



Cassini's Ring Grazing and Grand Finale Orbits: Topping Off an Awesome Mission

Scott Edgington (1), Linda Spilker (1), and Athena Coustenis (2)

(1) NASA/Jet Propulsion Laboratory, Pasadena, CA, 91109-8099, USA, (2) LESIA, Paris Observatory, Paris Science Letters, 92195 Meudon Cedex, France

The Cassini-Huygens mission, a joint collaboration between NASA, ESA, and the Italian Space Agency, is in its last year of operations after nearly 13 years in orbit around Saturn. Cassini will send back its final bits of unique data on September 15th, 2017 as it plunges into Saturn's atmosphere, vaporizing and satisfying planetary protection requirements.

Before that time Cassini will continue its legacy of exploration and discovery in 2017 and return unique science data provided by orbits taking the spacecraft into unexplored regions near Saturn and its rings. From the new vantage points, Cassini will continue to study seasonal and temporal changes in the system as northern summer solstice approaches. With the exception of one remaining targeted Titan flyby, all of Cassini's close icy satellite flybys, including those of Enceladus, are now completed.

In November 2016, Cassini transitioned to a series of orbits with peripases just outside Saturn's F ring. These 20 orbits include close flybys of some tiny ring moons and excellent views of the F ring and Saturn's outer A ring. The 126th and final close flyby of Titan will propel Cassini across Saturn's main rings and into its Grand Finale series of orbits.

Cassini's Grand Finale, starting in April 2017, is comprised of 22 orbits at an inclination of 63 degrees. Cassini will repeatedly dive between Saturn's innermost rings and upper atmosphere providing insights into fundamental questions unattainable during the rest of the mission. Cassini will be the first spacecraft to explore this region.

These close orbits provide the highest resolution observations of both the rings and Saturn, and direct in-situ sampling of the ring particles, composition, plasma, Saturn's exosphere and the innermost radiation belts. Saturn's gravitational field will be measured to unprecedented accuracy, providing information on the interior structure of the planet, winds in the outer layers of Saturn's atmosphere, and the mass distribution in the rings. Probing the magnetic field will give insight into the nature of the magnetic dynamo, telling us: why the magnetic field is weak; why it exhibits little, if any, axial tilt; and the true rotation rate of the planet. The ion and neutral mass spectrometer will sniff the exosphere and upper atmosphere for molecules that escape the atmosphere itself and water-based molecules originating from the rings. The cosmic dust analyzer will sample the composition of particles from different parts of the main rings. Until the execution of these final orbits, the answers to such new questions will remain mysteries.

The science highlights of Cassini's Grand Finale orbits will be discussed.

This work was carried out in part at the Jet Propulsion Laboratory, California Institute of Technology, under contract with NASA. Copyright 2017 California Institute of Technology. Government sponsorship is acknowledged.