National Aeronautics and Space Administration

Now Orbiting Jupiter – Juno!

After an almost five-year journey to the solar system's largest planet, NASA's Juno spacecraft successfully entered into orbit around Jupiter during a 35-minute engine burn on July 4. Watch the short video of team members as they receive the good news.

Soon after the burn was completed, Juno turned so that the Sun's rays could once again reach the 18,698 individual solar cells that give Juno its energy. The spacecraft returned to high-rate communications on July 5 and began powering up its science instruments, which were turned off in the days leading up to orbit insertion. The remaining science instruments will be powered up before the end of July.

Over the next few months, Juno's mission and science teams will perform final testing on the spacecraft's subsystems and final calibration of science instruments. The next time Juno's orbit carries it close by the planet will be on Aug. 27. The flyby is expected to provide some preliminary science data which should be released around Sept. 1. The official science collection phase begins in October when Juno enters its 14-day science orbit.

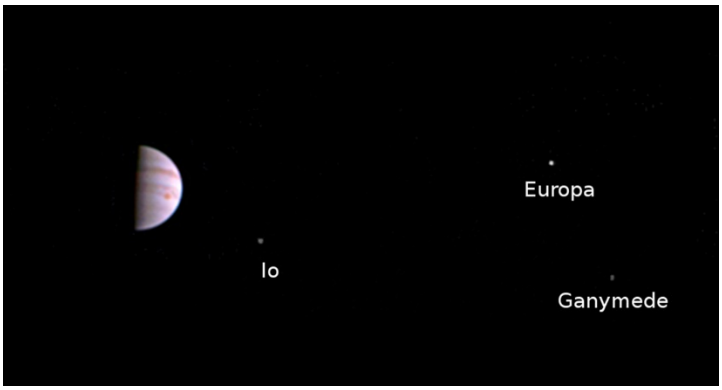
Juno's principal goal is to understand the origin and evolution of Jupiter, furthering our understanding of how giant planets form and the role they played in shaping the rest of the solar system. Juno will investigate the existence of a solid core, map Jupiter's intense magnetic field, measure the amount of water and ammonia in the deep atmosphere, and observe the planet's auroras. Jupiter also can provide critical knowledge for understanding planetary systems being discovered around other stars.

Juno will circle the Jovian world 37 times, soaring low over the planet's cloud tops – as close as about 2,600 miles. During these flybys, Juno will probe beneath the obscuring cloud cover of Jupiter and study its auroras to learn more about the planet's origins, structure, atmosphere and magnetosphere.

The JunoCam camera captured the view below on July 10 when the spacecraft was 2.7 million miles from Jupiter, on the outbound leg of its initial 53.5-day capture orbit.

The first high-resolution images of the gas giant are still a few weeks away.

JunoCam is a color, visible-light camera designed to capture remarkable pictures of Jupiter's poles and cloud tops. As Juno's eyes, it will provide a wide view, helping to provide context for the spacecraft's other instruments. The Juno team plans to place all images taken by JunoCam on the mission's website, where the public can access them.



The JunoCam camera captured this view on July 10 when the spacecraft was 2.7 million miles from Jupiter, on the outbound leg of its initial 53.5-day capture orbit. It shows atmospheric features on Jupiter, including the Great Red Spot, and three of the massive planet's four largest moons -- Io, Europa and Ganymede, from left to right in the image. The first high-resolution images of the gas giant are still a few weeks away.
Credit: NASA/JPL-Caltech/SwRI/MSSS

Follow the mission on Facebook and Twitter.

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

OSIRIS-REx Prepares for Launch

Launch is quickly approaching for OSIRIS-REx, NASA's first asteroid sample return mission. Planned to lift off from Cape Canaveral Air Force Station on September 8 aboard an Atlas V rocket, the spacecraft will arrive at asteroid Bennu in 2018. Bennu is about 1,900 feet in diameter or roughly the size of six football fields. The asteroid, little altered over time, is likely to represent a snapshot of our solar system's beginnings.

During a year-long orbit, the spacecraft's cameras and instruments will photograph the asteroid, take measurements and conduct surface mapping and sample site reconnaissance operations to help the mission team select the most promising site before performing the sampling maneuver in 2020.

