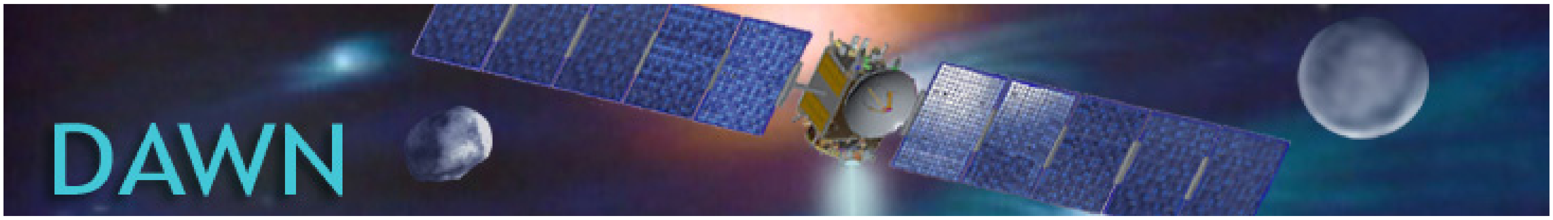





# MISSION

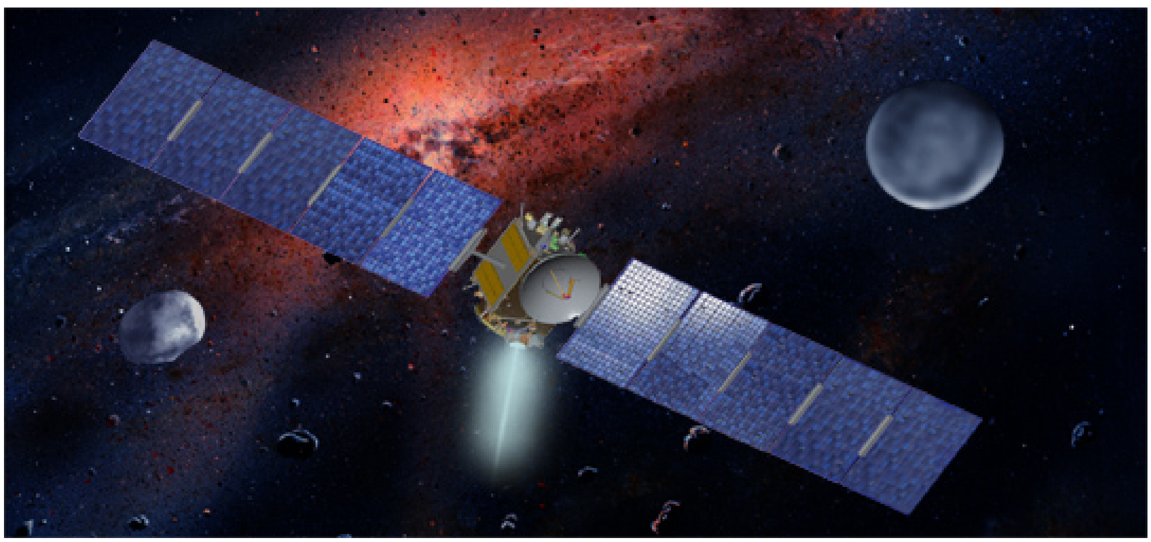
## Overview

**Overview**
Background
Dawn Dictionary
Dawn Journal
Dawn's Early Light
Fact Sheet
FAQs
Ion Propulsion
Mission Status
Objectives
Partners
Spacecraft
Timeline
Mission milestones
Trajectory

**Please review this Web site.**

**Tell us what you think.**

### Welcome to the Dawn Web site.



Dawn title art background is from a painting by William K. Hartmann titled "A cocoon nebula, perhaps the primordial solar nebula."

Dawn's goal is to characterize the conditions and processes of the solar system's earliest epoch by investigating in detail two of the largest protoplanets remaining intact since their formations. Ceres and Vesta reside in the extensive zone between Mars and Jupiter together with many other smaller bodies, called the asteroid belt. Each has followed a very different evolutionary path constrained by the diversity of processes that operated during the first few million years of solar system evolution.

