, may lead to NASA contributions to the European Space Agency's ExoMars mission, scheduled for launch in 2013, or other Mars missions.

JPL team members involved in the instrument's development are Allen Farrington, proposal and project manager; Frank Grunthaner, co-investigator; Tim Munson, system engineer; Yong Chong, electronics; Xenia Amashukeli, sub-critical water extraction; Peter Willis, microfluidics; and Victor White, sensor deposition and microfluidic fabrication.

The principal investigator is Dr. Jeffrey Bada of UC San Diego. Other co-investigators and science team members include Diana Blaney, Max Coleman and Albert Yen of JPL; Richard Mathies, UC Berkeley; Aaron Zent, NASA Ames Research Center; Richard Quinn, SETI Institute, Ames; and Pascale Ehrenfreund, Leiden University, the Netherlands.

The instrument's goal is to search for organic compounds on Mars' surface and subsurface. Urey's investigation of the martian environment will involve searching for organic compounds indicative of life and prebiotic history at a sensitivity many orders of magnitude greater than the Viking lander or other in-situ organic detection systems. The instrument will perform the first in-situ search for key classes of organic molecules using state of the art analytical methods that provide part-per-trillion sensitivity. It will determine whether these molecules are abiotic or biotic in origin and will evaluate the survival potential of organic compounds in the environment using state of the art chemo-resistor oxidant sensors.

Grunthaner said the instrument will have the capability to investigate as far as two meters below the surface, a key factor in the search for whether there ever were biological compounds on the planet, whether there is biology there today or whether conditions exist to develop it in the future. "We're going to look to see if there are any organics at all; then if we find them, we can discriminate the various organic compounds that are there," he said.

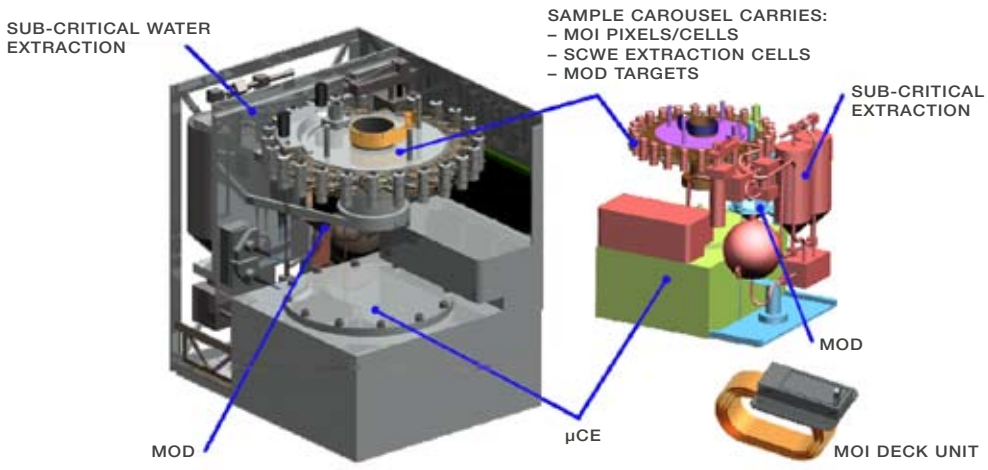
Urey is designed to carry out two complementary experiments. The instrument uses a sub-critical water extractor, Mars organic detector and a micro-capillary electrophoresis analyzer to investigate the target organic compounds in samples. Samples will be analyzed to detect the presence of organic compounds—and to determine their composition.

A chemometric sensor array, the Mars Oxidant Instrument, will measure the reaction rates of films that have different sensitivities to particular types of oxidants expected to be present in the Mars surface environment. By controlling the temperature of these films and their exposure to dust, ultraviolet light and water vapor, Urey will evaluate organic degradation pathways that may take place at sampled localities on Mars. These data will provide important insights into the observed organic matter inventory and the potential for survival of various classes of organic compounds under martian environmental conditions.

