

Stockpile Stewardship

Nevada
Test
Site

Stockpile Stewardship Program

Introduction

When the Nevada Test Site was established in 1951, it provided a proving ground for a burgeoning U.S. nuclear weapons program. One hundred atmospheric nuclear tests occurred at the test site between 1951 and 1962. When the U.S. entered into an atmospheric testing moratorium, all testing moved underground. In 1992, the president instituted a moratorium on nuclear testing. In order to certify the safety and reliability of the nation's nuclear stockpile, developing improved computer models and advanced experimental capabilities that provide accurate predictive capability of weapon performance in the absence of nuclear testing became the main goal of the National Nuclear Security Administration's Stockpile Stewardship Program.

The Birth of the Stockpile Stewardship Program

The Stockpile Stewardship Program was established in response to the 1994 National Defense Authorization Act (Public Law 103-160) which requires, in the absence of nuclear testing, a program to:

1. Support a focused, multifaceted program to increase the understanding of the enduring stockpile;
2. Predict, detect, and evaluate potential problems of the aging stockpile;
3. Refurbish and re-manufacture weapons and components, as required; and
4. Maintain the science and engineering institutions needed to support the nation's nuclear deterrent, now and in the future.

As the civilian steward of the nation's nuclear weapons complex, the U.S. Department of Energy (DOE) National Nuclear Security Administration is responsible for the safety and reliability of the nation's nuclear arsenal. The U.S. Department of Defense (DoD) partners with the DOE in setting requirements and establishing production goals. A key challenge to the Stockpile Stewardship Program is to balance military weapon performance goals against civilian and military surety and safety concerns.

Assessment and Certification

In the absence of nuclear testing, different experiments and tools are relied upon to obtain data relevant to nuclear warhead performance as components within a warhead potentially change properties with age. The Stockpile Stewardship Program utilizes several approaches to assess and certify the nuclear weapons stockpile. Test data from new experiments and improved computer modeling help address the reliability of the nuclear weapons stockpile by allowing scientists to improve understanding of the dynamic properties of aging nuclear materials.

A suite of enhanced capabilities and facilities across the Nuclear Weapons Complex (which includes weapons laboratories, production plants, and the Nevada Test Site) have been developed to fill in the knowledge gaps and to provide data relevant to identified stockpile concerns. Capabilities specific to the Nevada Test Site include the following:

- Subcritical Experiments obtain technical information about the U.S. nuclear weapons stockpile in the absence of nuclear testing. In subcritical experiments, chemical high explosives generate high pressures that are applied to nuclear weapon materials, such as plutonium. The configuration and quantities of explosives and nuclear materials are such that no nuclear explosion will occur. Thus, the experiments are consistent with the existing U.S. nuclear testing moratorium. They are called "subcritical" because there will be no critical mass formed, i.e., no self-sustaining nuclear fission chain reaction will occur. Scientific data is obtained on the behavior of nuclear weapon materials by the use of a wide variety of sophisticated, high speed diagnostic instruments.



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- The Joint Actinide Shock Physics Experimental Research (JASPER) two-stage gas gun experiments generate high shock pressures, temperatures, and strain rates that simulate those of a nuclear weapon. The gas gun forces a high-velocity projectile to a target containing special nuclear material. When the projectile hits the target it produces a high-pressure shock wave. Diagnostic equipment, triggered by the initial wave, measures the properties of the shocked material inside the target.
- The Atlas pulse power machine discharges electrical energy into a cylindrical metal shell to produce an intense pressure pulse that implodes a target containing non-nuclear materials of interest. Highly advanced optical and x-ray diagnostic equipment measures the properties of the imploding materials within the target.
- The Big Explosives Experimental Facility (BEEF) is a hydrodynamic testing facility at the Nevada Test Site. BEEF provides data, through conventional high-explosive experiments, to support the Stockpile Stewardship Program, along with a variety of new experimental programs that expand the nation's non-nuclear experiment capabilities.

Maintaining Nuclear Test Readiness

The President directed the U.S. Department of Energy to maintain a test readiness program in the event that resumption of nuclear weapons testing becomes necessary. Overall readiness is supported by experimental programs conducted at the test site. In particular, test readiness at the Nevada Test Site is critically dependent on laboratory-based experiments that exercise high-bandwidth recording and advanced diagnostic development that are not required for non-nuclear experiments.

Program Thrusts

The DOE weapons laboratories are engaged in a balanced and integrated program of computational simulation, fundamental scientific research, and improved nuclear and non-nuclear experiments. Experimental data, obtained from experiments conducted at Atlas and BEEF, are being used to assess weapon component performance. Together with past nuclear test results, they are also being used to validate computer simulations, which rely heavily on fundamental scientific research as a source of data and a basis for the detailed physics models in the weapons codes. Once validated, weapons physics simulations will guide the judgments made about integral stockpile performance, reliability and safety issues.

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