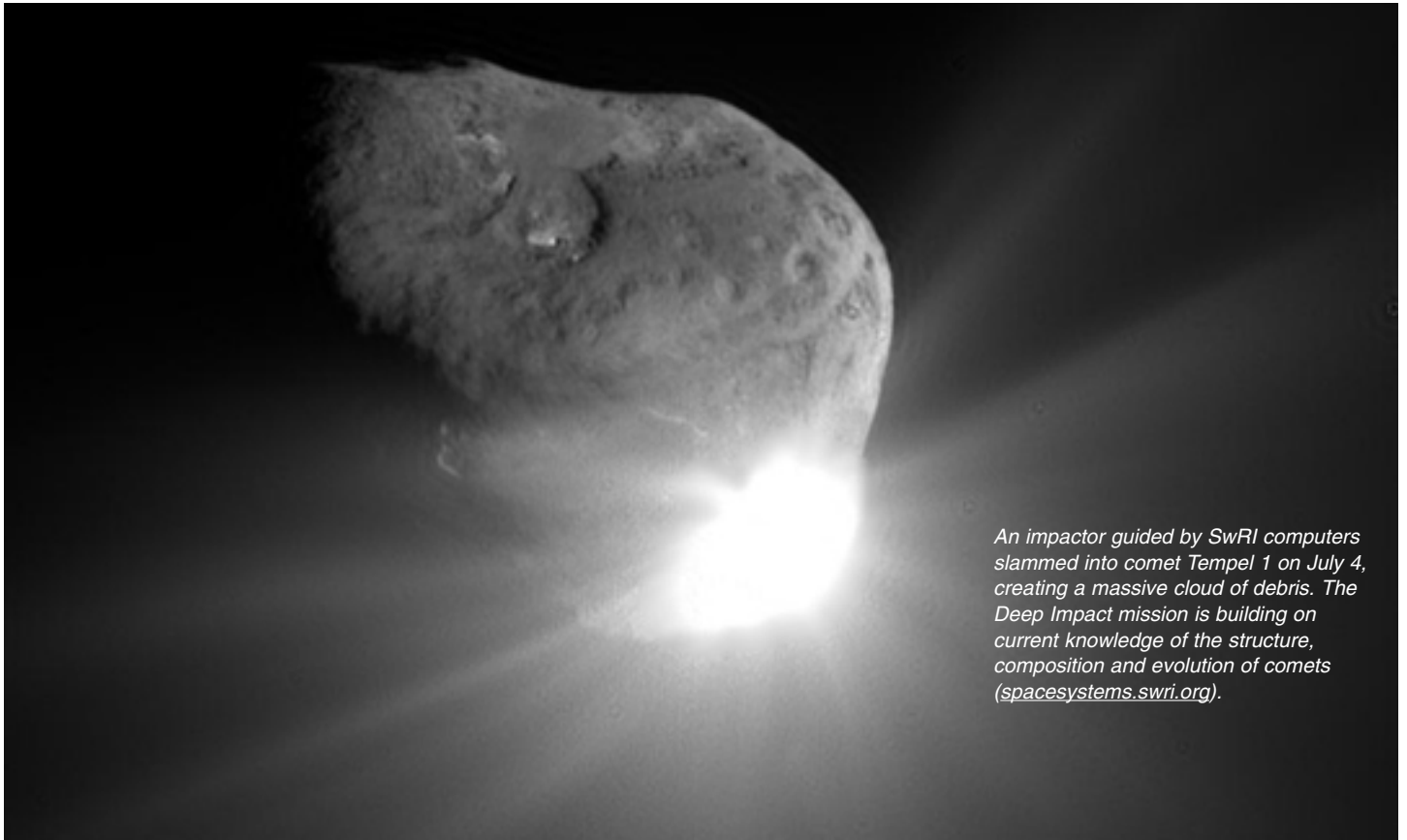


# Space Science & Engineering



*An impactor guided by SwRI computers slammed into comet Tempel 1 on July 4, creating a massive cloud of debris. The Deep Impact mission is building on current knowledge of the structure, composition and evolution of comets ([spacesystems.swri.org](http://spacesystems.swri.org)).*