Dawn has much to offer the general public. It brings images of varied landscapes on previously unseen worlds to the public including mountains, canyons, craters, lava flows, polar caps and, possibly ancient lakebeds, streambeds and gullies. Students can follow the mission over an entire K-12 experience as the mission is built, cruises to Vesta and Ceres and returns data. The public will be able to participate through the Solar System Ambassadors and through participation on the web.
+ Mission Objectives

### Dawn's Early Light

National Aeronautics and Space Administration

NASA Facts

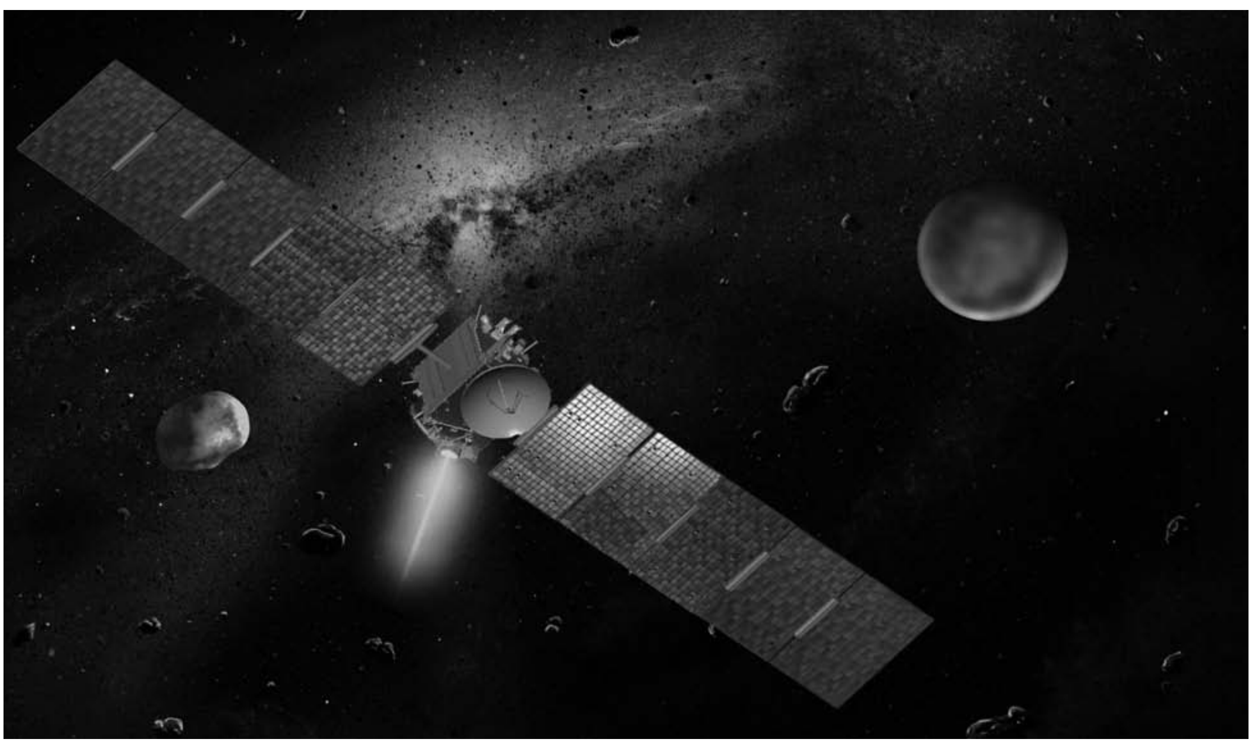
# Dawn

## 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 massive Jupiter’s gravitational pull. 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 hopes to unlock some of the mysteries of planetary formation, including the building blocks and the processes leading to their state today.

### Why Vesta and Ceres?

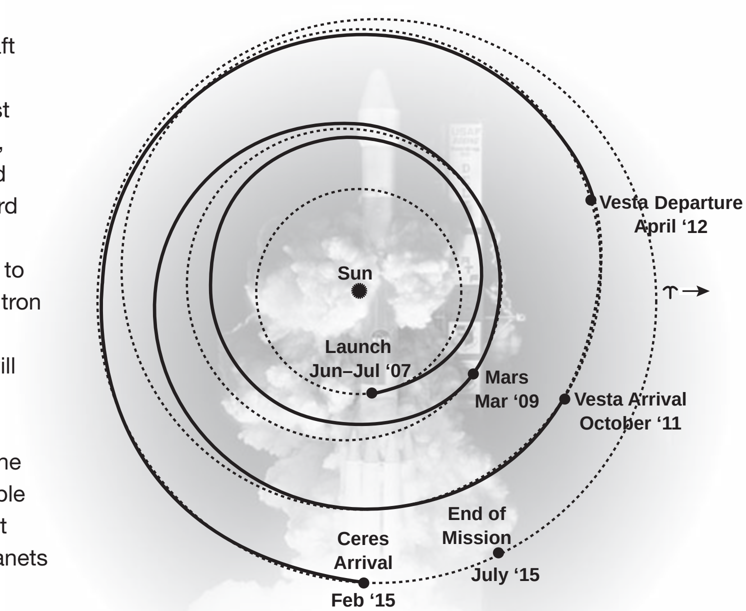
Caught up in a cosmic tug of war between the Sun and Jupiter, two of the largest main belt asteroids, Vesta and Ceres, survived Jupiter’s destructive effects and have remained intact since their formations. Furthermore, evidence shows that each has followed a different evolutionary path, seen by their distinct characteristics. 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 primitive surface and evidence of water content, which may lead to frosty polar caps. Vesta’s physical characteristics reflect those of the inner planets, whereas Ceres is representative of 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 to the icy outer regions of the Solar System.



