





*On October 15, 1997, the Cassini–Huygens spacecraft was launched on an almost 7-year journey to the Saturn system. On its way, Cassini–Huygens passes Venus (twice), Earth, and Jupiter — arriving at the Saturn system on July 1, 2004. On arrival, the Huygens probe will be released from the Cassini orbiter and will descend to the surface of Saturn’s largest moon, Titan, on November 27, 2004. During the Huygens probe mission, data about Titan’s atmosphere, winds, and surface conditions will be collected. These data will be sent back to Earth using the Cassini orbiter’s high-gain antenna as a relay. The Cassini orbiter will orbit Saturn for 4 years. The spacecraft’s 12 onboard instruments will collect data about Saturn, the rings, the magnetosphere, Titan, and Saturn’s smaller moons.*

*The Cassini–Huygens mission is managed for the National Aeronautics and Space Administration (NASA) by the Jet Propulsion Laboratory (JPL) of the California Institute of Technology. The European Space Agency, the Italian Space Agency (Agenzia Spaziale Italiana), and many European and American academic and industrial partners have teamed with NASA to make the Cassini–Huygens mission a reality.*

*The Cassini orbiter stands 2 stories tall; at launch, it weighed 5,300 kilograms (11,594 pounds). Over half of the orbiter’s mass is propellant. The Huygens probe, built by ESA, is 2.7 meters (8.86 feet) in diameter and weighs approximately 350 kilograms (766 pounds).*

### The Cassini–Huygens Spacecraft: A Special Robot

Cassini–Huygens is a robotic spacecraft: that means that Cassini–Huygens is controlled by people on Earth. The spacecraft consists of many different components that work together to keep Cassini–Huygens functioning. Take a tour of the Cassini–Huygens spacecraft and see how all of these different components work.

Computers on board process commands sent from Earth. These commands tell the spacecraft what to do; whether it is burning fuel to change the speed of the spacecraft, triggering the camera to get a good image of Saturn, sending data that have been stored on the solid-state recorder back to Earth, or any other spacecraft activity.

In order to send commands between the onboard computers to Earth, the spacecraft needs a set of ears. Cassini–Huygens has three ears, all in the form of antennas. The primary antenna, or ear, is the large high-gain antenna, which measures 4 meters (13.1 feet) in diameter. In addition, Cassini–Huygens is equipped with two low-gain antennas, which serve as secondary communication ears. One low-gain antenna is mounted in the center of the high-gain antenna and the second one is located near the Huygens probe. The spacecraft’s 12 science instruments serve as the eyes, ears, nose, tongue, and hands of the spacecraft, providing Cassini–Huygens with the ability to sense the surrounding environment. The spacecraft will need food, or energy, to power the multitude

of electronics. This food is supplied by three radioisotope thermoelectric generators. To make the many maneuvers necessary to tour the Saturn system, Cassini–Huygens is equipped with two sets of legs. The main engine serves as the “walking legs,” providing the endurance and strength necessary to make the long journey from Earth to Saturn. Cassini–Huygens also has a set of “dancing legs” in the form of orientation thrusters. These small thrusters are used to point instruments at different targets and to aim the antenna toward Earth.

Finally, the Huygens probe is like a baby to Cassini–Huygens. The probe is attached to the spacecraft during the long journey to Titan. Upon arrival, the probe will be separated from the spacecraft and it will make a solo journey through the atmosphere of Titan. The Huygens probe is built with a computer (brain), instruments (senses), radio (mouth), parachutes (wings), and heat shield (shell — like a hermit crab). Just like a human body, all of the spacecraft’s components are supported by a skeletal structure.

Building a robotic spacecraft that will travel hundreds of millions of miles to its destination takes careful planning. Spacecraft designers need to carefully assess all the objectives of the mission and then choose the electrical and mechanical systems that will be necessary to achieve those mission goals. The Cassini–Huygens spacecraft contains components that are typical of those required on a spacecraft.

Components on a spacecraft like Cassini–Huygens often have an analogy with the human body. Besides the legs, hands, brains, eyes, ears, child, skeleton, and food detailed in this illustration, are there any other senses or human parts that Cassini–Huygens should have? Can Cassini–Huygens smell? If so, how? Now take a look at the Huygens probe. What “body parts” does the Huygens probe have that are similar to human body parts? What “parts” doesn’t it have?

### EDUCATIONAL ACTIVITY

#### Building a Model Spacecraft

To build a model of Cassini–Huygens, go to the Cassini website at <http://www.jpl.nasa.gov/cassini>. All you have to do is click on the section marked “Products” and scroll down to the section on the models. You may also obtain a model by sending your request to:

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