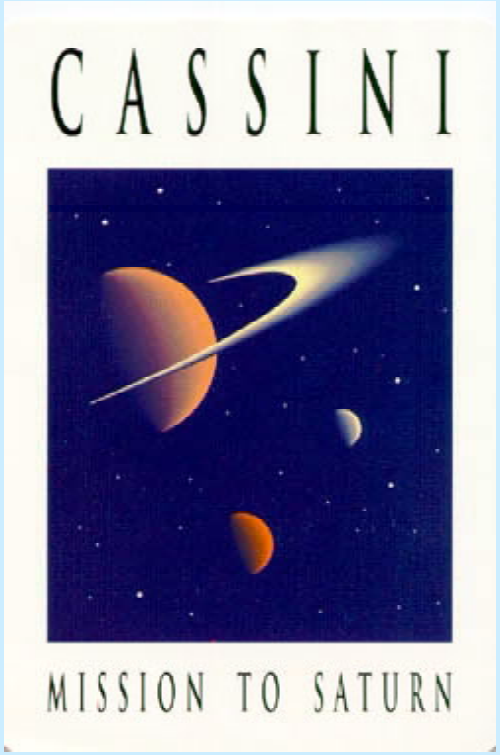


Cassini Mission

A journey to the Saturn System

Saturn

Saturn is the sixth planet from the Sun, orbiting at an average distance of 9.54 astronomical units (1429.4 million kilometers or 888 million miles).

Saturn physical facts:
Diameter = 120,660 km (75,412 miles) - compare to Earth (12,756 km)
Mean Distance from Sun = 9.5 au = 888 million miles = 1429 million km
Mass = 569×10^{24} kg
(95 times more massive than Earth)
Rotation Period = 10 hours and 40 minutes

Saturn System Facts

Saturn is the second largest planet in the Solar System.

There are 30 known satellites of Saturn.

The largest, Titan, has a thick nitrogen-rich atmosphere.

Saturn has an extensive magnetosphere.

Did you know?
Saturn emits 79% more energy
than it receives from the Sun.

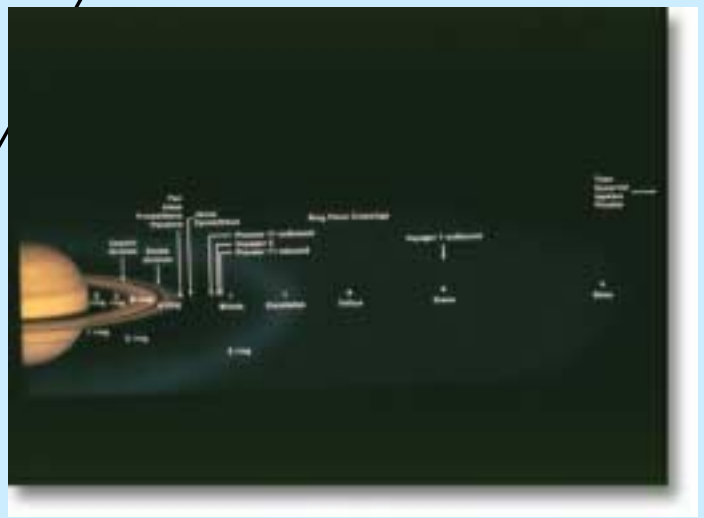
Saturn's "Road Map"

The order of the rings and moons, starting with the closest to Saturn, is:

Saturn
D-Ring
C-Ring
B-Ring
Cassini Division
A-Ring
Encke Division
Pan
Atlas
Prometheus
Pandora
F-Ring

Epimetheus
Janus
G-Ring
Mimas
E-Ring
Enceladus
Tethys
Telesto
Calypso
Dione
Helene
Rhea

Titan
Hyperion
Iapetus
Phoebe
New Satellites

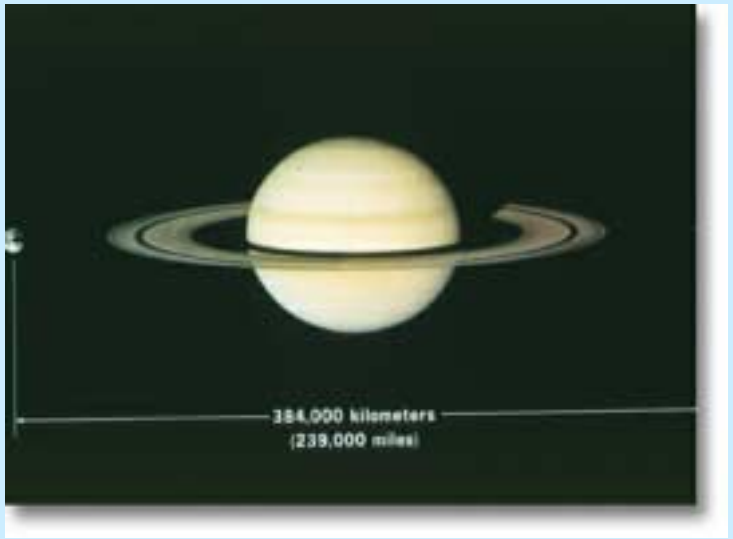


Saturn Compared to Earth-Moon System

If you placed Saturn and the main rings (excluding the diffuse E-Ring) between the Earth and the Moon, Saturn would barely fit!

Earth-Moon distance 384,000 km (239,000 miles)
Saturn and ring system diameter = 170,000 km (106,250 miles)

Ring system here does not include the E-ring.



Saturn's Atmosphere

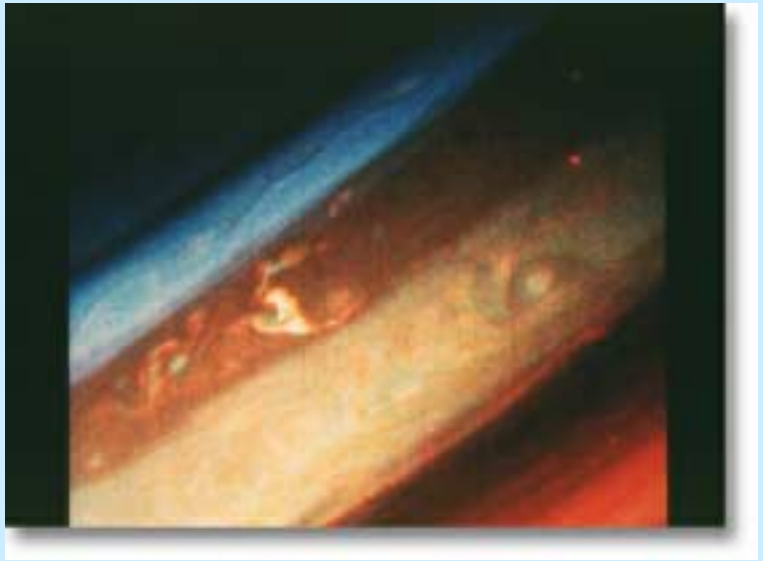
Saturn's primary atmospheric contents are:

Hydrogen (94%)
Helium (6%)

In addition, there are traces of ammonia, methane, ethane, phosphine, acetylene, methylacetylene, and propane.

