

Sandia National Laboratories

TODAY'S COMPLEX

The U.S. nuclear weapons complex—the laboratories and facilities that research, design, produce, maintain, and dismantle such weapons—must ensure that the arsenal is reliable, safe from accidents, secure from unauthorized use, and no larger than needed to maintain national security. To fulfill those goals, the complex needs resources and facilities to extend the life of nuclear warheads, assess their reliability and safety, understand how aging and modifications affect weapons, and retain employees with essential expertise. It also requires the capacity to dismantle retired weapons in a timely fashion, and methods for verifying further reductions in nuclear weapons. Additionally, the complex must minimize security risks of storing, transporting, and disposing of weapons-usable materials.

The administration and Congress will make important decisions over the next few years on how the complex can use limited resources to best meet these challenges. Doing so requires smart choices based on strict attention to priorities.

Sandia National Laboratories (SNL) is responsible for the non-nuclear components and systems integration of U.S. nuclear weapons. Often called the engineering laboratory of the U.S. nuclear weapons complex, it grew out of Z Division, the ordnance design, testing, and assembly branch of Los Alamos during World War II. Z Division moved to Sandia Base, outside Albuquerque, NM, to have easier access to an airfield and work more closely with the military.

In 1948, Z Division became Sandia Laboratory, and in 1956 a second Sandia site was established in Livermore, CA; these two locations ensure proximity to the other two U.S. nuclear weapons research and design facilities—Los Alamos and Lawrence Livermore—that design the nuclear explosive packages for all U.S. weapons.

SNL also operates the Tonopah Test Range (TTR) in Nevada and the Weapons Evaluation Test Laboratory (WETL) at Pantex Plant in Texas; it has five additional satellite sites around the country.

Like the other sites in the nuclear weapons complex, SNL is overseen by the National Nuclear Security Administration (NNSA), a semi-autonomous agency within the Department of Energy (DOE).

Sandia Today

With the end of the cold war and the 1992 moratorium on nuclear explosive testing, SNL's primary mission shifted from developing components for new nuclear weapons to maintaining the safety, security, and reliability of the existing U.S. nuclear stockpile without nuclear explosive testing.

In support of congressional requirements for an annual report certifying the safety, security, and reliability of the U.S. nuclear weapons stockpile, SNL conducts regular evaluations of non-nuclear components of these weapons. SNL's surveillance data, peer reviews, and the results of experimental and computational simulations inform the Annual Stockpile Assessment by the Departments of Defense and Energy.

To carry out its assessment, SNL relies on facilities like the WETL, the Z machine at its Albuquerque site, and the TTR. The WETL evaluates weapons subsystems to identify defects in the stockpile. The Z machine helps scientists understand how plutonium reacts during a nuclear detonation by generating powerful X-rays that mimic the high pressure and heat levels in a detonating nuclear warhead. At the TTR, drop tests are conducted with joint test assemblies—bombs pulled from the stockpile that have had their nuclear material removed. On average, 10 such tests per year are conducted.

Sandia's main weapons-related tasks include:

- **Systems engineering of nuclear weapons.** SNL is responsible for the integration of the nuclear explosive package with the non-nuclear components of the warhead.

- **Research, design, and development of non-nuclear components of nuclear weapons.** SNL is responsible for most non-nuclear weapons components, and continues to conduct research on these, especially on weapons surety (safety, access control, and use control) and on how component materials are affected by aging.
- **Manufacture of some non-nuclear components.** The Kansas City Plant in Missouri produces most non-nuclear components, but SNL manufactures some specialized components, like neutron generators (the “trigger” that initiates the fission reaction in a nuclear weapon) and microelectronics; it also maintains a backup capability to produce batteries and high explosive components.
- **Safety, security, and reliability assessments of stockpile weapons.** The most high-profile element of this work is the annual report certifying that warheads in the stockpile remain reliable, safe, and secure.
- **High explosive research and development.** SNL, along with Pantex, is responsible for research and development on the high explosive material that surrounds the fissile core of a nuclear weapon and compresses the plutonium in the pit, leading to nuclear detonation.
- **Environmental testing.** Environmental testing assesses the effects of environmental conditions (e.g., shock, high temperatures, vibration) on nuclear weapons, to simulate the conditions they may be subjected to during delivery to their targets. Since the end of nuclear explosive testing, much of this testing at SNL has addressed the need to ensure that nuclear weapons components are sufficiently hardened to withstand the radiation of a nuclear explosion (e.g., from another weapon delivered to the same target).

