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

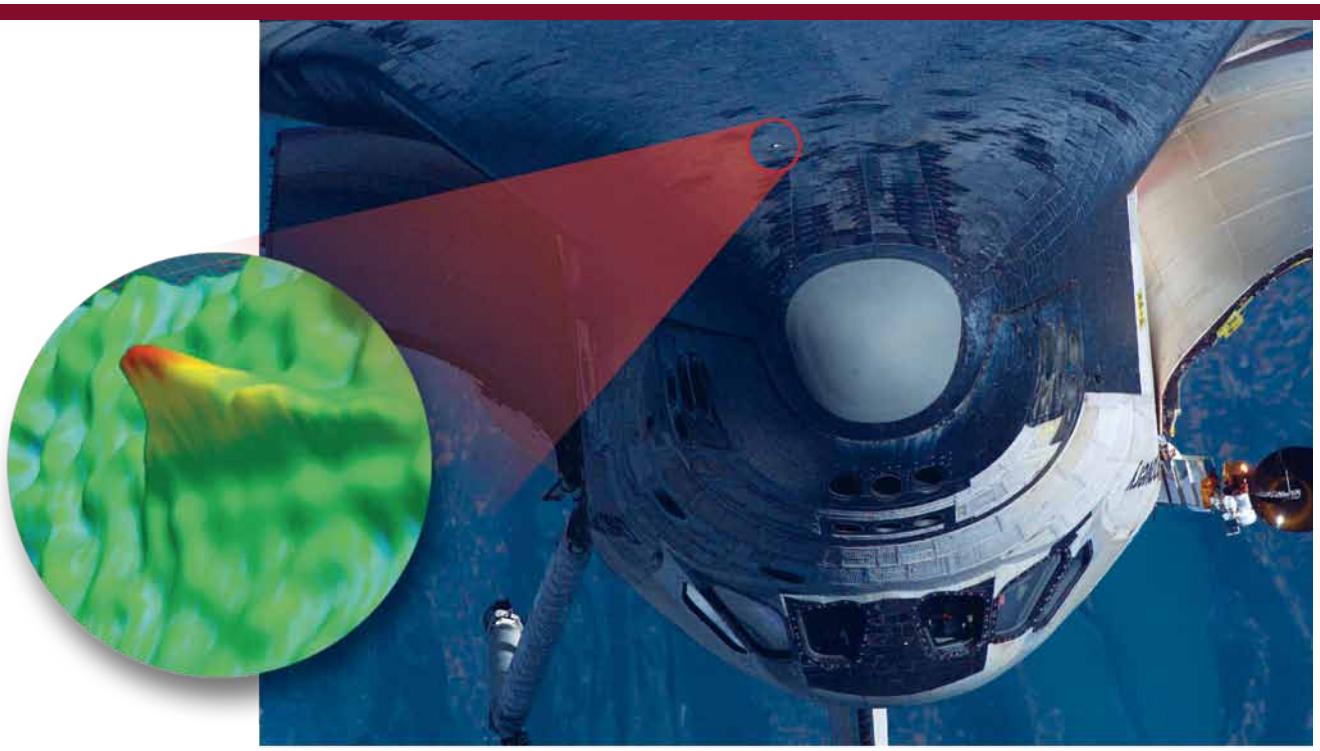
Sandia launched into space-related work in the 1960s to help the United States assess compliance with the Limited Test Ban Treaty. Sandia helped develop the Vela satellite program to detect gamma rays from atmospheric and space nuclear tests, which led to a myriad of contributions to Defense Support Program and GPS satellites. Today, a Sandia nuclear detonation detector is set to soar into space aboard the next-generation GPS III satellite. 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 continued with the Multispectral Thermal Imager (MTI) satellite launched in 2000 to conduct basic scientific research to explore evidence of nuclear proliferation. Years after it was expected to go dark, MTI also 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



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

answer. Researchers supported the conclusion that foam debris shed from the fuel tank hit the orbiter wing during launch and was the most probable cause of the tragedy. From the resumption of shuttle flights in 2005 until the final Atlantis flight in 2011 — 22 missions in all — Sandia engineers protected astronauts with space-based inspections of the orbiter's heat shields, using Sandia's Laser Dynamic Range Imager (LDRI) and the LDRI Orbiter Inspection System (LOIS). Today, Sandia's materials testing capabilities also include the National Solar Thermal Test Facility, which tests the heat resistance of materials used in space. And Sandia is assessing the impact of the harsh space environment on the performance of novel materials and optical equipment aboard the International Space Station in its Materials International Space Station Experiments.

Sandia's Materials on the International Space Station Experiment (MISSE-7) experiment launched on space shuttle Atlantis in November 2009. Sandia has been receiving data from this research payload ever since.

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 110 watts of power for the Mars Science Laboratory's Curiousity rover, which landed in August 2012. Sandia nuclear scientists and engineers have been conducting safety analyses for the Mars Science Laboratory since 2006 and will continue to do so for future nuclear-powered space missions.

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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