National Aeronautics and Space Administration

New Horizons Awake and Ready for Pluto

After a voyage of nearly nine years and three billion miles- the farthest any space mission has ever traveled to reach its primary target - the New Horizons spacecraft came out of hibernation on December 6th for its long-awaited 2015 encounter with the Pluto system.

Operators at the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, MD, confirmed that New Horizons, operating on pre-programmed computer commands, had switched from hibernation to "active" mode. Moving at light speed, the radio signal from New Horizons – currently more than 2.9 billion miles from Earth, and just over 162 million miles from Pluto – needed four hours and 26 minutes to reach NASA's Deep Space Network station in Canberra, Australia.

Mission operations manager Alice Bowman and team member Karl Whittenburg watch the screens and wait for confirmation.

"This is a watershed event that signals the end of New Horizons crossing of a vast ocean of space to the very frontier of our solar system, and the beginning of the mission's primary objective: the exploration of Pluto and its many moons in 2015," said Alan Stern, New Horizons principal investigator from Southwest Research Institute, Boulder, CO.

Since launching on January 19, 2006, New Horizons has spent 1,873 days - about two-thirds of its flight time - in hibernation to save wear and tear on spacecraft components and reduce the risk of system failures.

"Technically, this was routine, since the wake-up was a procedure that we'd done many times before," said Glen Fountain, New Horizons project manager at APL. "Symbolically, however, this is a big deal. It means the start of our pre-encounter operations."

With a seven-instrument science payload that includes advanced imaging infrared and ultraviolet spectrometers, a compact multicolor camera, a high-resolution telescopic camera, two powerful particle spectrometers and a space-dust detector, New Horizons will begin observing the Pluto system on Jan. 15. The closest approach will occur on July 14. Pluto is a gateway to an entire region of new worlds in the Kuiper Belt, and New Horizons is going to provide the first close-up look at them.

In October, NASA and the Space Telescope Science Institute announced that the Hubble Space Telescope had detected three small, ancient Kuiper Belt Objects (KBOs) that New Horizons may be able to explore a few years and a billion miles after it leaves the Pluto system. Read more about why these mysterious KBOs are of huge interest to scientists and how the mission was designed to explore them – if these primitive, dimly lit, hard to find objects could be detected. With the good news from Hubble, a historic first-look at KBOs will be possible.

Follow New Horizons on social media: Facebook and Twitter.

INSIDE

December 2014 • Volume 15 Number 2

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MESSENGER Dazzles with Amazing Images of Mercury

The MESSENGER spacecraft continues to unravel the history and evolution of the solar system's innermost planet, Mercury. During more than three years of orbital operations, MESSENGER has acquired over 250,000 images and extensive other data sets. The plan is to continue orbital operations until early 2015, when the spacecraft will impact the surface of the cratered rocky body. Mercury is still a mysterious place but we know her so much better now than we did before MESSENGER.

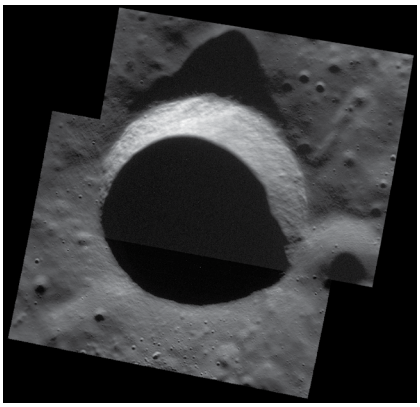
August 3rd was the 10-year anniversary since launch. The MESSENGER science team conducted their 33rd meeting October 28-30 in Santa Fe, NM. Team members continue to publish new findings and give presentations at scientific conferences.

At the annual meeting of the American Geophysical Union in San Francisco in December, 25 abstracts from the mission team were submitted to the special session on "Mercury: Results from MESSENGER's low-altitude campaign" while another 10 abstracts were submitted to other sessions.

Mission controllers at the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, MD, plan to conduct four orbital correction maneuvers (OCM) to raise the spacecraft's minimum altitude sufficiently to extend orbital operations and delay the inevitable impact onto Mercury's surface. Because of progressive changes to the orbit over time, the spacecraft's minimum altitude continues to decrease. The third OCM, on October 24, nudged the spacecraft from a closest approach altitude of 16.1 miles above the surface to 115.1 miles. The final OCM is planned for January.

If you were riding along on MESSENGER, here's one view you would see.
Credit: NASA/JHUAPL/CIW

The image above is part of the targeted observations taken during the low altitude orbits. This view shows a small, simple crater situated on the eastern rim of the larger Verdi impact basin, which is 90 miles in diameter. With the Sun shining from the left, the north-facing wall of the crater is in shadow.



