National Aeronautics and Space Administration

Pluto – Just One Year Away!

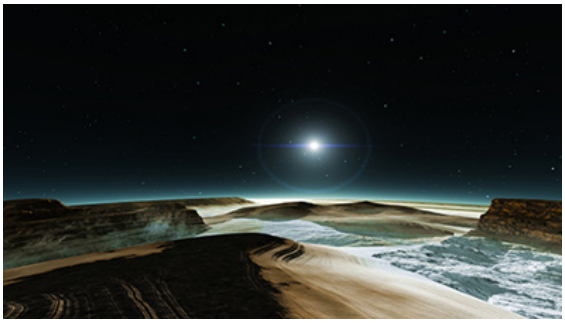
With 90% of the journey under its belt, New Horizons is now 2.7 billion miles from Earth and speeding toward Pluto at nearly 33,000 miles per hour. The excitement is growing!

Will the spacecraft avoid all the hazards and fly safely by?

What will we see on Pluto's surface? How will it compare to the rocky inner planets and the many asteroids and comets we've seen up close?

Will Pluto totally surprise us, as some of the moons of Saturn and Jupiter have?

How about the 5 moons – what will they look like? Will we discover more?



Artist's concept of the Sun as seen from Pluto's surface.
Credit: NASA/JHUAPL/SwRI/Marc Buie

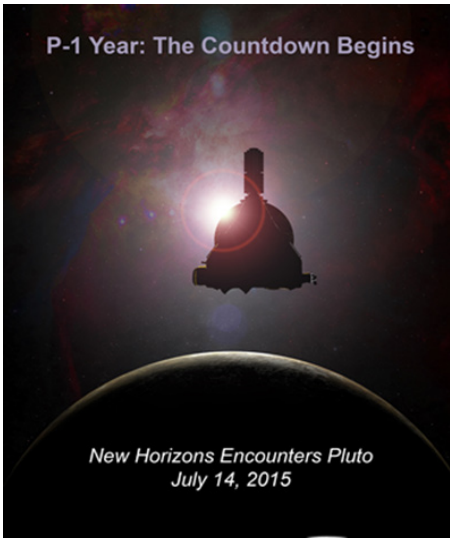
The mission team is leaving nothing to chance in their Pluto Encounter Planning efforts to make the most of this first-ever opportunity to learn much as possible about such a far-off mysterious world. They have been participating in a variety of management and encounter reviews, mission operations readiness review, hazards analysis and the Safe Haven by Other Trajectory (SHBOT) decision meeting with NASA Headquarters. SHBOT would be an alternative trajectory through the Pluto system that would preserve most of the science mission but avert deadly collisions if the current flyby plan is found to be too hazardous as the spacecraft gets close.

The New Horizons spacecraft has spent the majority of its cruise time to Pluto in hibernation mode. The mission team performed a quick two-week maintenance wakeup in January, then put the probe back into hibernation mode. In June, the team began the last active checkout that will last 10 weeks. It will be a very thorough examination of the spacecraft's primary and backup systems and seven instruments and will include the first optical navigation campaign to home in on Pluto.

Another milestone on the long journey happens on August 25, when New Horizons crosses the orbit of Neptune. By cosmic coincidence - not design – it is the exact 25th anniversary of Voyager 2's closest approach to Neptune in 1989. After that, the mission will be in "Pluto space!"

From late August through early December, New Horizons will take her final snooze before Prince Charming, Alan Stern, and the team wake up their princess for the big event! The early phase of the Pluto system encounter will begin January 2015, with the closest approach in July.

This summer, the Hubble Space Telescope will conduct an intensive search for a suitable Kuiper Belt object (KBO) that New Horizons could visit after it streaks through the Pluto system. If an acceptable target is found and if NASA approves, the spacecraft's trajectory can be modified in the fall of 2015 to rendezvous with the target KBO three to four years later. Another first for this mighty probe!



Follow New Horizons on social media: Facebook and Twitter.

I N S I D E

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Visit our websites — discovery.nasa.gov and newfrontiers.nasa.gov

OSIRIS-REx Construction Underway

NASA's asteroid sample return mission, OSIRIS-REx, received approval in April to begin building the spacecraft, flight instruments and ground system that will reach asteroid Bennu in 2018 after launch in fall of 2016. The sample will return to Earth in 2023.

The spacecraft carries five instruments that will remotely evaluate the surface of Bennu. After more than a year of asteroid reconnaissance, the spacecraft will use a robotic arm to collect samples of at least 2 ounces (60 grams) and return them to Earth for scientists to study.