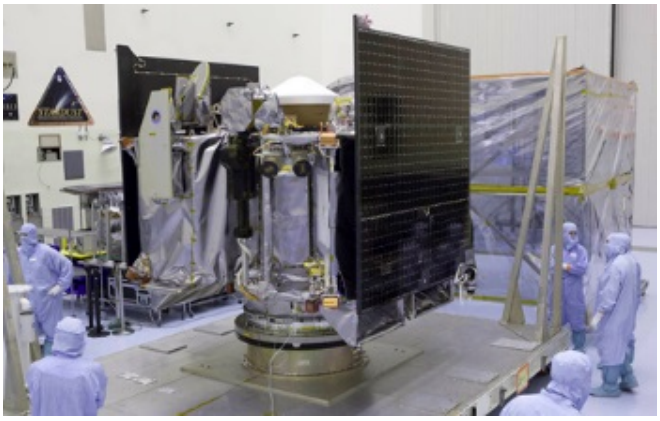
Once the sample location is chosen, the spacecraft will approach the surface at .2 mph, a fraction of walking pace, and, without landing, stretch out its sample collecting arm. The device will agitate the asteroid's surface and collect more than two ounces of material. Watch the videos to see how it works. It will depart for Earth in 2021, delivering the pristine sample of Bennu back to Earth in 2023. Scientists expect Bennu may hold clues about the source of Earth's water and organic molecules.

OSIRIS-REx carries a student-built experiment called REXIS, the Regolith X-ray Imaging Spectrometer, that will determine elemental abundances on the surface of Bennu. Chosen in a competitive process, it brings together students and faculty from Massachusetts Institute of Technology (MIT) and Harvard University, both in Cambridge. Students will perform data analysis as part of their coursework.

In May, the spacecraft arrived at the Kennedy Space Center in Florida aboard a U.S. Air Force C-17 cargo plane from Colorado, where Lockheed Martin Space Systems designed and built the spacecraft in its Littleton facility. Team members began final preparations in advance of launch, including final testing and pre-launch checks. Ultimately, it will be fueled prior to being moved to its launch pad. The mission has a 34-day launch period beginning on Sept. 8.

"This team has done a phenomenal job of assembling and testing the spacecraft," said Dante Lauretta, principal investigator for OSIRIS-REx at the University of Arizona, Tucson. "As we begin the final preparations for launch, I am confident that this spacecraft is ready to perform its science operations at Bennu. And I can't wait to fly it."

Follow the mission's social media: Facebook, Twitter, YouTube, PI Blog, and subscribe to email mission updates.



OSIRIS-REx is revealed after its protective cover is removed inside the Payload Hazardous Servicing Facility at Kennedy Space Center (KSC). Credit: NASA/Dimitri Gerondidakis

Technicians and engineers remove a solar array panel from OSIRIS-REx to allow thorough tests of the release of the deployment mechanism prior to flight. Credit: NASA/Kim Shiflett.

A solar array is inspected, tested and cleaned before being integrated with the OSIRIS-REx spacecraft. Credit: NASA/Kim Shiflett

Surprises Galore as Pluto is Revealed

Since New Horizons' historic flyby of the Pluto system in July 2015, incredible images of the dwarf planet and her moons have astonished and amazed scientists and the public. And her team has received numerous awards to recognize their spectacular achievement.

Now, a year later, NASA has approved an extended mission (KBO Extended Mission, or KEM) to fly onward to an object deeper in the Kuiper Belt, known as 2014 MU69. The flyby of this ancient outer solar system object will take place on January 1, 2019.

Pluto's heart-shaped feature has intrigued both scientists and the public. The enhanced color view at right zooms in on a portion of Pluto's great ice plains, where at lower right the plains border rugged, dark highlands informally named Krun Macula. The highlands rise 1.5 miles above the surrounding plain and are scarred by clusters of connected, circular pits that typically reach between 5 and 8 miles across.