The Dawn spacecraft will return exciting and valuable data from its ambitious journey to Vesta (left) and Ceres (right). Captured by the Hubble Space Telescope, the images shown above are the best views currently available of the two asteroids.

## New Views of Old Worlds

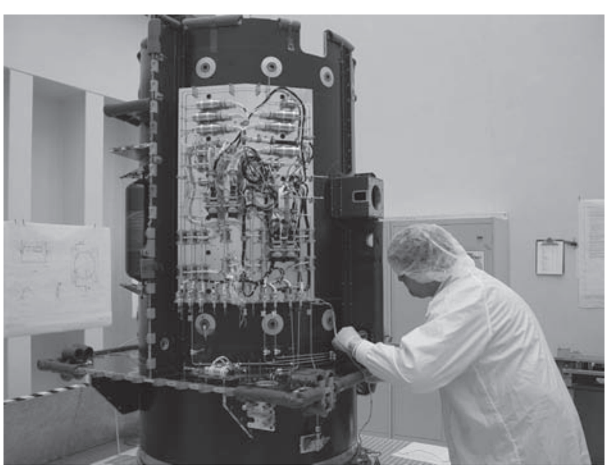
The Dawn mission marks the first time that a spacecraft will orbit a main belt asteroid, enabling a detailed and intensive study of it. Furthermore, Dawn will be the first spacecraft ever to orbit two targets after leaving Earth, thus allowing the same suite of instruments to be used to gather comparative 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, the complex and varied landscapes, as well as gain 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.




**Tentative Trajectory**
Launching from Cape Canaveral in summer 2007, the Dawn spacecraft encounters Vesta four years later, then travels an additional three years to reach Ceres.

## Innovative Propulsion System Aboard

Dawn's journey to the asteroid belt, spanning nearly nine 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—or perhaps even impossible—with a more conventional propulsion system. Two large solar panels, stretching approximately 19.7 meters (65 feet) from tip to tip, help to harness power from the distant Sun to the ion engines. The power then ionizes the onboard fuel, xenon, accelerating the ions, which in turn accelerate the spacecraft.



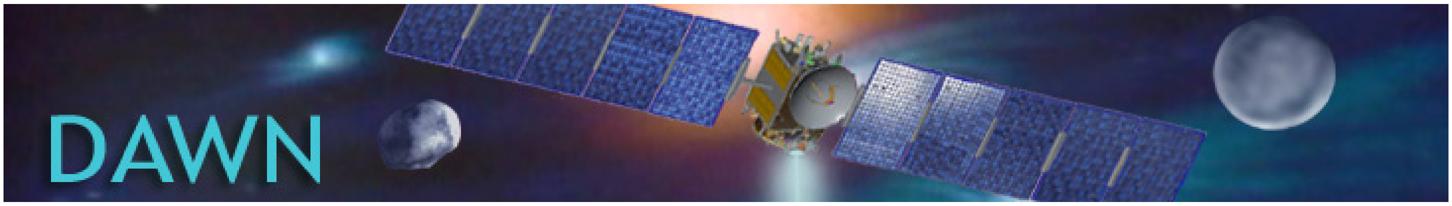
Working in a clean room facility at JPL, a mission engineer assembles the xenon feed system of Dawn's ion propulsion system.

## 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 nearly decade-long 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.






