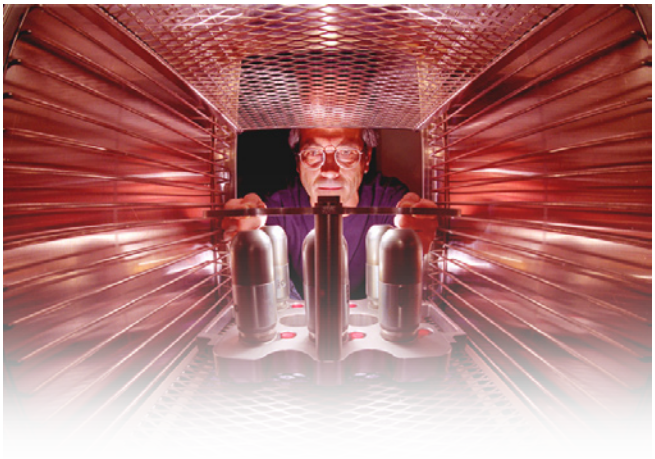
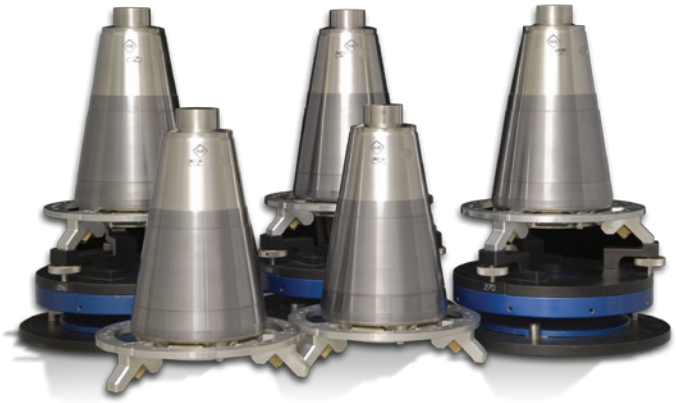
Sandia Nuclear Weapons Core Products

Assurance of the national security of the United States is the primary function of our government. The role of nuclear weapons in assuring deterrence is inherently a government responsibility and national laboratory mission assignment because of the complexity of designing and certifying a complex, integrated system to work only when authorized. In addition, the national consequences of loss of confidence in weapon reliability or the unfathomable impacts of a nuclear accident or security failure must be addressed at the highest levels of government.

These national-level consequences drive requirements for "always/never" surety—near absolute assurance that the weapons always work when authorized and only when experiencing the specific environments that are expected, and that they never provide yield from accident environments or unauthorized use attempts. Our national mission and associated science and technology base derive from the challenges of assuring these "always/never" requirements in extremes of reliability without underground testing; extremes of safety in accidents; extremes of security; extreme operating environments; extreme time requirements (i.e., sitting passively without testing for long periods of time); challenges of introducing evolving technologies that are certifiable in all of these requirements; and the extreme consequences of failure of the reliability, safety, security, or safeguarding of the technology.

Sandia National Laboratories provides core products to fulfill the non-nuclear engineering responsibility as well as to provide the overall weapon system engineering integration of the nuclear explosive package with the components that enable it to function reliably and safely with the military delivery system. Core products include those that are critical to the reliability, safety, security, and survivability of the nuclear weapons. These core products often cannot be procured from a commercial vendor because there are rigorous design requirements and a need to qualify them as part of the overall system; the availability of future suppliers creates unacceptable risk; and a fundamental understanding of the science and technology base is required to ensure reliable and safe functionality for the system lifetime. Core Sandia products are as follows:





Warhead System Engineering and Integration

This activity involves the complex responsibility of designing, integrating, modeling, and testing all the thousands of parts to work together in a fully functional weapon system to meet all military requirements. The final product is the fully functional weapon certified to meet all the reliability, safety, security, radiation survivability, size, weight, and many other military requirements.

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Arming, Fuzing, and Firing Systems

These three integrated subsystems provide the critical functions that reliably operate the weapon at its intended target when authorized. These functions include weapon unlocking, sensing of the exact location with precise timing, nuclear safety and use control features, and firing of the main explosive detonators at the critical time. The ability to design, test, and manufacture radiation hardened electronics is essential to the functionality of most types of warheads.

Neutron Generators

The neutron generators provide the neutrons necessary to reliably initiate the fissioning process at the precise time in the nuclear implosion process that the plutonium core has become super¬critical. The design, manufacturing, and testing capability of these components is part of the overall Sandia neutron generator enterprise.

Gas Transfer Systems

The radioactive gas creates the initial fusion process. The gas storage technology, reservoirs, valve systems, and even the shipping and storage containers are part of this Sandia product set.

Surety Systems

Surety is the overall safety, use control, and security approaches to ensure that weapons cannot operate until properly authorized. For nuclear safety, a weapon is designed such that in abnormal (accident) environments, it will fail in a manner that is predictably safe based upon first principles of known material responses and physics underpinned by science and technology. Nuclear safety is often implemented through principles of isolation of the explosives from energy sources, incompatibility of intended arming signals with accidental signals, fail-safe inoperability of critical functions before any safety barriers fail in accident environments, and the use of redundant, independent safety features. Stronglinks, weaklinks, exclusion regions, lightning arrestor connectors, barriers, and even the design of the arming, fuzing, and firing system are examples of these safety core products.

For use control and security, Sandia also applies a set of principles referred to as SAFE: Secure always; Aware of the situation; Forbids undesirable consequences; Enables when specifically authorized. Sandia use control and security core products include permissive action links, code management systems, safeguard transporters, and multiple security technologies.

In addition to these core products, Sandia provides many support products such as spin rockets and parachutes required for weapon operations; joint test assemblies, surveillance sensors, telemetry, instrumentation, and testers required for stockpile evaluation; and manuals required for field support of the weapons by the military users.

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