

## Dawn Spacecraft Launches on Trip to Asteroid Belt

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Cape Canaveral, FL

NASA's Dawn spacecraft launched today atop the Delta II rocket at the Cape Canaveral Air Force Station in Florida. It will travel for an 8-year **5.5 billion-kilometer** trip to the asteroid belt. It will reach the asteroid Vesta in August, 2011 and Ceres in February, 2015.

Dawn will be the first purely scientific mission to be powered by an advanced technology called ion propulsion. Using its ion propulsion system, it will spiral to low altitudes and orbit each asteroid for about 6 months during the mission.



Instruments aboard the Dawn spacecraft will investigate the internal structure and surface qualities of each asteroid. Inside the asteroids, Dawn will measure the density and the make-up of these two very different asteroids. On the surface, Dawn will investigate what elements and minerals are present. This information is called the morphology of the surface features. Although both asteroids haven't changed since their formation, Vesta is thought to be dry and

Ceres is probably wet. Scientists hope that their different evolutionary paths will help us understand the role that water content and size played in planetary evolution.

According to Christopher Russell, Principal Investigator of the Dawn mission, Vesta is "a comparison object for materials in the inner part of the asteroid belt. That part also marks a transition to objects that become more like the bodies in the outer solar system, in particular the icy bodies, and we believe that Ceres will give us some surprises in that regard."

All of what we now know about Vesta and Ceres comes from ground-based and Earth-orbiting telescopes like NASA's Hubble Space Telescope (HST). This evidence is revealed by sunlight reflected from the surface of the asteroids in the ultraviolet, visible, and near-infrared regions, and by emitted radiation in the far-infrared and microwave regions.

Although Vesta is about the size of Arizona, from the Hubble Space Telescope it appears to be the size of a potato suspended from one goal post and viewed from the other end of the football field. Vesta rotates once every 5 hours, 20.5 minutes on its short axis.

Vesta appears to be dry, evolved and differentiated with surface features ranging from basaltic lava flows to a deep crater near its southern pole. The basin is so deep that it exposes the asteroid's subsurface, or mantle. Astronomers believe that some meteorites found on Earth are fragments of Vesta's surface that were blasted out during collisions in its early history. The Dawn mission may help scientists determine whether this is a possibility.

Ceres' physical characteristics have remained a mystery even though it was the first asteroid discovered 200 years ago. It is about as big as Texas and it is located further from the sun than is Vesta. It appears to have a very primitive surface. Some minerals show evidence of water

content, and possibly a very weak atmosphere with seasonal frost forming at the poles. Ultraviolet images of the asteroid from the HST show that Ceres is a slightly flattened sphere with a rotation rate of 9.08 hours. It has a large dark spot on its surface that is about **250 km**, in diameter. Images are not clear enough, however, to tell us if the spot is an impact crater or merely darker colored land. Reflected light studies suggest that Ceres is covered with a dry clay. We have found no meteorites on Earth that can be identified as having come from Ceres.

In addition to images, thermal (heat) emissions from Vesta have led scientists to conclude that it has a dusty surface, and radar signals bounced off both Ceres and Vesta have given us some information about the roughness of their surfaces.

At this point, we have reached the limit of what can be observed about these asteroids using technology here on Earth. The Dawn spacecraft will be equipped with special equipment like a framing camera, a mapping spectrometer, and a gamma ray/neutron spectrometer to observe the asteroids from a distance of **less than 1000 km**.

Dawn images of Ceres and Vesta's surfaces will be used to study the structure of rocks and craters and look for evidence of a tectonic history. Imagery and gravity measurements will be used to more accurately measure the asteroids' mass, shape, volume, and rotation rate.

Infrared and gamma ray spectrometry will be used to search for water-bearing minerals. Knowing the elemental and mineral composition will help scientists determine the asteroids' thermal history and evolution. It will also provide more evidence about whether certain meteorite samples are truly from Vesta.

Dawn is part of NASA's Discovery Program of robotic missions. These missions give scientists the opportunity to dig deep into their imaginations and find innovative ways to unlock the mysteries of the solar system. These missions represent a breakthrough in the way NASA explores space: with lower-cost, highly

focused planetary science investigations designed to enhance our understanding of the solar system.

For more information on Dawn, visit the mission Web site at:

<http://dawn.jpl.nasa.gov>