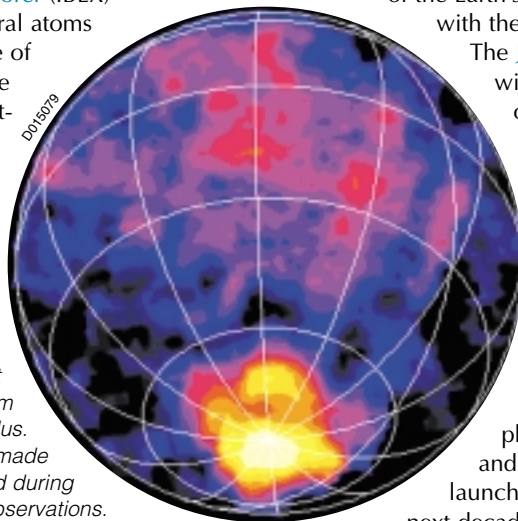
*Courtesy NASA/JPL/UMD*

Our world-class programs in solar and space physics and planetary science resulted in three missions proposed by Southwest Research Institute scientists being selected by NASA. The [Interstellar Boundary Explorer](#) (IBEX) will image energetic neutral atoms radiating in from the edge of the solar system where the solar wind is slowed, heated and compressed. This poorly understood region shields the solar

*Researchers at the Goddard Space Flight Center and SwRI found a dramatic warm spot thought to be a sign of internal heat (yellow) emanating from Saturn's icy moon Enceladus.*

*The Cassini spacecraft made the unexpected find during infrared radiation observations.*

*Courtesy NASA/JPL/GSFC*



system from dangerous galactic cosmic radiation. *IBEX* will launch in the summer of 2008. The [Magnetospheric Multiscale](#) (MMS) mission will examine the process of magnetic reconnection, which governs the interaction of the Earth's magnetic field with the solar wind.

The *Juno* mission will be the first to orbit over the poles of the gas giant Jupiter, performing an in-depth study of its internal structure, atmosphere and magnetosphere. Both *MMS* and *Juno* will launch early in the next decade.

Excitement builds as the New Horizons mission — the first to explore [Pluto, its moon Charon and possibly the Kuiper Belt](#) — comes to fruition. SwRI leads the science investigation for the spacecraft, which was assembled and tested this summer. Pending final approval, the craft will be launched from the Kennedy Space Center in January 2006.

Instrumentation for the Two Wide-angle Imaging Neutral-atom Spectrometers (TWINS) mission has been delivered, and the first of two satellites is awaiting launch to make the first stereo energetic neutral atom images of the [magnetosphere](#).

Under contract to Ball Aerospace, SwRI led the development of seven computer [avionics systems](#) that enabled the NASA Deep Impact Flyby and Impactor spacecraft to make their historic encounter with comet Tempel 1. SwRI engineers are currently building computers for NASA's Kepler, WISE and GLAST missions and DARPA's Orbital Express mission.

NASA technicians prepare the New Horizons spacecraft for testing at the Goddard Space Flight Center. SwRI leads the science investigation for the probe, which will examine Pluto and its moon Charon.



Courtesy JHU/APL

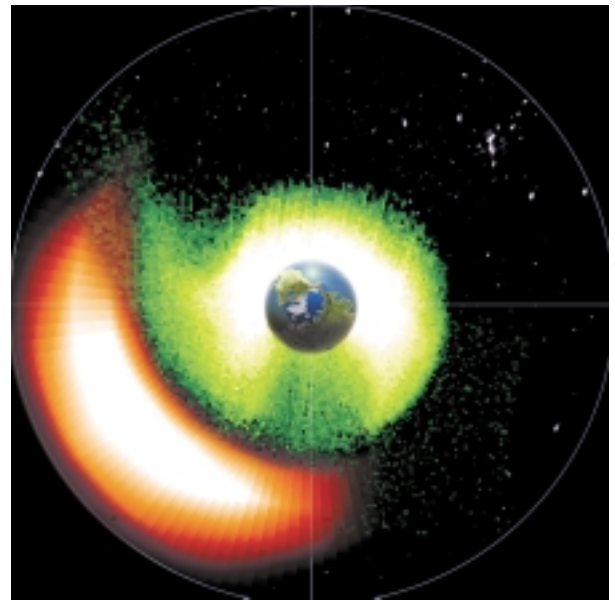
D015085

SwRI led an international team that developed a **plasma spectrometer** for the *Cassini* spacecraft's four-year voyage to Saturn and its rings and moons. Using spectrometer data, scientists determined that Saturn's magnetospheric plasma is composed largely of atomic and molecular ions produced from the rings and icy satellites.

