Discovery and New Frontiers News

A Quarterly Newsletter of NASA's Discovery and New Frontiers Programs

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New Frontiers AO Released

On April 20, NASA released the New Frontiers 2009 Announcement of Opportunity (AO). NASA expects to select up to three New Frontiers mission proposals for a 10- month Phase A study and to approve one to proceed after evaluation of Phase A reports. Launch is to occur no earlier than late CY 2016 and no later than CY 2018.

Proposed missions must address the science objectives of one of the eight mission concepts identified in the National Research Council's 2007 report, Opening New Frontiers in Space: Choices for the Next New Frontiers Announcement of Opportunity.

Proposals are due July 31, 2009. Direct questions regarding this solicitation to Thomas.H.Morgan@nasa.gov (subject line to read "NEW FRONTIERS AO").

Next Discovery AO on the Way

In May, NASA announced that the Science Mission Directorate (SMD) intends to release a Draft Announcement of Opportunity (AO) in June 2009 for Discovery Program space science investigations. It is anticipated that two to three investigations will be selected for 9-month Phase A concept studies and one will be approved to proceed.

Discovery Program investigations must address NASA's planetary science goals as described in Solar System Exploration, NASA's 2006 roadmap for planetary science. Investigations may focus on any body in the Solar System, excluding the Earth and the Sun, and including Mars and the Moon. Investigations may not focus on extra-solarplanetary systems. Discovery Program investigations may propose the use of Advanced Stirling Radioisotope Generators for missions enabled by radioisotope power systems.

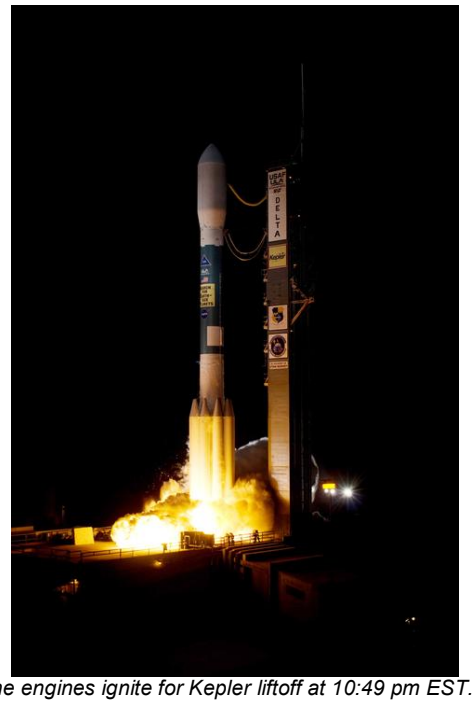
The target date for the release of final AO is November 2009. Questions may be addressed to michael.h.new@nasa.gov.

Check out the new Discovery and New Frontiers Mission Milestone Interactive at

discoverynewfrontiers.nasa.gov

Kepler Mission Begins Search for Other Earths

On March 6, the Delta II rocket carrying the Kepler spacecraft lit up the Florida sky after a spectacular launch from Cape Canaveral Air Force Station, on a search for Earth-size planets orbiting other stars. We may soon know if there are others like us in our galactic neighborhood or if we are alone.



The engines ignite for Kepler liftoff at 10:49 pm EST. Credit: NASA/Tony Gray

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Kepler will spend three-and-a-half years staring at more than 100,000 stars in our Milky Way galaxy, looking for signs of Earth-size planets. Some of the planets are expected to orbit in a star's "habitable zone," a warm region where water could exist on the surface, increasing the possibility of life. The Kepler photometer, the largest camera ever flown in space, will detect “transits,” or slight dips in the starlight, which occur when planets pass in front of their stars.

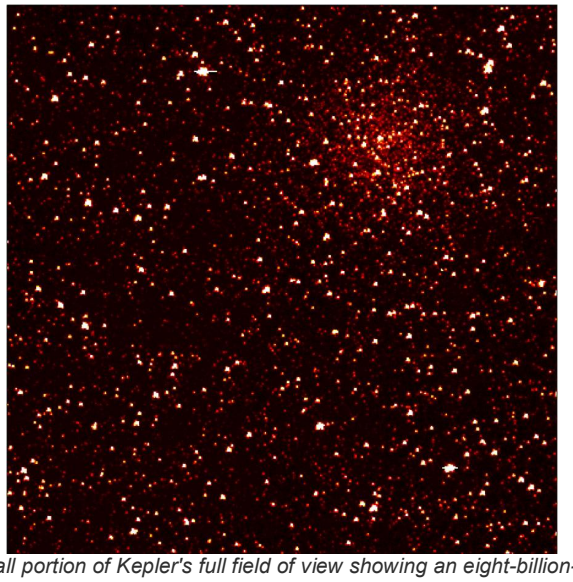
The weeks since launch have been loaded with activity. The initial signal from the spacecraft was acquired on schedule, and the probe began generating its own power from the solar panels. Engineers began the 60-day process of "commissioning," powering on and checking out Kepler’s systems to ensure everything is working properly, including the star cameras, sun sensors, X-band radio link and Ka-band radio transmitter.

