SAND99-2838J

SANDIA NATIONAL LABORATORIES: The First Fifty Years

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On Nov. 1, 1999, Sandia National Laboratories celebrates its 50th birthday. Although Sandia has its roots in the World War II-era Manhattan Project, Sandia began operating as a separate nuclear weapons engineering laboratory under the management of AT&T on Nov. 1, 1949. Today the lab employs more than 7,000 people at its two sites in Albuquerque and Livermore, Calif., and has research and development missions in national security, energy and environmental technologies, and U.S. economic competitiveness. Lockheed Martin Corporation operates Sandia for the U.S. Department of Energy.

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Few Albuquerque residents have a chance to see what's inside Sandia National Laboratories, which is protected by fences and security police and the boundaries of Kirtland Air Force Base. But they might be surprised to learn that much of the scientific research carried out behind Sandia's fences in the last 50 years has become part of their everyday lives.

Inside the steering wheel of most modern cars, for example, are airbags that have saved countless lives in automobile accidents. The airbags are triggered by a tiny switch that detects acceleration, or in the case of an auto accident, deceleration. If your car slams to a stop, the "**rolamite switch**" triggers the airbag in fractions of a second, keeping you from hitting the windshield.

The original rolamite switch was invented in the 1960s by Sandia scientist Don Wilkes. It originally served as an extremely reliable inertial sensor that made U.S. nuclear weapons safer. Today new and improved rolamites are found in most 1990s-made U.S. automobiles.

A little piece of Sandia's history also is present in the tens if not hundreds of electronic devices you use everyday — from clock radios to computers. In 1962 Sandia scientist Willis Whitfield unveiled a way of removing the millions of tiny particles of

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dust and other debris that normally float unseen in the air around us. His idea for a room with a filtered, top-to-bottom air flow — called the **laminar airflow clean room** — has made possible modern advances in microelectronics manufacturing. Particles in the air can ruin microchips, and ruined microchips drive up the cost of chip making.

Today the clean room concept is employed widely in modern hospitals as well; filtered laminar air flow minimizes airborne bacteria in surgery units and keeps patients' open surgery wounds clean.

Like the rolamite switch, the clean room is a technology that grew out of Sandia's need for extremely reliable nuclear weapon components. Most of Sandia's technical work, in fact, has its roots in nuclear weapons research.

The lab was established in 1945 to provide weapons engineering support to Los Alamos Laboratory in the "nuclear buildup" days following the Manhattan Project. Sandia began as "Z Division," an outpost of Los Alamos Scientific Laboratory located on Sandia Base (now Kirtland Air Force Base). Sandia's engineering and field testing role was distinct from Los Alamos' nuclear weapon design mission — in short, Sandia was responsible for the nuts-and-bolts needs of the U.S. nuclear arsenal.

In 1949 the Atomic Energy Commission, ancestor of today's Department of Energy, asked the Bell System to assume management of Sandia, which prompted President Harry Truman's brief letter of May 13, 1949, to AT&T president Leroy Wilson asking him to assume direction of the laboratory.

A phrase from that letter remains today a motto known to all Sandia employees: "In my opinion," wrote Truman, "you have here an opportunity to render *an exceptional service in the national interest*." AT&T began rendering that service on November 1, 1949, which Sandia now celebrates as its official birthday.

Since 1949, Sandia has become one of the foremost research and development facilities in the United States and the world. Its core mission has always been to support the nuclear design laboratories — Los Alamos and, after 1956, Lawrence Livermore National Laboratory in California — by converting their nuclear designs into increasingly safer, more secure, and more reliable weapons.

During the Cold War, the introduction of new nuclear weapon designs continually created new areas of expertise at Sandia. Research began in 1955, for example, to design

a weapon that could be dropped from a low altitude and its detonation delayed until the pilot and aircraft escaped. Known as **laydown weapons**, the bombs had their free-fall slowed by special parachutes and their impacts softened by redesigned casings.

