

APPRECIATE THAT SCIENCE IS A WAY OF EXPLAINING THE WORLD AND THAT SCIENCE KNOWLEDGE CHANGES OVER TIME. IDENTIFY WAYS IN WHICH SCIENTISTS WORK TOGETHER AND PROVIDE EVIDENCE TO SUPPORT THEIR IDEAS.

STARDOME OBSERVATORY & PLANETARIUM FACTS, RESOURCES AND ACTIVITIES ON...

CASSINI-HUYGENS SPACECRAFT

GETTING TO SATURN

In this resource and activity, we introduce the students to an important spacecraft that is soon to end its mission in a spectacular way.

Cassini-Huygens is a robotic spacecraft studying Saturn and its moons. The spacecraft has two main elements: Cassini, an orbiter developed by NASA, and Huygens, a lander developed by the ESA. Launched in 1997, Cassini is designed to orbit around Saturn, and the Huygens probe to be dropped through the atmosphere of Titan, Saturn's largest moon.

Due to Saturn's distance from the Sun, it is not feasible to use solar panels to power Cassini. Instead, the Cassini orbiter is powered by the radioactive decay of plutonium-238, the heat from which is used to generate electricity. Using plutonium for power created a lot of controversy at the time of launch but despite the protests concerning the safety of such a spacecraft, Cassini launched without a hitch.

On the way to Saturn Cassini performed two gravity assists, one at Venus, and the other flying past Earth. This shot Cassini past the Asteroid Belt and into the outer Solar System with speeds reaching 19km per second.

Even though Cassini arrived at Saturn in 2004 and will stay until 2017, it still won't see Saturn complete even half an orbit around the Sun.

In July 2004, Cassini arrived at Saturn via a very tricky path through a gap between Saturn's rings. Since Saturn's distance from Earth is vast, signals from Cassini take over an hour to reach us. This meant that Cassini maneuvered through the particles

independently from human instruction. Cassini managed it without a scratch!

The Huygens probe was designed to collect and transmit information from its descent into Titan's atmosphere for 30 minutes, but it continued to transmit data for three times longer.

In April 2008, Cassini received additional funding to run through to September 2010 on what was called the Cassini Equinox Mission. Cassini could orbit Saturn and its moons an additional 60 times, and observe the changes in the seasons. This mission extension was considered so scientifically interesting that in 2010 the Cassini mission entered its second extension called the Cassini Solstice Mission. Cassini will continue to operate until May 2017.

Several plans of how to end the mission were considered, including letting the spacecraft crash into an icy satellite, visiting one of the other gas giants, or setting up a stable orbit around either Titan or Phoebe. In the end it was decided that Cassini would make a controlled descent into Saturn's atmosphere - a controlled crash landing! This exciting end means Cassini may be able to collect more data from the innermost ring of Saturn. It is an exciting end to this epic mission.

DISCUSSION POINTS

What are some options for powering a spacecraft when solar energy just won't cut it?

What causes seasons to change on Saturn?

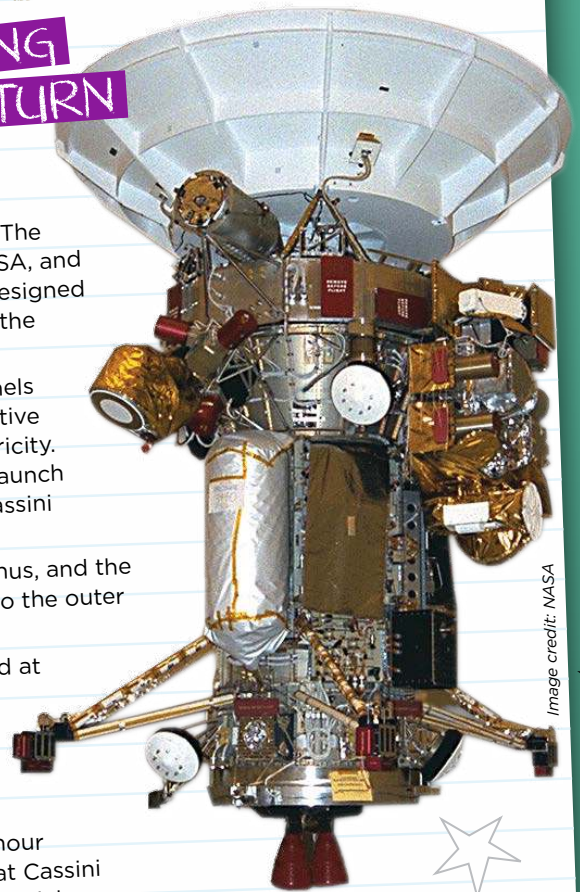


Image credit: NASA

Check out these other resources...

