



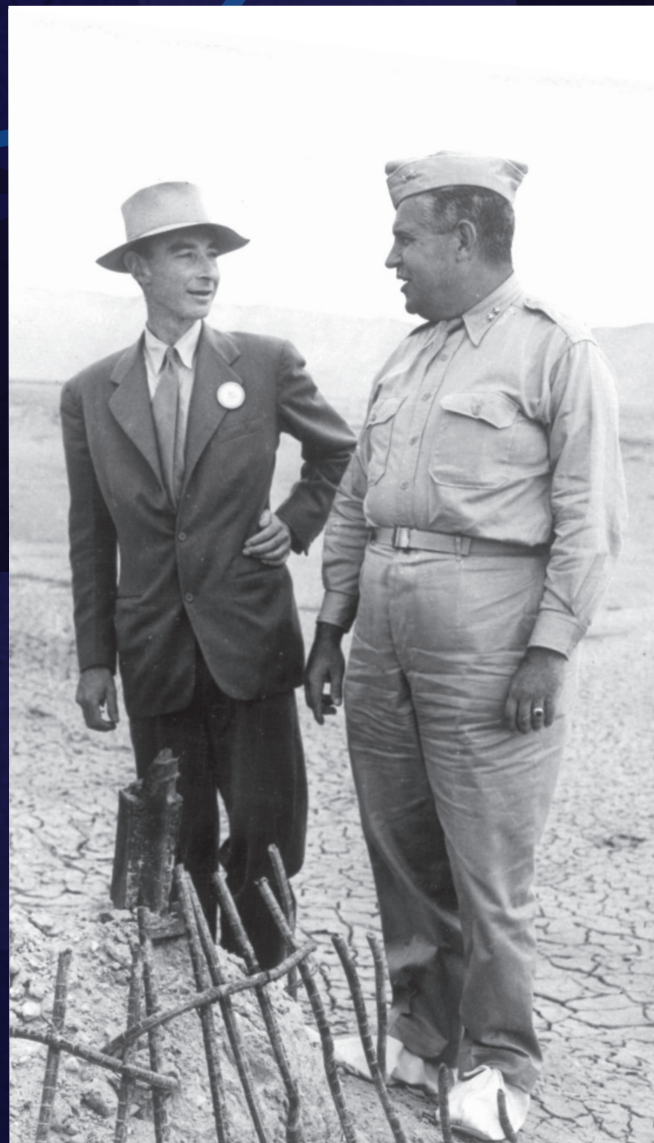
A Mission That Matters

PLUTONIUM PIT PRODUCTION AT
LOS ALAMOS NATIONAL LABORATORY



The Plutonium Facility at Los Alamos National Laboratory, known as PF-4, began operations in 1978. PF-4 plays a significant role in U.S. nuclear weapon stockpile stewardship and is the facility where nearly all plutonium operations in the nation occur. The Plutonium Facility also supports national interests in plutonium-238 heat source fabrication, surveillance, production, dismantlement, and materials management.





J. Robert Oppenheimer, director of the Los Alamos Laboratory where the atomic bomb was designed, and Manhattan Project director Leslie Groves in 1945 at ground zero of the first detonation of a nuclear weapon, known as the Trinity Test.

About Pit Production

Los Alamos produced the first plutonium pits, or the cores of a nuclear weapon, in 1945, during the Manhattan Project led by J. Robert Oppenheimer. Since the end of World War II, Los Alamos performed limited pit production for research purposes with a short production campaign from 2007 to 2011 in support of the W88 warhead.

From 1952 to 1989, the majority of plutonium pits for U.S. nuclear weapons were manufactured at the Rocky Flats Plant near Denver, Colorado, while Los Alamos continued to advance in its plutonium research and development. When Rocky Flats closed in the early 1990s, PF-4 at



Los Alamos became not just the premier plutonium facility in the nation—but the only one. That’s why the National Nuclear Security Administration (NNSA) called upon Los Alamos to play a key role in advancing plans for stockpile modernization that fulfill the requirements of the mission of the Department of Defense.

Today, the Laboratory is laying the groundwork for manufacturing new pits that are bound for a weapon already in the stockpile, the W87-1 nuclear warhead. Right now, Los Alamos National Laboratory is the only place in the country where pits can be made.