Field tests of the instrument have been conducted in Chile's Atacama Desert. The area is among the best sites on Earth for studying organic survival and degradation, due to its dry and oxidizing environment, the presence of sulfate mineral deposits and low levels of indigenous living organisms and detectable organic compounds.

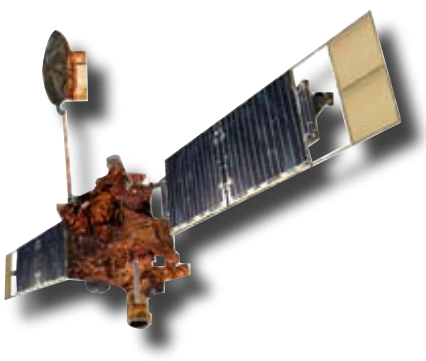
A second proposal, the Mars Organic Molecule Analyzer, was selected along with Urey for technology development studies that could also lead to participation in ExoMars. This instrument would investigate organic molecular signatures and the environment in which they exist using a mass spectrometer and gas chromatograph. The principal investigator is Dr. Luann Becker, UC Santa Barbara. The two technology development studies are funded for a total of $1.5 million.

NASA also announced that it will fund a U.S. scientist, Alian Wang of Washington University, St. Louis, to participate as a member of the ExoMars science team.



Left: The Urey Mars Organic and Oxidant Detector is named for the late UC San Diego scholar Harold Urey, whose pioneering work on isotopes earned him the Nobel Prize in Chemistry in 1934 and later led him to theories of planetary evolution.

Above: A concept drawing of the Urey Mars Organic and Oxidant Detector.



Panel will study Global Surveyor events

NASA has formed an internal review board to look more in-depth into why JPL's Mars Global Surveyor went silent in November 2006 and recommend any processes or procedures that could increase safety for other spacecraft.

Mars Global Surveyor launched in 1996 on a mission designed to study Mars from orbit for two years. It accomplished many important discoveries during nine years in orbit. On Nov. 2, the spacecraft transmitted information that one of its arrays was not pivoting as commanded. Loss of signal from the orbiter began on the following orbit.

Mars Global Surveyor has operated longer at Mars than any other spacecraft in history and for more than four times as long as the prime mission originally planned.