Kepler's science instrument, the photometer, was powered on and calibrated. Initially the dust cover, which protected the photometer from contamination before and after launch, remained closed so that the first images would be dark, helping engineers characterize the noise in the instrument's electronics. This noise will be removed from the actual science data, giving the photometer the capability to detect minute changes in a star's brightness caused by planets.

After analyzing the "dark" calibration data, scientists concluded that the telescope's focal-plane array, the area where light is focused, was behaving as expected. The dust cover was ejected on April 7 when engineers sent commands to break a "burn wire" and release a latch holding the cover closed. Watch an animation of the release.

First Views of Planet-Hunting Territory Captured

On April 8, Kepler took its first images of the patch of sky where it will hunt for planets like Earth. The "first light" images show the vast starry field in the Cygnus-Lyra region of our Milky Way galaxy. One image shows Kepler’s entire field of view, a region with an estimated 4.5 million stars, more than 100,000 of which were selected as ideal candidates for planet hunting. Two others zoom in on portions of the large area.



A small portion of Kepler's full field of view showing an eight-billion-year-old cluster of stars 13,000 light-years from Earth.
Credit: NASA/Ames/JPL-Caltech

The image is color-coded so that brighter stars appear white and fainter stars look red. Also in the field are star clusters, background galaxies beyond the Milky Way and three stars that are known to have "hot Jupiters" orbiting them. Kepler observed these stars for an early confirmation of its planet detection capability and verified that the telescope is operating well within the focus requirements.

"It's thrilling to see this treasure trove of stars," said William Borucki, science principal investigator for Kepler at NASA's Ames Research Center, Moffett Field, CA. "We expect to find hundreds of planets circling those stars.”

The Search Begins

Kepler began its search for other Earth-like worlds on May 12. The first science data are scheduled to be sent down to Earth in late June and analysis will begin. The first planets expected to be detected are the "hot Jupiters" – the gas giants that circle close and fast around their stars. NASA's Hubble and Spitzer space telescopes will follow up with these planets and learn more about their atmospheres. Neptune-size planets will most likely be found next, followed by rocky ones as small as Earth. These could take at least three years to discover and confirm. Ground-based telescopes also will contribute to the mission by verifying some of the findings.

The Discovery Program sends hearty congratulations to Jim Fanson, the Kepler project manager at JPL who guided the mission through launch and commissioning, and welcomes Roger Hunter, the new Kepler project manager at NASA Ames Research Center.

Education and Public Outreach Highlights

Since launch, many Kepler team members have given talks about the mission at schools, universities, libraries, conventions, book stores, organization meetings, and science festivals across the country, in Paris and Antarctica. One talk was presented at a Star Trek convention “where they are pretty serious about the detection of habitable planets.” They have also conducted educator workshops, given radio interviews, participated in webcasts, and staffed a display at JPL’s annual open house. Thousands of people have been engaged by the Kepler Mission team.

A new planetarium show that features the Kepler Mission, “Strange Planets,” will be featured at the Lawrence Hall of Science planetarium from June 15 through August 10. Others around the country will be showing it in the future.

William Borucki – Kepler Mission Science Principal Investigator

Space scientist Bill Borucki is a soft-spoken, pleasant person who grew up in a small town in Wisconsin where he liked to build and launch rockets. He still does, and he convinced NASA to build and launch Kepler, the first spacecraft capable of finding Earth-size planets orbiting other stars.

Bill displays a number of similarities to another mild-mannered Midwesterner, a guy named Clark Kent. As the force behind what many call "NASA's coolest mission," Bill summoned veritable superpowers to get the innovative Kepler mission off the ground. Knowing what he and his team have accomplished, you get the feeling there might be a giant "S" hiding under that unassuming shirt and tie.