Simply shadowed.
Credit: NASA/JHUAPL/CIW

Inside the simple crater shown in the image above the sun never shines! This is a mosaic of two images, showing higher-resolution details of the crater's sunlit wall but leaving the ice that may lie in the darkness unseen. This crater has a diameter of 4.5 miles.

Honor for Sean Solomon

Sean Solomon, principal investigator of the MESSENGER mission and director of Lamont-Doherty Earth Observatory, is one of 19 new recipients of the National Medal of Science and National Medal of Technology and Innovation— the nation's highest honors for achievement and leadership in advancing the fields of science and technology, according to the White House.

President Barack Obama presented the medal to Dr. Solomon in a ceremony in the East Room of the White House on November 20.

During the ceremony, Obama praised the scientists for their "spirit of restless inquiry" and said, "The work of the people here today changed our world."

Sean Solomon receives his medal from the president.
Credit: Evan Vucci, AP

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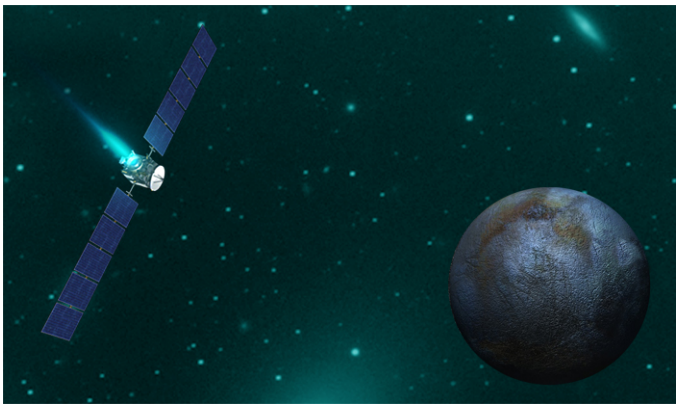
Dawn Operating Normally After Safe Mode Triggered

After Dawn spacecraft's ion thrusting engine unexpectedly stopped on September 11 and the spacecraft entered safe mode, engineers immediately began working to restore the spacecraft to its normal operational state. The source of the problems was identified and corrected. Normal ion thrusting resumed on September 15, and the spacecraft has continued toward Ceres as planned.



Artist concept of Dawn spacecraft on its way to dwarf planet Ceres. Credit: NASA/JPL-Caltech/UCLA/McREL

As a result of the change in the thrust plan, Dawn will enter into orbit around dwarf planet Ceres in April 2015, about a month later than previously planned. The plans for exploring Ceres once the spacecraft is in orbit, however, are not affected.

Final calibrations and checkouts prior to Ceres arrival were conducted in October, with a Ceres Readiness Review in November. Approach to Ceres begins in January, with the first science orbit beginning on April 22.

The mission team determined that the cause was likely the same phenomenon that affected Dawn three years ago on approach to the protoplanet Vesta: an electrical component in the ion propulsion system was disabled by a high-energy particle of radiation. The same strategy that was used successfully to recover from the radiation strike on approach to Vesta was followed again.

On December 1, Dawn acquired its first resolved image of Ceres, approximately nine pixels, from a distance of 1.2 million km, about three times the distance from the Earth to the Moon.

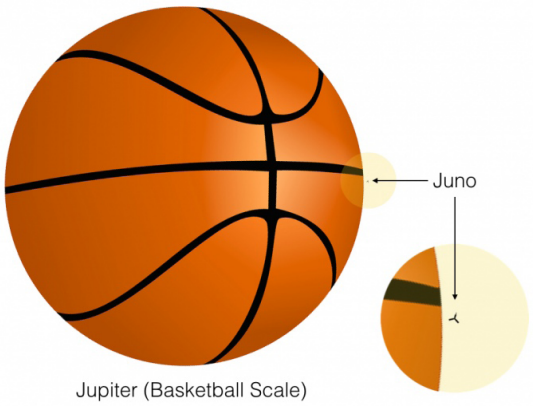
Follow Dawn on social media: Facebook, Twitter, Google + and YouTube.

Juno Continues to Speed toward Jupiter

On August 5, Juno celebrated its three year anniversary since launch. Accomplishments to date include successful commissioning of nine instruments; completing two main engine burns (or Deep Space Maneuvers); and carrying out an Earth flyby on October 9, 2013, to gain a gravity-assist boost in speed of about 8,800 mph to set it on course for Jupiter orbit insertion in July 2016.

