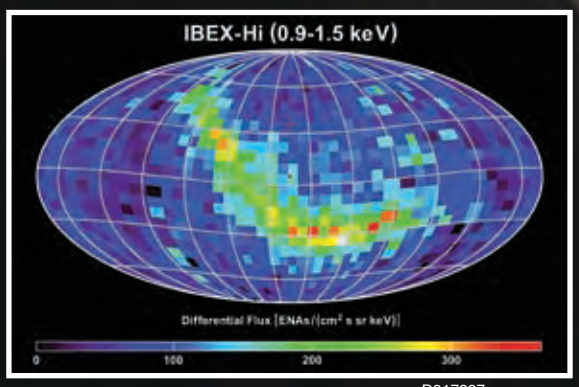
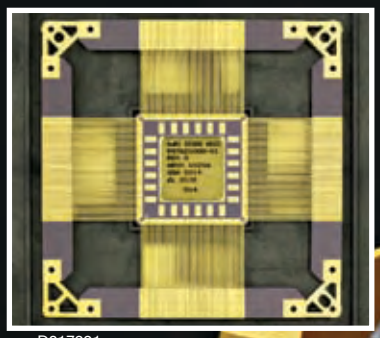
Space Science and Engineering



1 *Courtesy NASA/IBEX* D017237



2 D017221

SwRI developed the Radiation Assessment Detector for the Mars Science Laboratory, scheduled for launch in 2011. RAD will measure fluxes of solar energetic particles and cosmic rays at Mars' surface, providing data needed to characterize the Martian radiation environment in preparation for possible future human exploration.

3 *Courtesy ESA/Astrium Ltd.* D017236

4 *Courtesy NASA/GSFC* D017235

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

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 leads NASA's Interstellar Boundary Explorer mission, which recently completed the first-ever sky maps of energetic neutral atom emissions from the edge of the solar system. Compiled over a six-month period of data collection, the IBEX maps reveal a bright, narrow band of ENA emissions unpredicted by existing theories or models of this turbulent region, where the million-mile-an-hour stream of plasma flowing from the Sun encounters the local interstellar medium. IBEX is gathering data for a second sky map, which will document any temporal changes in this mysterious feature.

Following the successful launch of NASA's Lunar Reconnaissance Orbiter in July, the SwRI-built Lyman-Alpha Mapping Project has been mapping the ultraviolet reflectivity of the Moon, concentrating on the permanently shaded regions near the north and south poles. LAMP also observed the impact of the Lunar Crater Observation and Sensing Satellite (LCROSS) in the crater "Cabeus" near the Moon's south pole and obtained excellent spectra of the ejecta plume. SwRI scientists also studied the impact with ground-based telescopes in New Mexico and Hawaii.

LAMP is one of several SwRI-developed imaging spectrometers operating in space. Nearly identical instruments are flying on NASA's New Horizons mission to Pluto and the European Space Agency's Rosetta comet mission. We are building the ultraviolet spectrometer for NASA's New Frontiers Juno mission to Jupiter, for which we are also providing the Jovian Auroral Distributions Experiment, a pair of sensors that will measure the electrons and ions that produce Jupiter's powerful aurora. Scheduled for launch in 2011, Juno will be the first spacecraft to study Jupiter from a polar orbit and is expected to yield important new insights into Jupiter's composition, internal structure and giant magnetosphere.

SwRI heads the science investigation for NASA's four-spacecraft Magnetospheric Multiscale mission, which will use Earth's magnetosphere as a "laboratory" to study magnetic reconnection, a universal astrophysical process that converts magnetic energy into kinetic energy and heat. In addition to overseeing the MMS science investigation, our staff is developing the hot plasma composition analyzers as well as the central data processing units for the payload. MMS passed its confirmation review and is now in the implementation phase. Launch is planned for 2014.

Staff members are building instruments for two European Space Agency missions. The Spectral Imaging of the Coronal Environment (SPICE) spectrograph is designed to fly on Solar Orbiter, a mission to investigate the origins of the solar wind and its evolution in the inner solar system. The BepiColombo Mercury orbiter will fly a suite of particle instruments, including our "Strofio" instrument, which will measure the neutral particles ejected from Mercury's surface to form the planetary exosphere.

The Institute has provided avionics for more than 50 missions without a single on-orbit failure. SwRI avionics systems are currently flying on the Worldview-2 imaging and mapping satellite, as well as NASA's Kepler and Fermi Gamma-Ray Space Telescope missions. The Wide-field Infrared Survey Explorer, launching in December, will survey the entire sky, detecting infrared emissions from a variety of astronomical objects, ranging from cosmic dust to brown dwarfs and ultra-luminous galaxies.

Staff members also are continuing development of the HiSentinel stratospheric airship and developing concepts for planetary exploration missions utilizing balloon platforms. ❖

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

1. *This IBEX sky map shows the bright ribbon of energetic neutral atom emissions emanating from the upstream region where the solar wind encounters the local interstellar medium. SwRI scientists, in cooperation with other members of the IBEX science team, are studying this puzzling and unexpected feature. Researchers theorize that the ribbon reflects the alignment of the interstellar magnetic field outside the heliosphere.*

2. *SwRI avionics engineers have developed innovative Application-Specific Integrated Circuits compatible with Consultative Committee for Space Data Systems standards. These ASICs are an enabling technology for future low-power, low-mass and low-volume spacecraft avionics systems.*

3. *The Spectral Imaging of the Coronal Environment ultraviolet spectrograph project led by SwRI was selected by NASA for the European Solar Orbiter mission, which will employ a combination of remote-sensing and* in-situ *instrumentation to investigate the origins of the solar wind and its evolution in the inner solar system.*

4. *This artist's concept illustration shows the Lunar Reconnaissance Orbiter spacecraft in orbit some 30 miles above the surface of the Moon. Institute researchers are analyzing data from the SwRI-built LAMP instrument for evidence of water ice in the permanently shadowed craters in the Moon's northern and southern polar regions.*