Chapter 4
Nuclear Weapons Program Infrastructure

4.1 *Overview*

The Department of Energy (DOE) through the National Nuclear Security Administration (NNSA) and in partnership with Department of Defense (DoD) is responsible for ensuring that the United States has a safe, secure, and reliable nuclear deterrent.[1] The characteristics of this deterrent are evolving as the world changes. In 2001, U.S. policy on strategic deterrence was revamped in recognition that the premise for the strategy had progressed from one of deterring a peer adversary to one of also responding to emerging threats. The 2001 Nuclear Posture Review (NPR) directed modifications in the structure of the deterrent to adjust to changes in the nature of the threat. Specifically, the NPR called for the following:

- Changing the size, composition, and character of the nuclear stockpile in a way that reflects the reality of the end of the Cold War;
- Achieving a credible deterrent with the lowest possible number of nuclear warheads consistent with national security needs, including obligations to our allies; and
- Transforming the NNSA nuclear weapons complex (also referred to as the "Complex") into a responsive infrastructure that supports specific stockpile requirements and maintains the essential U.S. nuclear capabilities needed for an uncertain global future.

In accordance with the policy outlined in the 2001 NPR, the structure of the U.S. nuclear deterrent is in the process of transition from one that relies on nuclear weapon stockpile quantities to one that relies on capabilities. The science-based Stockpile Stewardship Program (SSP) was established in the mid- 1990s in recognition of the fact that the nation needed new tools to sustain the stockpile without underground nuclear testing. More than a decade later, these tools are being used to support the needs of the stockpile. The next step in the process of transformation is to leverage the investments in the SSP to enhance the responsiveness of the design, certification, and production components of the Program.

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[1] This chapter was excerpted from the DOE/NA-0014 document, *Stockpile Stewardship Plan Overview FY07-11*, November 13, 2006; and DOE/NA-0013 *Complex 2030*: *An Infrastructure Planning Scenario for a Nuclear Weapons Complex Able to Meet the Threats of the 21st Century*, October 23, 2006.

4.1.1 Complex Transformation

The NNSA has a vision for the nuclear weapons complex of 2030. This scenario consists of four over-arching, long-term strategies: first, in partnership with the DoD, transform the nuclear stockpile, refurbish limited numbers of legacy designs, and accelerate dismantlement of the Cold War stockpile; second, transform to a modernized, cost-effective nuclear weapons complex; third, create a fully integrated and interdependent nuclear weapons complex; and lastly, drive the science and technology base essential for long-term national security.

These strategies are being complemented by near-term actions to build confidence in the transformation process. The U.S. is committed to achieving a credible deterrent with the lowest possible number of nuclear weapons. Hence, establishing a responsive infrastructure that could facilitate reductions in the size of the stockpile, developing a warhead concept that reduces the likelihood of resuming underground nuclear testing, and accelerating dismantlement of retired weapons are all essential elements of a necessary path forward.

4.1.2 The U.S. Nuclear Weapons Complex

The following briefly describes each of the major operations of the current U.S. nuclear weapons complex and its associated missions. Figure 4.1 provides an overview of the locations of current facilities in the complex.

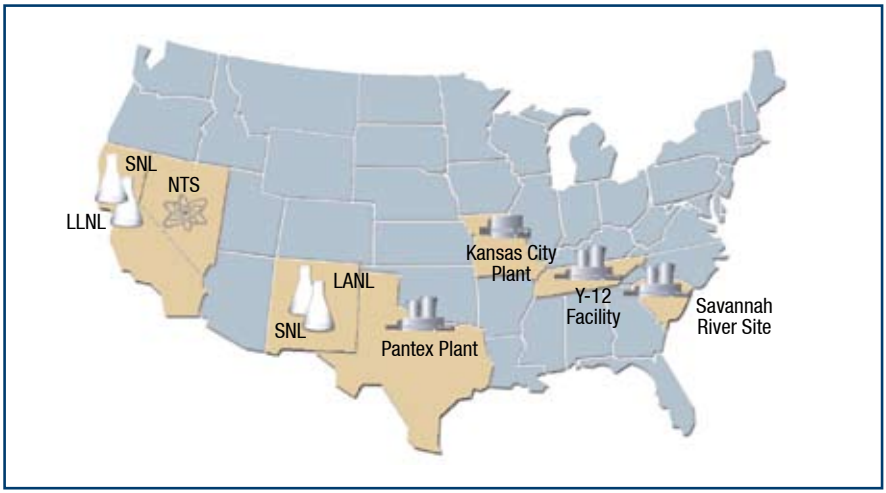

Figure 4.1 The Nuclear Weapons Complex

Pantex Plant

Pantex Plant (see Figure 4.2), located 17 miles northeast of Amarillo, Texas, in Carson County, is charged with maintaining the safety, security, and reliability of the nation's nuclear weapons stockpile. The facility is managed and operated by a contractor, BWXT Pantex, for the DOE/NNSA.

