NASA Facts

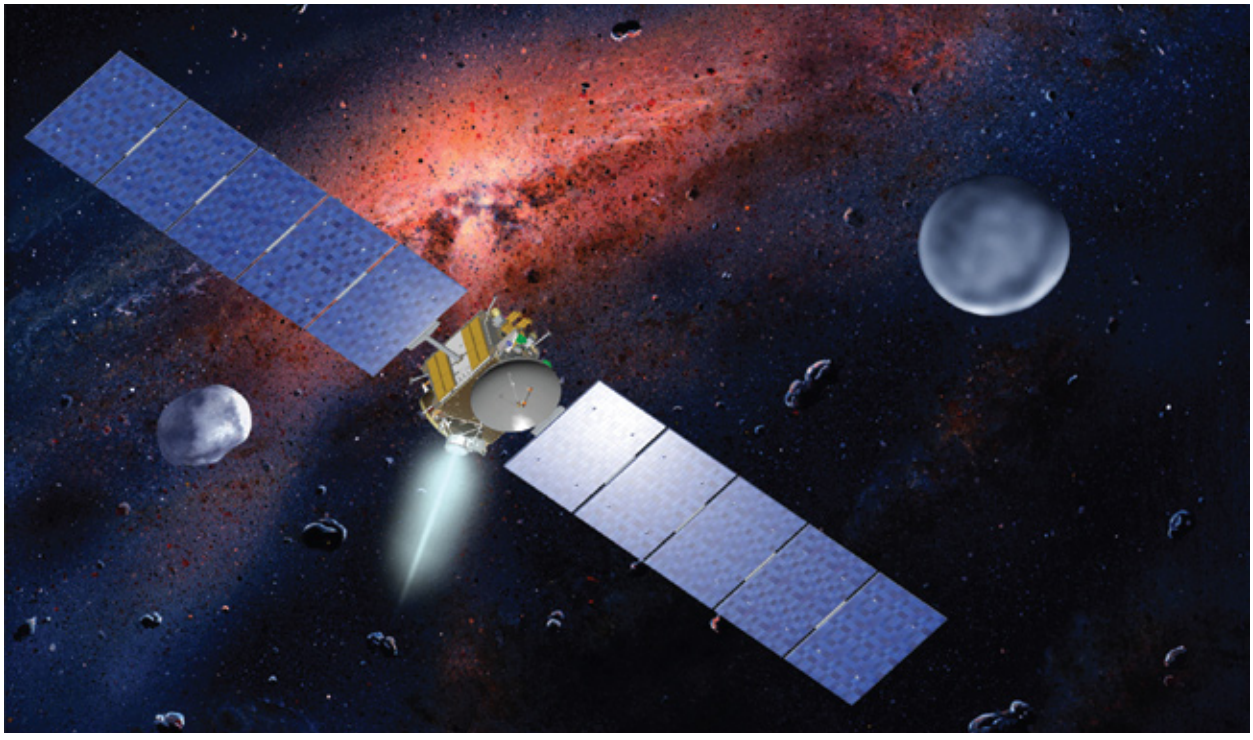
Dawn

A Journey to the Beginning of the Solar System

Exploring a new frontier, the Dawn mission will journey back in time over 4.5 billion years to the beginning of our Solar System. How is this "time travel" possible? Many thousands of small bodies orbit the Sun in the asteroid belt—a large region between the orbits of Mars and Jupiter. They formed at the same time and in similar environments as the bodies that grew to be the rocky planets (Mercury, Venus, Earth, and Mars). Scientists theorize that the asteroids were budding planets and never given the opportunity to grow, due to gravitational stirring by massive Jupiter. Sometimes called minor planets, asteroids contain clues that reveal the conditions and processes acting at the Solar System's earliest epoch. By investigating two very different asteroids, Ceres and Vesta, the Dawn mission seeks to unlock some of the mysteries of planetary formation.

Why Vesta and Ceres?

Caught up in a cosmic tug of war between the Sun and Jupiter, two of the largest inhabitants of the main asteroid belt, Vesta and Ceres, survived the collisional environment of the region and have remained intact since their formations. Furthermore, evidence shows that each has distinct characteristics; therefore, each must have followed a different evolutionary path. Vesta appears to be dry, evolved, and differentiated with surface features ranging from basaltic lava flows to a deep crater near its southern pole. Ceres, in contrast, has a dusty, clay-like surface and evidence of water, which has led scientists to suspect the presence of a thick water-ice mantle. Vesta's physical characteristics reflect those of the inner planets, whereas Ceres' are more like the icy moons of the outer planets. By studying these contrasts and comparing these two minor planets, scientists will develop an understanding of the transition from the rocky inner regions to the icy outer regions of the Solar System.



