

The Cassini-Huygens Mission

- Voyage to Saturn -



This is an artist's concept of Cassini during the Saturn Orbit Insertion (SOI) maneuver, just after the main engine has begun firing. The spacecraft is moving out of the plane of the page and to the right (firing to reduce its spacecraft velocity with respect to Saturn) and has just crossed the ring plane.

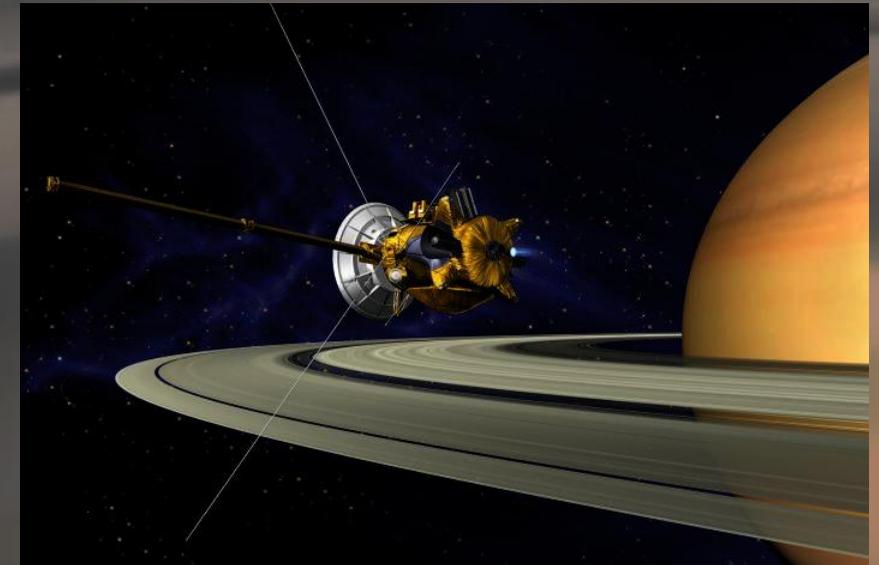
The SOI maneuver, which is approximately 90 minutes long, will allow Cassini to be captured by Saturn's gravity into a five-month orbit. Cassini's close proximity to the planet after the maneuver offers a unique opportunity to observe Saturn and its rings at extremely high resolution.

On October of 1997, a two-story-tall robotic spacecraft will begin a journey of many years to reach and explore the exciting realm of Saturn, the most distant planet that can easily be seen by the unaided human eye. In addition to Saturn's interesting atmosphere and interior, its vast system contains the most spectacular of the four planetary ring systems, numerous icy satellites with a variety of unique surface features. A huge magnetosphere teeming with particles that interact with the rings and moons,

and the intriguing moon Titan, which is slightly larger than the planet Mercury, and whose hazy atmosphere is denser than that of Earth, make Saturn a fascinating planet to study.

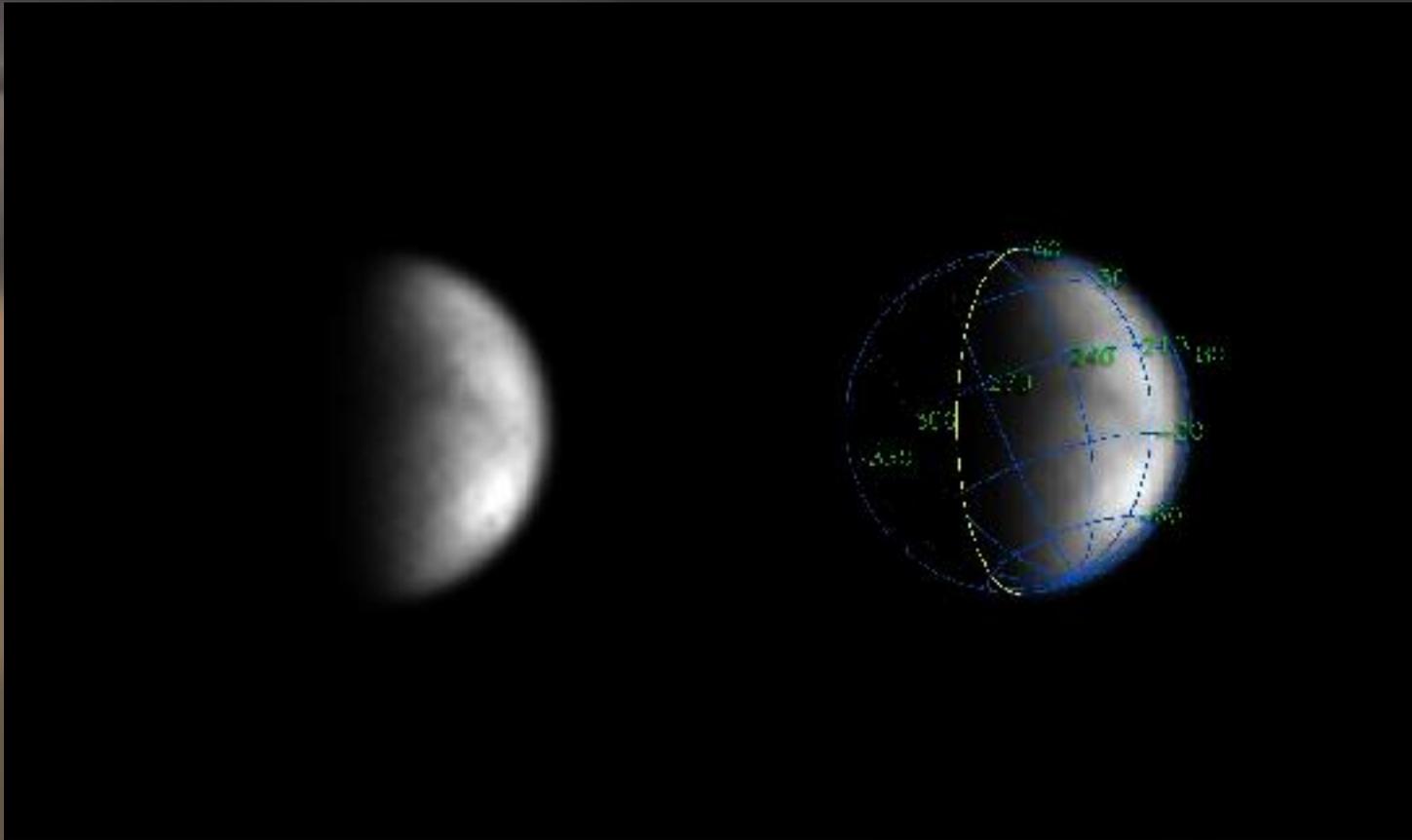
The Cassini mission is an international venture involving NASA, the European Space Agency (ESA), the Italian Space Agency (ASI), and several separate European academic and industrial partners. The mission is managed for NASA by JPL. The spacecraft will carry a sophisticated complement of scientific sensors to support 27 different investigations to probe the mysteries of the Saturn system. The large spacecraft will consist of an orbiter and ESA's Huygens Titan probe. The orbiter mass at launch will be nearly 5300 kg, over half of which is propellant for trajectory control. The mass of the Titan probe (2.7 m diameter) is roughly 350 kg.