- ➡ The Cassini Solstice Mission - <http://saturn.jpl.nasa.gov/index.cfm>
- ➡ ESA's Cassini-Huygens page - http://www.esa.int/Our_Activities/Space_Science/Cassini-Huygens



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FACTS, RESOURCES AND ACTIVITIES ON...

CASSINI-HUYGENS SPACECRAFT

THE DISCOVERIES

In this worksheet, you'll learn more out the discoveries made by the Cassini-Huygens spacecraft.

On its way to Saturn, when Cassini passed Jupiter it collected a large amount of information about its cloud belts and made significant discoveries about Jupiter's atmosphere.

While maneuvering through the rings of Saturn it gathered massive amounts of data leading to many new discoveries including a giant hurricane at Saturn's south pole, as well as the discovery of several previously unknown moons.

On a closer examination of the images of Saturn's moon Phoebe, large quantities of water ice were found to exist underneath its relatively thin, dark surface made up in part by carbon dioxide. This comet-like composition has led scientists to believe that Phoebe might be an icy planetoid from the Kuiper Belt that got captured by Saturn's gravity.



Hyperion is the largest non-spherical moon of Saturn. If it were larger it would have enough gravity to pull itself into the sphere shape like our Moon. Image credit: NASA

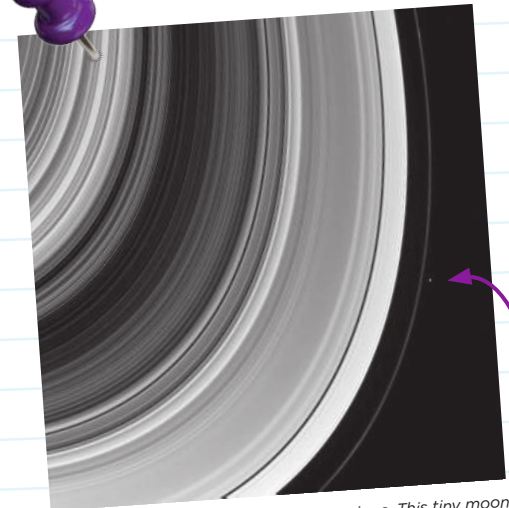
In 2014 a new moon was discovered forming out of one of Saturn's rings. This gives credence to the idea that Saturn's rings once stretched out much further, but gravity slowly collapsed the rings into moons.

When it was launched, the ESA were unsure if the Huygens probe would land in an ocean or dry land, so both possibilities were taken into account. It ended up landing on a dry, rocky orange surface, with indications of chunks of water ice scattered in its surroundings. On its descent it revealed that Titan's surface is covered by lakes and rivers of liquid

hydrocarbons. There are also trace amounts of at least a dozen other organic compounds in Titan's upper atmosphere that get destroyed by sunlight. The result is similar to the smog found over large cities but much thicker. In many ways, this is similar to the conditions on Earth early in its history when life was first getting started.

This year marks the 10th anniversary of Huygens probe descending through Titan's atmosphere to a successful landing, making it the first and so far only spacecraft to land on an object in the outer Solar System.

Even though Cassini's mission is due to end, the way in which it will end will also provide further information on the gas giant and its rings.



Pandora - the shepherd of the rings. This tiny moon sculpts the outer most ring and keeps it from spreading. Image credit: NASA

DISCUSSION POINTS

Saturn's moons have unusual names - Phoebe, Janus, Skathi and Tarvos are just some of them. If you discovered a new moon, what would you name it?

What would NASA need to consider if the Huygens probe might land on water or dry land?



ACTIVITY

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CREATING CASSINI

This activity sheet is split into age groups
- Primary, Intermediate and Secondary.
Have a look at the exercises below and
pick which best suits your class group.

PRIMARY/INTERMEDIATE

In groups, ask the students to design their own space probe to explore Saturn and its moons. They'll need to establish what they want to discover at the moons and plan accordingly. Each group will need to research and account for the weather conditions, how their spacecraft will be powered and how it's going to achieve its mission command.

Once each group has a plan, ask the students to sketch a design with at least two instruments that will measure different things e.g. a thermometer and an anemometer. The sketch should have the different instruments and parts of the probe labelled. Most importantly, the spacecraft will need a name!

Another part of planning a mission is creating a mission badge. Take a look at these examples and ask the groups to make up their own. Each group should present their spacecraft design to the class. They could create posters, models, fact sheets and design descriptions.

INTERMEDIATE/SECONDARY

This activity comes straight from NASA. Print out enough copies of the worksheet for each student and construct a model of Cassini. You'll need a sharp pair of scissors and glue or sticky tape to stick the different part together.

NASA WORKSHEET - <http://saturn.jpl.nasa.gov/kids/models/pprmdl.pdf>



Image credit: NASA

Check out
more mission
badges here...

http://history.nasa.gov/shuttle_patches.htm



Take a photo of your activity and
send it to us. We'd love to see it!
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