Stockpile Stewardship

The Birth of the Stockpile Stewardship Program

The Stockpile Stewardship Program (SSP) 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’s Defense Programs Office in order to certify the safety and reliability of the nation’s nuclear stockpile in the absence of nuclear testing. Under the Stockpile Stewardship Program, nuclear weapons activities at the NNSS were focused on non-nuclear experimentation to inform predictive models used in high-performance computing simulations that underpin performance, safety and reliability of the current and future stockpile.

Assessment and Certification

The Stockpile Stewardship Program utilizes several approaches to assess and certify the nuclear weapons stockpile. In the absence of nuclear testing, a wide variety of experiments and analysis tools are used to obtain data relevant to nuclear warhead performance. Of particular note is the need to track changes as components within a warhead potentially age or are replaced with newly-manufactured components through the process of Stockpile Life Extension (LEP) and modernization programs. Data from these experiments and improved computer modeling allow scientists and engineers to develop a better understanding of the dynamic properties of aging or replaced components and help to provide confidence in the reliability and safety of the nuclear weapons stockpile. A suite of enhanced capabilities and facilities across the Nuclear Security Enterprise (NSE) (which includes weapons laboratories, production plants and the NNSS) have been developed to fill in the knowledge gaps and to provide data relevant to
both identified and yet-to-be identified stockpile concerns. Capabilities specific to the NNSS 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. Scientific data are obtained on the behavior of nuclear weapon materials by the use of a wide variety of sophisticated, high speed diagnostic instruments developed by the NNSS/MSTS in collaboration with National Laboratory partners (LANL, LLNL and SNL).

- The **Joint Actinide Shock Physics Experimental Research (JASPER)** facility enables two-stage gas gun experiments that generate data on plutonium material behavior under the extreme conditions encountered in nuclear weapons. JASPER represents a strong partnership between the NNSS and Lawrence Livermore National Laboratory to carry out detailed measurements on small plutonium samples subjected to the high shock pressures, temperatures and strain rates that are required in predictive models of nuclear weapon performance. The JASPER gas gun projects a high-velocity projectile onto a target containing special nuclear material.

- The **Big Explosives Experimental Facility (BEEF)** is a hydrodynamic testing facility at the NNSS. BEEF provides data, through conventional high-explosive experiments, to support the SSP, along with a variety of new experimental programs that expand the nation’s non-nuclear experiment capabilities.

- Outlying sites of the NNSS provide staff and technologies to support Stockpile Stewardship efforts in collaboration with laboratory colleagues. NNSS engineers, scientists and technicians provide critical experimental fielding support and develop sophisticated diagnostics required for present and future Stewardship experiment needs at various facilities. These facilities include DARHT, LANSCE and DEOS at Los Alamos, New Mexico; Livermore’s National Ignition Facility (NIF) and Contained Firing Facility; Sandia’s Z-machine; and the MSTS Special Technologies Laboratory (STL) in Santa Barbara, California.

### 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 the NNSS are being used, together with past nuclear test results and other experimental platforms across NNSA sites, to assess the performance, safety and reliability of the stockpile. The data obtained at NNSS sites are being used to develop and validate the physics models used in computer simulations that underpin current and future stockpile assessments.