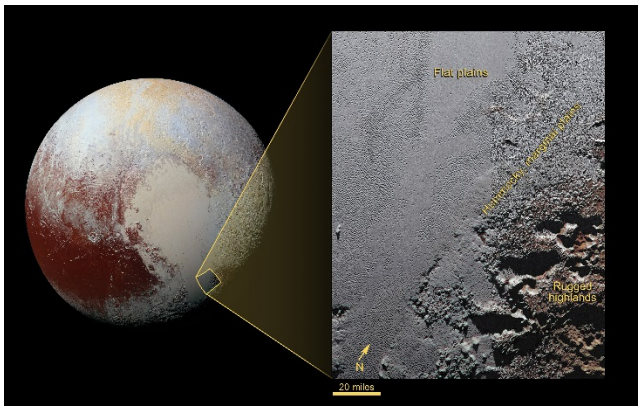
The New Horizons team created a "movie" that includes all of the highest-resolution images that faced the spacecraft as it flew past Pluto on July 14, 2015. It displays the various types of surface terrain and will help scientists determine the processes that formed and shaped them.

This movie pans from top to bottom, offering great views of many of Pluto's distinct landscapes along the way. Starting with hummocky, cratered uplands at top, the view crosses over parallel ridges of the "washboard" terrain; chaotic and angular mountain ranges; the craterless, cellular plains; coarsely "pitted" areas of sublimating nitrogen ice; zones of thin nitrogen ice draped over the topography below; and rugged, dark, mountainous highlands scarred by deep pits

A large section of Pluto's icy surface is being constantly renewed by a process called convection that replaces older surface ices with fresher material. Mission scientists used state-of-the-art computer simulations to show that the surface of the plain informally named Sputnik Planum is covered with icy, churning, convective "cells" 10 to 30 miles across and less than one million years old.

"Sputnik Planum is one of the most amazing geological discoveries in 50-plus years of planetary exploration. The finding by our science team that this vast area – bigger than Texas and Oklahoma combined – is created by current day ice convection is among the most spectacular of the New Horizons mission," said New Horizons Principal Investigator Alan Stern.

These convective surface motions average only a few centimeters a year which means cells recycle their surfaces about every 500,000 years – a fast clip on geological timescales.



Pits on Pluto form valleys almost twice as deep as the Grand Canyon in Arizona and have floors covered with nitrogen ice. Credit: JHUAPL/SwRI

"Unexpected" describes many of the surface features seen so far, such as the vast, craterless, very young plains. New Horizons will continue to send back images from the Pluto system flyby for a few more months, uncovering many more mind-blowing surprises about these distant small worlds.

Visit New Horizons news archive to learn about the latest news and discoveries.

Follow New Horizons on social media: Facebook, Twitter and YouTube.

Like a cosmic lava lamp, a large section of Pluto's icy surface is being constantly renewed by convection that replaces older surface ices with fresher material.

Credit: JHUAPL/SwRI

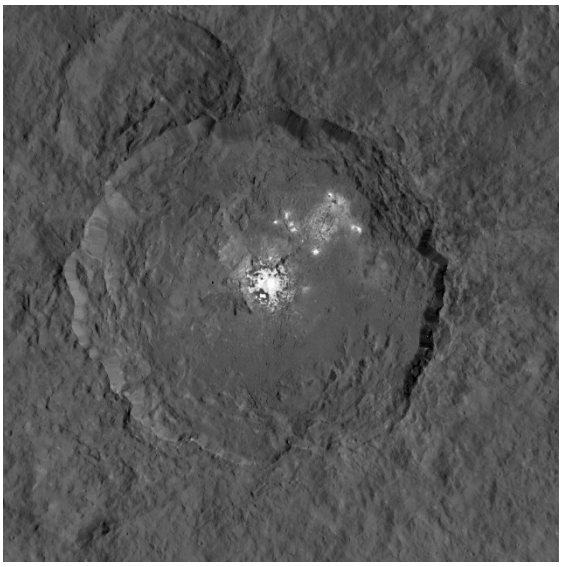
Dawn Completes Prime Mission, Returns 69,000 Images of Vesta and Ceres

Since going into orbit around dwarf planet Ceres on March 6, 2015, the Dawn spacecraft has returned a vast amount of intriguing images and data, adding to the wealth of new knowledge gained from its earlier visit to asteroid Vesta. The prime mission ended on June 30, surpassing all mission requirements, but NASA has approved an extended mission for further science data acquisition at Ceres.