During the Earth flyby, Juno's Advanced Stellar Compass captured images of the Earth-Moon system, showing us humans on Earth what our world would look like to a visitor from afar. The series of images were compiled into an intriguing video.

At closest approach to Jupiter, Juno will fly to within only 3,100 miles above Jupiter's cloud tops. If Jupiter were the size of a basketball, the equivalent distance would be only about 0.315 inches!



Juno's proximity to Jupiter's cloud tops at closest approach, with the planet to the scale of a basketball. Credit: NASA/JPL-Caltech

This close proximity allows Juno to take extremely accurate measurements of Jupiter's gravitational and magnetic fields. It also allows the spacecraft to duck underneath the damage the spacecraft's electronics.

As of mid-November, Juno less than two years from arrival at Jupiter and is:

- Approximately 383 million miles from Earth
- Approximately 171 million miles from Jupiter

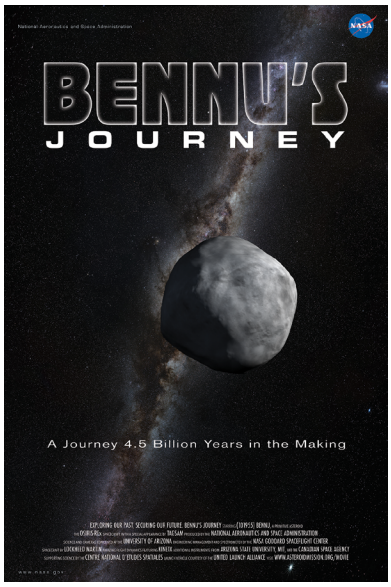
Follow Juno on social media: Facebook, Twitter and YouTube.

OSIRIS-REx Deep in Preparations for Asteroid Encounter

NASA's asteroid sample return mission, OSIRIS-REx, is making great progress toward a planned launch in September 2016. Recent accomplishments include successful completion of subsystem and system critical design reviews, testing of the Touch-And-Go Sample Acquisition Mechanism (TAGSAM) development unit through full ranges of motion, start of Sample Return Capsule construction, complete with parachute drop testing, and four of five instrument engineering models successfully integrated into the Spacecraft Test Lab (OCAMS, OVIRS, OTES, and REXIS).

OSIRIS-REx will leave Cape Canaveral, Florida, on an Atlas V rocket and spend one year orbiting the Sun. The spacecraft will then make a flyby of Earth for a gravity-assist, using our planet's gravitational field to "borrow" a small amount of Earth's orbital energy. This additional energy is used to increase OSIRIS-REx's orbital inclination and sling it back into space for a rendezvous with asteroid Bennu.

Approach begins when Bennu is just a point of light more than 1.2 million miles away from the spacecraft, in August 2018. As OSIRIS-REx approaches the asteroid, it will use an array of small rocket thrusters to match the velocity of Bennu in its orbit around the Sun. This rendezvous requires not only being in the same place at the same time, but also moving at the same speed and in the same direction as the asteroid.



Watch "Bennu's Journey," a lovely video taking you back 4.5 billion years to the formation of our solar system.

Bennu travels around the Sun at an average speed of 63,000 mph. To reach Bennu, OSIRIS-REx will perform a series of braking maneuvers, slowing down by 1,186 mph, resulting in a relative approach velocity of about 0.45 mph.

A survey of Bennu begins in October 2018 and will last for nearly a year. It will include preliminary and then detailed surveys and mapping that will ultimately result in selection of a sample site.

OSIRIS-REx will fly in formation with Bennu during the asteroid encounter. Moving into position for sample acquisition late 2019, the total change in velocity is just over 0.45 mph, miniscule compared to the large maneuvers required to arrive and depart from the asteroid vicinity. The encounter culminates in the touch-and-go maneuver to collect the samples.

The window for departing Bennu opens in March 2021. At this time OSIRIS-REx will fire the main engines and depart Bennu, traveling at a speed of 716 mph. This burn will place OSIRIS-REx on a trajectory that intersects the orbit of the Earth in September 2023, bringing material that is billions of years old to vastly enhance our understanding of our solar system.

Follow the mission on social media: Facebook, Twitter, Yotube and subscribe to the email newsletter.

InSight Reaches Key Milestone

NASA's next Mars lander, the InSight mission, has begun the assembly, test and launch operations (ATLO) phase of its development, on track for a March 2016 launch to Mars.