In recent years, Sandia has used its parachute experience to help NASA create improved chutes for Space Shuttle landings and has helped a private company design better automobile airbags. ***The airbags reference is redundant since it was already discussed under rolatmites above. Suggest referring here to the inflatable balloons on the Sojourner Mars mission, or the two Sandians who defused the Unabomber's cabin in Montana.***

Concerns about the safety of nuclear weapons led to Sandia's introduction in 1960 of the **Permissive Action Link (PAL)**, a coded electromechanical security lock preventing unauthorized use of a U.S. nuclear weapon. The development helped reassure the American public that a "Dr. Strangelove" scenario involving a stolen nuclear weapon was quite impossible. Today Sandia scientists are turning improved versions of the technology into hacker-proof locks for computer systems.

Sandia's **treaty verification and nonproliferation** efforts are a natural outgrowth of the lab's work making U.S. weapons safer and more secure. Sandia began its first efforts in support of worldwide nuclear test detection with its support of the VELA satellite launched in 1963. Today U.S. satellites constantly monitor ***Russia,*** China, and other nations for nuclear tests and other illegal activities forbidden by international law.

As world leaders worry about the spread of nuclear, chemical, and biological weapons technology to rogue nations and terrorists, Sandia also provides technical assistance to help **safeguard other nations' military technologies** — including former Cold War foe Russia — from those who seek to acquire weapons of mass destruction.

Meanwhile, the weapons in America's nuclear stockpile are getting older and the U.S. has agreed not to detonate nuclear weapons or design new ones. Sandia's ongoing "**stockpile stewardship**" mission requires that lab weapon scientists make sure these aging weapons remain safe and reliable for years to come. In doing so, they are simulating nuclear detonations in Sandia's increasingly **powerful accelerators** and are analyzing weapon performance using **advanced computer capabilities**.

During the energy crisis in 1973, Sandia responded to threats to the nation's future energy security, working to develop better, cheaper ways of **capturing "renewable" energy** from the sun, wind, and nuclear fusion and helping U.S. oil producers enhance their abilities to recover fossil fuels. Sandia continues to make technological breakthroughs in these areas, working closely with the alternative-energy industry.

The **Waste Isolation Pilot Plant**, or WIPP, is Sandia's most visible, longest-lasting, and controversial project. Its beginnings date back to 1975, when the U.S. government asked Sandia to help find a way to dispose safely of hundreds of thousands of barrels of low-level radioactive waste generated as byproducts of the U.S. nuclear weapons program. Sandia served as scientific advisor throughout the project, overseeing the thousands of geologic, radiation safety, and waste transport studies that ultimately led to the Environmental Protection Agency's certification of WIPP last year.

On March 26, 1999, a truck carrying the first shipment of WIPP waste from Los Alamos rolled onto the repository site 26 miles east of Carlsbad, N.M., and the first boxes of waste were emplaced in WIPP's geologically stable salt beds 2,150 feet below the surface. This historic date is a significant milestone in the enormous task that faces the nation of cleaning up Cold-War-contaminated sites all over the country.

In today's post-Cold War and volatile world climate, Sandia's main mission remains national security, but its role of providing "exceptional service in the national interest" has expanded to include **helping American industry compete more effectively in the world marketplace**. Sandia works closely with hundreds of industrial partners to make sure technologies developed as part of the nuclear weapons mission get fully utilized outside the lab's fences, and to ensure that Sandia takes full advantage of technologies and capabilities developed in private industry.

Under Lockheed Martin, selected to manage the lab in 1993, Sandia has continued and expanded its R&D in computational and information sciences, semiconductor manufacturing technologies, advanced energy and power sources, combustion science and technology, and global climate change research.

In a world in which the knowledge of nuclear weapons cannot be erased, avoiding nuclear conflict through deterrence and careful management of the stockpile has become

a critical national priority. Sandians are proud of their contributions to nuclear deterrence across a wide field of science and technology. Because nuclear weapons are far from becoming obsolete, Sandia plans to serve as one of the nation's stockpile stewards through the first fifty years of the 21st century.

Sandia exists to serve national needs, whatever their nature. Although the next century's challenges will differ from those of the past, the world will secure its future through science and technology. Sandia will continue contributing its unique world class capabilities. However, the future belongs to Sandia's greatest resource: its innovative, energetic, and dedicated people who come from all parts of the United States and the world.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.