Annex A

FY 2011 Stockpile Stewardship Plan

May 2010

National Nuclear Security Administration
United States Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

"So today, I state clearly and with conviction America's commitment to seek the peace and security of a world without nuclear weapons. I'm not naive. This goal will not be reached quickly -- perhaps not in my lifetime. It will take patience and persistence. But now we, too, must ignore the voices who tell us that the world cannot change.

…we will reduce the role of nuclear weapons in our national security strategy, and urge others to do the same. Make no mistake: As long as these weapons exist, the United States will maintain a safe, secure and effective arsenal to deter any adversary, and guarantee that defense to our allies…But we will begin the work of reducing our arsenal."

President Barack Obama
April 5, 2009 – Prague, Czech Republic

Our budget request represents a comprehensive approach to ensuring the nuclear security of our Nation. We must ensure that our strategic posture, our stockpile, and our infrastructure, along with our nonproliferation, arms control, emergency response, counterterrorism, and naval propulsion programs, are melded into one comprehensive, forward-leaning strategy that protects America and its allies.

Maintaining our nuclear stockpile forms the core of our work in the NNSA. However, the science, technology, and engineering that encompass that core work must continue to focus on providing a sound foundation for ongoing nonproliferation and other threat reduction programs. Our investment in nuclear security is providing the tools that can tackle a broad array of national challenges – both in the security arena and in other realms. And, if we have the tools, we will need the people to use them effectively.

The NNSA will need to develop and retain the next generation of scientists, engineers, and technicians required to meet our enduring deterrence requirements as well as the critical work in nonproliferation, nuclear counterterrorism, and forensics. People are ultimately our most important resource. We are working closely with our national laboratories to develop and retain the necessary cadre of the best and the brightest to successfully carry out all of our technically challenging programs into the foreseeable future.

Thomas P. D'Agostino
DOE Undersecretary for Nuclear Security
Statement before the House/Senate Committee/Subcommittee on Appropriations/Armed Services
March 2010

Annex A

Stockpile Stewardship Plan

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1. Introduction

The Stockpile Stewardship Program, administered by the Department of Energy's National Nuclear Security Administration (NNSA), was established by a Presidential Decision directive and authorized by Congress in October 1993. Its purpose is to sustain the safety and effectiveness of the nation's nuclear deterrent without returning to the use of underground nuclear tests. Through the present day, the stewardship endeavor has accomplished its intended purposes, but it now faces multiple challenges. Its successes, however, provide a resilient foundation from which the ongoing transition of the nuclear deterrent can be sustained and impediments overcome. Additionally its successes are moving the nuclear weapons arsenal of the Cold War Era to a smaller, safer, more secure, and still effective stockpile of the future. The purposes of Stockpile Management activities are to oversee the details by which nuclear weapons in that stockpile are maintained, assessed, made more safe and secure, have their effective service life extended through planned refurbishments, and eventually retired and dismantled in accordance with national policy.

The United States (U.S.) Congress funds the work of the NNSA mission through four appropriation accounts:

A) Weapons Activities,
B) Defense Nuclear Nonproliferation,
C) Naval Reactors, and
D) Office of the Administrator.

The Stockpile Stewardship and Management Program work is presently organized into the first category, and it is to these Weapons Activities that *Annex A FY 2011 Stockpile Stewardship Plan* principally addresses itself.

The NNSA Office of Defense Programs administers the nuclear stockpile stewardship and management endeavor in partnership with the Office for Emergency Operations, the Office for Infrastructure and Environment, and the Office for Defense Nuclear Security and the Office for Cyber Security. NNSA performs its nuclear security mission in collaboration with the Department of Defense (DoD).

1.A. The Complex as it Pertains to Stockpile Stewardship and Management

NNSA's nuclear security complex consists of an overall mission; overarching strategies for achieving this mission; unique scientific, technological, engineering and fabrication capabilities that enable the execution of the mission and its strategies; and, ultimately, the successful application of these exceptional capabilities to produce solutions that meet national needs. The complex must execute its functions in a manner that is safe, secure, and respectful of the environment, while continuing to implement effective practices that manage risks and costs.

The unique capabilities of the Stockpile Stewardship and Management portion of the NNSA complex are incorporated at three national laboratories, four sites dedicated to production, and one national test site. These interlinked operations are distributed throughout seven states. The endeavor has been organized into Weapons Activities involving thirteen programs or campaigns. These Weapons Activities, working through the laboratories and production sites, provide the products required by the Stockpile Stewardship and Management mission.