Bill Borucki – Kepler's Man of Steel

While Superman could fly to other worlds with relative ease, he didn't have to navigate the maze of changing requirements, reallocated funding, technical issues, and political challenges that Bill has helped steered the Kepler mission through. Even with X-ray vision, he might not have been able to foresee the obstacles. But he was there to watch his dream come true on March 6 when the Kepler spacecraft took off from Cape Canaveral, faster than a speeding bullet, on its way to search for other habitable worlds.

Bill grew up in Delavan, Wisconsin, a great place for a boy who loved science and building things. He was president of the school's science club – the students liked to reject the teacher's suggestions for projects and pursue their own ideas. "We decided to build a transmitter to contact UFOs," he said, "so I built the ultraviolet transmitter, others built the infrared and visible transmitters and a magnetometer. I don't think any of them worked all that well, but we had a great time. I learned so much trying to build these things. You don't always have to succeed to learn a lot."

Young Bill also belonged to a rocket club, and he got interested in amateur radio and building electronic equipment and antennae. He enjoyed communicating with other people around the world.

Bill remembers the very dark night sky and how it lit up with stars during the new moon. He and his friends built telescopes and cameras to photograph the stars. In the summertime they rode their bicycles to the Yerkes Observatory at nearby Lake Geneva to look through the 40-inch telescope. "Great big things were nice to look at," he said, "but the fun was to build things yourself from your own ideas, because then you understood how they worked."

His parents were not science-oriented but they were encouraging. Bill and his father built everything from a backyard tower to hold his antenna to soapbox derby cars and model airplanes. Bill attended the University of Wisconsin at Madison and he found college to be a wonderful experience. He especially enjoyed meeting people with different ideas.

Bill earned both a B.S. and M.S. in physics, then applied for a job at NASA, the only place he considered. "I wanted to work on spacecraft," he recalled, "And NASA was it." He got offers from both from NASA's Ames Research Center in Northern California and the Lewis (now Glenn) Research Center in Cleveland. His father advised him to go west, and he's been at Ames ever since. "I've really enjoyed working at NASA, it has always been fascinating," he said. "It's a great way to go through life, attacking worthwhile problems with a good team."

In his early years at Ames, he conducted studies on the radiation environment of entry vehicles. When he found that the existing spectrograph didn't work for the types of extreme tests they were conducting, he designed and built a new one. The results of his investigations were used in the design of the heat shields to protect the Apollo astronauts during re-entry into Earth's atmosphere.

Next he worked in the Theoretical Studies Branch where they looked at the atmospheres of Earth and other planets and built theoretical models of the atmosphere to understand how mankind's influence would change it. His group published many papers on how ozone would be affected by nitrogen oxides. "We didn't predict a hole in the ozone layer," he said, "but we did predict that the decrease would be seen first at the poles."

Another area of Bill's research concerned the effects of lightning activity in planetary atmospheres. He conducted a variety of laboratory studies and participated in spacecraft observations to determine the amount and distribution of lightning activity on other planets. He also earned a second M.S. in meteorology.

During this time Bill's interests merged. He focused his knowledge of spectroscopy and photometry and his theoretical studies of planetary atmospheres into thinking about how photometry and spectrometry could be used to find other planets.

These revolutionary ideas resulted in a paper he published in 1984, "The Photometric Method of Detecting Other Planetary Systems." The following year he published "Detectability of Extrasolar Planetary Transits." He pursued his ideas with patience and persistence and developed experimental systems to prove the transit method of finding extrasolar planets. In 2000 he proposed a planet-finding mission to NASA, in response to a call for Discovery mission proposals. The Kepler Mission was selected as the 10th Discovery mission in December 2001.

Kepler encountered many unforeseen and unpredictable delays throughout the various development phases. "We're doing something new that's never been done," he said. "It means there are going to be surprises and difficulties to surmount. I admire very much the people at NASA Headquarters who work so hard to make these missions successful. We have a wonderful team of people from Ames, JPL, universities, and other NASA centers. It's been great working with everyone."

Kepler has 30 co-investigators in the science working group and dozens of other collaborators. In Europe a team of over 200 scientists has formed the Kepler Asteroseismic Science Consortium. They will use Kepler data see for the first time what's going on inside a star – how fast it rotates, how much of the hydrogen has been burned, what is the density.

Bill's family joined him to witness the launch in Florida. He met his wife in college, and they have 3 daughters and 8 grandkids. "I've been working on this idea for 25 years," he said, "so my kids and grandkids have heard about it since they were born. They were delighted to be at the launch, which was magnificent. The solid rockets looked like sparklers as they fell away from the rocket. It was like the spirit of all the team was being launched into space after dedicating so much time and effort to get it into orbit."