Did you know?
What makes those colorful golden bands in Saturn's upper atmosphere?

---Ammonia ice crystals



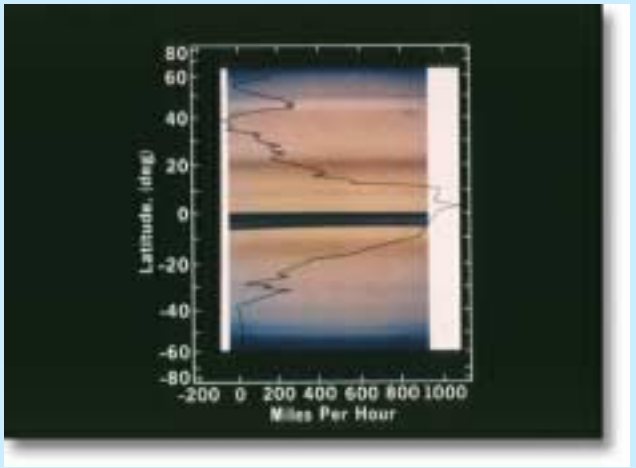
Saturn's Wild Winds

Saturn has the second fastest measured winds in the Solar System.
Only Neptune has faster winds.

Wind speeds at similar latitudes north and south of the equator are nearly the same.

Equatorial Speeds: blow to the East at 500 meters/second (1,100 miles per hour)

How fast is that?



•A jet airplane travels at an average speed of 550 miles per hour.
•The strongest hurricane (cyclone) winds top out at about 220 miles per hour.
•A tsunami travels along the open water at 550 miles per hour.
•The speed of sound is 660 miles per hour at 30,000 feet.

Who was Cassini?

French Italian Astronomer: Giovanni Domenico Cassini (1625-1712) changed his name to Jean Dominique Cassini when he moved to Paris.

Cassini was a member of the Royal Academy of Sciences in Paris, France.

Important discoveries:

Cassini originally gained fame by determining the rotation periods of Jupiter and Mars. Cassini was a meticulous observer and his dutiful technique allowed him to discover 4 of Saturn's moons - Iapetus, Rhea, Dione, and Tethys.

Cassini also discovered the large gap in Saturn's rings which now bears his name (The Cassini Division).

The Huygens Connection

The atmospheric probe that will go to Titan is named “Huygens.”

Dutch Astronomer Christiaan Huygens (1629-1695)

Christiaan Huygens discovered Titan and was the first person to understand Saturn’s rings.

Huygens was a member of the Royal Academy of Sciences in Paris, France.

He was also a leader in the fields of optics and mechanics.

Christiaan Huygens invented the pendulum clock which was the first accurate timekeeping device.

Cassini's Partners

Cassini is managed for NASA by the Jet Propulsion Laboratory in Pasadena, California. In addition, Cassini is supported by academic and industrial partners in 33 US states and 16 European Nations.

The Huygens Probe is managed by the European Space Agency.

Cassini Spacecraft

Spacecraft has 12 science instruments and 12 engineering subsystems while the Huygens Probe carries and additional 6 science instruments.

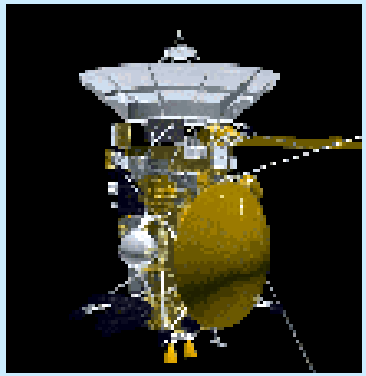
Spacecraft Orientation:

+X-axis = remote sensing pallet
(note that primary remote sensing boresights view in the direction of the -Y-axis).

+Y-axis = Magnetometer Boom

+Z-axis = main engine assembly
(note that the High Gain Antenna points in -Z-axis).

Cassini Spacecraft



Cassini is a very large spacecraft!

Total spacecraft mass at launch (including propellant) = 5586 kg (12,220 lbs)
Propellant mass at launch = 3132 kg (6890 lbs)
Spacecraft height = 6.87 meters (22.3 feet)
High Gain Antenna Diameter = 4 meters (13.1 feet)
Magnetometer Boom Extension = 11 meters (36 feet)
Data Storage Capacity (on-board) = 4 Gbits
Electrical power at launch = 875 watts
Main Engine thrust capability = 445 Newtons (100 pounds of force)
Number of Science Instruments = 12

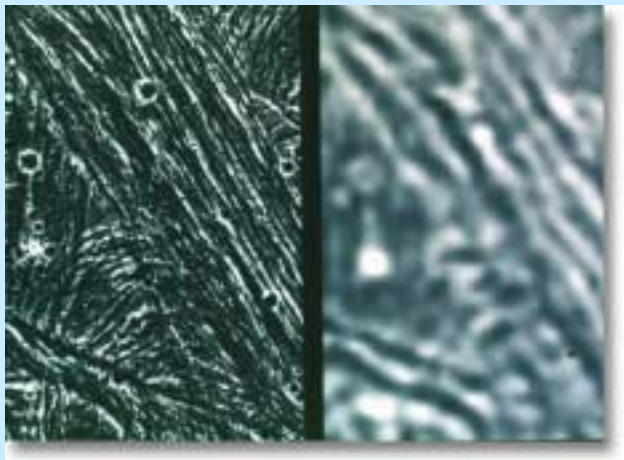
Data Quality Comparison

The cameras on-board Cassini have a much higher resolution than those on the Voyager spacecraft.

As a comparison look at the difference between the Voyager cameras and those flown on the Galileo spacecraft.

Resolution of Voyager Image = 1.3 kilometers (0.8 miles) per pixel
Resolution of Galileo Image = 74 meters (243 feet) per pixel
(more than 17 times better than Voyager image)

Cassini's cameras will provide even better resolution than the Galileo cameras.