Figure 4.2 Pantex Plant

Pantex has five primary missions:

1. Evaluate, retrofit, and repair weapons in support of both life extension programs and certification of weapons safety and reliability;
2. Dismantle weapons that are surplus to the strategic stockpile;
3. Sanitize components from dismantled weapons;
4. Develop, test, and fabricate high explosive components; and
5. Provide interim storage and surveillance of plutonium pits.

All work at the Pantex Plant is performed in the context of several interdependent and equally important priorities: (1) the security of weapons and information; (2) the safety and health of workers and the public; and (3) the protection of the environment. Approximately 3,500 people are employed at Pantex; about 3,200 work for BWXT Pantex, and the remaining staff work for one of the federal entities represented at the Plant.

Kansas City Plant

The Kansas City Site Office is a principal NNSA non-nuclear production site within the weapons complex. The Kansas City Plant (KCP) (Figure 4.3) is managed and operated by Honeywell Federal Manufacturing & Technologies. Products developed at the KCP include electrical, electronic, electromechanical, plastic, and nonfissionable metal components for nuclear weapons. The Kansas City Plant provides critical support for Directed Stockpile activities and the Stockpile Maintenance and Stockpile Evaluation programs.

Figure 4.3 Kansas City Plant

Y-12 Facility

The national security mission of the Oak Ridge Operations Office is carried out at the Y-12 National Security Complex (see Figure 4.4), formerly known as the Oak Ridge Y-12 Plant, in Oak Ridge, Tennessee. Part of the Manhattan Project, Y-12 was built to produce enriched uranium for the first nuclear weapon during World War II. Portions of every weapon in the U.S. nuclear stockpile have been manufactured at the Y-12 facility.

Figure 4.4 Y-12 National Security Complex

Programs at Y-12 include manufacturing and reworking nuclear weapon components, dismantling nuclear weapon components returned from the national stockpile, serving as the nation's storehouse of special nuclear materials, and providing special production support to other programs. Y-12 is responsible for uranium components, salt components, and secondary assembly. Y-12 maintains the capability to produce and assemble uranium and lithium components, recover materials from the fabrication process and retired weapons, and to produce non-nuclear weapons components.

Y-12 is operated by BWXT Y-12 for DOE.

Savannah River Site

The primary nuclear weapons missions performed at the Savannah River Site (SRS) include limited-life component exchanges, reservoir surveillance, and tritium extraction. These missions currently involve the filling and shipping of new and reclaimed reservoirs containing tritium, deuterium, and non-tritium gases, and surveillance of gas transfer system components. A new Tritium Extraction Facility became operational at the SRS in 2006 to process targets irradiated in one of the Tennessee Valley Authority reactors to produce new tritium. This facility is producing tritium for the first time in the U.S. since 1988.

The SRS tritium operations include processes for:

- purification and enrichment of tritium;

- mixing and compression of tritium, deuterium, and non-tritium gases;
- pinch-welding of gas-filled reservoirs;
- reclamation of returned reservoirs;
- function testing, inert metallography, and environmental conditioning for reservoir surveillance;
- quality inspection, packaging, and shipping of reservoirs; and
- tritium extraction from irradiated targets.

Figure 4.5 Workers at the Savannah River Site

Figure 4.5 depicts workers at the Savannah River Site working with shielded cells to protect themselves from harmful radiation exposure.

Los Alamos National Laboratory (LANL)

The Los Alamos National Laboratory (LANL) in New Mexico is the design laboratory that shares responsibility with Lawrence Livermore National Laboratory in California for the safety and reliability of the nuclear explosives contained within U.S. nuclear weapons. While both design laboratories maintain the capability to design and develop new nuclear weapons, LANL possesses unique capabilities in neutron scattering, enhanced surveillance, pit production, and plutonium science and engineering. Figure 4.6 depicts LANL workers in Technical Area (TA)-55, the Los Alamos plutonium facility.

Figure 4.6
Workers in LANL TA-55

LANL oversees refurbishment and surveillance for both nuclear and non-nuclear components of stockpile weapons and handles diagnostics for all plutonium pits. LANL is the associated physics lab for the B61-3/4/10, B61-7/11, W76, W78, W80-0, W80-1, and W88 Warheads.