Bill's life has been dominated by the Kepler Mission in recent years, often 10 hours a day, 7 days a week. He said that seeing Kepler launch and knowing it will answer a very big question – are there lots of Earths out there or are we alone? – is tremendously satisfying and worth the 25 years of effort and sacrifice that's been required. Everyone is very excited about looking at the results and understanding the implications. The team expects to start getting useful data in June.

Bill's advice for students who have an interest in space exploration is to take the core subjects of mathematics, physics, chemistry and engineering. "But you also need to take courses to make sure you can write and speak well," he said. "You will spend a lot of time communicating your ideas and interacting with others to solve problems. If you can't inspire others to work on these ideas with you, you'll never do it by yourself. You really need to speak clearly about your goals and why they're important."
Bill Borucki sets a great example for pursuing your dream, convincing others of its value, and persevering to realize it. He looks forward to seeing what questions the next group of young scientists will ask and what answers they will uncover.

M³ Findings Confirm Lunar Highland Theory

The Moon Mineralogy Mapper instrument flying onboard India's Chandrayaan-1 spacecraft has had a number of data collection periods since launch last October that have already resulted in a significant science finding.

The April 10 issue of Science Magazine features an article about early results presented at the 40th Lunar and Planetary Science Conference on March 24. Dr. Carle Pieters, M^3 principal investigator, reported that M^3 data confirms the "lunar magma ocean" hypothesis about the origin of the moon's bright highlands. Moon soil returned from Apollo and examined under microscope led scientists to theorize that the highlands were the remains of "rocky scum that floated to the top of a churning ocean of moon-girdling magma soon after the moon formed."

Later ground-based and orbital observations supported the theory but now there is proof with the M^3 finding that the entire Inner Rook Mountains are anorthosite. Japanese scientists operating the Multiband Imager on the Kaguya spacecraft also reported finding anorthosite in 70 lunar impact craters. Together the two recent findings validate the magma ocean and the true nature of the lunar highlands.

The Chandrayaan-1 spacecraft has experienced some technical issues that are being worked to find causes and resolutions. M^3 representatives attended a mission planning meeting April 22-24 at the Indian Space Research Organisation.

Education and Public Outreach Highlights

Team members staffed a Moon Mineralogy Mapper / Chandrayaan-1 booth at JPL's annual open house May 2-3. They shared hands-on activities and demonstrations with spectra, talked about lunar imagery and data and answered questions. More than 12,000 people visited the area.

Visitors learn about M^3 at JPL's open house.

NASA Selects New Studies of Mars And Mercury

In May NASA announced the selection of two science investigations. One will aid in the interior examination of Mars and the other will probe the tenuous atmosphere of Mercury. The projects, which will be funded as Discovery Program Missions of Opportunity, also establish new alliances with the European Space Agency (ESA).

The selections were among eight proposals submitted in December 2008 in response to NASA's new Stand Alone Missions of Opportunity, known as SALMON. NASA solicited proposals for studies that address planetary science research objectives on non-NASA missions. A key criterion is that science goals, including data archiving and analysis, must be accomplished for less than $35 million.

The Lander Radio Science on ExoMars, or LaRa, will use NASA's Deep Space Network of radio telescopes to track part of ESA's ExoMars mission. Scheduled to launch in 2016, the mission consists of a fixed lander and a rover that will roam Mars collecting soil samples for detailed analysis. Data relayed from the lander back to the network will allow scientists to measure and analyze variations in the length of the day and location of the planet's rotational axis. This data

will help researchers further dissect the structure of the Red Planet's interior, including the size of its core. When combined with the lander's onboard instruments, the data also may help confirm whether the planet's interior is still, at least partially, composed of liquid. William Folkner of NASA's Jet Propulsion Laboratory in Pasadena, CA, is the principal investigator.

The second selection, STROFIO (STart from a ROtating FIeld mass spectrOmeter), will investigate Mercury as a key component of the Italian Space Agency's suite of science instruments that will fly aboard ESA's BepiColombo mission. Scheduled for launch in 2013, the mission is composed of two spacecraft. Japan will build one spacecraft to study the planet's magnetic field. ESA will build the other to study Mercury directly.

Artist's rendering of BepiColombo spacecraft.