Here are some of the mission's highlights at Ceres:

Bright Spots – A month before going into orbit around Ceres, while still 52,000 miles from the dwarf planet, Dawn captured images showing mysterious bright spots on the surface. This puzzled scientists and fascinated the public – what could they be? Curious observers cast their votes at the mission's website – volcano, geyser, rock, ice, salt deposit or something else?

In September, Dawn was returning images from an altitude of 915 miles. Its framing camera returned new views of Occator crater, location of the brightest spots, showing better defined shapes of the brightest spot and crater floor and revealing a complex, beautiful landscape. Scientists produced animations that provide a virtual fly-around of the crater.



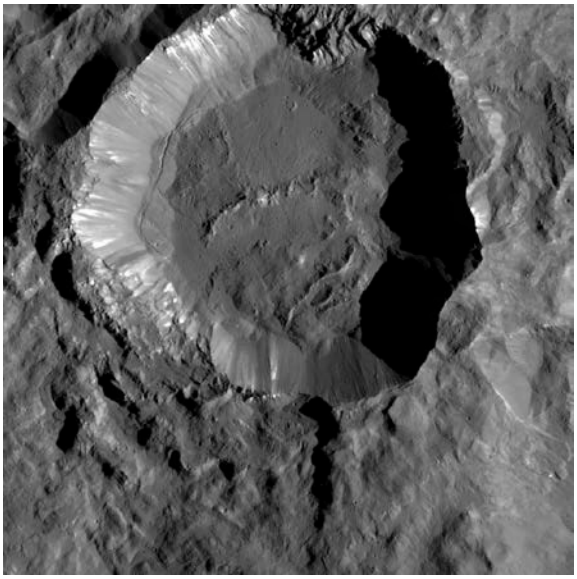
This composite of two Occator images at different exposures captures both the detail in the bright spots and the background surface.
Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Congratulations to Dawn for receiving the 2015 National Aeronautic Association Robert J. Collier Trophy and the National Space Club and Foundation's Nelson P. Jackson Award

In December, research published in the journal Nature revealed Ceres has more than 130 bright areas, most associated with impact craters. Then in June 2016, another study reported in Nature disclosed that Ceres brightest area in Occator Crater has the highest concentration of carbonate minerals ever seen outside Earth. The scientific analysis found the dominant mineral is sodium carbonate, a type of salt found on Earth in hydrothermal environments. It appears to come from inside Ceres, suggesting that internal temperatures are warmer than previously believed. More intriguingly, the results suggest that liquid water may have existed beneath the surface of Ceres in recent geological time. The salts could be remnants of an ocean that reached the surface and then froze millions of years ago.

Watch an animation of Ceres rotation and Occator Crater, which has a central pit covered in bright material and measures six miles wide and .3 miles deep. Scientists think Occator is among the youngest features on Ceres, estimating its age at about 78 million years old.

In December, Dawn began returning images from its lowest and final altitude of 240 miles above the surface. Follow Dawn's findings to learn about the latest news and discoveries.



Kupalo Crater, measuring 16 miles across, is one of the youngest craters on Ceres, with bright material that could be salts exposed on its rim and walls. Its flat floor likely formed from impact melt and debris.
Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

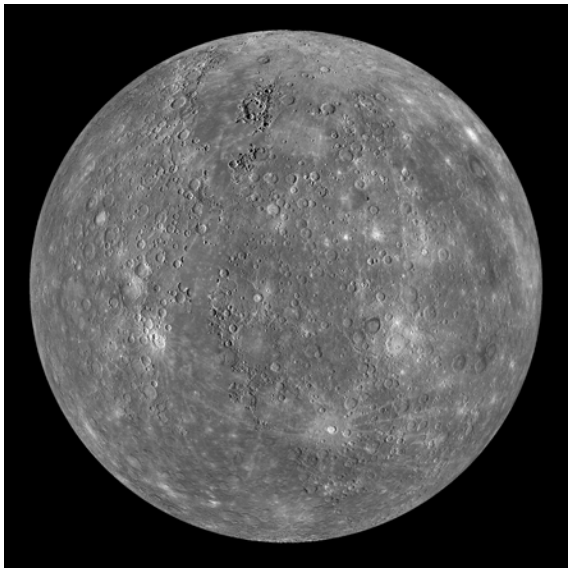
Follow Dawn on social media: Facebook, Twitter, YouTube and Google+

MESSENGER Mission Wraps Up

While the MESSENGER mission ended on April 30, 2015, with the spacecraft impacting the surface of Mercury after more than four years in orbit, the mission team continues to examine the images and data, publish their findings, and transfer data products to NASA's Planetary Data System.