LOS ALAMOS NATIONAL LABORATORY:
ESTABLISHED IN: 1943
NUMBER OF EMPLOYEES: APPROX. 17,000
FOOTPRINT: 40 SQUARE MILES
CURRENT OPERATOR:
TRIAD NATIONAL SECURITY, LLC

PLUTONIUM FACILITY:
OPERATIONAL IN: 1978
FOOTPRINT: 236,192 SQUARE FEET
SUPPORTS NATIONAL SECURITY PROGRAMS INCLUDING:
STOCKPILE STEWARDSHIP
PLUTONIUM PROCESSING
NUCLEAR MATERIALS STABILIZATION
MATERIALS DISPOSITION
NUCLEAR FORENSICS
NUCLEAR COUNTER-TERRORISM
NUCLEAR ENERGY



Safe, Secure, Reliable

Pit production and other NNSA-led weapons modernization programs enable credible and sustainable strategic deterrence for the nation and the world. Why is deterrence important?

Since 1992, the number of nuclear weapons in the stockpile has decreased by more than 9,950. As of September 2020, the active stockpile contained 3,750 weapons.

After the Cold War, the global situation was relatively stable, and so there wasn't a need to make new weapons. But today, the world looks very different

than it did in the decades after the Cold War. Global nuclear powers such as Russia, China, and North Korea are shifting and U.S. nuclear deterrence is a proven strategy to prevent nuclear war across the world.

Now, the nation's strategy is to continue to extend the life of many of its nuclear weapons systems while designing and producing some new ones. To that end, the plutonium pit mission at the Lab is one of the activities that ensures a safe, secure, and reliable nuclear weapon stockpile by replacing aging pits in existing weapons.

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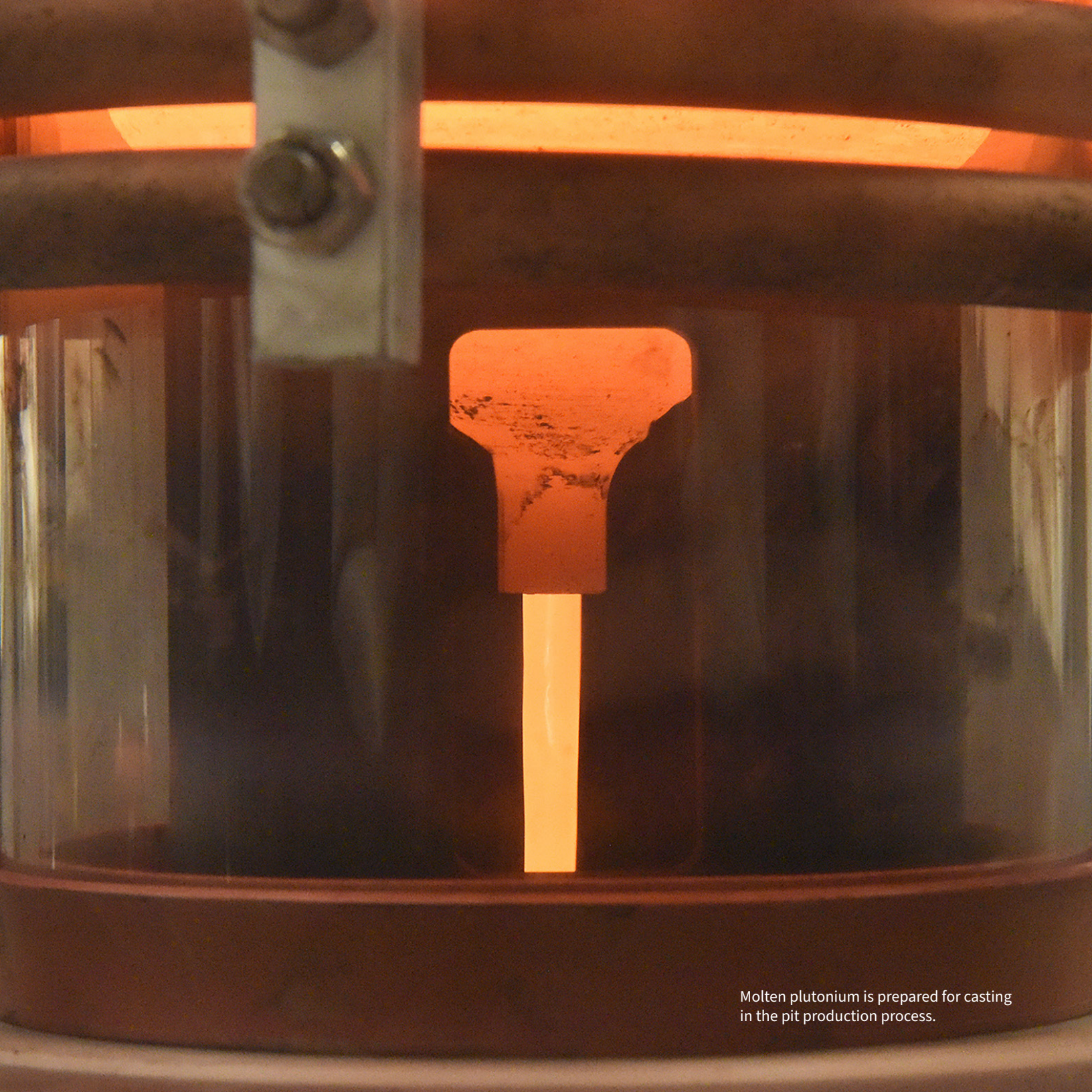
The global nuclear landscape is not only more dangerous but also more dynamic than it has been in some time. Concurrent with the challenges in nuclear deterrence, nonproliferation and counterterrorism, and naval propulsion, we need to revitalize our old infrastructure and keep pace with emerging technologies.... This past year alone, NNSA has delivered more than 200 modernized weapons to the Department of Defense. There should be no doubt in anyone's minds —NNSA is modernizing our stockpile both on-schedule and at pace.”