Lawrence Livermore National Laboratory (LLNL)

The Lawrence Livermore National Laboratory (LLNL) in Livermore, California is the design laboratory that, together with LANL, supports the integrated NNSA program of surveillance, including efforts to better predict aging phenomena, assessment (validated by simulation and

experiments), and refurbishment of stockpile components. Principal activities include stockpile surveillance, stockpile assessment, stockpile refurbishment, and integrated program management.

Figure 4.7 The National Ignition Facility

LLNL is also responsible for weapon designs and provides high explosives research and laser facilities such as the National Ignition Facility (NIF) (see Figure 4.7) for weapon physics experiments. LLNL also handles the diagnostics for nuclear secondaries. LLNL is the associated physics lab for the W62; B83-0/1; W84; and W87 warheads; in the future, LLNL will be the associated physics lab for the W80-2/3.

Sandia National Laboratories, New Mexico (SNL/NM) and California (SNL/CA)

Sandia National Laboratories

Sandia National Laboratories is the third of the U.S. national nuclear weapons laboratories and has two locations associated with each of the national design laboratories (LANL and LLNL).

Figure 4.8
A Technician Prepares the Cathode Cover of the Sandia-Designed, High-Intensity Flash X-Ray System for Weapons Certification

Sandia National Laboratories, New Mexico (SNL/NM) performs the following activities:

- systems engineering of nuclear weapons (see Figure 4.8);
- design, development, and manufacturing of non-nuclear components of nuclear weapons; and,
- field and laboratory non-nuclear testing.

Sandia National Laboratories, California (SNL/CA) provides mechanical, electrical, structural, and chemical engineering for the nuclear weapons programs at LLNL.

Nevada Test Site (NTS)

The Nevada Test Site (NTS), northwest of Las Vegas, performed above-ground and underground nuclear weapons testing and evaluation from the 1950s until 1992. Although the United States is currently observing a self-imposed moratorium on underground nuclear testing (UGT), the NTS maintains the capability to resume UGT if so directed. Sub-critical nuclear tests are still performed at the NTS (see Figure 4.9).

Figure 4.9 Vito Subcritical Experiment Racklet

4.2 Stockpile Stewardship Program

The *National Defense Authorization Act for Fiscal Year 1998* (Public Law 105-85) required the DOE to develop an annual Stockpile Stewardship Plan for the sustainment of the U.S. nuclear stockpile in the absence of UGT.[2] The SSP is the implementing strategy of the NNSA to ensure a credible U.S. nuclear deterrent without UGT. Stockpile stewardship is an all-encompassing program that includes:

- operations associated with surveying, assessing, maintaining, refurbishing, manufacturing, and dismantling the nuclear weapons stockpile;
- activities associated with the research, design, development, simulation, modeling, and non-nuclear testing of nuclear weapons components; and
- assessment of safety, security, and reliability as well as certification of the stockpile.

In the past, nuclear testing and the continuous development and production of new nuclear weapons were essential to preserve high confidence in the stockpile. However, the United States has not manufactured a new weapon-type since the early 1990s. Under the SSP, the U.S. strategy is to maintain the existing nuclear weapons stockpile using improved experimental capabilities complemented by advanced simulation and surveillance tools as a substitute for underground nuclear testing.

[2] This section was excerpted from the DOE/NA-0014 document, *Stockpile Stewardship Plan Overview FY07-11*; November 13, 2006.

4.2.1 The Transition to a Science-Based Substitute

The 1992 legislation that ended the U.S. nuclear testing program caused an immediate concern that, when certain unique nuclear component problems arose, they might not be possible to repair. Until that time, nuclear testing might have been used to confirm and define the problem, and to validate any modifications to fix the problem.[3] It was generally accepted that, without nuclear testing, no new replacement warheads could be fielded. This led to the establishment of a Science-Based Stockpile Stewardship (SBSS) program in 1993 to develop a science-based substitute for nuclear testing. The SBSS program evolved into the current DOE/NNSA campaigns that support this substitute, including the Advanced Simulation and Computing (ASC) campaign.