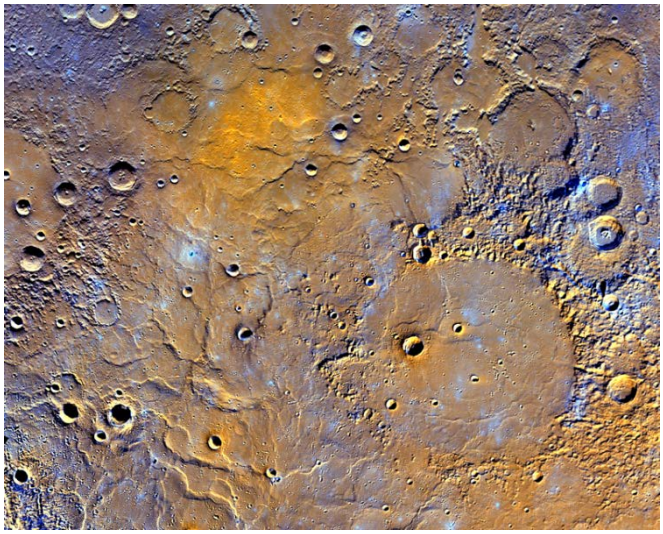
"During its four years of orbital observations, MESSENGER revealed the global characteristics of one of our closest planetary neighbors for the first time," said MESSENGER Principal Investigator Sean Solomon, Director of Columbia University's Lamont-Doherty Earth Observatory. "MESSENGER's scientists and engineers hope that data from the mission will continue to be utilized by the planetary science community for years to come, not only to study the nature of the innermost planet, but to address broader questions about the formation and evolution of the inner solar system."

The seventh Discovery mission to be selected by NASA, the **ME**rcury **S**urface, **S**pace **EN**vironment, **GE**ochemistry, and **R**anging mission launched on August 4, 2004. After entering into orbit about Mercury on March 18, 2011, MESSENGER completed 4,104 orbits and imaged 100% of the planet. The overachieving spacecraft needed to return 2,500 images to meet baseline science goals, but instead it sent back more than 277,000 images from Mercury orbit.



Global mosaic view of Mercury.
Credit: NASA/JHUAPL/CIW

The team has updated and archived the mission website, making it easy to learn about the top science results and technology innovations and to explore maps, videos, images and much more. Interactive maps invite users to investigate craters and other features using Mercury on Google Earth. Interactive games and simulations answer many mission-related questions while education modules highlight science and engineering in action.



This view of Mercury's northern volcanic plains uses enhanced color to emphasize different types of rocks on the surface. At the bottom right, the 181-mile-diameter Mendelssohn impact basin may have at one time been nearly filled with lava. Toward the bottom left, large wrinkle ridges, formed during lava cooling, are visible. Also in this region, the circular rims of impact craters buried by lava can be identified. Near the top, the bright orange region shows the location of a volcanic vent.
Credit: NASA/JHUAPL/CIW

May 2018 Launch Planned for InSight

On December 22, NASA reported suspension of the planned March 2016 launch of the Interior Exploration using Seismic Investigations Geodesy and Heat Transport (InSight) mission to Mars. The decision followed unsuccessful attempts to repair a leak in a section of the prime instrument in the science payload.

In March, NASA announced a new launch window that begins May 5, 2018, with Mars landing scheduled for Nov. 26, 2018.

InSight is a terrestrial planet explorer that will place a single geophysical lander on Mars to study its deep interior. The mission 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 (including Earth) more than four billion years ago.