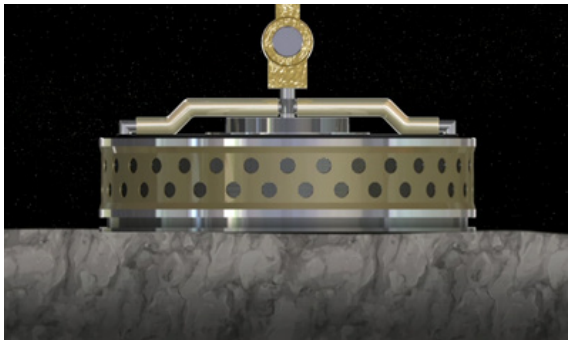
One of the instruments is the OSIRIS-REx Laser Altimeter, or OLA, which is designed and built by the Canadian Space Agency. The instrument is a vital part of the mission, contributing to determining the shape of the asteroid, one of the main goals. Knowing the shape will reveal densities and topography and aid in understanding the geology of the asteroid - all essential to decide where is the best place to grab a sample.

Construction of the OLA hit a snag, and its future was uncertain until June. Building the OLA became problematic following a change in the mandatory approval process, which resulted in delays that could have meant the instrument would not be delivered in time. Fortunately, the situation got resolved, and the Project and OLA team are celebrating the Canadian Treasury Board's approval to begin building the OLA flight unit.

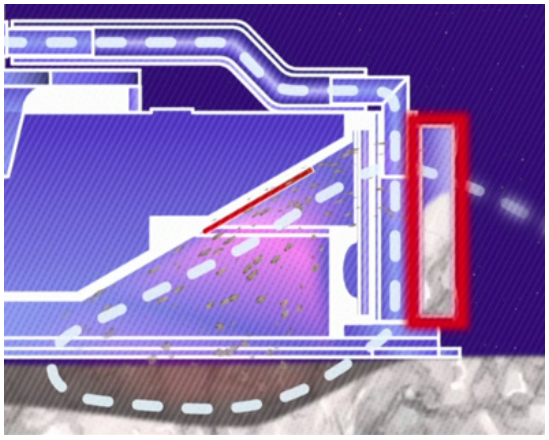
Key objectives of the OSIRIS-REx mission include finding answers to basic questions about the composition of the very early solar system and the source of organic materials and water that made life possible on Earth. The mission will also support NASA's efforts to understand the population of potentially hazardous near-Earth objects and characterize those suitable for future asteroid exploration missions.

The Messages to Bennu campaign for people around the world to submit their names to be etched on a microchip that will fly aboard the spacecraft is open until September 30, 2014. And it's not a one-way trip! The microchip will be included in the sample return capsule so participants will enjoy the entire mission, from launch to Earth return. Nearly 300,000 names have been submitted so far.

The Touch-And-Go Sample Acquisition Mechanism (TAGSAM) will collect rocks and soil from the asteroid without having to land – just a quick grab and go. Watch this video to learn how TAGSAM will get it done.



Artist's concept of the TAGSAM touching the surface of asteroid Bennu.



Screen shot from an animation showing how the TAGSAM releases a burst of nitrogen gas when it touches the surface, causing loose rocks and soil to flow into the collector, in red.

The mission to Bennu is a very long ride, and you can get involved:

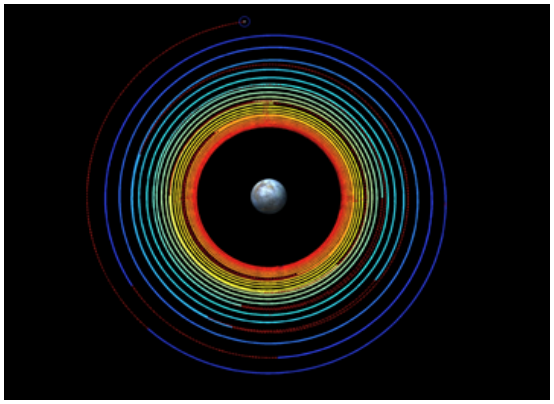
- Subscribe to the email newsletter
- Follow OSIRIS-REx across social media: Facebook, Twitter, and YouTube
- Visit the merchandise store at osirisrexstore.com
- Add your name to Messages to Bennu
- Join the rewarding Target Asteroids! program

Dawn - Six Months from Approach to Ceres!

The very ambitious Dawn mission to orbit asteroids Vesta and Ceres continues the journey toward its second destination in the main asteroid belt. Using an ion propulsion system to make its way through the solar system, Dawn is nearly two years since departure from Vesta and six months from the beginning of the Ceres approach phase.