While there is considerable controversy concerning the technical feasibility of a science-based substitute for nuclear testing, it is the current policy of the U.S. to work toward this goal. It was originally estimated that it would take decades to accomplish this objective. To provide assurances that the lack of nuclear testing would not put the U.S. on a path to unintended unilateral disarmament (due to the forced retirement of one warhead-type after another as they aged and developed unique catastrophic nuclear component problems), three additional programmatic steps were taken in 1993. First, the stockpile plan was restructured. As Active Stockpile (AS) warheads were reduced from Cold War stockpile quantities to a START I level, the U.S. decided to retain some of them as Inactive Stockpile (IS) reliability replacement warheads. If one warhead-type developed a unique problem, another type from the IS reliability replacement category could serve as a substitute. This was a programmatic and technical hedge against a possible unique nuclear component problem that could not be resolved without nuclear testing. Second, the DOE established a special facility at Los Alamos to produce plutonium pits in a laboratory environment, with a capacity to produce a small number of pits per year. At that time, it was assumed that the production of new pits of a tested and proven design, especially in a laboratory rather than a mass production environment, could provide a replacement alternative if it were eventually required. Third, the President approved keeping the NTS in reserve[4] as a last resort if the U.S. needed to return to nuclear testing to preserve the U.S. nuclear deterrent.

There are several concerns about the feasibility and practicality of a science-based substitute for nuclear testing. The various elements of the NNSA SSP

[3] More than 99 percent of all warhead problems have been detected through non-nuclear testing and surveillance and have been fixed by replacing components without nuclear testing.

[4] The NTS is active for many other functions but it is in reserve for nuclear testing.

and other supporting campaigns require a significant portion of the NNSA budget. The length of the projected timeline for achieving a fully functioning science-based substitute for nuclear testing raises skepticism. Many in the community with a scientific background believe that the only way to have high confidence is with an empirical (nuclear) test. The arguments that support the science-based approach recognize that at any given moment, an empirical test would provide more accurate data and higher confidence than without a test.

However, looking at the evolution of both nuclear testing and computer simulation over time, a mature computer simulation can provide better data and confidence than a test conducted in the beginning of the U.S. nuclear testing program. Nuclear tests in the late 1940s were supported with only crude technology and very limited computing capabilities. DOE computers in the 1980s provided much better data estimates and technical predictions than those of the first generation of nuclear tests. Today's science-based program has the advantage of using all previous test data, in addition to the data derived from the various supporting particle physics and other non-nuclear experiments that the U.S. continues to conduct. Thus, modern non-nuclear experiments—supported by the full complement of historical data, more mature technology, and experienced scientific judgment—provide greater accuracy and confidence than a nuclear test conducted 40 or 50 years ago. Many believe that there will come a time when developing capabilities and knowledge will allow U.S. scientists and engineers to achieve a level of accuracy and confidence equivalent to that which was possible to obtain with a nuclear test in the early 1990s when UGT was terminated in the United States.

4.2.2 Stockpile Stewardship Program Elements

The established goals of the SSP are achieved through the integration of stockpile support, surveillance, assessment, design, and manufacturing processes. The SSP has been coordinated with the DoD and is comprised of the following elements:

- Directed Stockpile Work (DSW);
- Campaigns;
- Readiness in Technical Base and Facilities (RTBF);
- Secure Transportation Asset (STA);
- Nuclear Weapons Incident Response (NWIR);
- Facilities and Infrastructure Recapitalization Program (FIRP);
- Environmental Projects and Operations Program (EPO); and
- Defense Nuclear Security (formerly Safeguards and Security).

Directed Stockpile Work (DSW)

The goal of DSW is to ensure that U.S. nuclear weapons are safe, secure, and reliable. This goal is achieved by:

- developing solutions to extend weapon life by identifying and correcting potential technical issues;
- refurbishing warheads to install life extension solutions and other authorized modifications to enhance safety, security, and reliability;
- conducting evaluations to assess or certify warhead reliability and to detect/anticipate potential weapon issues, primarily due to aging;
- conducting scheduled warhead maintenance;
- producing and installing limited life components (LLCs);
- dismantling warheads retired from the stockpile; and
- providing the unique personnel skills, equipment, testers, and logistics support to perform nuclear weapons operations.

Figure 4.10
Non-Nuclear Testing Being Conducted on a Warhead

As an example of Directed Stockpile Work, Figure 4.10 depicts a warhead undergoing non-nuclear tests.

Campaigns

Campaigns are focused scientific and technical efforts to develop and maintain critical capabilities needed to enable continued certification of the stockpile for the long-term. Campaigns are technically challenging, multifunctional efforts that have definitive milestones, detailed work plans, and specific deliverables. Currently, there are six campaigns in the following areas:

- Science;
- Engineering;
- Inertial Confinement Fusion (ICF) Ignition and High-Yield;
- Advanced Simulation and Computing (ASC);
- Pit Manufacturing and Certification; and
- Readiness.