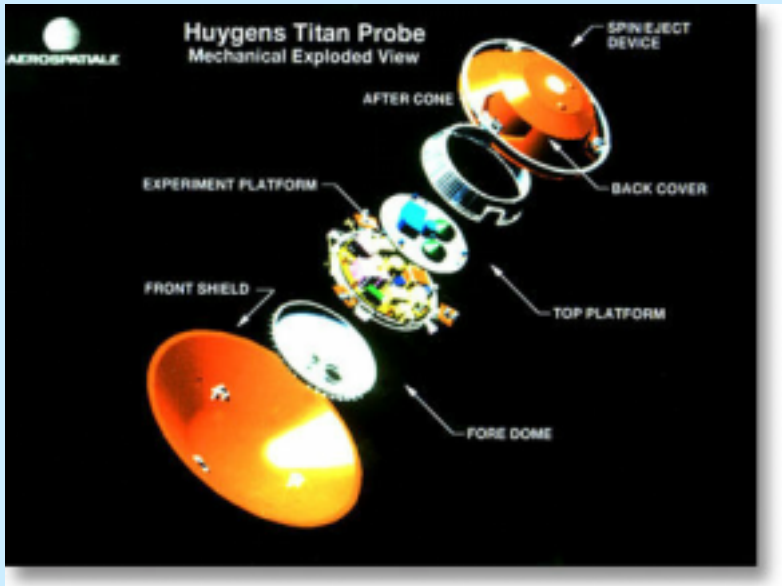


Huygens Probe

The Huygens Probe will perform a parachute-assisted landing on Titan. The probe has a heat shield, parachute package, engineering equipment including batteries, and six scientific instruments to collect data at Titan.

Mass = 350 kg (770 lbs)
Power = 250 Watts
Diameter of Probe's heat shield = 2.7 meters (8.9 feet)
Number of Science Instruments = 6

Probe Mission Day = 14 January 2005
Probe Mission Duration = 2.5 hours



Why such a short mission?

The environment on Titan's surface is very cold (temperatures on the surface average 95° Kelvin (-178 C, -288° F) and the batteries are not expected to last longer than a couple of hours in those conditions.

Also, the probe will use the Cassini Orbiter as a relay station back to Earth. All the science data Huygens collects will be transmitted directly to Cassini. Once the Cassini Orbiter dips below Huygens' horizon, the probe and the orbiter will no longer be able to communicate with each other. By the time the orbiter returns to Titan, many months will have passed and the probe's systems will be frozen.

Huygens Descent Profile

As the probe enters Titan's atmosphere and slows, a small parachute is released which deploys the main probe parachute. Once the parachute is fully open the decelerator shield is jettisoned and the probe drifts toward Titan's surface. About 40 kilometers (24.86 miles) above the surface the main chute is jettisoned and a smaller drogue chute carries the probe the remaining distance.

Descent time = 2.5 hours
Impact Speed = 15 miles per hour
Surface collection time = 30 minutes

Cassini's Launch Vehicle

Cassini was lifted into orbit using a Titan IVB launch vehicle.

The Titan IVB comprises two large, high-thrust solid rocket motors and two stages of hypergolic (burn on contact) liquid propellant rockets. The additional Centaur upper stage uses cryogenic (super-cold) liquid hydrogen and liquid oxygen propellants.

Height of assembled launch vehicle = 183 feet
As a comparison, when the space shuttle with its external tank is standing on the launch pad, it is almost as tall as the Titan IVB. The Apollo/Saturn V rocket series was twice as tall.

Lift Capacity = 5,770 kilograms (12,700 pounds). This is approximately the same weight as a school bus.

Sending Cassini to Saturn

Liftoff occurred at 4:43 am Eastern Time on 15 October 1997.

Launch Location = Cape Canaveral Air Force Station in Florida.

Did you know?
The total launch mass (including the Titan IVB, Cassini, and the launch propellant was 1 million kilograms (2.2 million pounds).

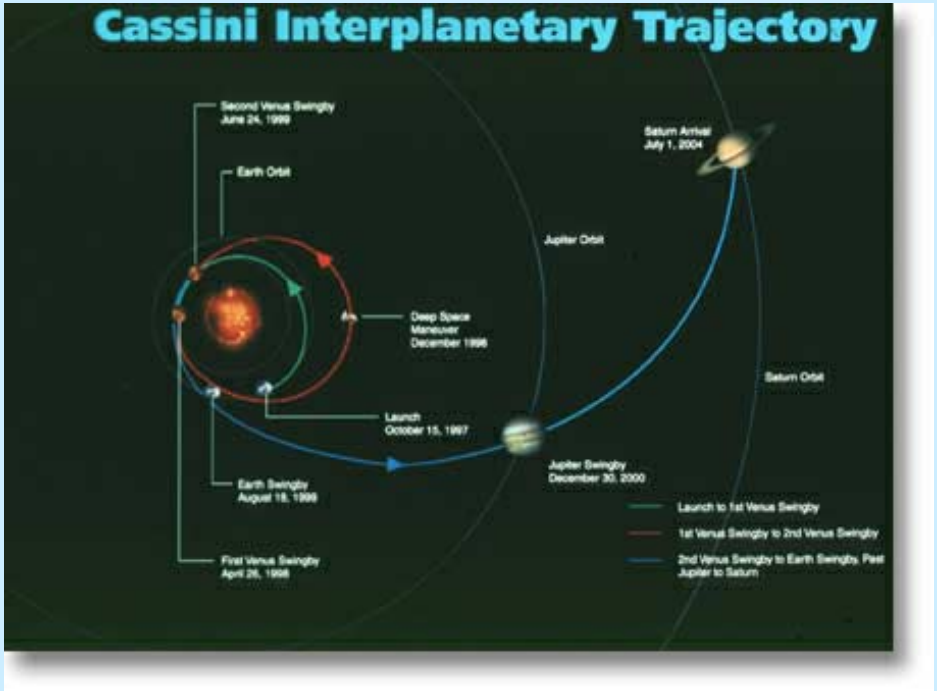
Getting to Saturn

Cassini is much to heavy to go directly from Earth to Saturn. To minimize the fuel required to reach Saturn, Cassini uses the concept of gravity assist.

Gravity assist is a process where Cassini uses the gravity of another planet to give it a push in velocity.

On its way to Saturn, Cassini flew by Venus (2), Earth, and Jupiter.

This is known as a Venus-Venus-Earth-Jupiter Gravity Assist (VVEJGA).