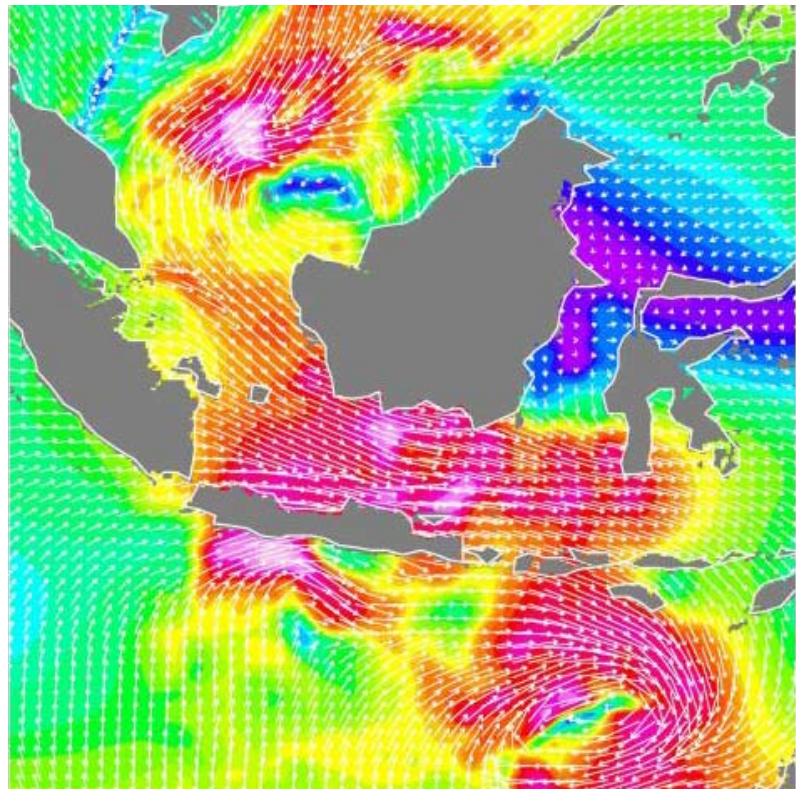
QuikScat

shows rough seas, atmospheric conditions at time of two Java Sea disasters

A ferry carrying more than 600 passengers sank in the Java Sea between the island of Java and Borneo just before midnight on Dec. 29, 2006, during high winds and rough seas. On Jan. 1, 2007, a plane carrying more than 100 people crashed on its flight over the Java Sea; high winds and turbulent weather are being investigated as possible causes. The origin of surges of deadly winds in this usually relatively calm region is poorly monitored and understood. However, ocean winds data from JPL's QuikScat satellite show potential for helping alleviate such deficiencies.

Data obtained from QuikScat on Dec. 30 and Jan. 1 shed new insights into the atmospheric conditions at the time of these incidents. QuikScat data are available in near real time to operational weather forecasting agencies around the world. The data from Dec. 30 and Jan. 1 observed that the strong winds in the Java Sea originated from the surge of a strong winter monsoon from the Asian continent. The monsoon winds blew south across the South China Sea and deflected eastward after they crossed the equator due to the rotation of Earth. The winds strengthened as they were channeled through the land masses of Indonesia. The winds in the Java Sea remained strong through Jan. 1.

Associated with the eastward winds, twin cyclones (a counter-clockwise circulation in the Northern Hemisphere and a clockwise circulation in the Southern Hemisphere) were also observed by QuikScat; the stronger one was south of the equator (summer hemisphere) between Java and Australia, and a weaker one was north of the equator (winter hemisphere) west of Borneo.



In this image from Jan. 1, the different colors denote different wind speeds. White arrows are wind vectors showing both direction and speed.

See a color version of the image at *http://photojournal.jpl.nasa.gov/catalog/PIA09110.*

The large-scale, broad and simultaneous observations by QuikScat make it possible to put the local weather into the context of the large-scale circulation, and confirm one of the assumptions that links the cold surge of the Asian monsoon with tropical cyclones in the western Pacific.

Scientists report Titan liquid lakes

By Carolina Martinez

Scientists report definitive evidence of the presence of lakes filled with liquid methane on Saturn's moon Titan in a cover story in the journal Nature earlier this month.

Radar imaging data from a July 22, 2006, flyby provide convincing evidence for large bodies of liquid on Titan today. A new false-color radar view gives a taste of what Cassini saw. Some highlights of the article follow below.

Lake characteristics:

• Radar-dark patches are interpreted as lakes based on their very low radar reflectivity and morphological similarities to lakes, including associated channels and location in topographic depressions.

• Radar-dark surfaces are smooth and most likely liquid, rock, ice or organics. More than 75 radar-dark patches or lakes were seen, ranging from 3 kilometers (1.8 miles) to more than 70 kilometers (43 miles) across.

• Some lakes appear partly dry, while others seem liquid-filled. Some of the partly filled lakes may never have filled fully, or may have partly evaporated at some point in the past. The dry lakes have margins or rims and a radar brightness similar to the rest of the surrounding terrain, making them appear devoid of liquid.

• The varying states of how full the lakes are suggest that lakes in this region of Titan might be temporary on some unknown timescale.

• Approximately 15 of the dark patches seem filled and show no clear evidence of erosion. These dark patches resemble terrestrial lakes confined within impact basins (Clearwater Lakes in Canada, for example) or within volcanic calderas (Crater Lake, Oregon, for example). The nest-like nature of these lakes and their limited range of sizes make it unlikely that they originated from an impact. A volcanic origin for the depressions is possible, given their appearance.