The approach phase, which begins in January 2015, will initiate the sequence to bring Dawn into orbit around Ceres, with the spacecraft about 400,000 miles from the dwarf planet. This distance is somewhat greater than the distance of our Moon from Earth. The camera and one spectrometer will start capturing data to assist in refining details for the subsequent close-up investigations.

The ion propulsion system will continue to gently reshape Dawn's orbit around the Sun so that in April its orbit will be nearly the same as that of the dwarf planet. Relative to the stars, the speed of both will be about 38,500 mph, but relative to each other, next to nothing. The gravity of Ceres will gently capture Dawn and allow it to enter into orbit at an altitude of about 8,400 miles.



Dawn's spiral descent from survey orbit (blue) to the high altitude mapping orbit (red) will take 6 weeks to achieve.

Credit: NASA/JPL

Once in orbit around Ceres, Dawn will fly at four successively lower altitudes, each selected to optimize the investigations. The great maneuverability of ion propulsion to spiral from one observation orbit to another, each one lower than the one before, will give scientists incredible detailed views of the exotic world of rock and ice.

The month-long "survey orbit" will be at an altitude of about 2,730 miles above the surface. Next the "high altitude mapping orbit" (HAMO) brings Dawn to 910 miles above Ceres where it will perform extensive observations for two months. Ultimately, Dawn will reach its "low altitude mapping orbit," or LAMO, at only 230 miles above the surface.

Right now the best image of Ceres taken by the Hubble Space Telescope shows only a blurry sphere. As Dawn gets closer and closer to this far-off world, the images returned to Earth will reveal exciting new details, unlocking the many mysteries of this massive object in main asteroid belt. What will we learn, and what new questions will Ceres pose?

The Dawn mission team received the Smithsonian National Air and Space Museum's highest group honor in Washington DC in March. The Trophy for Current Achievement honors outstanding achievements in the fields of aerospace science and technology. In 50 years of space exploration, no other spacecraft has orbited a distant solar system body, then left to travel to-and eventually orbit-another extraterrestrial body. Dawn is the fourth Discovery mission to win the prestigious award.

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

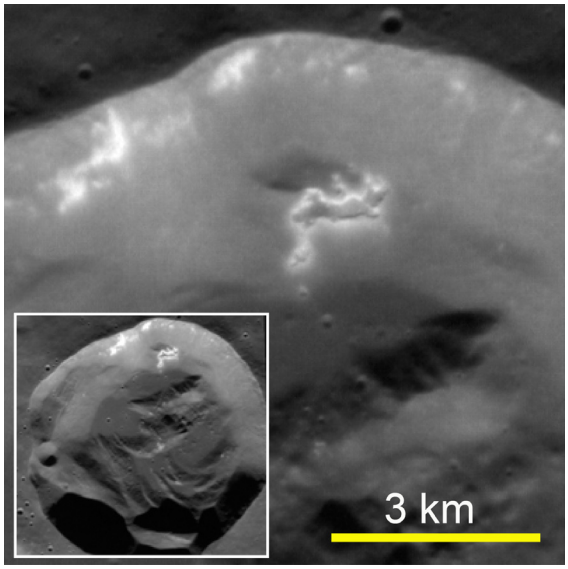
In May, Dawn scientists and engineers gathered to discuss the successful acquisition and analysis of data at Vesta and to plan for similar success at Ceres.

Credit: T.H. Prettyman

MESSENGER Continues Successful Run at Mercury

More than three years since entering into its historical orbit around the first planet from the Sun, the MESSENGER spacecraft continues to return images and data that are adding tremendously to our knowledge of Mercury. The project is preparing to begin a low-altitude imaging campaign that promises to reveal even more. MESSENGER will be orbiting as close as 15 miles above the surface.

The closer approach will allow MESSENGER's instruments to capture high-resolution observations of Mercury and build greatly upon those previously taken from higher altitudes. For example, the hollows (irregularly shaped, high-reflectance depressions that are often associated with craters) first revealed by the probe's instruments in 2011 are suspected to have formed because volatile compounds sublime off the surface, but observations to date could not confirm this hypothesis.