**—Jill Hruby, Under Secretary for Nuclear Security and
Administrator of the National Nuclear Security Administration**

THE TWO-PEER PROBLEM



China's emergence as a nuclear power has led to what experts call the “two-peer problem.” Where the United States previously only had one nuclear peer in Russia, China's rise now makes it more important than ever that the U.S. stockpile remains credible.



Molten plutonium is prepared for casting in the pit production process.

WHY DO WE NEED NEW PLUTONIUM PITS?

Plutonium is a man-made element that was discovered in 1940. During the time when the U.S. made many of its nuclear weapons, much was still unknown about the behavior of plutonium, a material that radioactively decays over time. Many of those questions were answered during the era of nuclear weapons above-ground testing, but after the Comprehensive Nuclear Test-Ban Treaty of 1992, the U.S. can now only test nuclear weapons through science, research, and non-nuclear tests.

We now know more about plutonium aging and decay, and how the changing properties of a plutonium pit could affect the performance of a nuclear weapon. That knowledge has led the U.S. to choose to replace the aging plutonium pits in many weapons as a precaution. The U.S. recycles plutonium from old pits to make new ones. Several old pits are required to make a new pit, meaning the number of pits is actually decreasing even as we work to ensure the reliability of the stockpile.



Metal is welded to research, develop, and test processes for pit production.

WHAT DOES IT TAKE TO MAKE A PIT?

A ring of purified plutonium, known as an electrorefining ring, is safely held by an employee after the foundry process.

Although Los Alamos has made pits from new materials in past decades, this pit mission is different because the Lab is recycling plutonium from old pits to make new pits, which adds many steps in the process. These steps are primarily performed by a key division at the Lab called Pit Technologies.



NITRATE & CHLORIDE RECOVERY

Dissolve plutonium by-products and residues in acid to recover plutonium from the residue stream



ANALYTICAL CHEMISTRY

Analyze plutonium samples to ensure chemical and isotopic constituents are within specifications



MATERIALS CHARACTERIZATION

Analyze plutonium and metal samples for physical properties, such as grain size, surface chemistry, and strength

Beyond the Pits

In addition to its critical role in stockpile stewardship, PF-4 supports plutonium-238 heat source fabrication for NASA deep space missions, americium production, materials recovery and recycling, and nuclear nonproliferation programs.