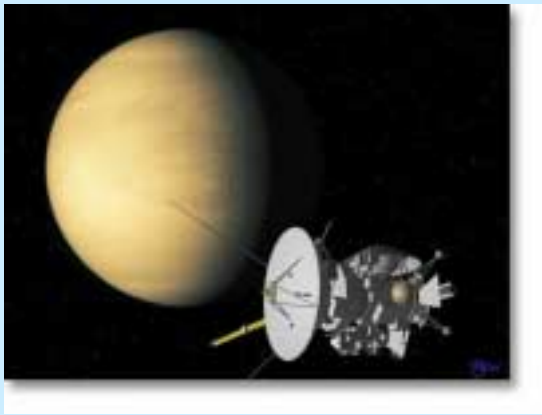
Cassini's Flyby Dates

Venus = 26 April 1998 - altitude 337 km (210 miles)

Venus = 24 June 1999 - altitude 598 km (374 miles)

Earth = 18 August 1999 - altitude 1166 km (725 miles)

Jupiter = 30 December 2000 - altitude 9,721,846 km (6,076,154 miles)



Earth’s Moon

Cassini flew past the Earth and Moon on 18 August 1999.

The spacecraft’s closest approach to the Earth was 1166 kilometers (725 miles) which occurred at 03:28 UTC.

Io Close-Up

Jupiter's moon Io floats above the planet's cloud tops in this image captured by the Cassini spacecraft's Imaging Science Subsystem on the dawn of the new millennium, January 1, 2001, two days after Cassini's close approach to Jupiter.

Did you know?

There is room for two and one-half Jupiters between Io and Jupiter's cloud tops.

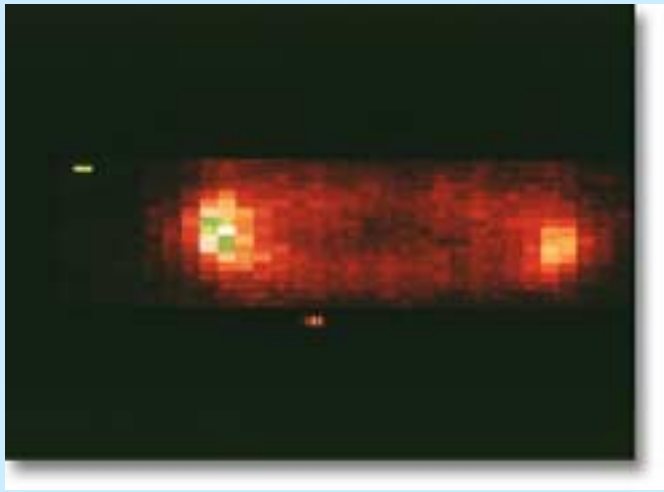
Io is approximately the size of Earth's Moon.

Io and Jupiter

This image of Jupiter with Io in the foreground was taken on December 12, 2000. This image was taken at a distance of 19.5 million kilometers (12.1 million miles) from Jupiter.

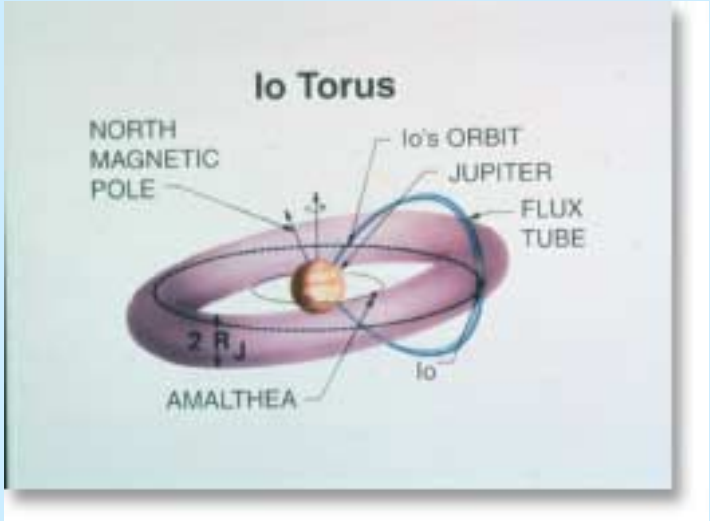
Gas Ring Around Jupiter

A doughnut-shaped ring of gas surrounding Jupiter is made visible in this Image captured in extreme ultraviolet wavelengths by the Cassini spacecraft. The ring called the Io torus, draws its raw material from gases spewed by Volcanoes on Io.



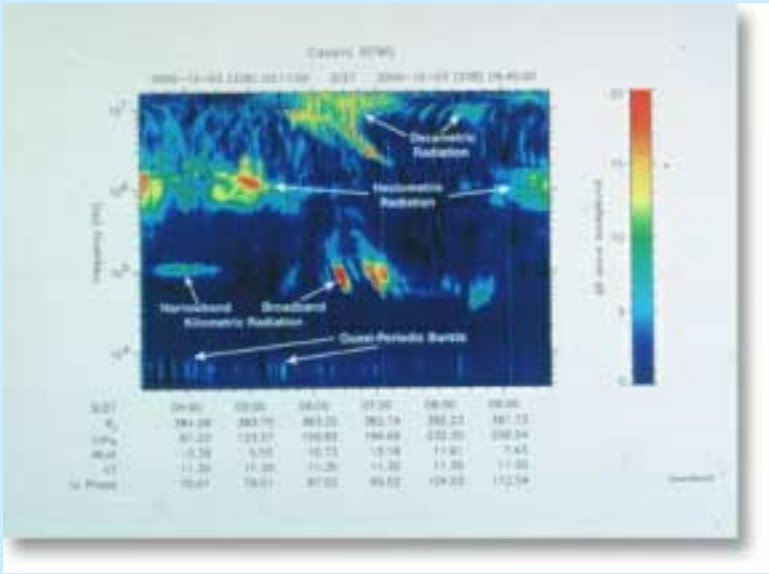
Io Torus

Io is volcanically active because tides are raised within it by the gravity of Europa and massive Jupiter. These movements are so enormous that they continually heat and melt the interior. The gases released in eruptions are ionized by interaction with Jupiter's radiation belt, creating a trail of "ionized exhaust." This trail is called a "torus."



Radio Emissions at Jupiter

These data were collected over a 6.5 hour time period on December 3, 2000. The Cassini Spacecraft was at a distance of just over 27 million kilometers.



