



National Aeronautics and  
Space Administration  
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Pasadena, California

## Cassini-Huygens Launch





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).

### Cassini Launched from Canaveral

The Cassini–Huygens spacecraft was launched from Cape Canaveral Air Station in Florida at 4:43 a.m. Eastern Daylight Time (1:43 a.m. Pacific Daylight Time) on October 15, 1997, aboard a Titan IVB with a solid rocket motor upgrade. The Titan IVB with a Centaur upper stage launched the spacecraft into a low-Earth orbit, where the Centaur upper stage gave Cassini–Huygens a second push out of Earth orbit towards Venus.

Cassini–Huygens will spend 6 years and 9 months in transit between Earth and Saturn.

The Titan IVB is made up of two large, high-thrust solid rocket motors and two stages of liquid propellant rockets. The Centaur upper stage uses cryogenic (super-cold) liquid hydrogen and liquid oxygen as propellants.

Once assembled, the Titan IVB/Centaur rocket stands 55.7 meters (183 feet) tall. That’s about as tall as a 20-story building. When the space shuttle is standing on the launch pad, the rocket is almost the same height, while the Apollo/Saturn V rocket was twice as tall. This launch system develops up to 15 million newtons (3.4 million pounds) of thrust. At launch, the system holds 0.9 million kilograms (2 million pounds) of propellant, and it weighs 1 million

kilograms (2.2 million pounds). The Titan IVB/Centaur is capable of placing 5,770 kilograms (12,700 pounds) into a geostationary orbit. That’s like putting into orbit something that weighs about as much as a school bus.

### EDUCATIONAL ACTIVITY

#### Launch Your Own Rocket!

During launch, a rocket makes use of Newton’s Third Law of motion, which states that every action has an equal and opposite reaction. A rocket can launch only when it expels gas out of its engine. The rocket pushes on the gas and the gas pushes on the rocket. A good demonstration of Newton’s Third Law can be made with a balloon. Fill a balloon with air and hold the end closed with your fingers. The balloon stays still in your hand. But if you let go of the end, the movement of the air out of the balloon (the action) causes the balloon to move (the reaction). The air pressure is the same everywhere on the inside wall of the balloon, except along the diameter between the open end and the “front” end. Because the pressure is not the same along the diameter — it’s *unbalanced* — air is forced out the end of the balloon, while the unbalanced pressure at the “front” end of the balloon sends it in the opposite direction.

Now, you can build your own rocket and launch it!

What will you need?

- An effervescent (bubbling) antacid, or a children’s drink tablet that you can get at any drugstore or market.
- Tap water.
- An empty film canister — not the ordinary black and gray kind, because the cap seals around the outside of those. You want the kind that has a cap that sits inside the top of the canister. Ask at a camera store for empties.

Place the effervescent tablet in the canister. Fill the canister halfway with tap water. Quickly seal the lid onto the canister and place it, top down, on the sidewalk. Stand back! The canister becomes an instant rocket. (Be sure to wear eye protection, and never point the canister at anyone!)

**Why does the canister launch itself?** The reason the canister launches itself is that as the tablet effervesces (bubbles up), the air (gas) pressure increases. And once the pressure is high enough, the canister lid can no longer hold the gas in. Although the sidewalk prevents the lid from going down, there is nothing keeping the canister from going up. The gas pushes out toward the ground and propels the canister skyward. The action of the gas expulsion *downward* generates a reaction of the canister *upward*.