• Some lakes have steep margins and very distinct edges, suggesting a topographic rim. These lakes are consistent with seepage or groundwater drainage lakes.

• Other lakes have diffuse, more scalloped edges, with a gradual decrease in radar brightness towards the center of the lake. These lakes are more likely to be associated with channels, and may be either drainage lakes or groundwater drainage lakes.

• Yet other lakes have curvy channel-like extensions, similar in appearance to terrestrial flooded river valleys (Lake Powell, for example).

• Bright patches near the lake edges could be small islands peeking through the surface. Floating "icebergs" are unlikely because most materials would not float in liquid hydrocarbons.

Other observations:

• Based on the lake characteristics, Cassini scientists think they are observing liquid-filled lakes on Titan today. Another possibility is that these depressions and channels formed in the past and have now been filled by a low-density deposit that is darker than any observed elsewhere on Titan. However, the absence of wind-blown features in this area makes the low-density hypothesis unlikely.

• These northern hemisphere lakes are the strongest evidence yet that Titan's surface and atmosphere have an active hydrological cycle, though with a condensable liquid other than water. In this cycle, lakes are filled through methane rainfall or intersect with a subsurface layer saturated with liquid methane.

• As Titan's seasons progress over the 29-year cycle of Saturn's orbit around the sun, lakes in the winter hemisphere should expand by steady methane rain, while summer hemisphere lakes shrink or dry up entirely.

To read more about the radar imaging data from the July 2006 flyby, visit *http://www.jpl.nasa.gov/news/news.cfm?release=2006-097.*

News Briefs

John Mather

Nobel Prize winner to speak

John Mather, the head of the Cosmic Background Explorer team from NASA Goddard who received a Nobel Prize last year, will address JPL staff on Wednesday, Jan. 24, at 11 a.m. in von Kármán. The event will be webcast on Daily Planet, *http://dailyplanet.jpl.nasa.gov*.

Mather shared the Nobel Prize in physics with George Smoot of the University of California for their collaborative work on understanding the Big Bang. The Cosmic Background Explorer studied the pattern of radiation from the first few instants after the universe was formed. In 1992, the Cosmic Background Explorer team announced that they had mapped the primordial hot and cold spots in the cosmic microwave background radiation. These spots are related to the gravitational field in the early universe, only instants after the Big Bang, and are the seeds for the giant clusters of galaxies that stretch hundreds of millions of light years across the universe.

High-tech conference coming up

JPL will host the 19th annual High-Tech Conference for Small Business on March 6 and 7 at the Radisson Hotel near Los Angeles International Airport.

The two-day conference will focus on subcontracting and marketing opportunities for small, minority, women-owned and veteran-owned businesses in high-tech industries. It includes several "how-to" workshops featuring information on major programs, small business initiatives and other topics.

Attendees will have the opportunity to meet with approximately 250 corporate, federal, state and city government representatives to discuss potential contracting and subcontracting opportunities. One-on-one counseling to discuss potential business opportunities is available with more than 100 exhibitors.

For more information, contact Amber Norton, ext. 4-7531, or Jasmine Colbert, ext. 4-8689.

Service awards bestowed

For the period of August through December 2006, the following JPL recipients celebrated 25 or more years of service and were invited to attend a luncheon and ceremony in their honor on Dec. 6.

50 years: William Breckenridge.

45 years: Frank Barath.

40 years: Donald Germann, J. Klose, Robert Kocsis, Arthur Lonne Lane, Hartwell Long, Jerry Neal, Dennis Page, Neil Yarnell, Andrew Zoltan.

35 years: Joseph Ajello, Eri Cohen, Bruce Goldstein, Jeremy Jones, John McKinney, Edward Mettler, Gerald O'Connell, Stanley Sander, Martin Slade III, John Stocky, Sandi Thomas.