Science Campaign

The goals of the Science Campaign are:

- to develop improved capabilities to assess the safety, reliability, and performance of the nuclear physics package of weapons without further UGT;
- to enhance U.S. readiness to conduct additional UGT if directed by the President; and
- to develop essential scientific capabilities and infrastructure.

The Science Campaign provides capabilities to support continuous assessment activities; certify Life Extension Program (LEP) and RRW warheads (if they are developed); improve response times for resolving Significant Finding Investigations; and qualify warhead replacement components that meet the goals of a responsive infrastructure. The Science Campaign is principally responsible for the development of Quantification of Margins and Uncertainties (QMU), the methodology that applies scientific capabilities to stockpile certification issues and to communicate certification findings in a common framework.

The pace of work under the Science Campaign is timed to support an Advanced Simulation and Computing (ASC) Campaign milestone in FY 2010 to release substantially improved simulation codes for nuclear components in support of RRW and other certification requirements in the 2012 time frame. This shared code release will require the incorporation of improved physics and materials models, which must be provided by FY 2009, including validated models for plutonium equation-of-state and constitutive properties, improved boost physics models, completion of the second axis of the Dual Axis Radiographic Hydrodynamic Testing (DARHT) facility as a validation tool, and the use of the High Energy Density Physics (HEDP) facilities.

The Science Campaign is the principal mechanism for supporting the scientific knowledge and skills base that is required to maintain the technical vitality of the national nuclear weapons laboratories, to enable them to respond to emerging national security needs, and to maintain a technological edge in order to prevent a national security reversal. As such, the campaign also develops and maintains the scientific infrastructure of the three national nuclear weapons laboratories and maintains a set of academic alliances to help ensure scientific command in important fields of research. Finally, the Science Campaign is maintaining readiness to conduct UGT, as directed by the President. Figure 4.11 illustrates an experiment being conducted at the High Explosives Applications Facility at LLNL as part of the NNSA Science Campaign.

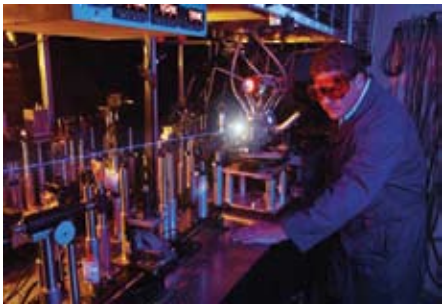

Figure 4.11
An experiment being conducted at the High-Explosives Applications Facility at LLNL

Engineering Campaign

Four Engineering Campaign subprograms provide the U.S. Nuclear Weapons Complex with modern tools and capabilities in engineering sciences to ensure the safety, security, reliability, and performance of the current and future United States nuclear weapons stockpile, and a sustained engineering basis for stockpile certification and assessments throughout the life-cycle of each weapon.

The goal of the Engineering Campaign is to develop capabilities to assess and improve the safety, reliability, and performance of the non-nuclear and nuclear explosive package engineering components in nuclear weapons without further UGT. Additionally, the purpose is to increase the U.S. ability to predict the response of all components and subsystems to external stimuli (large thermal, mechanical, and combined forces and extremely high radiation fields) and the effects of aging, and to develop essential engineering capabilities and infrastructure. The four subprograms of the Engineering Campaign are:

- *Enhanced Surety* – provides validated surety (safety, security, and control) technology as options for the stockpile refurbishment/replacement program to assure that modern nuclear surety standards are fully met and a new level of use denial performance is achieved so that security for nuclear weapons remains effective against ever-changing threats.
- *Weapon Systems Engineering Assessment Technology* – provides the scientific understanding, experimental capability, diagnostic development, and data required to develop and validate engineering computational models and to develop an assessment methodology for weapons design, manufacturing, qualification, and certification.
- *Nuclear Survivability* – provides the tools and technologies needed to design and qualify components and subsystems to meet requirements for radiation environments (e.g., intrinsic radiation, production, and surveillance radiography), space environments, and hostile environments; develops radiation-hardening approaches and hardened components; and modernizes tools for weapon outputs. Validated tools and technologies for the entire stockpile, including current and future LEPs, are provided through this subprogram and its integration with weapon-specific Directed Stockpile Work.

- *Enhanced Surveillance* – provides component and material lifetime assessments to support weapon refurbishment decisions and develops advanced diagnostics and predictive capabilities for early identification and assessment of stockpile aging concerns.