# MISSION

## Spacecraft

**Spacecraft**

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Mission Status

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Mission milestones

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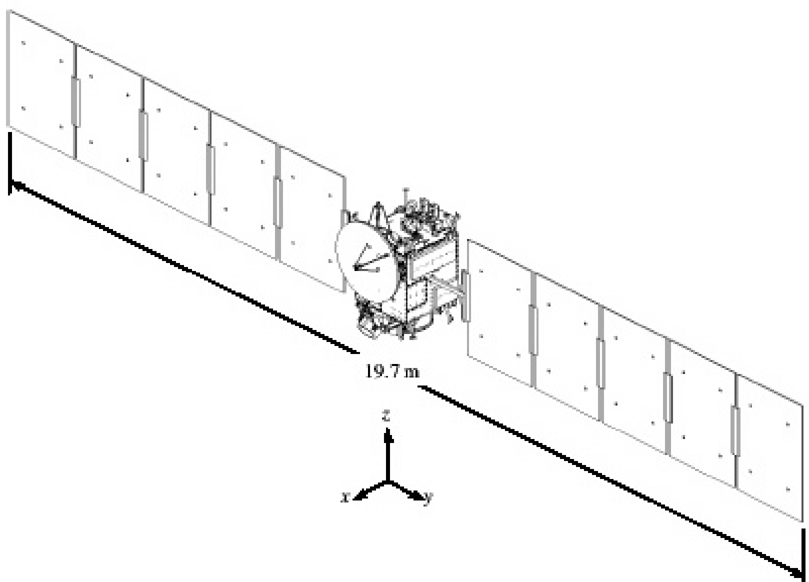
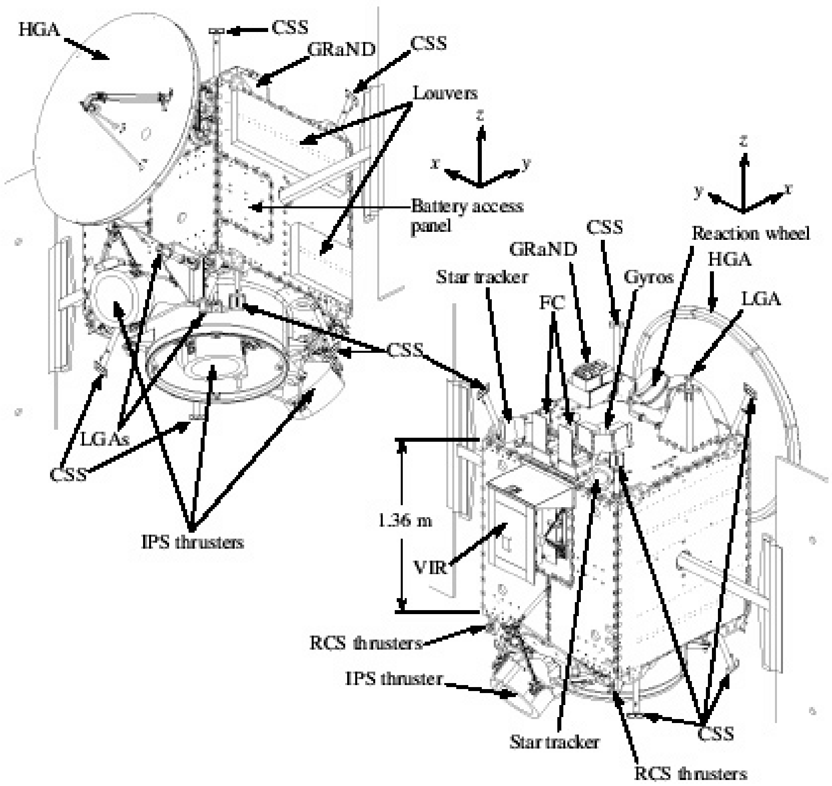



### Key Spacecraft Characteristics:

- Fully redundant, low-risk, all assemblies flight proven and used in many Orbital satellites
- Solar electric propulsion assembled and tested at the JPL by the NASA Solar Electric Power Technology Application Readiness team and validated on Deep Space 1 mission.
- 100 W traveling wave tube amplifier, tracking, telemetry and command system with fixed 1.5 m high-gain antenna, medium-gain fan beam & omni antennas, small deep space transponders
- 10 kW triple-junction solar array
- Flight proven attitude conrol system used on the Orbview, Topex/Poseidon ocean topography mission, and the Far Ultraviolet Spectrum Explorer
- Simple hydrazine reaction control subsystem with twelve 0.9 N engines used on the Indostar spacecraft
- Command and data handling uses off the shelf components as used on the Orbview program
- Flight software, modular, multitask as used on Orbview
- Structure is aluminum with new instrument panel for Dawn payload as used on Indostar

## SPACECRAFT DIAGRAM:




**KEY**

HGA – High Gain Antenna
LGA – Low Gain Antenna
CSS – Coarse Sun Sensors
GRaND – Gamma Ray and Neutron Detector
IPS Thrusters – Ion Propulsion Thrusters
RCS Thrusters – Reaction Control System Thrusters
VIR – Visual and Infrared Mapping Spectrometer
FC – Framing Camera

This figure depicts the Dawn flight system. Upper views are the same scale.

+ Learn about Dawn's ion propulsion