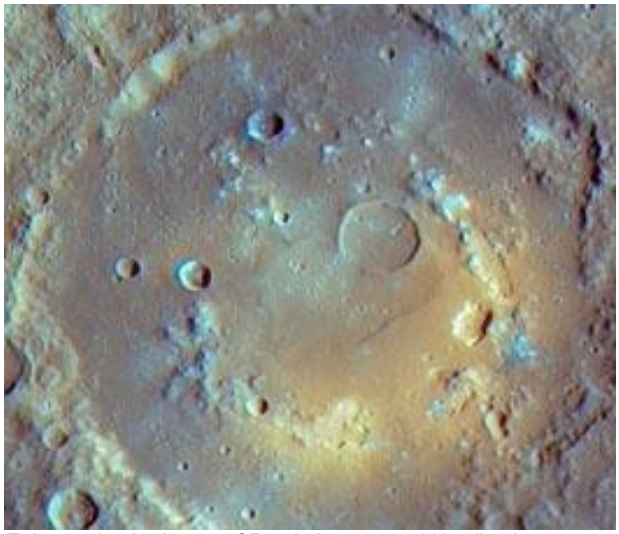
The STROFIO investigation is one of 4 sensors that constitute the Search for Exospheric Refilling and Emitted Natural Abundances (SERENA) consortia. It will use a unique mass spectrometer to study the atoms and molecules that compose Mercury's atmosphere to reveal the composition of the planet's surface. Stefano Livi of the Southwest Research Institute in San Antonio, TX, is the principal investigator.

MESSENGER Reveals Mercury as a Dynamic Planet

Analyses of data from the MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft's second flyby of Mercury last fall show the planet's atmosphere, magnetosphere, and geological past are all characterized by much greater levels of activity than scientists first suspected.

During the October 6, 2008, flyby, the probe captured more than 1,200 high-resolution and color images of the planet, unveiling another 30 percent of Mercury's surface that had never before been seen by spacecraft and gathering essential data for planning the remainder of the mission.

"One of the biggest surprises was how strongly the planet's magnetospheric dynamics changed from what we saw during the first flyby in January 2008," said MESSENGER Principal Investigator Sean Solomon from the Carnegie Institution of Washington. "Another was the discovery of a large and unusually well preserved impact basin that was the focus for concentrated volcanic and deformational activity."



Enhanced-color image of Praxiteles crater, 113 miles in diameter, taken on Oct. 6, 2008. Irregularly shaped depressions on the crater floor may indicate past volcanic activity in this area.

The first detection of magnesium in Mercury's exosphere and neutral tail provides confirmation that magnesium is an important constituent of Mercury's surface materials. The nearly global imaging coverage of the surface has yields fresh insight into how the planet's crust was formed." These findings are reported in four papers published in the May 1 issue of Science magazine.

Scientists continue to examine data from the first two flybys as they also prepare to collect more information from a third flyby of the planet on September 29, 2009. A number of planning activities have taken place during the past quarter in anticipation of the final flyby and Mercury orbit.

A large contingent of the MESSENGER science team gathered in Woodlands, TX, at the end of March to present results from the second Mercury flyby at the 40th Lunar and Planetary Science Conference. A kickoff meeting was held on March 31 to begin planning for the third flyby.

On April 15, MESSENGER release 4 to the Planetary Data System (PDS) was made. This release consists of formatted raw data for all instruments and calibrated products for the Magnetometer, Mercury Atmospheric and Surface Composition Spectrometer, and Mercury Dual Imaging System for the period including the second flyby.

On May 7 the Mercury Atmospheric and Surface Composition Spectrometer completed the fourth part of the coordinated, complementary measurements taken along with the European Space Agency's Venus Express mission to determine the interplanetary hydrogen emissions in the region between the two spacecraft. The data are now being analyzed.

The 18th MESSENGER Science Team Meeting was held May 12-14 in Providence, Rhode Island, at Brown University.

Education and Public Outreach Highlights

The MESSENGER Educator Fellows hosted 'Update Session 2009' at the National Science Teachers Association annual conference, held March 19-22 in New Orleans. Ten Fellows attended in person and 8 via web conference. Topics included a mission update, review of the "Mission Design" education module and best practices for educator workshops. Five Fellows gave presentations at the conference.

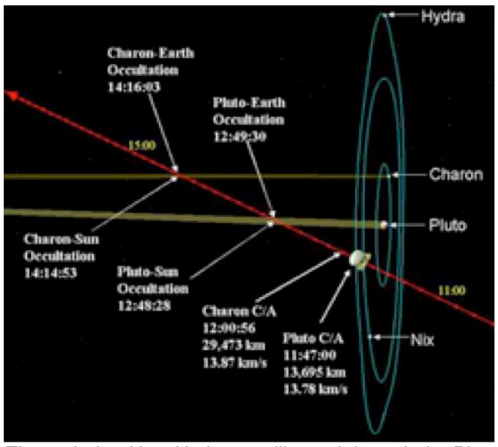
During the 5.5 years since the program began, Fellows have conducted 539 workshops and trained 12,468 educators using MESSENGER materials.