Inertial Confinement Fusion (ICF) Ignition & High-Yield Campaign

The goal of the ICF Ignition and High-Yield Campaign is to develop laboratory capabilities to create and measure extreme conditions of temperature, pressure, and radiation relevant to nuclear weapons performance, and to conduct SSP-related research in these environments. The Campaign has four strategic objectives related to the study of these HEDP conditions: (1) achieve ignition in the laboratory and develop it as a scientific tool for stockpile stewardship; (2) execute HEDP experiments necessary to provide advanced assessment capabilities for stockpile stewardship; (3) develop advanced technology capabilities that support the long-term needs of the SSP; and (4) maintain a robust national program infrastructure and scientific talent in HEDP.

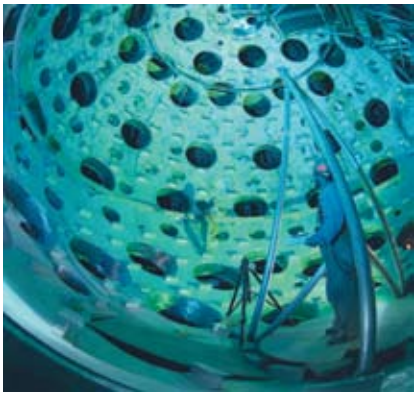

Figure 4.12
A Technician Examines the Target Chamber of the National Ignition Facility During Construction

The demonstration of laboratory ignition will be executed at the NIF (see Figure 4.12), in accordance with the National Ignition Campaign (NIC). The NIF/NIC, as the major focus of the ICF Campaign, encompasses a plan to perform the necessary research, technology development, procurement, engineering, and integration of hardware to perform a credible first ignition experimental campaign on the NIF in FY 2010. Continuing campaigns after 2010 will define physics requirements for ICF fusion in SSP applications and explore various drivers.

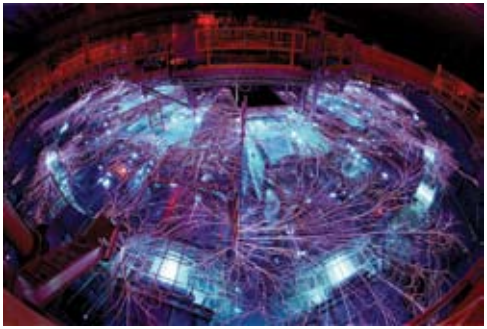

Figure 4.13
"Arcs and Sparks" The Z-Machine at the Moment of Firing

In addition to the NIF, the ICF Campaign utilizes two other, second-generation research facilities that are now in the final stages of completion: the Z Refurbishment pulsed power facility at SNL (see Figure 4.13) and the OMEGA

Extended Performance at the University of Rochester Laboratory for Laser Energetics in New York.

Advanced Simulation and Computing (ASC) Campaign

The ASC Campaign develops leading-edge computational science (see Figures 4.14 and 4.15) as a surrogate to nuclear testing, allowing detailed simulation of complex weapons environments under nuclear conditions to support the broad portfolio of the nation's nuclear deterrence needs.

Figure 4.14 The Red Storm Platform in the Supercomputing Annex at SNL in New Mexico

ASC meets weapons assessment and certification requirements by developing world-leading supercomputers and complex computer codes. Enabling competencies include: building large-scale integrated physics codes validated through non-nuclear experimental data and legacy nuclear tests; developing the ability to quantify confidence bounds on the uncertainty in experimental results; and providing the necessary computing hardware and software environments to code users, in collaboration with industrial partners, academia, and government agencies. ASC tools simulate device performance across the entire weapons life-cycle including assurance that systems in the stockpile meet all performance, surety, and stockpile-to-target sequence requirements.

Figure 4.15
BlueGene/L Supercomputer at LLNL
(*The unusual slant to BlueGene/L's cabinets is a necessary design element to keep cooled air flowing properly around each cabinet's 2,000-plus processors.*)

Pit Manufacturing and Certification Campaign

Within the Pit Manufacturing and Certification Campaign, three subprograms make unique contributions to the SSP. The Pit Manufacturing subprogram objectives are to manufacture limited quantities of pits that meet all quality requirements for entry into the stockpile and to develop a limited pit manufacturing capability at existing LANL facilities. The Pit Certification subprogram objective is to certify the nuclear performance of a W88 warhead with a LANL-manufactured pit without nuclear testing and to establish a basis for the certification processes in the production of future replacement pits. The Pit Manufacturing Capability subprogram objective is to establish the capability

to manufacture replacement pits, other than the W88, by developing and demonstrating processes applicable to either existing LANL facilities or a future pit manufacturing facility.