Cassini Science Targets

Cassini's 5 groups of science objectives at Saturn are:

Saturn - the planet and its atmosphere
Saturn's Rings
Titan - landing site for the Huygens Probe
Saturn's 29 known "Icy Satellites"
Magnetosphere

Saturn Science Objectives

Saturn Science Objectives:

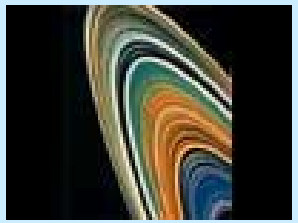
a) Determine the temperature field, cloud properties, and composition Saturn's atmosphere.
b) Measure the global wind field, including wave and eddy components; observe synoptic cloud features and processes.
c) Infer the internal structure and rotation of the deep atmosphere.
d) Study the diurnal variations and magnetic control of the ionosphere of Saturn.
e) Provide observational constraints (gas composition, isotope ratios, heat flux) on scenarios for the formation and the evolution of Saturn.
f) Investigate the sources and the morphology of Saturn lightning (Saturn Electrostatic Discharges and lightning whistlers).

Rings Science Objectives

Rings Science Objectives:

a) Study the configuration of rings and dynamical processes (gravitational, viscous, erosional, and electromagnetic) responsible for ring structure.
b) Map composition and size distribution of ring material.
c) Investigate interrelation of rings and satellites, including imbedded satellites.
d) Determine dust and meteoroid distribution in the vicinity of the rings.
e) Study interactions between the rings and Saturn's magnetosphere, ionosphere, and atmosphere.

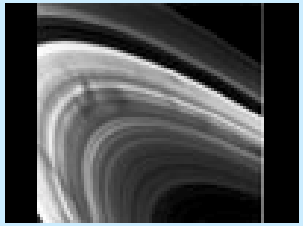
Enhanced Color of Rings



False color images of Saturn's rings show different colors that illustrate some of the possible variations in the chemical composition in the ring system.

How big are those ring particles?
Typical ring particle sizes range from micrometers (roughly the size of cigarette smoke) to tens of meters and larger.

Ring Spokes



Spokes were originally discovered when the Voyager spacecraft flew past Saturn in the early 1980s.

Spokes form at a distance from Saturn where the rotational speed of the ring particles matches that of the planet's magnetic field lines. Further studies of spokes link their formation to regions on Saturn associated with intense long-wavelength radio emissions.

Spokes appear rapidly as the ring rotates toward the dawn terminator and then diffuse gradually near the dusk terminator.

They are composed of micrometer sized particles.

Titan

Titan has a thick atmosphere that is primarily composed of Nitrogen.

Nitrogen ~ 95%
Methane ~ 5%
traces of hydrocarbons and hydrogen cyanide

Distance from Saturn = 1,222,000 km (759,478 miles)
Orbital Period = 15.94 days
Diameter = 5150 km (3200 miles) - 40% the diameter of Earth
Surface Temperature = 95° Kelvin (-178° C, -288° F)

Did you know?
Titan has a larger diameter than Mercury or Pluto.

How big is Titan?

Earth, Mars, Venus, and Mercury in comparison to Titan, Earth's Moon, and the Galilean Satellites.

Diameter of each body in the image:
Mercury = 4,880 km (3,033 miles)
Venus = 12,100 km (7,520 miles)
Earth = 12,756 km (7,928 miles)
Mars = 6,788 km (4,219 miles)
Titan = 5,150 km (3,200 miles)
Ganymede = 5,280 km (3,282 miles)
Io = 3,640 km (2,262 miles)
Europa = 3,000 km (1,865 miles)
Callisto = 5,000 km (3,108 miles)

Titan Science Objectives

Titan Science Objectives:

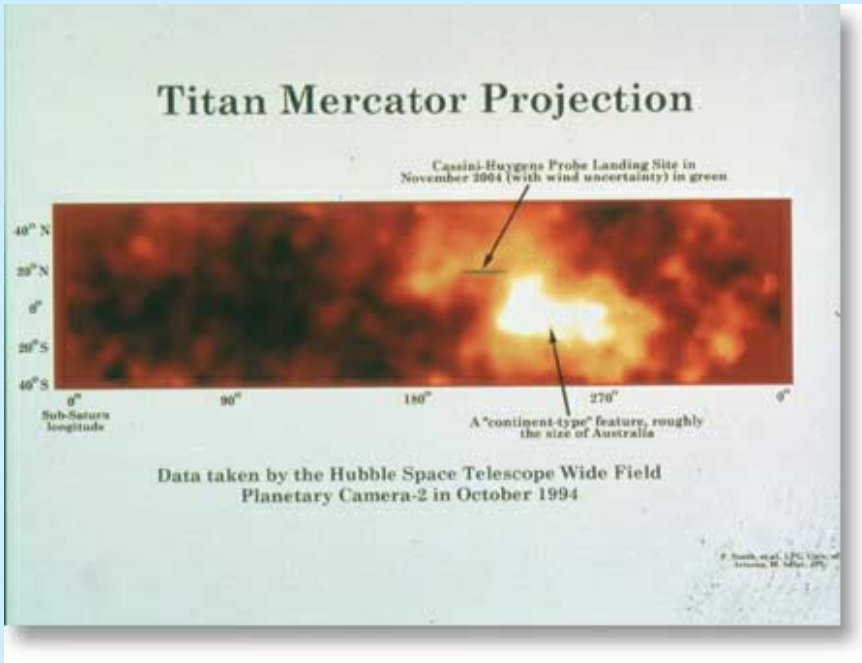
a) Determine the abundance of atmospheric constituents (including any noble gases), establish isotope ratios for abundant elements, constrain scenarios of formation and evolution of Titan and its atmosphere.
b) Observe vertical and horizontal distributions of trace gases, search for more complex organic molecules, investigate energy sources for atmospheric chemistry, model the photochemistry of the stratosphere, study formation and composition of aerosols.
c) Measure winds and global temperatures; investigate cloud physics, general circulation, and seasonal effects in Titan's atmosphere; search for lightning discharges.

Titan's Surface

In 1994, the WF-PC2 on the Hubble Space Telescope provided the first glimpse below Titan's cloud layer. A large white area approximately the size of Australia was seen in the Hubble image. Because the region rotates at the same rate as Titan, it is believed that the large white region is a surface feature.

The Huygens probe will land is a region close to the large continental mass.

Did you know?
Titan's surface could be partially covered with lakes of liquid hydrocarbons.