The mission is named in honor of the seventeenth-century, French-Italian astronomer Jean Dominique Cassini, who discovered the prominent gap in Saturn's main rings, as well as the icy moons



Iapetus, Rhea, Dione, and Tethys. The ESA Titan probe is named in honor of the exceptional Dutch scientist Christiaan Huygens, who discovered Titan in 1655, followed in 1659 by his announcement that the strange Saturn "moons" seen by Galileo in 1610 were actually a ring system surrounding the planet. Huygens was also famous for his invention of the pendulum clock, the first accurate timekeeping device.

A final trajectory correction maneuver is



scheduled for June 16. On arrival date, June 30, Cassini will become the first spacecraft to orbit Saturn. Once in orbit it will conduct an extensive, four-year tour of the Saturn system, including its majestic rings and many known moons.

"The arrival date and trajectory to Saturn were

specifically selected to accommodate this flyby, which will be the only opportunity during the mission to study Phoebe at close range," said Dave Seal, mission planner for the Cassini-Huygens mission at NASA's Jet Propulsion Laboratory, Pasadena, Calif.

"Phoebe's orbit is simply too far from Saturn, at almost 13 million kilometers (about 8

million miles), nearly four times as far as the next closest major satellite, Iapetus. A later encounter is not feasible."

"The last time we had observations of Phoebe was by Voyager in 1981," said Dr. Torrence Johnson, former Voyager imaging team member, Galileo project scientist and current Cassini imaging team member. "This time around, the pictures of the mysterious moon will be about 1,000 times better, as Cassini will be closer." Voyager 2 captured images of Phoebe from about 2.2 million kilometers (about 1.4 million miles) away. Cassini will obtain images from a mere 2,000 kilometers (about 1,240 miles) above the moon's surface.

Cassini will also collect spectroscopic and radar data that could decipher the composition and origin of this distant moon. Cassini's Phoebe images, already twice as good as any image returned by Voyager 2, show large craters and variation in surface brightness.

"We anticipate that Phoebe will be heavily cratered in the higher resolution images we expect to see in the next few days," said Dr. Peter Thomas, a member of the imaging team

and a senior research associate at Cornell University, Ithaca, N.Y., who specializes in studies of small satellites. "The hints of different brightnesses also suggest that the highest resolution images, several hundred times better, will show a variety of materials.

Discovered in 1898 by American astronomer William Henry Pickering, Phoebe is of great interest to scientists. "With the instruments Cassini carries, we might learn more about Phoebe's internal structure and composition. What we have are many unanswered questions: Did it ever melt? Does it have evidence of past interior melting? Was it ever an icy body? Why is Phoebe in such an odd orbit?" said Dr. Dennis Matson, project scientist for the Cassini-Huygens mission at JPL.

Phoebe has a diameter of 220 kilometers (about 136.7 miles), which is equal to about one-fifteenth the diameter of Earth's moon. Phoebe rotates on its axis every nine hours and 16 minutes, and it completes a full orbit around Saturn in about 18 months. Its elliptical orbit is inclined approximately 30 degrees to Saturn's equator. Phoebe's retrograde orbit means that it goes around Saturn in the opposite direction of

the larger interior Saturnian moons. Previous ground-based observations have shown water ice present on its surface.

Phoebe is also unusual in that it is very dark. It reflects only six percent of the sunlight it receives. Phoebe's darkness and retrograde orbit suggest that it is most likely a captured object. A captured object is a celestial body that is caught by the gravitational pull of a much bigger body, generally a planet. Some scientists believe Phoebe might even be an object from the outer solar system, similar to the objects found in the Kuiper Belt. The Kuiper Belt is a collection of small icy bodies beyond Pluto that were never drawn together by gravity to form a planet.

"The dark and odd-shaped Phoebe may be a piece of the building blocks from which some of the planets formed," said Dr. Bonnie Buratti, scientist on the Cassini-Huygens mission at JPL. "It might hold clues about the early formation of our solar system."

The Cassini-Huygens mission is a

cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Cassini-Huygens mission for NASA's Office of Space Science, Washington, D.C. JPL designed, developed and assembled the Cassini orbiter.

