Space Science and Engineering

spacecraft instrument systems • theoretical & observational studies • space plasma physics • spacecraft computer development • spacecraft support systems & software • planetary science • solar & heliospheric physics • data analysis & science support • electromechanical systems design • stellar astronomy • spacecraft management • spacecraft avionics systems design • power systems design

The New Horizons spacecraft lifted off from the Kennedy Space Center in January 2006. SwRI leads the science mission to Pluto, Charon and the Kuiper Belt beyond.

Courtesy NASA

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In the pursuit of knowledge and the spirit of exploration, Southwest Research Institute is leading several NASA spacecraft missions on journeys to worlds beyond our own.

New Horizons successfully launched in January, beginning a decade-long voyage to Pluto, its moon Charon and on to the Kuiper Belt (www.pluto.jhuapl.edu). Its first major science investigation begins in February 2007 when the spacecraft rounds Jupiter for a gravity-assist that will slingshot the spacecraft toward its final destination.

Production of the flight hardware for the Interstellar Boundary Explorer mission continued for a mid-2008 launch (ibex.swri.org). A pair of energetic neutral atom cameras onboard the spacecraft will provide the first images of the interstellar boundary, the region between our solar system and interstellar space.

As the first spacecraft to orbit over the poles of the gas giant Jupiter, Juno will examine the planet's origin, atmosphere, internal structure and magnetosphere. Juno will be the first solar-powered spacecraft at Jupiter. SwRI leads the Juno mission and is also developing the Jovian Auroral Distributions Experiment and Juno Ultraviolet Spectrograph for the planned 2011 launch.

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The hot plasma composition analyzer, one of several instruments set to fly aboard the Magnetospheric Multiscale mission, measures intense fluxes of ions accelerated by reconnecting magnetic field lines in the Earth's magnetosphere. These fluxes tell scientists how much matter is accelerated and whether it originates in the solar wind or the Earth's ionosphere.

Courtesy Bate et al 2003 (Monthly Notices of RSA, vol. 341, pp. 213-229)

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Viewed from above, this model illustrates the inflow of gas to a jovian-mass planet as it forms. SwRI researchers determined that the presence of gas during the formation process results in a planet-to-satellite(s) mass ratio of 10,000:1, as observed in the gas planets of our solar system.

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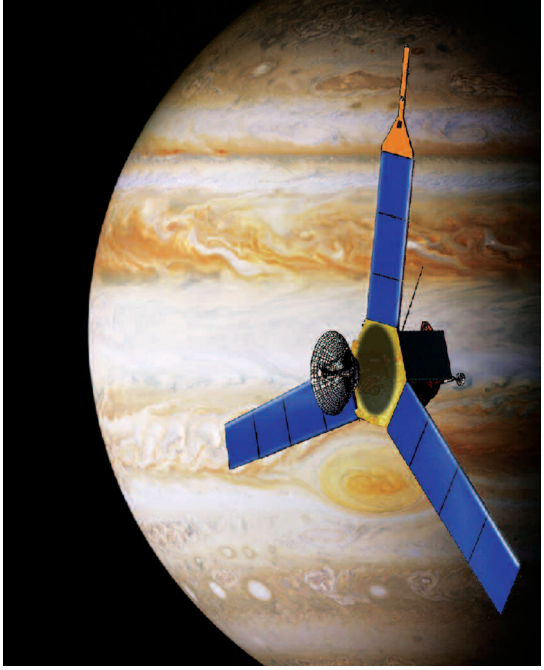
In cooperation with Los Alamos National Laboratory, SwRI is building the IBEX Hi instrument. Here, the engineering model is prepared for testing in an SwRI vacuum calibration chamber. SwRI leads the IBEX mission to study the interstellar boundary.



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An SwRI researcher is serving as the Juno principal investigator in the mission to study the origin, internal structure, atmosphere and magnetosphere of Jupiter. Our staff is also providing two science instruments.

The Magnetospheric Multiscale mission is moving into mission definition and confirmation reviews (mms.space.swri.edu). Designed to examine magnetic reconnection and other processes that occur around Earth, the mission will build on researchers' understanding of astrophysical and solar system plasmas. MMS is scheduled to launch in 2013.

In addition to managing large missions, SwRI provides scientific and avionics instrumentation for a variety of programs. A spectrometer developed by Los Alamos National Laboratory and SwRI as part of the dual-spacecraft Radiation Belt Storm Probes mission will study space weather phenomena in Earth's magnetosphere. We are developing computer and avionics systems for the forthcoming Wide-field Infrared Survey Explorer and Kepler missions, as well as several commercial satellites. Our avionics systems are performing command and data handling for the recently launched CALIPSO mission.

Internal funding helped develop a miniature time-of-flight mass spectrometer with an ultra-high resolution of 60,000. High molecular weight molecules, such as proteins, are currently measured with laboratory mass spectrometers weighing hundreds of pounds. Our compact, 20-pound unit identifies these molecules under field conditions and shows great promise for Earth-bound applications as well as space studies.

SwRI scientists continue to use observations, computer simulations and modeling to build on current knowledge about the solar system. In support of the New Horizons mission, SwRI astronomers worked with other institutions to discover that Pluto has two previously unseen moons, since named Nix and Hydra. Subsequent studies concluded that these moons were likely born in the same giant impact that gave birth to Pluto's larger moon, Charon.

An SwRI-led team discovered that the shape of the termination shock, the boundary at the edge of our solar system, affects the energization of anomalous cosmic rays in a way that solves the mystery of the lack of these highly energetic particles observed when the Voyager 1 spacecraft recently crossed this boundary. Other research explained why the masses of the outer gas planets, compared to the total masses of their satellites, have a constant ratio of roughly 10,000:1. The presence of gases, primarily hydrogen, during the formation of these satellites is believed to limit their growth and select for a common satellite system mass fraction. As part of an international team, staff members also showed that iron-meteorite parent bodies probably emerged from the same disk of planetary debris that produced the Earth and other inner solar system planets. ❖

Visit spacescience.swri.org for more information or contact Vice President Dr. James L. Burch at (210) 522-2526 or jim.burch@swri.org.

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Courtesy SMDC

The HiSentinel™ stratospheric airship, the first in a family of long-endurance airships, reached a historic altitude of 74,000 feet during a demonstration flight in November 2005. SwRI led the development team, which includes Aerostar International and the Air Force Research Laboratory.