In addition to its nuclear weapons mission, SNL conducts research and development on nuclear nonproliferation, nuclear

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counterterrorism, energy security, defense, and homeland security. It also provides engineering design and support for the NNSA Office of Secure Transportation, which transports nuclear weapons, components, and special nuclear materials (SNM).

As part of the NNSA’s plan to consolidate weapons-usable materials in the nuclear weapons complex, SNL in 2008 became the first NNSA site to remove all Category I and II SNM (the categories requiring the highest level of security).

SNL is operated by Sandia Corporation, a subsidiary of Lockheed Martin Corporation. It employs nearly 10,700 workers across all its sites, including about 9,300 at its main site in New Mexico, and another 1,000 in California.

Budget

SNL’s total FY 2013 funding from the DOE is roughly \$1.8 billion. Of this, the majority—\$1.4 billion—comes from the NNSA for nuclear weapons activities, with additional NNSA funding for nuclear nonproliferation. SNL also receives DOE funding for environmental management (cleanup related to defense nuclear programs), site security, and energy research and development. Unlike the other weapons labs, which are funded almost exclusively by the DOE, a large portion of SNL’s annual budget (about one-third in FY 2011, the last year for which data are currently



Sandia National Laboratory, Albuquerque, NM, 2009

available) comes from non-DOE sources for “work for others”—research or other work for private companies or other government agencies.

SNL requested a total of \$1.8 billion for FY 2014, of which roughly \$1.5 billion was for weapons activities. The largest line item in SNL’s FY 2014 weapons activities budget request (\$871 million) is for directed stockpile work, part of the Stockpile Stewardship Program that supports current and future life extension programs, and includes surveillance and maintenance activities. The second-largest budget line (\$171 million) within the weapons category is for site stewardship (that is, for the operation and maintenance of NNSA program facilities). SNL also requested \$128 million for the Advanced Simulation and Computing Campaign, which funds high-end simulation capabilities for weapons assessment and certification and to predict the behavior of nuclear weapons.

Current Issues

LIFE EXTENSION PROGRAMS (LEPS)

Sandia is a key player in managing LEPS for all the nuclear weapons in the U.S. stockpile. It is responsible for non-nuclear components of each weapon, whereas Los Alamos and Lawrence Livermore National Laboratories are in general responsible for the nuclear components of warheads each designed.

LEPs are intended to extend a weapon’s life by 20 to 30 years by refurbishing, reusing, or replacing components affected

by aging. Recent LEPs also investigate options to improve the safety, security, and reliability of the warheads by, for example, adding use-control features. However, there is a danger that extensive changes to the nuclear explosive package could reduce confidence in the weapon’s reliability.

Most recently, SNL participated in the LEP for the W76 submarine-launched ballistic missile warhead. SNL’s role included redesigning the arming, fuzing, and firing systems, which ensures that the warhead detonates at the correct height and also includes safety features to ensure that it will only explode under specific conditions. In 2009, Sandia and Los Alamos certified the new W76-1 warhead, allowing it to go into full-scale production. The NNSA expected to complete the program in 2018 but the FY 2013 budget request slowed production to devote more funding to the B61 LEP.

SNL is developing an LEP for the B61 nuclear bomb that will consolidate four existing versions of the bomb into one, the B61-12. The yield (explosive power) of the new B61-12 will be less than that of the highest yield of the four existing bombs. In part to compensate for the decreased yield, the B61-12 will also include a new guided tail kit to increase the bomb’s accuracy. The first production unit for the B61-12 is planned for 2019.

SNL is also involved in upcoming LEPs for the W78 intercontinental ballistic missile warhead and the W88 submarine-launched ballistic missile warhead, which could lead to an interoperable warhead for both systems. As part of this work, Sandia plans to develop a modular firing system that can be used in more weapons, including the W87, which is scheduled for a future LEP.

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