1.B. Products

Many of the products delivered in support of the Stockpile Stewardship and Management Program involve physical items. For example: nuclear weapon systems, components, and ancillary equipment; specialty subsystems that involve plutonium, highly enriched uranium, tritium (a radioactive hydrogen isotope), and energetic materials (e.g., high explosives); plus necessary warhead alterations and refurbishments. Another segment of products are not comprised of physical hardware, but still address critical national security need. For example: complex technological reviews and assessments of security challenges facing the nation, basic scientific understanding of high-energy-density plasmas, interactions of fusion processes with their material surroundings, radiation transport and interactions, advanced technology options for enhancing the surety of the stockpile, and fundamental understanding of difficult materials and chemical interactions. Yet another portion of products involve the generation and sustainment of critical capabilities that enable other stewardship elements to accomplish their mission—for example: advanced calculational or experimental tools for assessing and sustaining the existing stockpile; security services and secure processes for the transportation and storage of high consequence items and materials; unique test facilities for classified or unclassified assemblies; protected cyber networks; and means and resources to prevent harm to the environment.

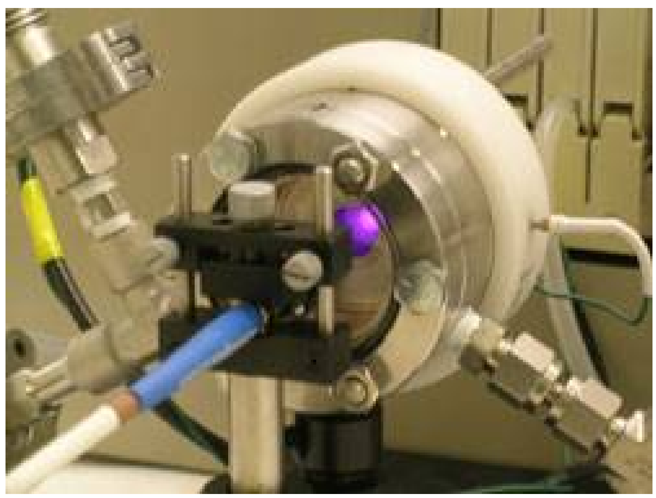

Figure A-1-1. Glow discharge optical emission analysis of plutonium metal.

The research, development, and manufacturing capabilities create the product mix that the nation requires for its nuclear security. Entities within the complex refurbish the nuclear deterrent and deal with its ultimate dismantlement and consequent disposition of materials. Organizations sustain the reliability and safety of the stockpile by developing design solutions to correct significant findings when necessary, and by generating a robust technical basis from which to understand the current status of our country's nuclear weapons. This technical basis is continuously updated, reassessed, and rigorously peer reviewed. Exceptional design capabilities for nuclear weapons, extensive experimental and computational simulation tools, specialized production processes, comprehensive tests conducted either internally or jointly with the DoD, and meticulous performance of surveillance programs, all serve to assess the existing nuclear stockpile and to support future weapon refurbishment options as necessary.

A critical stewardship enabler is the science, technology, and engineering (ST&E) foundation upon which the nation's ability rests to realize and certify the existing and future nuclear deterrent. This technological base involves both human talent and physical facilities. Solving important technical challenges with preeminent science and engineering capabilities provides one of the major means by which critical skills will be preserved. A good example of such a challenge is the fundamental understanding of "boost" of the primary stage, an extremely complicated physics phenomenon which involves the production of high-energy neutrons through the fusion of hydrogen isotopes to increase the amount of fissile material that will undergo fission, thereby yielding more energy. Full understanding of "boost" processes will exercise the nation's most excellent technical talent in the areas of physics, computational simulation, materials science, advanced diagnostics, and other engineering disciplines.

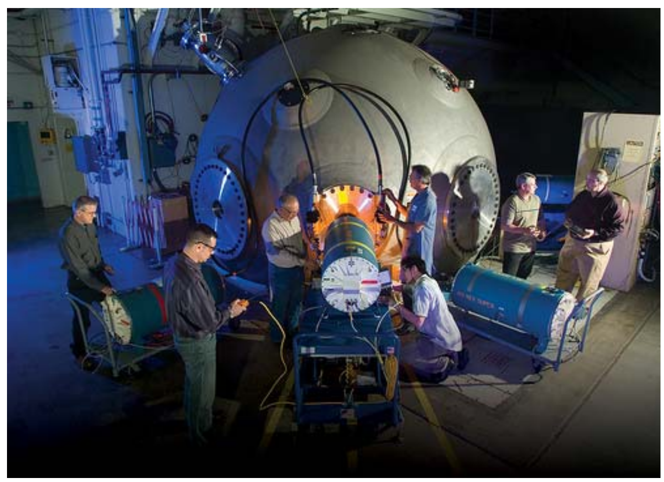

Figure A-1-2. High Explosives Application Facility – a national resource for explosives, pyrotechnics, and propellants research and development.