NASA's successful **IMAGE** spacecraft, launched in 2000, continues to provide an unprecedented look at the way plasmas in the near-Earth space environment are linked to the ionosphere and to each other. SwRI researchers discovered that the Earth's plasmasphere severely erodes during large geomagnetic storms, allowing the outer Van Allen belt to move Earthward.

Two SwRI instruments have been selected for other NASA missions. The **Radiation Assessment Detector**, to fly onboard the Mars Science Laboratory, will characterize radiation at the surface of Mars to determine the hazards that astronauts could face one day. The **Lyman Alpha Mapping Project**, a compact ultraviolet mapping spectrometer, will fly on the Lunar Reconnaissance Orbiter mission to search for permafrost in permanently shadowed craters.

Using internal research funds, we developed an innovative technique for reliably measuring **minor ion species in space environments**. Our technique dials protons down to one-tenth of a percent without affecting the measurement of minor ion species such as oxygen.



D015084

Reproduced with permission of the AGU

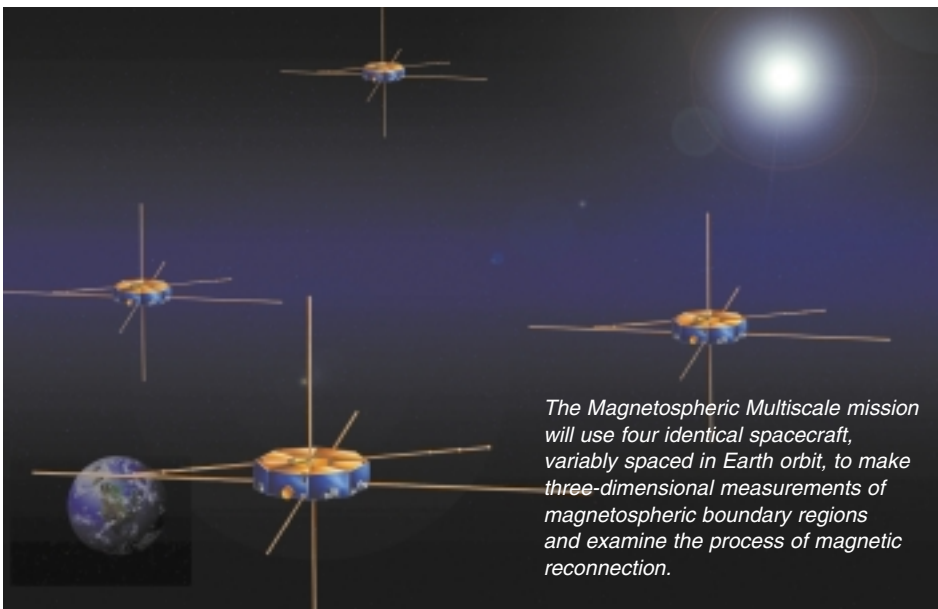
Studies using the **IMAGE** spacecraft have shown that the electromagnetic "ring current" that encircles the Earth in space is often short-circuited into the Earth's ionosphere, generating intense electric fields that cause fluctuations in the Earth's plasmasphere.

This technique is planned for use on the MMS mission.

Using computer simulations, SwRI scientists showed that Pluto and its moon Charon might have had a **giant impact** in their distant past. Models suggest that a large object collided obliquely with the growing planet, creating its satellite and leading to the pair's angular momentum. Other recent research shows that ultrasound waves detected in the solar atmosphere could be key diagnostics to the long-sought source of the high-temperature solar corona.

A team that included SwRI researchers proposed a model in which the outer planets underwent an orbital shakeup well after the planet formation process had ended. The new model accounts for properties of the planets' orbits and provides a source for impactors in the inner solar system believed to have created the **lunar impact basins**. ❖

Visit [spacescience.swri.org](http://spacescience.swri.org) for more information or contact Vice President Dr. James L. Burch at (210) 522-2526 or [jburch@swri.org](mailto:jburch@swri.org).



D015081

The **Magnetospheric Multiscale** mission will use four identical spacecraft, variably spaced in Earth orbit, to make three-dimensional measurements of magnetospheric boundary regions and examine the process of magnetic reconnection.