MESSENGER education and science team members staffed a table during Maryland Day at the University of Maryland on April 25. Over 600 people participated in educational activities and received Mercury lithographs and posters.

Pluto Planning Underway

A New Horizons Project Risk Review was conducted on February 26 as Pluto encounter planning has matured enough to allow for a better assessment of the risks involved. The analysis identified some mission and encounter planning issues that have been assigned a risk level based on the likelihood and consequences. Mitigation strategies have been identified and are being evaluated.

The project continues to focus on the Pluto Encounter Sequence development. The baseline Pluto Encounter P-7 to P+2 days core sequence was completed in May and another simulation has now been completed on the New Horizons Operations Simulator.



The path that New Horizons will travel through the Pluto system, flying 7,767 miles from Pluto at closest approach.
Credit: Yanping Guo, APL

A Pluto Encounter Preliminary Design Review (EPDR), Part 2, and Navigation Peer Review were conducted May 20-21 at the Applied Physics Lab with an Independent Review Team whose charter was to provide guidance on encounter processes and planning. During the EPDR, the New Horizons technical and management teams presented a minute-by-minute timeline of the planned 2015 Pluto encounter.

The closest approach to Pluto will occur on July 14, 2015. Approximately 30 specific scientific objectives are planned, including surface and composition mapping, atmospheric studies, and searches for new moons and rings. During the main nine days of closest approach, more than 380 observations are planned of Pluto, its three moons, and the space between and around this system. The entire encounter will last from January to July 2015, allowing the instruments to capture more and more detail on the surface and atmosphere as it gets closer.

Preparations are underway for the New Horizons Annual Checkout 3 (ACO3), which begins on July 7 as the spacecraft exits hibernation. Starting this year, the wakeup will take place each year in summer instead of the fall, anticipating spring planning and summer activity for the July 2015 encounter. Also this year the activities will be minimized to save time for the mission planners who are focused on writing Pluto encounter close-approach sequences with a 2010 deadline. The minimal wakeup for 2009 saves fuel, since de-spinning the spacecraft to conduct observations won't be needed, eliminating the need to spin up again to prepare for the next hibernation cycle.

Dawn Swings by Mars, Resumes Thrusting

The Dawn spacecraft flew to within 337 miles of Mars on February 17, where it got a boost from the Red Planet's gravity and continued its interplanetary journey in a new solar orbit that will get the probe to asteroid Vesta in 2011.

A science topography workshop was held at JPL March 9-11 to better understand the observation and data processing strategies that will be needed to produce a topographic map of Vesta. The project continues to develop its Vesta Science Plan, with completion anticipated in late June.

The Dawn flight team loaded new flight software (Version 8.0) to the spacecraft on April 13 and successfully rebooted the spacecraft into the new version on April 14. The reboot placed the spacecraft into the safe-mode state. After the team completed the post-reboot health and status confirmation and determined the spacecraft was healthy and stable on the new flight software, they proceeded with safe-mode recovery. The spacecraft was commanded back to Earth-point on April 15 and was put back into nominal cruise configuration on April 18.

The ion propulsion system was reactivated on June 8 and thrusting was resumed. The flight team completed all of the engineering activities that were planned to occur during the seven-month coast phase. This concludes the last significant coast phase of the mission, and the spacecraft will be thrusting the rest of the way to Vesta.

Education and Public Outreach Highlights

On March 7, the Dawn E/PO team sponsored a "Dawn Mars Flyby Webinar" educator workshop, featuring Dawn's lead scientists and chief engineer sharing mission updates live with participants at the Jet Propulsion Laboratory in Pasadena, CA, and broadcast to participants in three other locations simultaneously. The satellite facilities were the Oregon Museum of Science and Industry in Portland, Denver Public Schools, and NASA's Educator Resource Center in Fairmont, WV.

Break out session at JPL workshop.

Presentations included overviews of the Discovery Program, Dawn's science and instrumentation, and how the mission will enhance our understanding of the origins of the solar system. Participants heard talks by Chris Russell, Dawn Principal Investigator, Carol Raymond, Dawn Deputy Principal Investigator, and Marc Rayman, Dawn Chief Engineer. Educators at each location then offered a variety of hands-on workshops and a tour of the local facility.