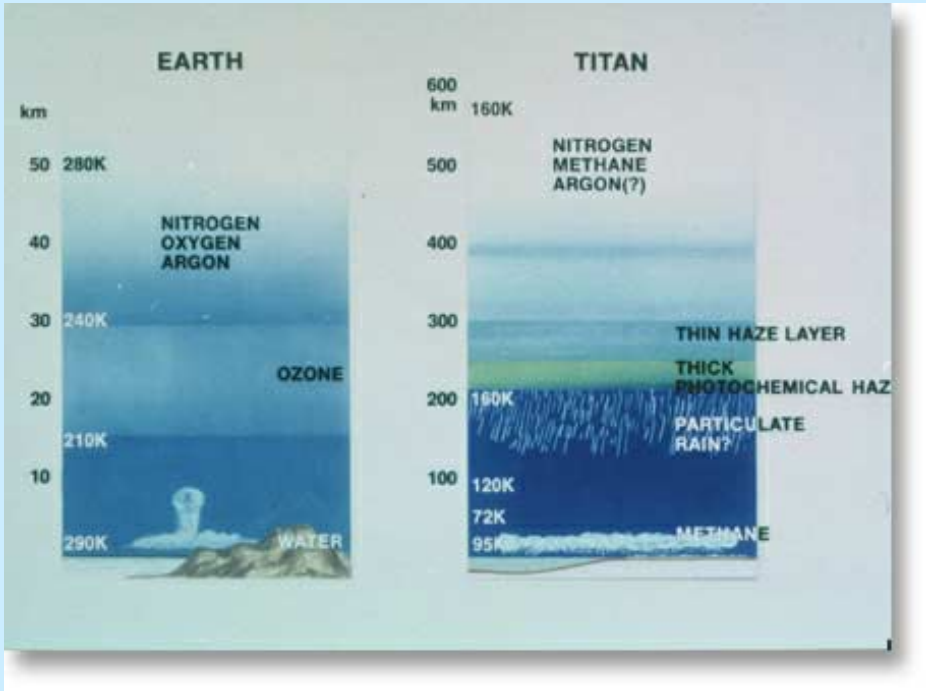
Titan vs. Earth Atmosphere

While Titan is only 40% the diameter as Earth, Titan's atmosphere extends 10 times higher than Earth's atmosphere.

Titan's atmosphere is composed primarily of nitrogen (90-97%) and methane (2-10%).

Earth's atmosphere is composed primarily of nitrogen (78%) and oxygen (21%).

Note that a commercial jet flies at an altitude of approximately 30,000 feet (5.7 miles or 9.14 km)

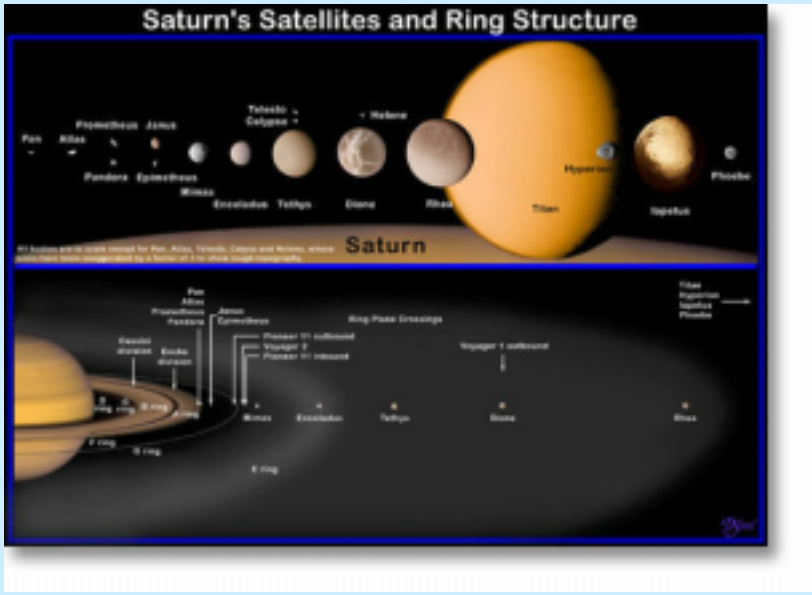


Icy Satellites

Saturn has 29 known “icy satellites” that are named after figures in Greek and Roman mythology.

The orbital mechanics of Saturn’s satellites are very complex. Some are embedded in rings, some are co-orbital (two satellites sharing the same orbital distance from Saturn), some are shepherd satellites, and some are Lagrangian satellites.

Did you know?
All but 2 of Saturn’s satellites rotate synchronously (they always show the same face toward Saturn just like Earth’s Moon does).

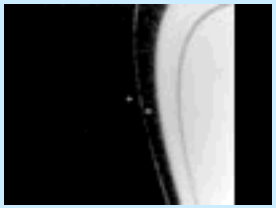


Icy Satellite Objectives

Icy Satellites Objectives:

a) Determine the general characteristics and geological histories of the satellites.
b) Define the mechanisms of crustal and surface modifications, both external and internal.
c) Investigate the compositions and distributions of surface materials, particularly dark, organic rich materials and low melting point condensed volatiles.
d) Constrain models of the satellites' bulk compositions and internal structures.
e) Investigate interactions with the magnetosphere and ring systems and possible gas injections into the magnetosphere.

Shepherd Satellites



Shepherd satellites are believed to play a key role in defining the edges of Saturn's A-ring and F-ring. Atlas lies several hundred kilometers from the outer edge of the A-ring. Prometheus and Pandora orbit on opposite sides of the F-ring. It is believed that Prometheus and Pandora constrain the width of the F-ring and may cause the ring's kinky appearance.

The Shepherd Satellites are: Atlas, Prometheus, and Pandora.

Lagrangian Satellites

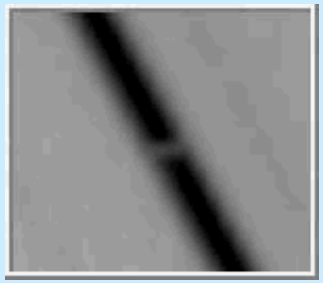
Lagrangian satellites orbit in the Lagrangian points of larger satellites. These are locations within an object's orbit in which a less massive body can move in an identical, stable orbit.

Lagrangian points lie 60° in front of or behind the larger satellite.

Which are the Lagranian satellites of Saturn?

- Helene is the Lagrangian satellite to Dione
- Calypso and Telesto and Lagrangian satellites of Tethys

Pan



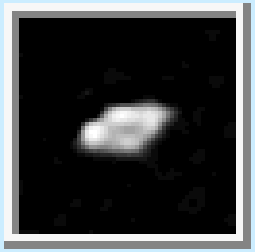
Name Origin: Pan was the Greek god of nature and the forest. He was a creature resembling a man with the hind legs and hooves of a goat.