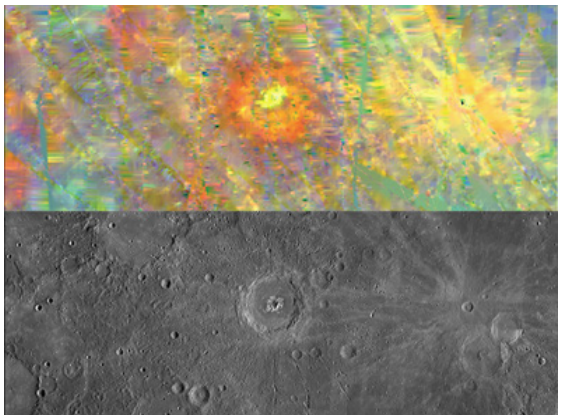
This high-resolution view from July 2011 shows a small, fresh 9-mile-diameter impact crater (inset) at a high northern latitude on Mercury. Bright material is exposed on the upper part of the wall, and hollows are seen where the wall has slumped toward the floor.

Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

At spacecraft altitudes below 210 miles, the Narrow Angle Camera will acquire images with pixel scales ranging from 20 meters to as little as 2 meters. These images, up to 10 times the resolution of those acquired so far, will reveal small features of the enigmatic hollows for the first time.

So far MESSENGER has returned more than 240,000 images from orbit, far surpassing the original mission proposal's promise 17 years ago of at least 1,000 images! Thousands more are still to come, the highest resolution views yet.

"MESSENGER's results to date have revolutionized our knowledge of Mercury's global geology, the nature of volcanism across the surface, the cratering record, and the history of the planet's contraction, and they have also revealed unexpected discoveries, such as hollows," said Nancy Chabot, who chairs MESSENGER's Geology Discipline Group. During the remainder of the mission, geological observations will narrow from a global perspective to views of selected areas in unprecedented detail.



Eminescu crater on Mercury shown in color composite and monochrome. Yellow areas correspond to high reflectance associated with fresh material that is less affected by space weathering. The hollows around the peak of the large crater, 80 miles in diameter, have similar colors.,

Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

Learn about the latest findings from publications in science journals and presentations at many science conferences.

The National Space Society awarded the MESSENGER Project Team a 2014 Space Pioneer Award in the Science and Engineering category. The award recognizes both the importance of the first dedicated probe to orbit Mercury and the significance of the scientific results already released. It was presented to Sean Solomon, Larry Nittler and Ralph McNutt at the society's International Space Development Conference in Los Angeles in May.

Follow MESSENGER on social media: Facebook and Twitter.

Juno Getting Closer to Jupiter

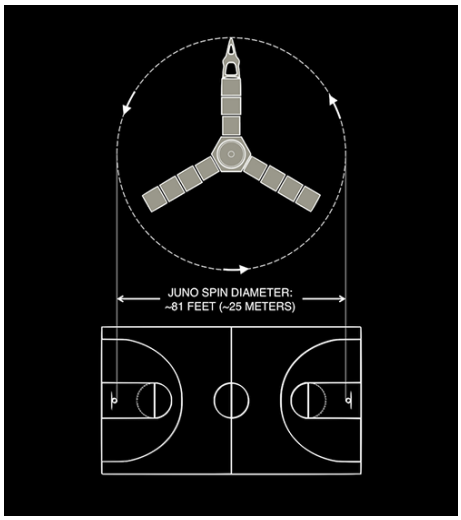
The Juno spacecraft continues on its rapid track toward Jupiter, traveling 1.38 billion miles since launch in August 2011 aboard an Atlas V 551 rocket, the most powerful of the Atlas launch vehicles. But this mighty rocket could only provide half the boost the heavy Juno craft needed to travel the huge distance to far-off Jupiter. An Earth fly-by gravity assist in October 2013 provided the energy boost necessary to reach the giant planet on July 4, 2016.

Since the fly-by, the mission team has conducted a briefing on science observations and an assessment review to examine anomalies and lessons learned.

During the long cruise period, the people on the ground continue planning, preparations, check-out and tests. The science team conducted a meeting in March, while in mid-April the operations team initiated an annual period of maintenance tests on Juno's science instruments which lasted approximately two weeks. The team also completed a planned calibration of one of Juno's two star tracker cameras.

In June, the remaining 6 of Juno's 11 solar panel arrays were activated. This brought online all 18,698 solar cells which cover a surface area of more than 650 square feet across the spacecraft's 29.5-foot-long arrays.

As of July 16, Juno's velocity is 10.3 miles per second relative to the Sun. It spins at a rate of two rotations per minute. The spacecraft is spin stabilized to ensure it is pointed in the right direction during the journey to Jupiter and oriented correctly to gather scientific data on arrival. Juno's spin diameter is 81 feet – about the distance between the hoops of a professional basketball court.