The Dawn web site has a compelling new interactive, Interact with GRaND! It illustrates how scientists learn about the composition of an asteroid by studying energy and neutrons that emanate from it.

EPOXI Characterizes Comet Hartley 2

Although the EPOXI mission's spacecraft is in a period of relative inactivity, the team is actively working on a number of areas of interest, including characterizing the next target, comet Hartley 2. Several investigations have been carried out to characterize the nuclear size and albedo, the large dust, and the rotation of the nucleus. These studies are timed for the period before the nucleus begins outgassing significantly as it approaches the sun.

Another effort is to determine the Hartley 2's rotational period to design the observing sequence for the approach to the comet. A series of observations with the Hubble Space Telescope in late April were somewhat puzzling. Subsequent observations with a variety of ground-based telescopes, particularly with Hawaii's Gemini-South and Gemini-North on the same night, suggest a rotational period near 2/3 day, but with narrow minima that were not caught in the HST observations.

The team is preparing to continue its role in testing software that could lead to improved interplanetary network communications. Last fall, a NASA-wide team used Disruption-Tolerant Networking, or DTN, software to transmit dozens of space images to and from the Deep Impact spacecraft which was more than 20 million miles from Earth. The test was called DINET (Deep Impact DTN experiment). Computers on the ground at JPL were used to simulate stations on Earth, Mars, and the Martian moon Phobos. The experiment was successful, with all the data transmitted without corruption even as various faults and breakdowns in the system were simulated.

The team was pleased to support this activity that will ultimately lead to much better communications across the solar system. The Preliminary Design Review for DINET-2 was conducted on May 13. The current timeline is being reviewed to determine when to begin DINET-2 activities on the spacecraft. It may begin following the infrared imaging of Earth at high southern latitudes scheduled for August 17.

Education and Public Outreach

EPOXI completed its second season of hosting Family Science Night at the National Air and Space Museum. Total attendance for 9 events was 3,144 visitors. Family Science Night is a field trip for local area schools designed as a family learning experience on space science subjects that are taught in the classroom. It takes place in the evening after the close of normal museum hours. It offers a shared, cross-generational learning experience that shows the nature of science and the lives of modern-day explorers. EPOXI hosted the first-ever Family Science Night at the NASM's Udvar-Hazy Center for 437 family members from Fort Belvoir Elementary School.

EPOXI E/PO team member John Ristvey presented a workshop at the National Afterschool Association convention in New Orleans on April 2 titled, "Small Worlds in the Solar System: Hands-On Modeling Activities." Fifty participants learned about the EPOXI and Dawn missions and experienced a variety of activities appropriate for afterschool programs.

Dr. Lucy McFadden demonstrates the components of the Deep Impact spacecraft at MD Day.
Credit: Elizabeth Warner

EPOXI had a strong presence at the University of Maryland's MD Day on April 25. Several of the team members demonstrated making dry ice comets while others reviewed the basic structure of comets. Dr. Tim Livengood constructed an active model of a transiting-exoplanet system to demonstrate the EPOXI detection technique, which was a hit in the NASA tent. MD Day this year had 77,500 in attendance with a good portion making their way through the "Mission Madness" tent and by the EPOXI tables.

Stardust – NExT Keeps on Cruising

The Stardust-NExT spacecraft continues in its normal cruise configuration, heading for a February 14, 2011, flyby of comet Tempel 1. The science team held an Encounter Planning Kickoff Meeting in Indian Wells, CA, March 4-5. A science team meeting and comet rotation modeling workshop were conducted on June 8-9 at Cornell University.

Artist's concept of Stardust at Tempel 1.

Education and Public Outreach

The education and public outreach team and invited educators met in conjunction with the science team in March to plan encounter activities with science team input. They have begun to develop an implementation plan for formal and informal education and outreach initiatives for the mission. A number of initiatives are underway.

ASPERA -3/Mars Express Extended

The Analyzer of Space Plasma and Energetic Atoms, or ASPERA-3, is an instrument flying aboard the European Space Agency's (ESA) Mars Express spacecraft to study the interaction between the solar wind and the Martian atmosphere. ASPERA-3 carries two sensors built by Southwest Research Institute (SwRI) and funded by the Discovery Program: an electron spectrometer and ion mass analyzer.