30 years: Robert Aster, Bryan Bell, Brent Blaes, Paulette Cali-Kaviani, John Davidson, John Lai, James Ling, Constance McCaig, James Raney, Judith Ryken, Allen Sacks, Kennis Stowers, Neil Toy, Peter Wannier, Sien-Chong Wu, Richard Zurek.

25 years: Marie Case, Min-Kun Chung, Alice Cobbin, Norberto Cresta, Cheng-Hsien Hsieh, Andrew Kwok, Karen Moran, Henry Ngo, James Okuno, Vena Pontiac, David Rochblatt, Yolanda Swanson, Wallace Tai, David Thiessen, Chris Webster, Cynthia Williams.

For information about the programs and services offered by Compensation, Rewards and Recognition, visit *http://hr/esr*.

Passings

Frank Goddard, 91, retired assistant laboratory director for research and advanced development, died Jan. 6.

During the Cold War era his career at JPL involved supersonic and hypersonic wind tunnel testing and ballistic missile technology on the Corporal and Sergeant rockets. He later played a significant role in the space program from the early lunar orbiters and landers to the Mariner and Viking missions to Mars, and ultimately the Voyager "grand tour" planetary spacecraft.

Goddard joined JPL in 1949 as chief of the High-Speed Wind Tunnel Section, and in 1952 became chief of the Aerodynamics Division. He later served as chief of the Aerodynamic and Propellants Department and as assistant director for NASA relations from 1959 to 1961, when he was appointed assistant director for planning for JPL. In this position, which he held until April 1962, he was responsible for the Lab's long-range planning activities. Goddard retired in 1977.

He is survived by his wife, Irene; sister Helen Boyers; son Stephen; grandchildren Erica, Emily and Caitlin; great-grandson Nathan; stepdaughter Daiva Kianersi; and step-grandson Adam Brown.

Goddard's family requests that donations in his name be made to The Planetary Society, attention Melanie Lam, 65 N. Catalina Ave., Pasadena, CA 91106.

John "Jack" Hardy, 66, a retired microwave engineer in Section 385, died Nov. 10.

Hardy joined JPL in 1966 and retired in 2005. He is survived by his wife, Maureen; daughters Lori, Jenni and Jill; five grandsons and one granddaughter.

No services were held.

Robert Norton, 67, a retired engineer from Section 352, died Nov. 19.

Norton worked at JPL from 1983 to 2000. He is survived by his wife, Hope; children Gary, Diana, Carrie, Kristen and John; and grandchildren Katie, Ashley and Noah.

No memorial service was held.

Letters

My granddaughter, Mallory Peck, was killed in an automobile accident on Rt. 210, in Montrose, on Oct. 22. We are never prepared for the death of a young person. There are not enough words to describe the support and donations from my friends and co-workers. Thank you so much. We want to thank JPL for the plant. It was beautiful.

Barbara Vaughn (grandmother)
Kelli Peck (mother)
Amanda Peck (sister)

My family and I would like to thank all of our JPL friends for their thoughts and condolences at the recent passing of my father-in-law, Jerry Greenstein. Jerry's connection to JPL was not just through me, but also as an engineer at General Dynamics working on the Centaur guidance system. The ERC plant sent to us had added meaning as well—the anthurium brings back memories of our extended family's vacation to Hawaii last summer. We greatly appreciate everyone's warmth and kindness.

Steve Edberg

My family and I thank our friends at JPL for your expressions of condolences at the passing of my father. Your kind thoughts, prayers, cards and plant are greatly appreciated.

Jeff Hilland

Thank you for the plant sent to my home after the passing of my father. I appreciate the cards and expressions of sympathy that I received from you. My heartfelt thanks to you who offered support and encouragement over this very difficult year.

Jeanne Makihara

Retirees

The following JPL employees retired in January:

Donald Lehr, 35 years, Section 5124.

Anne Elson, 24 years, Section 316.

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http://dailyplanet

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