NASA's Juno spacecraft spin diameter, as compared to the length of a professional basketball court.

Credit: NASA/JPL-Caltech

Watch a video of project scientist Steve Levin giving a brief overview of the mission at a recent educator workshop. Visualize Juno's current position and velocity using NASA's Eyes on the Solar System 3D interactive.

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

InSight Construction Begins

Construction on NASA's next Mars lander began in May, after a successful Mission Critical Design Review. InSight (short for Interior Exploration Using Seismic Investigations, Geodesy and Heat Transport) will delve deep beneath the Martian surface to study its interior. The mission will investigate how Earth-like planets formed and developed their layered inner structure of core, mantle and crust with instruments never before used on Mars.

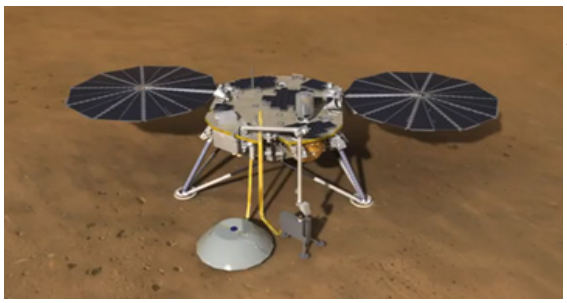
InSight will launch in March 2016 aboard an Atlas V 401 rocket from Vandenberg Air Force Base in California. It is scheduled to land on Mars in September 2016 to begin a two-year science mission. InSight will address one of the most fundamental issues of planetary and solar system science -- understanding the processes that shaped the rocky planets of the inner solar system more than 4 billion years ago. The mission will help inform the agency's goal of sending a human mission to Mars in the 2030s.

This new phase advances the mission from design and analysis to building and testing hardware and software, ultimately sending the spacecraft to Mars to answer the many questions about the Martian interior and deepen our understanding about how the Earth evolved.

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

"Mars actually offers an advantage over Earth itself for understanding how habitable planetary surfaces can form," said Bruce Banerdt, InSight principal investigator from JPL. "Both planets underwent the same early processes. But Mars, being smaller, cooled faster and became less active while Earth kept churning. So Mars better preserves the evidence about the early stages of rocky planets' development."

A truly international mission, InSight's science team is made up of researchers from Austria, Belgium, Canada, France, Germany, Japan, Poland, Spain, Switzerland, the United Kingdom and the United States.



Artist's concept of InSight lander deploying its instruments on Mars.

Credit: NASA/JPL-Caltech

Follow InSight on social media: Facebook and Twitter.

Educators Learn about Scale (no weigh-in required!)

On April 26, 142 educators gathered to learn about the "Scale of Discovery" at four sites across the U.S. – NASA's Jet Propulsion Laboratory (JPL) and Johnson Space Center, The Johns Hopkins University Applied Physics Laboratory (APL) and Montana State University.

The teachers, who work with students from kindergarten through college, participated in the fourth annual day-long professional development workshop hosted by the Discovery and New Frontiers Programs, the MESSENGER and New Horizons missions, and colleagues at Astromaterials Research and Exploration Science (ARES).

Linked via NASA's Digital Learning Network, the participants engaged in a variety of activities covering solar system scale, calculating trajectories and comparative planetology through lessons featuring gravity assists and comparing craters. Everyone received a flash drive with a wealth of NASA activities and curricula to take back to their learners. A large number of the attendees had come to the previous workshops, and many felt this one was the best yet.

More than 97% of participants rated the the overall session, materials and resources as good to very good (highest rating) with extensive praise and appreciation for the panels and activities. "I feel fortunate to have attended this workshop. I gained so much information and insight. My students will definitely benefit from this. Please continue to offer these wonderful workshops, students will ultimately be the beneficiaries."

The workshop showcased the six current D/NF missions that are in various stages, from development to cruise, and featured mission scientists and engineers in two panel discussions related to the theme of scale:

"Far In, Far Out" at APL – the MESSENGER, New Horizons and OSIRIS-REx missions featuring Hal Weaver, Gabe Rogers, Ralph McNutt and Olivier Barnouin

"So Near, Yet So Far" at JPL – the InSight, Juno and Dawn missions featuring Bruce Banerdt, Suzanne Smrekar, Steve Levin, Tim Weise and Sami Asmar

The introduction and panel discussions were broadcast live online and are available for viewing at the workshop archive.

Follow the Discovery and New Frontiers Programs on Facebook.

Discovery and New Frontiers NEWS

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