ESA's Science Program Committee has granted three extensions to the mission. December 2009 is the current end date but a further extension through 2012 is being considered. The ASPERA-3 Project is working with Discovery Program Office in an effort to extend operations commensurate with the mission.
The ASPERA-3 team held a three-day meeting in May, as did various other science teams from the Mars Express mission.

GRAIL Conducts Reviews

The GRAIL mission continues development with a variety of instrument and subsystem reviews. At a Risk Board session held on March 16 three items were added to the significant risks list, relating to electronic parts acquisition, flight software reuse, and review of contractor quality documents. The Star Tracker Preliminary Design Review (PDR) was held at Galileo Avionica, Italy on March 18.

Team members presented a GRAIL mission overview and PDR preparation papers at 2009 IEEE Aerospace Conference, Big Sky, Montana. A GRAIL Science Team working meeting was held at the Lunar and Planetary Science Conference in Houston, TX, on March 23-25.

A GRAIL Risk Management Peer Review was held on Apr. 3 at JPL. A thorough review of the risk management process and current risks was performed. Final comments were positive, and the board members agreed that the process was acceptable.

The project is proceeding on schedule toward the System Critical Design Review in November. Mass and power margins have tightened, and the project is monitoring them closely to prevent them from exceeding required limits.

The kick-off Mission Integration Working Group was held on June 3 at the United Launch Alliance (ULA) building at the Lockheed Martin-Denver facility. Because GRAIL flies on the last Delta II, this is considered the top project risk. ULA plans to manage the paring back of the Delta II launch crew by cross-training engineers and technicians to do both Evolved Expendable Launch Vehicle (EELV) and Delta II work. Launch Services has a preliminary plan in place to assure a successful launch. This issue will continue to be monitored closely through launch.

The GRAIL Mission Operations System Peer Review was held May 27-28. No significant technical issues were identified. The Standing Review Board members in attendance confirmed that the project had answered the driving issues from the PDR.

Education and Public Outreach

In March, the GRAIL E/PO MoonKAM web site was launched.

Members of the GRAIL E/PO team conducted a workshop about the moon for middle school girls at the Sally Ride Science Festival at the Massachusetts Institute of Technology on May 2.

Juno Completes Critical Design Review

The Juno team continued to conduct instrument and subsystem Critical Design Reviews (CDR), completing 23 of the 25 total CDRs by early April, leading to the system CDR in late April. The two remaining CDRs, Fault Protection and Mission Operations Subsystem, will be conducted after the system CDR.

In late March, the Juno team conducted Risk, Environmental, and Schedule Workshops at Lockheed Martin-Denver in preparation for the CDR. They held a pre-CDR Launch Sequence Review addressing the requirements, launch scenario and timeline/baseline reference mission.

The Juno Project/Flight System CDR took place April 20-23 at LM-Denver. The Standing Review Board (SRB) provided a briefing of their findings to the project team on April 24.
Approximately 28 Recommendations For Action were submitted to the project for disposition. The SRB recommended that the Project was ready to proceed to manufacturing, assembly, and integration, progressing toward Key Decision Point-D. The post-CDR briefings to the Agency Program Management Council are planned for July.

The Juno team completed the Fault Protection CDR on May 11-12. Initial indications are that the fault protection subsystem is in excellent shape. The Mission Operations Subsystem CDR will be held in September.

The 6.3 magnitude earthquake that struck L'Aquila, Italy, on April 6 was of particular concern to the Juno project. L'Aquila is the location of Thales Alenia Space Italia (TASI), the builder of Juno's Ka-Band Translator (KaT) hardware. The TASI plant was damaged in the earthquake, and the facility was rendered unusable. In late April the Juno hardware assemblies, test equipment and flight parts and boards were removed from the damaged plant. By mid-May Juno received confirmation from TASI that the KaT hardware was recovered, inspected and appeared to be usable. Testing will be done to assess its condition. The Agenzia Spaziale Italiana (Italian Space Agency) quarterly management meeting in Rome on May 5 included a damage assessment and discussion of recovery options and schedule for the KaT. The project is looking into options to accommodate late deliveries.

Juno held a Science Working Group Meeting in Nice, France, June 8-12. The project team gave presentations on the status of the design effort and results of the CDR. The mission design team provided a summary of the current mission profile, with an August 5 initial launch date. The science team covered Earth flyby plans and capture orbit science operations.

Education and Public Outreach

Juno team members staffed a large display area at JPL's annual open house May 2-3. Approximately 12,500 visitors saw the new Juno displays and received new bookmarks and fact sheets on the mission.

Discovery and New Frontiers News

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