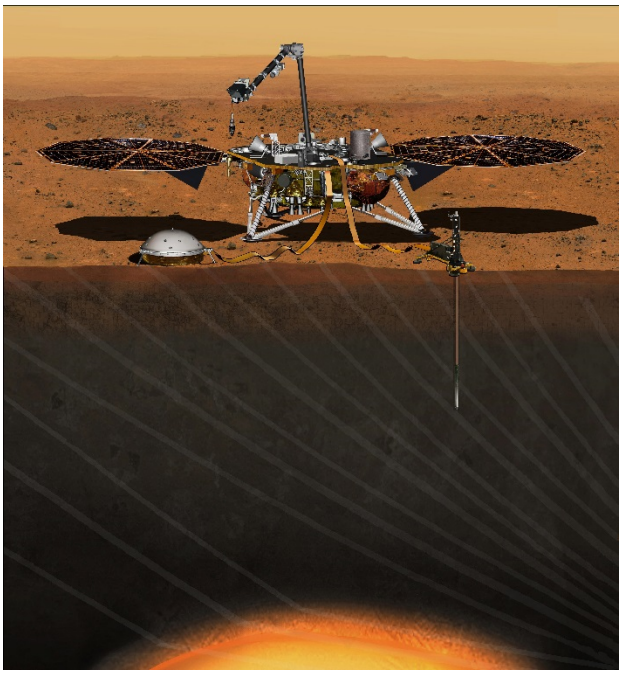
The instrument involved is the Seismic Experiment for Interior Structure (SEIS), a seismometer provided by France's Centre National d'Études Spatiales (CNES). Designed to measure ground movements as small as the diameter of an atom, the instrument requires a vacuum seal around its three main sensors to withstand the harsh conditions of the Martian environment.

When, during testing in extreme cold temperature (-49 degrees Fahrenheit), the instrument failed to hold a vacuum, NASA officials determined there was insufficient time to resolve the leak and complete thorough testing required to ensure a successful mission. The spacecraft, built by Lockheed Martin, was delivered to Vandenberg Air Force Base in California, on Dec. 16. With the 2016 launch canceled, the spacecraft was returned to Lockheed's Denver facility.

The project developed a new plan to redesign the science instrument. Following a briefing by InSight project managers to officials at NASA and CNES, the proposed plan was accepted.

The seismometer instrument's main sensors need to operate within a vacuum chamber to provide the exquisite sensitivity needed for measuring ground movements as small as half the radius of a hydrogen atom. The rework of the seismometer's vacuum container will result in a finished, thoroughly tested instrument in 2017 that will maintain a high degree of vacuum around the sensors through rigors of launch, landing, deployment and a two-year prime mission on the surface of Mars.

InSight's other key instrument is the Heat Flow and Physical Properties Package (HP3), provided by the German Aerospace Center (DLR).



This artist's concept depicts NASA's InSight Mars lander fully deployed for studying the deep interior of Mars.
Credit: NASA/JPL-Caltech

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The Impact of Discovery STEAM Experience

The Planetary Missions Program Office hosted our sixth annual multisite workshop on Saturday, April 9, focusing this year on STEAM engagement, STEM + Art, and featuring a great new maker project from our artist/educator collaborators Monica and Tyler Aiello.

Linked via NASA's Digital Learning Network, 240 participants at 4 sites explored mission design and engineering through "shoebox rovers" which demonstrate simple machines in a fun and innovative way. It's a highly engaging activity that is scalable for all ages. It builds engineering skills and understanding while encouraging teamwork and emphasizing that failure = opportunity!

Interspersed with the "making" was an overview of the current missions in the Discovery and New Frontiers Programs and presentations from members of the New Horizons, OSIRIS-REx, MESSENGER, Juno and Europa missions. The Aiellos described the new activity and guided participants through the steps of building their rovers.

The workshop, held at NASA's Jet Propulsion Laboratory and Johnson Space Center, The Johns Hopkins University Applied Physics Laboratory in Laurel, MD, and Think 360 Arts for Learning in Denver, attracted teachers, informal educators, students, and space-loving members of the public. Those at JPL and JSC were offered a tour of the facility.

Videos of all the presentations and workshop resource materials are available to watch on the workshop archive page.

Discovery AND New Frontiers NEWS

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