Exceptional service in the national interest

Sandia National Laboratories

Sandia Technology in Space

Sandia-developed satellites, engineering, materials contribute to U.S. space exploration

Sandia National Laboratories' efforts to reduce the threat of nuclear proliferation, ensure the safety and reliability of the nation's nuclear stockpile and monitor treaty compliance provide an added benefit: making sure astronauts are safe and equipment operates as the United States explores space. Sandia's extreme-environment testing has helped bolster the nation's capabilities when astronauts and space vehicles enter or exit orbit and explore the harsh environments of the moon, Mars and other planets. The labs' technical know-how on radiation hardening keeps electronic components and systems from malfunctioning. Sandia provided critical data to ensure the integrity of space shuttles on 22 missions. And for more than five decades, Sandia has developed GPS electronics and adapted technologies for use on space vehicles.

Satellite Capabilities

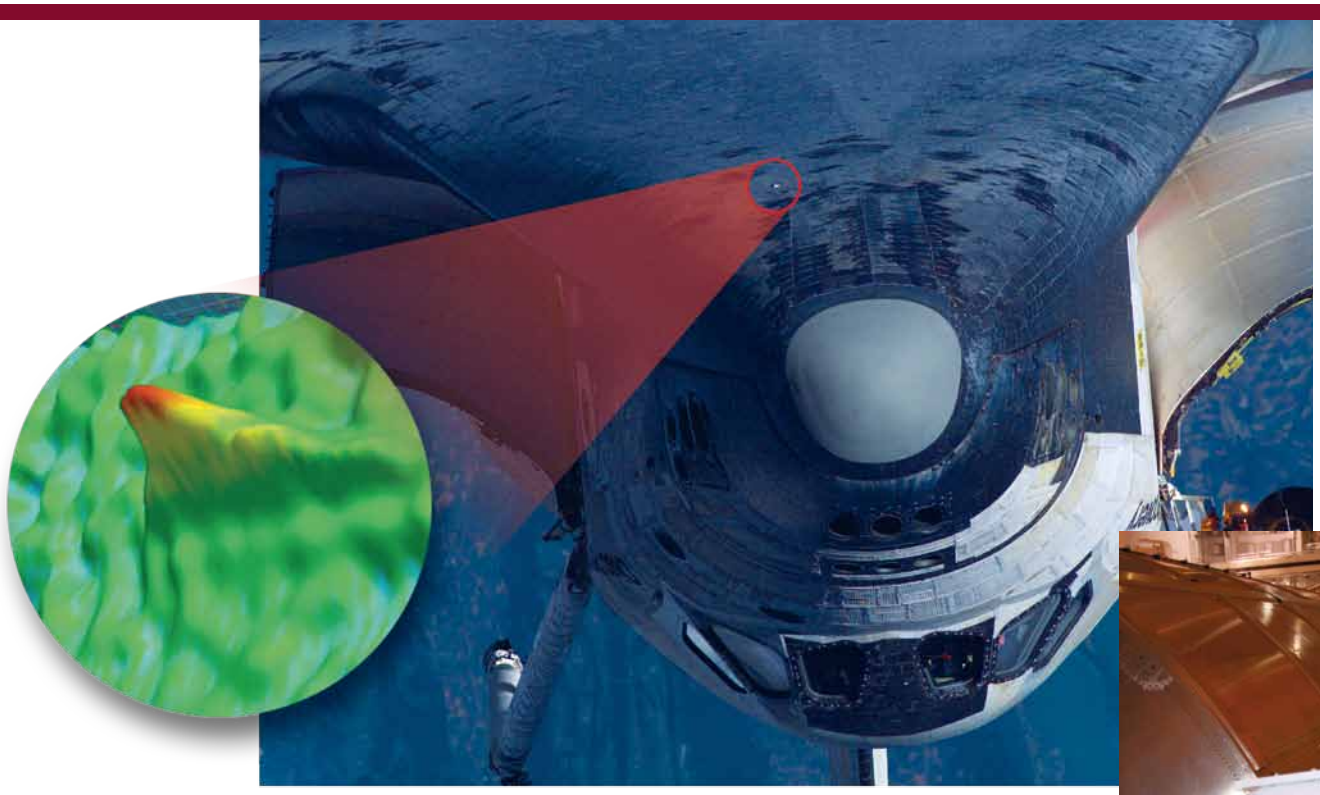
Sandia launched into space-related work in the 1960s to help the United States assess compliance with the Limited Test Ban Treaty. Sandia helped develop the Vela satellite program to detect gamma rays from atmospheric and space nuclear tests, which led to a myriad of contributions to Defense Support Program and GPS satellites. A Sandia-engineered imaging technique called Synthetic Aperture Radar (SAR) initially served on NASA's Seasat satellite for high-resolution radar imaging of Earth. Later, SAR's detection capabilities helped the Lunar Reconnaissance Orbiter confirm the presence of large quantities of water on the moon. Sandia's satellite work culminated in the Multispectral Thermal Imager (MTI) satellite launched in 2000 to search for nuclear proliferation. Years after it was expected to go dark, MTI continues to return valuable data about volcanoes, glaciers, climate change and the moon.

Radiation Hardening of Electronics

The extreme ionizing radiation in space means electronic components of satellites and space vehicles are highly susceptible to damage. Due to a long history working on radiation hardening, or rad-hard, Sandia has been called upon to rad-harden many space-electronic packages. For the 1990s-era Galileo mission to Jupiter and its moons, Sandia designed, fabricated and tested rad-hard circuits that allowed the spacecraft to survive and return data from within the giant planet's intense radiation belts.

Space Materials Testing

When the nation wanted to know what caused the 2003 Columbia space shuttle disaster, Sandia helped find the answer. Researchers supported the conclusion that foam



Extruding gap filler shown as LDRI data (in circle) from Sandia sensor. (NASA photo)

debris shed from the fuel tank hit the orbiter wing during launch and was the most probable cause of the tragedy. When shuttle flights resumed in 2005, Sandia's Laser Dynamic Range Imager (LDRI) was the primary tool for inspecting the Discovery shuttle's Thermal Protection System during missions. It was used to provide 2- and 3D video imagery to the crew to inspect Discovery's reinforced carbon-carbon panels on the wings and nose cap for damage as small as a 0.020-inch crack. Two additional LDRIs were built for two other shuttles. Today, Sandia's materials testing capabilities also include the National Solar Thermal Test Facility, which tests the heat resistance of materials used in space.

Sandia's orbiter inspection sensor housed in the payload bay, right, and being used to reach out toward the shuttle wing to scan tiles, left.

Engineering

Sandia has provided engineering solutions and microelectromechanical systems (MEMS) designs for space exploration. The labs' work on parachute technology for the military was used to design an airbag to soften the landing of NASA's Mars Pathfinder.

Powering the Future in Space

Nuclear power is being used to supply energy for the Mars Science Laboratory Mission, which launched in November 2011. Sandia nuclear scientists and engineers wrote the safety analysis for the nuclear battery, which will provide 110 watts of power for a Mars rover that is five times heavier than any prior rover.

As the United States takes future giant leaps for humankind in space, Sandia's technical capabilties will be riding alongside to explore the final frontier.

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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