NASA AND PLUTONIUM-238

Plutonium-238 is a heat-generator and can serve as a fuel source for instruments destined for the cold of deep space. Employees in PF-4 manufacture a suite of power supply products with plutonium-238, most notably the heat

sources that provide power for the Curiosity and Perseverance Rovers that are currently roaming the surface of Mars. Los Alamos heat sources will soon power the Dragonfly mission to Saturn's moon.

DETONATORS

Detonators are small devices used for detonating a high explosive. In a nuclear weapon, the detonation of those high explosives is what causes a plutonium pit to implode and create nuclear yield. Detonator production has been essential to the Laboratory since the Lab's inception during World War II.



ARIES

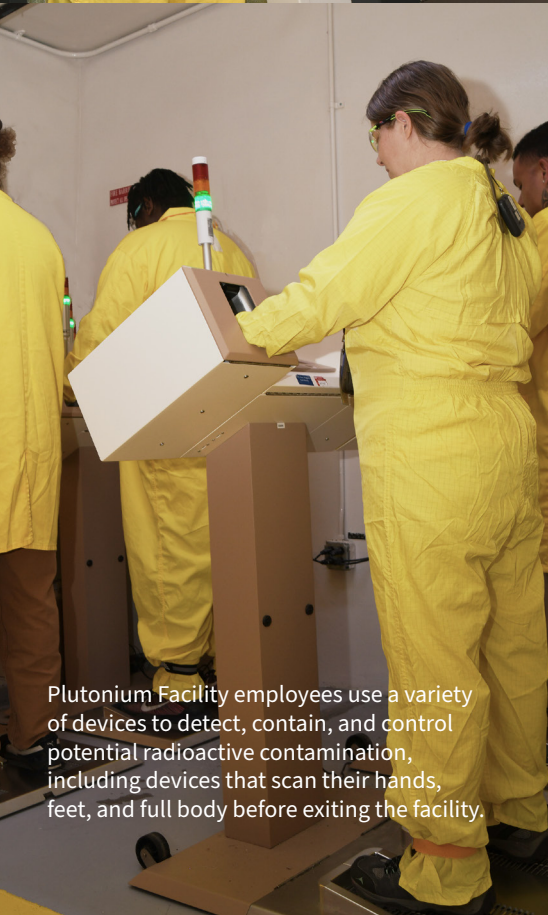
The renowned ARIES (Advanced Recovery and Integrated Extraction System) program is located within the NNSA's Office of Defense Nuclear Nonproliferation (DNN) Material Management and Minimization (M3) Program, which strives to "achieve permanent threat reduction by minimizing and, when possible, eliminating weapons-usable nuclear material around the world."

ARIES prepares surplus weapons-grade plutonium for final disposition by converting surplus plutonium components into an oxidized powder.

That powder form makes the plutonium material much more difficult for adversaries to use for any kind of weapons production. The process of using the material for weapons is almost impossible in countries lacking the infrastructure to process the powder.

The ARIES mission originated in the year 2000 when both the United States and Russia agreed to disposition 34 metric tons of weapons-grade plutonium declared to be in excess of national defense needs.





Plutonium Facility employees use a variety of devices to detect, contain, and control potential radioactive contamination, including devices that scan their hands, feet, and full body before exiting the facility.

Safety Abounds

PF-4 is one of the safest places in the country because of the redundant safety and security measures that protect our workforce, the environment, and the community.

INFRASTRUCTURE SAFETY: PF-4 is designed with a full suite of safety systems designed to mitigate potential unexpected events, from earthquake to wildfire, and has layers of complex systems to test, ventilate, monitor, and alarm.

TRAINING: Employees who work in PF-4, as well as across the Laboratory, undergo thorough and continuous training to ensure their readiness to do their job or to respond correctly to an abnormal event.

SECURITY: Not just anyone can enter the Plutonium Facility, in fact most can't get within miles of it. Only trusted and vetted employees work under the protection of significant layers of security and protocols.

WORK WITH HAZARDOUS MATERIALS: Employees in PF-4 use enclosures called glove boxes to protect them from exposure to plutonium and other hazardous materials. In secure rooms in the facility, employees don significant layers of personal protective equipment before working near radioactive materials, ensuring there are always many layers of safety between a human and a hazard.



