

# Lawrence Livermore National Laboratory

## 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.*

The Lawrence Livermore National Laboratory (LLNL), established in 1952 as the Lawrence Radiation Laboratory, was a spinoff of the University of California Radiation Laboratory at Berkeley. Arising from work by physicists Edward Teller and Ernest O. Lawrence, the lab was created to aid the United States in the research and development of nuclear weapons, in part by competing with Los Alamos National Laboratory. LLNL designed the first nuclear warhead for a U.S. submarine-launched ballistic missile and the first warheads for multiple independently targeted reentry vehicles (MIRVs), which allow a single missile to carry multiple warheads that can each be assigned to separate targets.

Today, LLNL is one of three privately managed facilities that conduct research on and design U.S. nuclear weapons, along with Los Alamos National Laboratory and Sandia National Laboratories.

LLNL's main site in Livermore, CA, is about 50 miles east of San Francisco. A second site—Site 300, used for experimental tests—is between Livermore and Tracy, CA.

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

## Lawrence Livermore Today

When the United States ended nuclear explosive testing in 1992, LLNL's primary mission shifted to stockpile stewardship. LLNL conducts life extension programs (LEPs) on existing weapons, which involves replacing components affected by aging with newly manufactured and sometimes modernized components. Under current NNSA plans, future LEPs will entail replacing existing warheads with new ones. In support of congressional requirements for an annual report certifying the safety, security, and reliability of the nuclear stockpile, LLNL conducts regular evaluations of weapons it has developed: the W62 and W87 intercontinental ballistic missile warheads, the W84 ground-launched cruise missile warhead (now in the inactive stockpile), and the B83-01 bomb. LLNL's surveillance data, peer reviews, and results of experimental and computational simulations inform the Annual Stockpile Assessment by the Departments of Defense and Energy. LLNL is also the lead design lab for the W78 life extension program, even though that warhead was designed at Los Alamos.

LLNL's nuclear-weapons-related tasks include:

- **Nuclear weapons research, design, and development.** No new nuclear weapon has been produced since 1990 but this work is still first on LLNL's agenda. Today LLNL's design work is focused on LEPs for existing weapons.
- **Testing advanced technology concepts.** "Advanced technology concepts" refers to new ideas for the design or use of nuclear weapons; past examples

include improving the use control of nuclear weapons and examining using nuclear weapons to destroy chemical and biological agents.

- **Plutonium and tritium research and development.** Plutonium is used in the primary of U.S. nuclear weapons; tritium is used to boost the primary's yield.
- **Hydrotesting and environmental testing.** Hydrotests experimentally simulate the conditions in an exploding nuclear weapon and environmental tests assess the effects of a nuclear detonation on various materials.
- **High explosive research and development.** The high explosive in a nuclear weapon surrounds the plutonium pit; when it is detonated it compresses the nuclear material, leading to nuclear detonation.

In addition to nuclear weapons work, LLNL also works to prevent nuclear proliferation and nuclear terrorism, develop capabilities to counter terrorism and other emerging threats, research new military technologies, better understand climate change and its impacts, and develop technologies for low-carbon energy. It houses some of the most powerful supercomputing capabilities in the world, which help carry out simulations for the Stockpile Stewardship Program.

The lab has about 6,800 employees at its main site and Site 300. After decades as a nonprofit managed by the University

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of California, LLNL is now run by the for-profit Lawrence Livermore National Security, LLC. This corporation was established in 2007 and comprises Bechtel National, the University of California, the Babcock & Wilcox Company, the Washington Division of URS Corporation, and Battelle.

### **Budget**

LLNL's FY 2013 budget is \$1.19 billion, of which \$981 million (82 percent) is for weapons activities. Within that category, the largest appropriation is \$272 million for the Inertial Confinement Fusion and High Yield Campaign, which funds the National Ignition Facility. The Advanced Simulation and Computing Campaign received \$208 million, and \$124 million went to directed stockpile work (which includes evaluation, maintenance, and refurbishment of the nuclear stockpile as well as weapons research and development). After weapons



Lawrence Livermore National Laboratory, 2011

NSNSA Nevada Field Office

activities, the next largest category in the LLNL budget is defense nuclear nonproliferation, funded at \$107 million for FY 2013.

For FY 2014, LLNL requested a total of \$1.14 billion, \$951 million (83 percent) of which is for weapons activities.

## Current Issues

### NATIONAL IGNITION FACILITY (NIF)

NIF houses the world's largest and most energetic laser. Its goal is to achieve "ignition"—a carefully controlled self-sustaining fusion reaction—in the laboratory. NIF uses inertial confinement fusion, in which 192 laser beams are aimed at a centimeter-sized gold target containing a tiny pellet of deuterium and tritium fuel. Success would create extreme temperatures and pressures similar to those found in nuclear weapons explosions, and allow scientists to examine thermonuclear burn in the laboratory.

NIF experiments are meant to complement other testing and help inform and validate weapons simulation computer codes while providing a better understanding of weapons physics. The NNSA also hopes that the cutting-edge research at NIF will help attract and maintain a new generation of scientists with nuclear weapons skills, which it calls crucial to its ability to assess age-related changes that might compromise weapons' reliability.

The facility has been controversial from the beginning, in part because of large budget increases and schedule slips; there have also been accounting irregularities that led to a significant understatement of project costs. In 1995 the facility was projected to cost \$1.1 billion and be completed in FY 2001. By the time NIF was dedicated in 2009, its official final cost (through the end of construction and laser system installation) was \$3.5 billion. A 2010 Government Accountability Office report notes, however, that this does not include necessary safety

infrastructure or costs related to ignition targets, which add more than \$2 billion, increasing the total project cost beyond \$5 billion.

NIF has once again missed its most recent target, which required it to achieve ignition by the end of FY 2012, and the future of the ignition program is in question. While NNSA officials have called ignition "essential" to the stockpile stewardship program, they have also said that "the Secretaries of Defense and Energy have certified stockpile safety and reliability for the past 15 years without NIF . . . and could continue to do so."

### SPECIAL NUCLEAR MATERIAL (SNM)

LLNL's "Superblock," a collection of buildings including LLNL's storage area for plutonium and weapons-grade uranium, is one of only two defense plutonium research and development facilities in the United States (the other is PF-4 at Los Alamos). As part of the NNSA's plan to streamline and consolidate the nuclear weapons complex, it planned to remove all Category I and II SNM (the categories requiring the highest level of security) from LLNL by the end of FY 2012. In September 2012, the NNSA reported that it had removed all "significant" amounts of plutonium from Livermore, leaving it with fewer than 500 grams for research. However, with the delay in the Chemistry and Metallurgy Research Replacement-Nuclear Facility at Los Alamos, LLNL may continue plutonium work for several more years.

The large quantities of SNM at LLNL, which is near San Francisco, have been a concern; 7 million people live within 50 miles of the lab. In 2008, LLNL failed a security drill designed to test whether terrorists could access stored SNM. The mock attackers reportedly accessed the Superblock and held out long enough to have constructed a radiological weapon, or "dirty bomb."

Now that LLNL may continue to carry out plutonium work, there are renewed questions about the increased need to transport plutonium from Los Alamos and whether current security levels at LLNL are adequate.

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