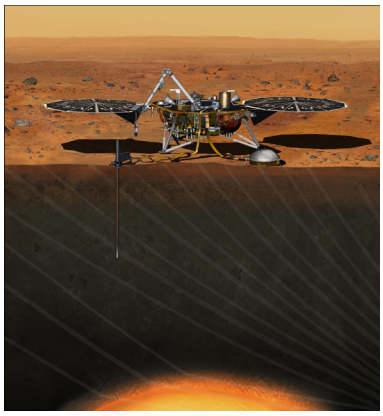
The subsystem elements have been developed by mission partners around the world. These will be integrated into a functioning system and into the flight vehicle. Once the spacecraft is assembled, the ATLO team will conduct rigorous tests and, ultimately, prepare for launch.

The lander, its aeroshell and cruise stage are being assembled by Lockheed Martin Space Systems (LMSS), Denver. Over the next six months, technicians will add subsystems such as avionics, power, telecomm, mechanisms, thermal systems and navigation systems onto the spacecraft. The propulsion system was installed earlier this year on the lander's main structure.

"The InSight mission is a mix of tried-and-true and new-and-exciting. The spacecraft has a lot of heritage from Phoenix and even back to the Viking landers, but the science has never been done before at Mars," said Stu Spath, InSight program manager at LMSS.

InSight stands for "Interior Exploration using Seismic Investigations, Geodesy and Heat Transport." It's a terrestrial planet explorer that will help us understand the processes that shaped the rocky planets of the inner solar system, including Earth, more than four billion years ago.

To investigate the planet's interior, the lander carries a robotic arm that will deploy surface and burrowing instruments. The Seismic Experiment for Interior Structure (SEIS) measures waves of ground motion carried through the interior from "marsquakes" and meteor impacts. The Heat Flow and Physical Properties Package measures heat coming toward the surface from the planet's interior.



Artist's concept of the lander on Mars.

Wind and temperature sensors and a pressure sensor monitor weather at the landing site, and a magnetometer measures magnetic disturbances caused by the Martian ionosphere.

Teachers Learn about Earth Science Through InSight

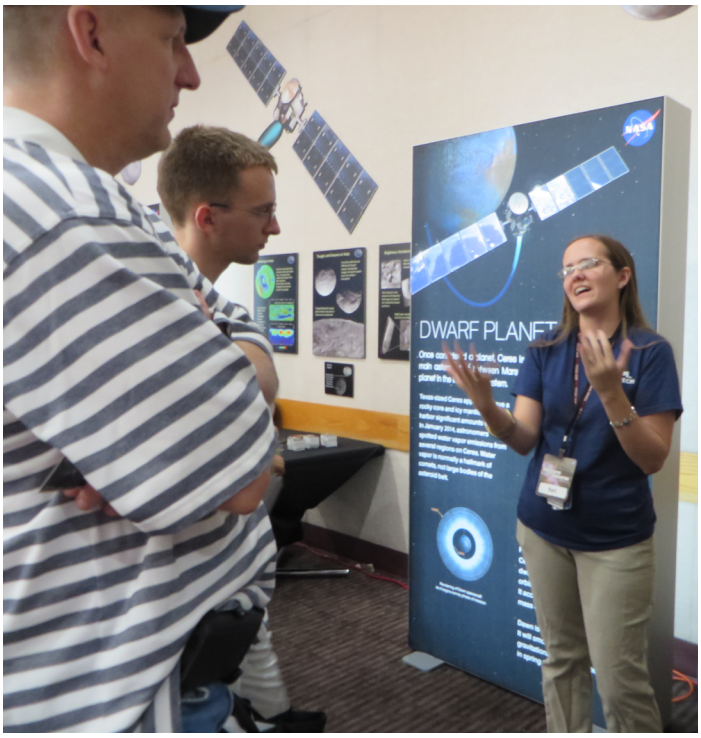
In September, InSight conducted an educator workshop called "Vital Signs of the Planet," for 50 teachers. It was a follow-on session to a summer professional development program that included a five-day field campaign to monitor tectonic deformation in Southern California. Led by the Southern California Earthquake Center, an InSight education partner, the day-long event immersed teachers in Earth science research and lessons to take back to their students.

Teachers who attended the Vital Signs workshop.

Follow InSight on social media: Facebook and Twitter.

Scenes from JPL Open House – October 2014

Visitors view the InSight working model.



Keri Bean describes the Dawn's upcoming orbit around Ceres.

Steve Levin explains how the Juno spacecraft will orbit Jupiter.

Discovery AND New Frontiers NEWS

Written and edited by:

Shari Asplund

Discovery & New Frontiers Program

Education and Communications Manager

Layout and design by:

Kristopher Perez, MSFC Software Developer