

THE VALUE OF PERFORMANCE.

NORTHROP GRUMMAN

Dawn

*Investigating the "Dawn"
of Our Solar System*

Dawn is a planetary science mission funded by NASA's Discovery Program. Northrop Grumman is partnered with Principal Investigator Dr. Chris Russell of UCLA and the Jet Propulsion Laboratory (JPL) for the mission.

Dawn's primary scientific objective is to advance understanding of the origin and evolution of the solar system by studying the protoplanet, Vesta and the dwarf planet Ceres. Both bodies appear to have remained intact since their formation 4.6 billion years ago. Earth-based studies indicated that these two protoplanets had very different and complementary compositions, which together would advance our understanding of the conditions and processes of planetary formation.

Powered by solar electric ion propulsion, the Dawn spacecraft traveled to the main asteroid belt between Mars and Jupiter. Dawn arrived at Vesta in July 2011 and spent more than a year orbiting the asteroid, conducting remote sensing observations using a suite of science instruments. The spacecraft departed Vesta in September 2012 and arrived for its science investigation at Ceres in March 2015. Dawn showed Vesta to be dry and rocky, as anticipated. Ceres shows evidence of briny water below a dry surface, with numerous bright salt deposits. Dawn completed its prime mission in 2016 and continues in an extended mission to observe Ceres.

Facts At A Glance

Vesta, the brightest asteroid, is named for the ancient Roman goddess of home and hearth. It is the only asteroid visible with the naked eye.

Ceres, the largest asteroid, and the first to be discovered, revolves around the Sun once every 4.6 terrestrial years and has a diameter estimated at about 960 km (575 miles).

The ion propulsion system employed by Dawn and pioneered on NASA's Deep Space 1 mission represents the culmination of over 50 years of development of electric engine systems in space begun by Dr. Wernher von Braun.

Mission

NASA Discovery Program

Customer

UCLA, Jet Propulsion Laboratory

Specifications

Spacecraft

Mass:	1,210 kg (2,668 lb.) at launch, 740 kg (1,631 lb.) unfueled
Dimensions:	20 m (65 ft) tip-to-tip, the spacecraft is 2.3 m (7.4 ft) high from separation plane to the top of the High Gain Antenna
Power:	Gallium Arsenide triple junction solar arrays, 10 kW at Earth and 1.4 kW at Ceres
Communications:	Deep Space Network – compatible with science downlink rates of 2-124 kbps
Propulsion:	Solar-electric propulsion using three gimballed NSTAR ion engines and a monopropellant reaction control system
Orbit Altitude:	Vesta: 2700 km - 200 km Ceres: 4400 km - 375 km
Mission Life:	10 years
Reliability:	Redundant and cross-strapped spacecraft bus electronics
Heritage:	GALEX, SORCE, STAR™ Bus
Status:	Fully operational

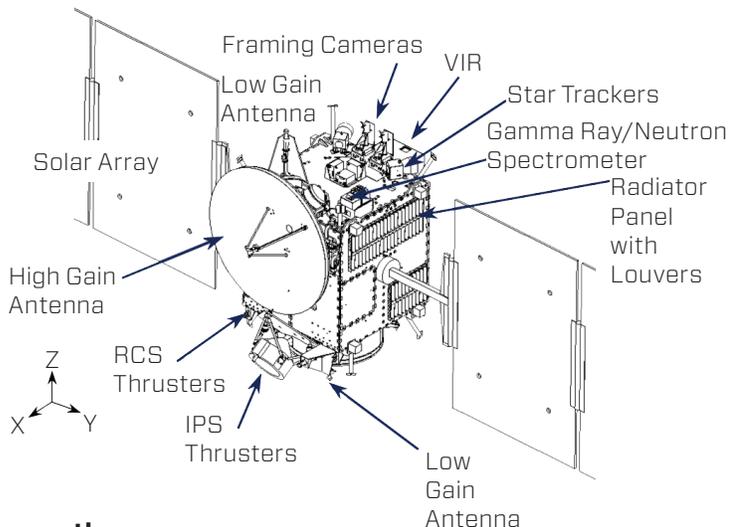
Launch

Launch Vehicle:	Delta II 7925H
Site:	Kennedy Space Center
Date:	September 27, 2007

Instruments

- Two Framing Cameras (MPS/DLR)
- Visible and Infrared Mapping Spectrometer (ASI/INAF)
- Gamma Ray and Neutron Detector (LANL)

Diagram of Dawn Spacecraft



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Key Mission Partners

UCLA, Jet Propulsion Laboratory

Principal Investigator: Dr. Christopher Russell (UCLA); JPL: Project management, mission systems engineering, ion propulsion subsystem, science operations and spacecraft flight operations

Max Planck Institute for Solar System Research/ German space agency (MPS/DLR)

Katlenburg-Lindau, Germany

Italian space agency/National Institute for Astrophysics (ASI/INAF)

Rome, Italy

Los Alamos National Laboratory Kennedy Space Center

Launch services via NASA Launch Services Contract

Northrop Grumman

Spacecraft design, integration and test, flight software, and launch operations, and flight operations support

Dawn Mission "Firsts"

- Dawn is the first spacecraft to orbit two protoplanets during a single mission.
- Dawn is the first mission to study the two most massive asteroids in the main belt.
- Dawn is NASA's first purely scientific mission to be powered by ion propulsion.



Dawn prior to launch

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