An Exciting Early Look

Even though *Cassini's* four-year mission has just begun, preliminary data are already revealing a complex world unlike any other in the solar system. In addition to leading the CAPS investigation, SwRI researchers are also active on the Imaging Science Subsystem (ISS), Composite Infrared Spectrometer (CIRS) and Ion and Neutral Mass Spectrometer (INMS) teams.

The ISS, led by the Space Science Institute, is designed to capture images in visible, infrared and ultraviolet light. *Cassini* researchers will use ISS to return hundreds of thousands of images of Saturn and its rings and moons. Many of these images are being released in natural color — that is, in colors that have not been enhanced.

Cassini flew by Saturn's moon Phoebe three weeks before it went into orbit around the planet. Phoebe is the first irregular (very distant) satellite of any planet ever seen close up.

The team obtained the highest resolution images of Saturn's rings and Titan ever taken, and some of those have revealed the unexpected. Researchers had speculated that Titan might have oceans or lakes composed of hydrocarbons, but the images taken so far have not shown any evidence that such oceans and lakes exist. Further studies of Titan over the next six months will provide a more definitive picture of the moon's landscape.

Researchers understand some parts of the rings, but not others. Saturn has several moons that orbit just outside the rings and produce waves in the outer part of the rings exactly where researchers expected them. Other parts of the rings have much structure and yet others are relatively featureless. The ISS team is working to understand these differences.

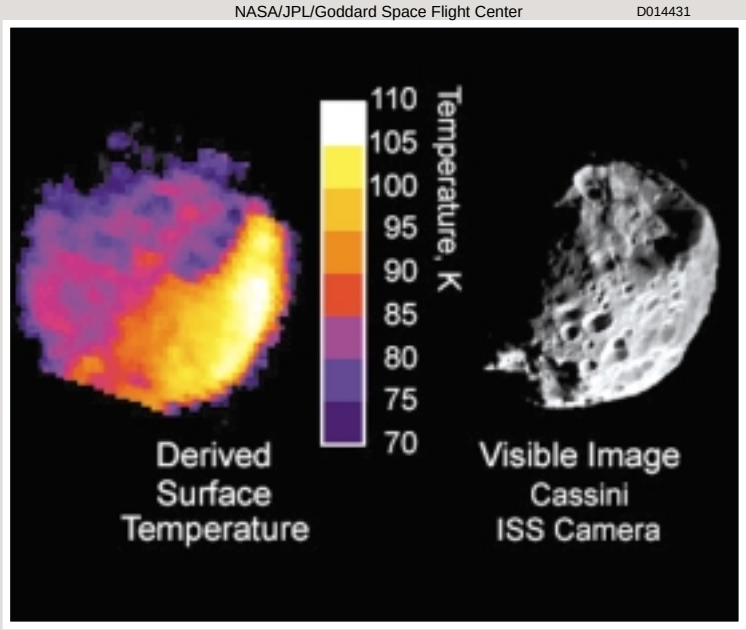
Because the nature of *Cassini's* orbits changes with time, the hundreds of thousands of images taken by the ISS cameras will show Saturn and its moons and rings in a variety of orientations. Some orbits will be roughly in the plane of Saturn's equator — useful for imaging the planet and its satellites. Other orbits will be at an angle to the equator, good for imaging the rings. Late in the tour, orbits that are almost polar will image the rings and Saturn's aurora.

Cassini will orbit Saturn 74 times in four years — more if the mission is extended. By the end of the tour, the spacecraft will orbit the planet once a week.

The CIRS instrument is designed to measure the infrared light from atmospheres, rings and surfaces in the Saturn system to learn about their temperature, thermal properties and composition. The NASA Goddard Space Flight Center built and manages the spectrometer.

CIRS has obtained unprecedented data on Phoebe and Titan, and on Saturn's rings. Phoebe data analysis has already given researchers their first detailed look at the temperature distribution across the surface of a small body in the outer solar system. Temperatures peaked at 107 degrees Kelvin (–267 degrees Fahrenheit) during the day and 75 degrees Kelvin (–324 degrees F) at night — which confirmed researchers' predictions. These temperature variations suggest the moon has a fluffy, porous surface that doesn't store heat well.

The CIRS team will continue to map surface temperatures on Saturn's major satellites, look for signs of internal heat on the possibly active moon Enceladus, analyze the composition of the atmospheres of Saturn and Titan and analyze the thermal radiation of the particles that make up Saturn's rings.



The Composite Infrared Spectrometer took this image of Phoebe on June 11. The left panel shows the distribution of surface temperatures, which varied from 107 degrees Kelvin (–267 degrees F) during the day to 75 degrees Kelvin (–324 degrees F) at night. The right panel shows Phoebe's extreme topography, which affects temperature distributions.

The University of Michigan leads the INMS investigation, which primarily focuses on investigating the atmosphere of Titan — the only moon in the solar system with a dense atmosphere.

For use with INMS ground operations, an SwRI team created a web-based application that is fairly new in the space science community. ION (INMS Operations Network) can be accessed from any web browser, and the data is stored in a high-end relational database. ION manages all aspects of communications with the instrument, including commands, telemetry, data analysis and charting, data system automation and much more.

SwRI staff members also assisted in the design of other *Cassini* web-database management systems, including the Cassini Activity Request System, the Cassini Information Management System (CIMS), the CAPS Ground Support System and the Science Opportunity Analyzer.

Storing instrument data in a relational database makes it easier for space scientists to query, combine, filter and order data in different ways for analysis. Because science instruments use the same general ground system design, the code also can be modified quickly and inexpensively for other missions; the Rosetta and New Horizons missions have benefited so far.

Already there are tens of thousands, if not hundreds of thousands, of requests for instrument time logged into CIMS. The SwRI team estimates the *Cassini* mission saved somewhere between 16 to 40 man-years, a savings of $3 to $7 million. The ION and CIMS systems received special recognition awards from NASA in 2003 and 2004.

The INMS team has gathered interesting data on the ring ionosphere, but is taking more time for analysis. INMS performs the first of more than 40 close passes of Titan in October. ❖

Comments about this article? Contact Dr. Henry C. "Luke" Dones (ISS) at (303) 546-6106 or luke@boulder.swri.edu, Dr. John R. Spencer (CIRS) at (303) 546-9674 or spencer@boulder.swri.edu and Robert L. Thorpe (ground mission management systems) at rob.thorpe@swri.org.