Space Science and Engineering

Southwest Research Institute remains a recognized leader in space science as well as in the development of spacecraft *in-situ* and remote-sensing instrumentation, avionics and electronics for both government and industry.

SwRI is the principal investigator institution for the Interstellar Boundary Explorer (IBEX) mission, which successfully launched in October 2008. After several weeks of maneuvers to reach its final high-altitude Earth orbit, IBEX began imaging energetic neutral atoms produced at the edge of the solar system in a region that shields the inner solar system from the majority of the dangerous galactic cosmic radiation. Maps of this region will enable researchers to study the global interactions between the solar wind and the interstellar medium for the first time.

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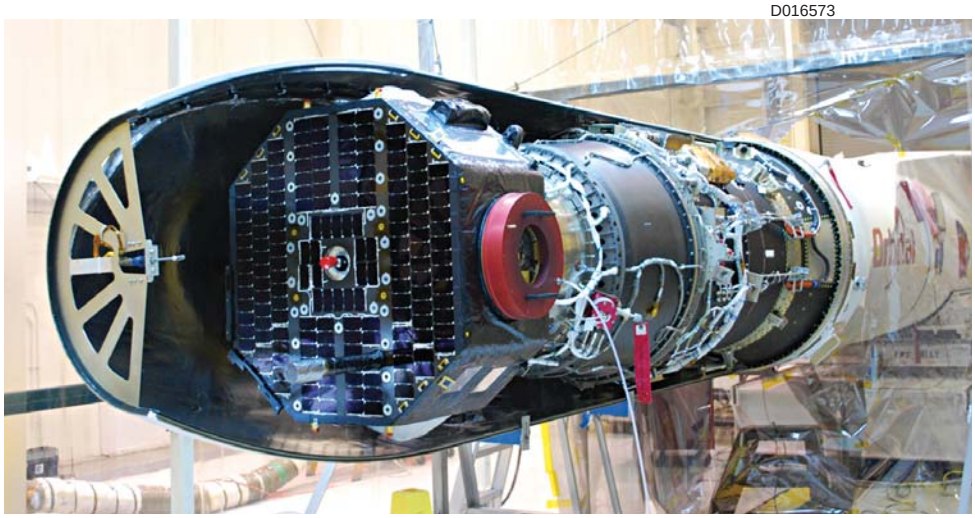

IBEX, shown mounted on an Orbital Sciences Corporation Pegasus launch vehicle, employed a unique method to reach its final orbit. Dropped from an L1011 aircraft at an altitude of 40,000 feet, the Pegasus rocket inserted IBEX into a low-altitude orbit, where IBEX's additional solid rocket motor and internal propulsion system then carried IBEX into the high-altitude orbit required for science operations.

Data analysis from the Ulysses and ACE spacecraft by an SwRI-led team of researchers revealed that the dynamic pressure of the solar wind — the continuous million-mile-per-hour outflow of plasma from the Sun — is significantly lower than during the previous solar minimum in 1996. These results indicate that less mass and energy are being supplied to the corona, the Sun's atmosphere, and that the boundaries of the solar system have probably contracted.

The Juno Jupiter orbiter mission passed its confirmation review and has entered the implementation phase. Our staff is conducting detailed design, development and testing activities in preparation for a 2011 launch. SwRI engineers are also building the Ultraviolet Spectrometer and the Juno Auroral Distributions Experiment. NASA's second New Frontiers mission, Juno will enter into a polar orbit around Jupiter in 2016, providing the first-ever look at the electromagnetic processes in the polar region that produce Jupiter's aurora. Juno will investigate Jupiter's composition and interior to learn about the planet's origin and the conditions in the early solar system that led to planetary formation.

Analyzing data from the Cassini Saturn orbiter, SwRI researchers and colleagues developed a conceptual model of the rotation-driven plasma outflow in Saturn's magnetosphere, which could explain the periodicities observed in Saturn's charged particles, magnetic fields and kilometric radio emissions. Another team led by SwRI used Mars-orbiting radar observations to evaluate the polar cap and the ground beneath it. Analysis suggests that the interior of Mars is colder and stronger than previously thought.

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SwRI recently delivered the HiSentinel50 prototype airship to the U.S. Army Space and Missile Defense Command for flight testing. The latest in a series of high-altitude airships that SwRI is developing, HiSentinel50 is designed to carry a 50-pound payload and operate for many days at altitudes above 60,000 feet. We are also developing a next-generation airship with an increased payload capacity.

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

SwRI will deliver the Radiation Assessment Detector developed for NASA's Mars Science Laboratory to the Jet Propulsion Laboratory this winter for integration onto the MSL rover. RAD will characterize the radiation environment that future astronauts would be exposed to on the surface of Mars. MSL is scheduled for launch in 2009.

In June, NASA launched the Fermi Gamma-Ray Space Telescope, a high-energy astrophysics mission to investigate such exotic phenomena as black-hole-powered active galactic nuclei, neutron stars and dark matter. SwRI provided the data processing unit for the gamma-ray burst detector, one of the observatory's two instruments. We also delivered avionics systems for two NASA astrophysics missions, the Kepler extra-solar planet finder and the Wide-field Infrared Survey Explorer (WISE) mission, as well as for the WorldView-2 commercial imaging and mapping satellite.