RADIATION MONITORING: The Lab also has thorough radiation monitoring for all individuals working near radioactive materials. Employees have an annual dose limit of 2,000 millirem, which is stricter than federal policy, and few ever get close to it. As employees process in and out of PF-4, they diligently scan their entire bodies, hands, and feet for contamination in addition to wearing a dosimeter, which monitors dosage.

AIR QUALITY: The Laboratory has 25 stations around the perimeter of the site that continuously monitor the air, making it among the most thoroughly monitored air in the world.

HAZARDOUS WASTE: The pit production process inherently creates offput that the Laboratory safely disposes of, commonly known as transuranic waste. Transuranic waste is mostly made up of supplies, instruments, or tools that have been in contact with radioactive materials like plutonium; these items are heavily analyzed before being placed in controlled configurations in designated locations. Most drums of transuranic waste are safely shipped for permanent storage at the Waste Isolation Pilot Plant in Carlsbad, New Mexico.



Because radiation measurements are detectable does not mean that they are hazardous. Radioactivity naturally occurs in the environment, including soil, water, and even food (most famously, bananas!).

Other sources of radiation include:

- cross-country plane flight (about 3.5 millirems)
- orange vintage fiestaware
- medical procedures such as x-rays and CAT scans
- radon (originating in soil and commonly found in homes)



Glossary

dosimetry: The science by which radiation dose is determined by measurement, calculation, or a combination of measurement and calculation.

Los Alamos National Laboratory: A multi-program, federally funded research and development center for the National Nuclear Security Administration (NNSA) of the U.S. Department of Energy (DOE). LANL's priority roles are serving as a nuclear weapons design agency and a nuclear weapons production agency; addressing nuclear threats; and performing national security science, technology, and engineering.

Manhattan Project: A program of research and development undertaken in Los Alamos, New Mexico during World War II to produce the first nuclear weapons that ended the war; led by J. Robert Oppenheimer.

modernization: NNSA activities to ensure the U.S. nuclear weapons stockpile continues to meet Department of Defense requirements while enhancing

safety and security; addressing aging; addressing the unavailability of replacement parts; and integrating with DOD's modernized nuclear weapons delivery systems without providing new military capabilities or the need for underground nuclear testing.

nonproliferation: To slow or stop the spread of nuclear arms.

nuclear deterrence: The maintenance of military power for the purpose of discouraging attack.

nuclear stockpile: Both active and inactive warheads held by the United States. Active warheads include strategic and nonstrategic weapons maintained in an operational, ready-for-use configuration; warheads that must be ready for possible deployment within a short timeframe; and logistics spares.

plutonium: A metallic element that is an important component of nuclear weapons for national defense and global nuclear deterrence.

plutonium pit: A core of a nuclear weapon. Currently, the only place in the U.S. where plutonium pits can be made is Los Alamos National Laboratory.

Plutonium Facility: A more than 200,000 square foot facility at Los Alamos National Laboratory where virtually all plutonium operations occur, including pit manufacturing. The only fully operational, full capability plutonium facility in the nation.

radiation: Energy radiated in the form of waves or particles through space or material.

stockpile stewardship: Maintaining and learning about the stockpile using science instead of above-ground nuclear testing.

transuranic waste: Consists of materials heavier than uranium, usually including supplies, instruments, and tools used in glove boxes where plutonium and uranium work occurs.

warhead vs. bomb: All nuclear weapons in the U.S. stockpile are designated as either a warhead (W) or a bomb (B) based on their launch platform or delivery vehicle (such as air, land, or sea).

war reserve: A collection of warfighting material held in reserve in pre-positioned storage to be used if needed in wartime.

Waste Isolation Pilot Plant (WIPP): A facility in Carlsbad, New Mexico with 2,000-foot deep salt bed layers where transuranic waste is safely and permanently stored.



Our mission is
vital and critical
to national—and global—security.

Thank you
for the work you do.



LOS ALAMOS
NATIONAL LABORATORY

Weapons Production

Enabling credible and sustainable strategic deterrence for the nation.

Find out more at lanl.gov

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