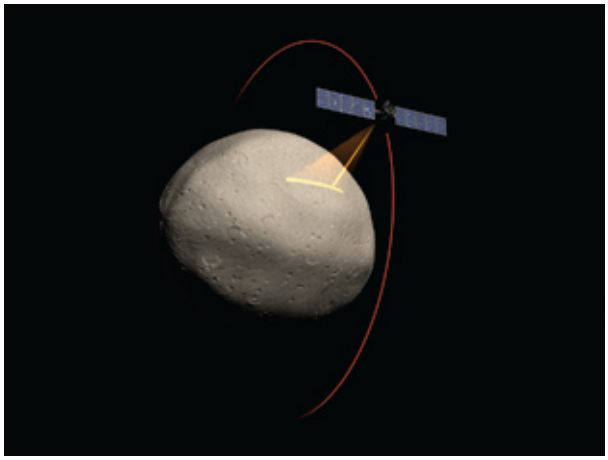
The Dawn spacecraft will provide exciting and valuable data from its ambitious journey to Vesta (left) and Ceres (right).

New Views of Old Worlds

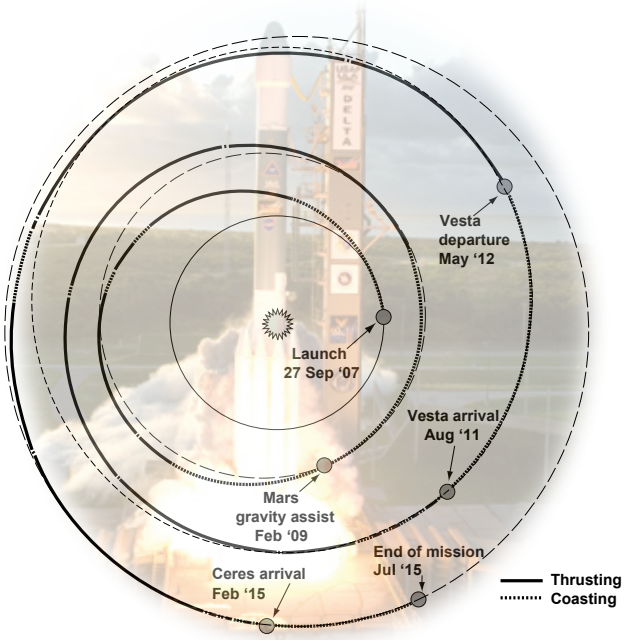
The Dawn mission marks the first time a spacecraft will orbit a body in the main asteroid belt and the first time a spacecraft will orbit two targets, enabling a detailed and intensive study of both. Dawn thus uses the same suite of instruments to gather comparative data on Vesta and Ceres. Aboard the spacecraft, the science payload consists of two cameras, a visible and infrared mapping spectrometer to reveal the surface minerals, and a gamma ray and neutron spectrometer to determine the elements that make up the outer parts of the asteroids. The spacecraft also will be used to measure the gravity field, thereby revealing details of these asteroids' interiors. With the data from these systems, scientists will study surface features and the complex and varied landscapes, gaining valuable new insights into the internal structure of these ancient worlds. What role did size have in determining how planets evolved throughout the Solar System? How did water affect the process of planetary formation? Data gathered during the Dawn mission will help scientists uncover the answers to these and other questions.

Innovative Propulsion System Aboard

Dawn's journey to the asteroid belt, spanning about eight years from launch to completion of data return, is made possible by ion propulsion. Initially tested and proven successful on NASA's Deep Space 1 mission, this innovative technology is now applied for the first time in the design and implementation of a dedicated scientific space flight with the Dawn mission. Ion propulsion allows Dawn to undertake a bold and important mission that would be unaffordable—and even impossible—with a more conventional propulsion system. Two large solar panels, stretching approximately 19.7 meters (65 feet) from tip to tip, collect energy from the distant Sun. Within the ion engine, the energy then ionizes the onboard fuel, xenon, accelerating the ions—which, in turn, accelerate the spacecraft.



Artist's conception of Dawn spacecraft gathering spectral data from Vesta. *Credit: NASA/McREL*



Trajectory
Launching from Cape Canaveral September 27, 2007, the Dawn spacecraft encounters Vesta in 2011 and will reach Ceres in 2015. *Credit: NASA/JPL*

Dawn Education and Public Outreach

NASA invites you to come along and share in the exciting journey through the asteroid belt with Dawn. Through education and public outreach, NASA provides opportunities to learn about the science of the Dawn mission, to meet the team, and to chart the Dawn spacecraft's progress throughout its eight-year exploration. Educational activities for space enthusiasts of all ages are available at the Dawn mission Web site. For more information visit: http://dawn.jpl.nasa.gov.

Program and Project Management

Dawn is the ninth Discovery mission in NASA's Science Mission Directorate and is a collaborative partnership made up of the University of California, Los Angeles; Jet Propulsion Laboratory; Orbital Sciences Corporation; Los Alamos National Laboratory; German Aerospace Center; Max Planck Institute for Solar System Research; Italian Space Agency; and Italian National Institute of Astrophysics. Dawn outreach materials are developed under contract by Mid-continent Research for Education and Learning (McREL), Denver, CO.

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