

Cassini's Grand Finale

After almost 20 years in space, NASA's Cassini spacecraft embarked on the last chapter of its remarkable story of exploration this past spring.

On April 26, Cassini began its Grand Finale with the first of 22 planned dives between Saturn and its rings. The final orbits brought the spacecraft closer to Saturn than ever before, providing stunning high-resolution images and new insights into the planet's interior structure and the origins of the rings.

No other mission has ever explored this unique region, and what scientists have learned and will learn from these final orbits will help to improve our understanding of how giant planets—and planetary systems everywhere—form and evolve.

During its final orbit on September 15 (while this issue of *Caltech* magazine was at the printer), Cassini was set to plunge into Saturn's atmosphere, sending back science data to Earth for as long as its thrusters could keep its antennas pointed at Earth. After losing contact, the spacecraft would burn up and disintegrate like a meteor, becoming part of the planet itself.

For more on Cassini, go to saturn.jpl.nasa.gov

Launched in 1997, Cassini has orbited Saturn since arriving there in 2004. During the past 13 years, the spacecraft has made many dramatic discoveries, including a global ocean within the moon Enceladus and liquid-methane seas on another moon, Titan. Cassini's mission was brought to a close because the spacecraft was running low on the rocket fuel used for adjusting its course. If left unchecked, there was a risk that it could collide with Saturn's moons and possibly contaminate future studies of habitability.

During the ring dives—where the spacecraft's speed surpassed 75,000 miles per hour—Cassini collected a host of valuable information that was too risky to obtain earlier in the mission. "The data we are seeing from Cassini's Grand Finale are every bit as exciting as we hoped, although we are still deep in the process of working out what they are telling us about Saturn and its rings," said JPL's Linda Spilker, the project scientist on Cassini, in July.

As of press time, Cassini has:

- Made detailed maps of Saturn's gravity and magnetic fields, revealing how the planet is arranged internally and possibly helping to solve the irksome mystery of just how fast Saturn is rotating
- Collected data showing that Saturn's magnetic field is surprisingly well-aligned with the planet's rotation axis, with a tilt of less than 0.06 degrees—much smaller than scientists had previously estimated
- Obtained the first-ever samples of the planet's atmosphere and main rings
- Returned extraordinary high-resolution views of Saturn's rings and the planet itself. Close-up views of Saturn's C ring—which features mysterious bright bands called plateaus—reveal that the plateaus have a streaky texture, whereas adjacent regions appear clumpy. Ring scientists believe the new level of detail may shed light on why the plateaus are there and what is different about the particles in them.

By the time you read this article, Cassini will be no more but will undoubtedly have yielded more insights into Saturn's rings ... and perhaps revealed a few surprises. For more on Cassini's last days, visit magazine.caltech.edu/post/cassini-finale.

The Cassini mission is a cooperative project of NASA, the European Space Agency, and the Italian Space Agency. NASA's JPL, a division of Caltech, manages the mission for NASA's Science Mission Directorate. JPL designed, developed, and assembled the Cassini orbiter. 

Below, left: The north pole of Saturn surrounded by a swirl of clouds. Center: Enceladus' south-polar jets backlit by sunlight, the moon itself glowing in reflected Saturn-shine. Right: The northern hemisphere of Pan, a small moon of Saturn.