Physical Data:
Diameter (irregular shape)= 20 km
Distance from Saturn = 134,000 km (83,750 miles)
Mass = unknown

Discovered by: Mark Showalter (1990)

Did you know?
Pan orbits within the A-Ring and helps to clear the Encke Gap in the A-Ring.

Atlas (AT-less)



Name Origin: The son of Iapetus. After the defeat of the Titans, Zeus ordered Atlas to uphold the vault of the sky.

Physical Data:
Diameter (irregular shape)= 37 km x 34.4 km x 26.4 km
Distance from Saturn = 138,000 km (86,250 miles)
Mass = unknown

Discovered by: Richard Terrile and the Voyager team (1980).

Atlas is one of the Lagrangian satellites.

Did you know?
Atlas helps to confine particles at the outer edge of the A-Ring.

Prometheus (pro-MEE-thee-us)

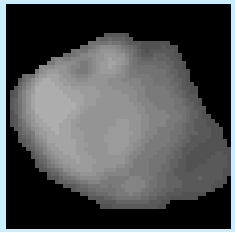
Name Origin: Son of Iapetus.

Physical Data:
Diameter (irregular shape)= 148 km x 100 km x 68 km
Distance from Saturn = 139,000 km (86,875 miles)
Mass = 3.69×10^{17} kg (5.05×10^{-6} times our moon's size)

Discovered by: Stewart Collins and the Voyager team (1980).

Prometheus is one of the shepherd satellites

Pandora



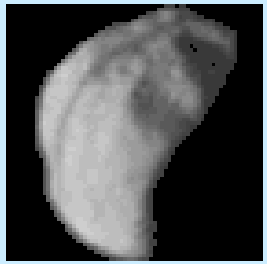
Name Origin: Pandora means “many gifts.” Pandora was a work of art who was transformed into a human by the gods.

Physical Data:
Diameter (irregular shape)= 110 km x 88 km x 62 km
Distance from Saturn = 142,000 km (88,750 miles)
Mass = 3.01×10^{17} kg (4.11×10^{-6} times our moon’s size)

Discovered by: Stewart Collins and the Voyager team (1980).

Pandora is one of the shepherd satellites.

Epimetheus



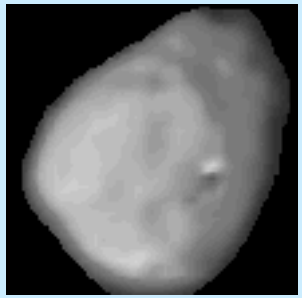
Name Origin: brother of Prometheus, husband of Pandora. Epimetheus was a Titan and one of the three original judges of dead souls.

Physical Data:
Diameter (irregular shape)= 138 km x 110 km x 110 km
Distance from Saturn = 151,000 km (94,375 miles)
Mass = 7.67×10^{17} kg (1.05×10^{-5} times our moon's size)

Discovered by: telescope observation (1966).

Did you know?
Epimetheus and Janus move in almost identical orbits at about two and a half Saturn radii. They are called "co-orbital" satellites.

Janus



Name Origin: An exalted Roman god and a figure of great antiquity and obscure origin. Always represented as having 2 faces (one looking forward and one looking backwards), Janus presided over the past, present, and future, over gates, doorways, entrances, and beginnings in general, and over war and peace.

Physical Data:
Diameter (irregular shape)= 194 km x 190 km x 154 km
Distance from Saturn = 151,000 km (94,375 miles)
Mass = 2.75 x 10^{18} kg (3.76 x 10^{-5} times our moon's size)

Discovered by: Telescope observation (1966)

Did you know?
Because Epimetheus orbits slightly faster than Janus, Epimetheus overtakes Janus in their orbit once every four years.

Mimas (MY-muss)

Name Origin: A Giant killed by the god Hephaestus and transformed into a rock hill.

Physical Data:
Diameter (irregular shape)= 418.2 km x 392.4 km x 382.8 km
Distance from Saturn = 186,000 km (116,250 miles)
Mass = 5.18×10^{19} kg (7.10×10^{-4} times our moon's size)

Discovered by: William Herschel (1789)

Did you know?
Mimas has an enormous crater on one side that nearly split the satellite apart.

Enceladus (n-SELL-uh-dus)

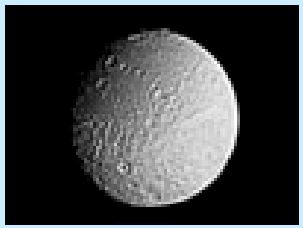
Name Origin: a giant and son of the Titans. Enceladus means “battle cry.”

Physical Data:
Diameter (irregular in shape) = 512.6 km x 494.4 km x 489.2 km (~310 miles)
Distance from Saturn = 238,000 km (148,750 miles)
Mass = 1.15×10^{20} kg (1.57×10^{-3} times our moon’s size)

Discovered by: William Herschel (1789)

Did you know?
Enceladus is very bright and may re-supply the E-ring with material through water eruptions.

Tethys (TEE-this)



Name Origin: wife of the powerful Titan Oceanus who ruled the seas before Poseidon. Tethys was the mother of all sea nymphs and of all rivers on Earth.

Physical Data:
Diameter (irregular shape)= 1071 km x 1056 km x 1051 km
Distance from Saturn = 295,000 km (184,375 miles)
Mass = 1.03×10^{21} kg (1.41×10^{-2} times our moon's size)

Discovered by: Jean Dominique Cassini (1684)

Did you know?
Tethys has two "lagrangian" moons: Telesto and Calypso.

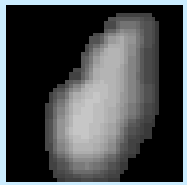
Telesto (tel-LESS-toe)

Name Origin: A muse whose specialty has been forgotten (muses were minor goddesses that represented human activities such as music or medicine).

Physical Data:
Diameter (irregular shape)= 30 km x 25 km x 15 km
Distance from Saturn = 295,000 km (184,375 miles)
Mass = unknown

Discovered by: Brad Smith, Steve Larson, and Harold Reitsema (1980).

Calypso (kuh-LIP-soh)



Name Origin: A nymph whose name means “I hide.” Calypso lived alone on an island until she fell in love with the mortal sailor and explorer Odysseus.

Physical Data:
Diameter (irregular shape)= 30 km x 16 km x 16 km
Distance from Saturn = 295,000 km (184,375 miles)
Mass = unknown

Discovered by: Don Pascu (1980)

Dione (die-OH-nee)

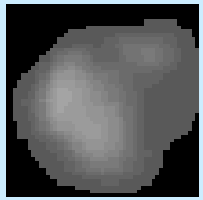
Name Origin: An ocean nymph, mother of the goddess Aphrodite.