Readiness Campaign

The goal of the Readiness Campaign is to develop and deliver design-to-manufacturing capabilities to meet the urgent and evolving needs of the stockpile and to support the transformation of the Nuclear Weapons Complex into an agile and more responsive enterprise with shorter cycle times and lower operating costs. As part of this goal, the Readiness Campaign provides technology that contributes to faster implementation of new requirements, reduction in cycle times, less waste, leaner manufacturing (fewer components or processing steps), and a capable workforce.

Key elements of this goal are to ensure that the operating costs of the production complex can be optimized to meet customer needs and to achieve greater efficiencies in operating the production complex to meet these needs. It provides design-to-manufacturing and technological readiness capabilities that address current needs and have applications to respond to potential contingencies that may arise. A substantial proportion of Readiness Campaign projects support base workload capabilities and future Nuclear Weapons Complex requirements.

Readiness in Technical Base and Facilities (RTBF) Program

The goal of the RTBF Program is to operate and maintain NNSA program facilities in a safe, secure, efficient, reliable, and compliant condition, including facility operating costs (e.g., utilities, equipment, facility personnel, training, and salaries); facility and equipment maintenance costs (e.g., staff, tools, and replacement parts); and environmental, safety, and health (ES&H) costs; and to plan, prioritize, and construct state-of-the-art facilities, infrastructure, and scientific tools that are not directly attributable to Directed Stockpile Work or to one of the campaigns, within approved baseline costs and schedules.

As highlighted by the DoD NPR, a highly responsive infrastructure can itself become part of a credible deterrent to our adversaries. The RTBF Construction Program plays a critical role in revitalizing the Nuclear Weapons Manufacturing and R&D infrastructure. Investments from this program will support important facilities that contribute to the Nuclear Weapons Complex, improving the responsiveness and/or functionality of the infrastructure and its technology base. Before advancing to capitalized design efforts, conceptual designs for the projects are usually prepared using operating funds.

The RTBF Program partners with the Facilities and Infrastructure Recapitalization Plan (FIRP) to restore the facilities and infrastructure of the

Nuclear Weapons Complex and to maintain them in appropriate condition to support the mission. This ensures that facilities necessary for immediate programmatic workload are maintained sufficiently to support that workload. The FIRP is a capital renewal and sustainability program that was established primarily to reduce the large backlog of deferred maintenance that had developed during the 1990s to an appropriate level, consistent with industry best practices. FIRP funding reduces deferred maintenance, recapitalizes the infrastructure, and reduces the maintenance base by eliminating excess real property. The NNSA is institutionalizing responsible and accountable facility management practices, and sustains the complex at or above industry standards.

The RTBF program contributes to the decisions supporting the improved governance of the Complex by maintaining an inventory of existing infrastructure capabilities, supporting the decisions to right-size the complex, and consolidating materials to assist in footprint reduction to reduce costs associated with long-term security requirements.

Secure Transportation Asset (STA)

The goal of the STA Program is to safely and securely transport nuclear weapons, weapons components, and SNM to meet projected DOE, DoD, and other customer requirements. The role of the STA is expanding as the DOE pursues the consolidation of nuclear materials and the dismantlement of retired warheads.

Nuclear Weapons Incident Response (NWIR)

The NNSA NWIR Program serves as the primary national capability for radiological and nuclear emergency response. The NWIR provides funding for emergency management, operations, support, and response activities that ensure a central point of contact and an integrated response to emergencies requiring DOE/NNSA expertise and technical assistance. The program is organized and personnel are trained to work as a team to respond with an effective range of technical and scientific capabilities to mitigate nuclear and radiological incidents worldwide.

NWIR provides core competencies in three areas:

- Knowledge of U.S. nuclear weapons, radiological dispersal devices, and improvised nuclear devices with specific specialties in spectroscopy, device modeling, radiography and device diagnostics, and assessment technology;
- Technical operations, including explosive ordnance disposal (EOD) procedures and techniques for device access, disablement, render safe

procedures, weapon recovery, stabilization and packaging, and final disposition; and

- Technical support requirements, including attribution, weapons effects, health and treatment capabilities, and the radiological elements of consequence management.