The SwRI-led Two Wide-angle Imaging Neutral-atom Spectrometers (TWINS) mission sent back the first stereoscopic images of Earth's inner magnetosphere obtained from energetic neutral atom imagers on board two widely separated spacecraft in high-inclination Earth orbit. Stereoscopic imaging holds great promise for advancing our understanding of the global three-dimensional structure and dynamics of the magnetosphere. ❖

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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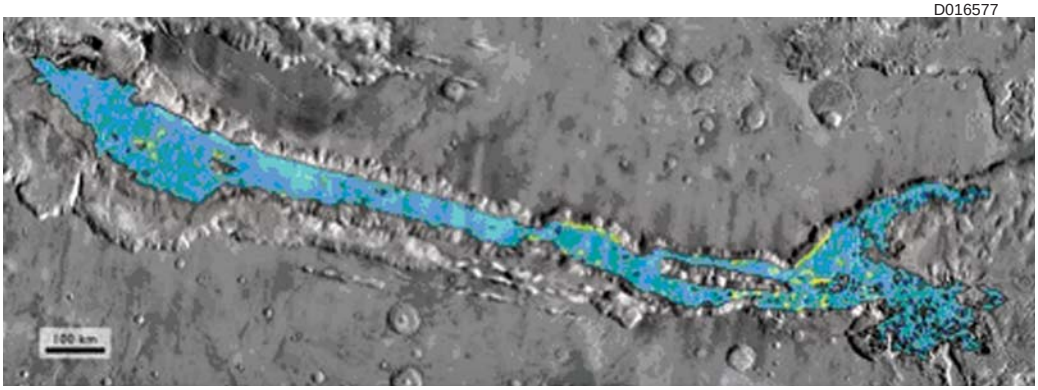

Courtesy NASA/JPL

Analyzing data and images from NASA's Mars Odyssey and Mars Global Surveyor missions, SwRI researchers hypothesize that a paleolake some 800 meters deep once filled the Valles Marineris on Mars, the largest canyon system in the solar system. Shown here is a mosaic of infrared images from Mars Odyssey on which a computer-generated map of the lake (light blue) has been superposed. Bursting of ice dams could have led to the formation of the spectacular outflow channels observed on the surface.

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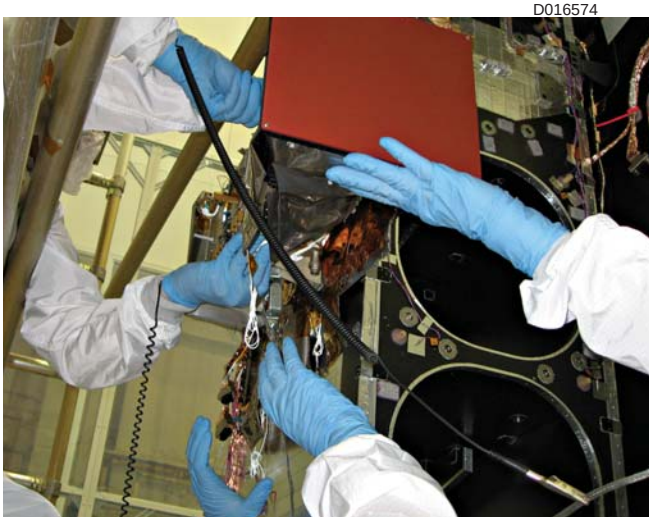

Engineers integrated SwRI's Lyman-Alpha Mapping Project onto the Lunar Reconnaissance Orbiter, which is scheduled for launch in the spring of 2009. From LRO's polar orbit approximately 30 miles above the lunar surface, LAMP will use reflected ultraviolet starlight to search for the spectral signature of water frost inside permanently shadowed craters near the Moon's north and south poles.

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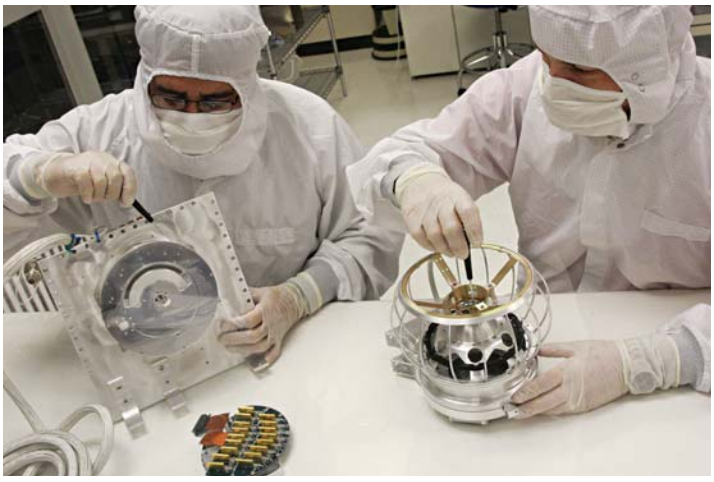

SwRI engineers are building engineering models of the Juno Auroral Distributions Experiment instrument for the Juno mission to Jupiter. JADE will measure the auroral electron and ion populations along the giant planet's magnetic field lines.