Physical Data:
Diameter = 1120 km (696 miles)
Distance from Saturn = 377,000 km (234,625 miles)
Mass = 1.43 x 1021 kg (1.96 x 10-2 times our moon's size)

Discovered by: Jean Dominique Cassini (1684)

Did you know?
Dione shares and orbit with Helene.

Helene (huh-LEE-nee)

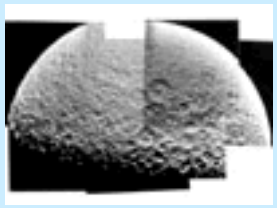


Name Origin: An Indo-European Earth goddess who, with her twin sister Clytemnestra, had been hatched from an egg. Helene's twin brothers are the Gemini twins Castor and Pollux.

Physical Data:
Diameter (irregular shape)= 35 km
Distance from Saturn = 378,000 km (236,250 miles)
Mass = unknown

Discovered by: Pierre Laques and Jean Lecacheux (1980).

Rhea (REE-uh)



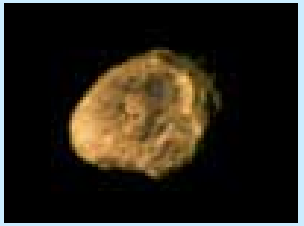
Name Origin: Wiife of Kronos and mother of the Olympian gods Zeus, Poseidon, Hades, and the goddesses Demeter, Hera, and Hestia.

Physical Data:
Diameter = 1528 km (950 miles)
Distance from Saturn = 527,000 km (329,375 miles)
Mass = 3.39 x 1021 kg (4.65 x 10-2 times our moon's size)

Discovered by: Jean Dominique Cassini (1672)

Did you know?
At 1528 km in diameter, Rhea is the second largest satellite of Saturn.

Hyperion (high-PEER-ee-on)



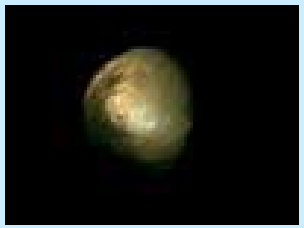
Name Origin: A Titan, father of of the pre-Olympian god Helios (the Sun), the goddess Selene (the Moon), and the goddess Eos.

Physical Data:
Diameter (irregular shape) = 350 km x 280 km x 225 km
Distance from Saturn = 1,481,000 km (925,625 miles)
Mass = 2.42 x 10^{19} kg (3.31 x 10^{-4} times our moon's size)

Discovered by: William Bond, George Bond, and William Lassell (1848).

Did you know?
Hyperion has an odd shape (like a hamburger patty) and rotates chaotically due to the gravitational influence of Titan.

Iapetus (eye-AP-eh-tuss)



Name Origin: One of the Titans and father of Atlas, Epimetheus, Prometheus, and Menoetius.

Physical Data:
Diameter = 1436 km (892 miles)
Distance from Saturn = 3,561,000 km (2,225,625 miles)
Mass = 2.56×10^{21} kg (3.51×10^{-2} times our moon's size)

Discovered by: Jean Dominique Cassini (1671)

Did you know?
Iapetus' leading face is only 1/6 as bright as its trailing face.

Phoebe (FEE-bee)

Name Origin: Phoebe was the youthful goddess of Earth's Moon, forests, wild animals, and hunting.

Physical Data:
Diameter (irregular shape)= 230 km x 220 km x 210 km
Distance from Saturn = 12,561,000 km (7,850,625 miles)
Mass = 5.46×10^{18} kg (7.48×10^{-5} times our moon's size)

Discovered by: William Pickering (1898).

Did you know?
Phoebe is possibly a captured asteroid, with a 550-day retrograde orbit and a 9-hour rotation period.

Saturn's "New" Satellites

New telescopic capabilities and more sophisticated observing techniques have led to a flurry of new moon discoveries throughout the solar system. Saturn is no exception. In the past few years, 12 new moons have been discovered orbiting the ringed planet. This brings the current total to 30.

To keep current on the different attributes of these new discoveries, watch the Cassini Mission web site, astronomy sites, or print publications on the subject.

Did you know?

Saturn is the current leader in the "moon race" at 30. Its neighbor Jupiter ranks second with 28 moons.

Saturn's Magnetosphere

Magnetic fields such as those of Earth and Saturn are approximated by a dipole (a simple structure with a north and south pole like a bar magnet).

There is no measurable off-set between the magnetic dipole and Saturn's rotation axes. This is unique in the Solar System (by comparison, Earth's Magnetic field is off-set from the rotation axis by 11.4°).

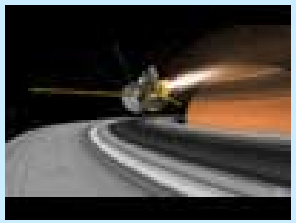
What is a magnetosphere?
Saturn generates a magnetic field that shields the planet, its rings, and moons from the solar wind. This shield is called a "magnetosphere."

Magnetospheres Objectives

Magnetospheres Objectives:

a) Determine the configuration of the nearly axially symmetric magnetic field and its relation to the modulation of Saturn Kilometric Radiation (SKR)
b) Determine current systems, composition, sources, and sinks of magnetospheric charged particles
c) Investigate wave-particle interactions and dynamics of the day-side magnetosphere and the magnetotail of Saturn and their interactions with the solar wind, the satellites, and the rings.

Arrival at Saturn



In order to slow the spacecraft sufficiently to allow it to be “captured” by Saturn’s gravity, Cassini’s main engine must burn for 90 minutes. This maneuver, called Saturn Orbit Insertion or SOI, is also the time when the spacecraft comes closest to the rings.

Saturn Orbit Insertion will occur on 1 July 2004.

Cassini will pass through the gap between Saturn’s F-Ring and G-Ring.

Closest Distance during SOI = 60,330 km

Initial Orbit

Following the SOI burn, Cassini will make a large orbit through the Saturn system. This first orbit will last 148 days.

This long initial orbit will set up the geometry for the first encounter with Titan and the Huygens Probe mission.

The Probe will be released on 25 December 2004 and will arrive at Titan on 14 January 2005.

Touring the Saturn System

Cassini will spend four years in orbit around Saturn.

During the four years, the spacecraft will make approximately 74 orbits of Saturn, using Titan turn Cassini's orbit.

Orbits will range in length from 7 to 155 days.

Cassini's orbital distance from Saturn will range from 156,858 km to 953,214 km and the spacecraft's orbit will change from equatorial to inclined at approximately 70°.

Cassini will make 43 flybys of Titan during the tour.