Seven unique Departmental Emergency Response National Assets provide nuclear/radiological assistance to support state and local agencies in responding to major national or international nuclear or radiological accidents or incidents. NWIR assets include:

- The Aerial Measuring System (AMS);
- Accident Response Group (ARG);
- Atmospheric Release Advisory Capability (ARAC);
- Federal Radiological Monitoring and Assessment Center (FRMAC) and Consequence Management Response Teams;
- Radiological Assistance Program (RAP);
- Radiation Emergency Assistance Center/Training Site; and
- Nuclear Emergency Support Teams (NEST).

NWIR also provides outreach, technical support, and training and exercise support to the response community. See Appendix E, *Nuclear Weapons Accident Response*, for additional information about the NWIR.

Facilities and Infrastructure Recapitalization Program (FIRP)

The FIRP mission is to restore, rebuild, and revitalize the physical infrastructure of the Nuclear Weapons Complex. This mission contributes significantly to the third leg of the New Triad, as identified in the 2001 NPR, and supports the objectives of the NNSA's transformation of the complex. The FIRP applies new direct appropriations to address an integrated, prioritized series of repair and infrastructure projects focusing on legacy deferred maintenance that will significantly increase the operational efficiency and effectiveness of the NNSA Nuclear Weapons Complex sites. The FIRP addresses the additional sustained investments above the RTBF base for focused reduction of deferred maintenance to: extend facility lifetimes; reduce the risk of unplanned system and equipment failures; increase operational efficiency and effectiveness; and allow for the recapitalization of aging facility systems. The FIRP works in partnership with the RTBF to assure the facilities and infrastructure of the Nuclear Weapons Complex are restored to an appropriate condition to support the mission, and to institutionalize responsible and accountable facility management practices.

The FIRP Recapitalization subprogram funds projects in accordance with established criteria and priorities that target legacy deferred maintenance reduction and repair of mission-essential facilities and infrastructure. These projects are key to restoring the facilities that house the people, equipment, and material necessary to support scientific research, production, and testing to conduct the SSP, and support the transformation of the complex. FIRP Facility Disposition activities reduce ES&H and security requirements, address a portion of the necessary footprint reduction of the complex, improve management of the NNSA facilities portfolio, and reduce long-term costs and risks.

Environmental Projects and Operations (EPO)

The mission of the EPO program is to continue to reduce risks to human health and the environment at NNSA sites and adjacent areas. The EPO program achieves this goal by:

- operating and maintaining environmental cleanup systems installed by the Office of Environmental Management; and
- performing long-term environmental monitoring activities and analyses.

The EPO operates in a cost-effective manner to assure compliance with federal, state, and local requirements and integrates a responsible environmental stewardship program with the NNSA stockpile stewardship and national security efforts.

Beginning in FY 2007, the NNSA is responsible for the funding and management of Long-Term Response Actions/Long-Term Stewardship (LTRA/LTS), which includes activities such as groundwater treatment; environmental monitoring of surface water, ground water, soils, and landfill remedies; reporting and liaison requirements for various states; and surveillance/monitoring of contaminated, decommissioned buildings that have not been demolished upon completion of Environmental Management program cleanup activities. These LTRA/LTS activities are funded within the EPO Weapons Activities appropriation.

Defense Nuclear Security (Formerly Safeguards and Security)

This program provides protection for NNSA personnel, facilities, SNM, nuclear weapons, and information against a full spectrum of threats, most notably terrorism. The Defense Nuclear Security Government Performance and Results Act unit for NNSA security is comprised of two subprograms: Defense Nuclear Security, managed by the NNSA Associate Administrator for Defense Nuclear Security, and Cyber Security, managed by the NNSA Chief Information Officer.

Physical Security constitutes the largest funding allocation of the NNSA security effort and includes:

- Protective Forces – a site's front-line protection, consisting primarily of armed, uniformed officers;
- Physical Security Systems – intrusion detection and assessment barriers, access controls, tamper protection monitoring, and performance testing and maintenance of security systems;
- Transportation – security for intra-site transfers of SNM, weapons, and other classified material that is not funded through STA (see Figure 4.16);
- Information Security – protection for the classification and declassification of information, critical infrastructure, technical surveillance countermeasures, and operations security;
- Personnel Security – encompasses the processes for administrative determination that an individual is eligible for access to classified matter, or is eligible for access to, or control over, SNM or nuclear weapons; and
- Materials Control and Accountability – control and accountability of SNM.

Figure 4.16
One of Several Training Transport Trailer Vehicles Used During Training Exercises for the Office of Secure Transportation

NNSA continues to maintain its Cyber Security defenses against cyber threats as they increase in number, complexity, and sophistication while supporting the application of advanced information technologies to the NNSA national security and other missions.