Extraordinary ST&E capabilities additionally allow NNSA to engage national security issues far beyond the boundaries of the Stockpile Stewardship and Management Program, including assessments of multivariable national threats, technical advice and services for national intelligence agencies, assessments of potential threats from weapons of mass destruction, syntheses of countermeasure approaches to terrorism, technology concepts to support nonproliferation initiatives; and forensics associated with nuclear and radiological substances.

Stewardship challenges intensify when dealing with a smaller, older, and evolving stockpile. ST&E capabilities serve to address three major stewardship areas:

1. Certification of Nuclear Detonation Performance and Reliability

This includes: (a) continual assessment with rigorous scientific and engineering peer reviews of the status of all nuclear weapons in the stockpile, (b) investigations (with attendant solutions) for significant anomalies occasionally uncovered in nuclear weapons, (c) nuclear and non-nuclear materials properties and dynamics, (d) the physics of nuclear reactions,

(e) hydrodynamic flows of materials under extreme pressures and temperatures, and (f) the physics of high-energy-density plasmas.

2. Development and Certification of Integrated Weapon Systems

This includes: (a) the engineering sciences to predict weapon system response in many scenarios and environments, (b) radiation effects sciences, and (c) the deployment of micro engineering technologies for enhanced safety, security, and reliability.

3. Deployment of Technologies for the Lifetime Cycle of Nuclear Weapons

This includes: (a) manufacturing and dismantlement technologies, and (b) novel technologies for the surveillance, maintenance, disassembly, and disposal of stockpile systems.

The special nuclear materials (SNM) research, manufacturing, and production elements of supply, study, and assess nuclear components and subsystems that incorporate weapons-grade plutonium, highly enriched uranium (HEU), and tritium. Plutonium and HEU subsystems for refurbished weapons often are obtained from the recovery and recycling of components that were formerly in the stockpile and less frequently from newly manufactured components. Tritium is produced to replace losses due to radioactive decay while in the stockpile. The unique SNM portions are not only essential for the fabrication, storage, security, assessment, and certification of existing nuclear weapons, but also to respond to existing or potential adversarial threats involving radiological weapons of mass destruction as well as to enable national nonproliferation strategies.

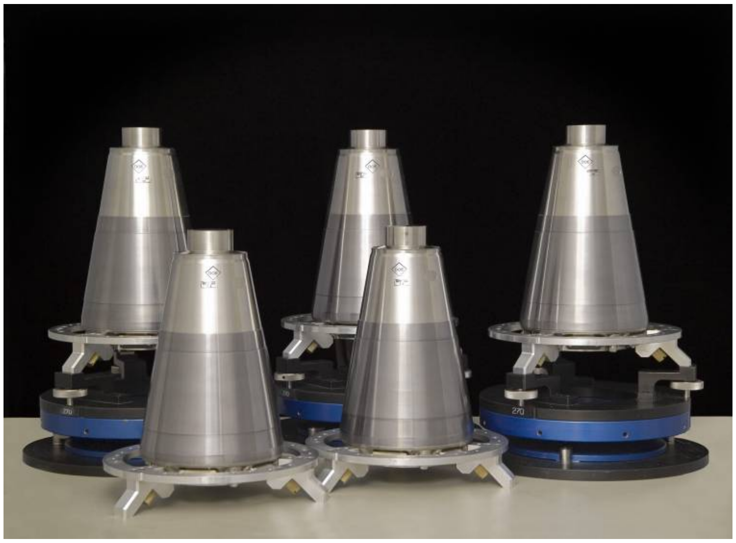

Figure A-1-3. First five arming, fuzing, and firing components produced for the W76-1 Life Extension Project.

The non-nuclear component research, development, manufacturing, and assembly portions are also essential to the Stockpile Stewardship endeavor. A set of critical national capabilities is maintained to produce and assess components and systems that involve high explosives and energetic materials; arming, fuzing, and firing sets; neutron generators; gas transfer systems; radars; power sources; use control, safety and security devices; development and implementation of command and control architectures. Products delivered under the Stockpile Stewardship program are technically sophisticated; require the ability to deal with highly energetic and radioactive substances; and demand rigorous testing under severe environmental conditions (many of which push the boundaries of current scientific knowledge).

The critical skills and capabilities described above not only serve the nuclear stockpile, but also engage the wider NNSA mission by assisting the study and mitigation of global threats and addressing broad national security challenges that extend beyond today's nuclear deterrent.

1.C. How is the Stockpile Stewardship and Management Program Organized and Integrated?

NNSA Weapons Activities

The Stockpile Stewardship and Management endeavor is organized into Weapons Activities involving thirteen programs or campaigns as depicted in Figure A–1–4. These efforts provide the necessary stewardship and management products to engage technically in a broad set of national issues that go beyond the nuclear stockpile and to produce solutions for the country to a myriad of challenges.

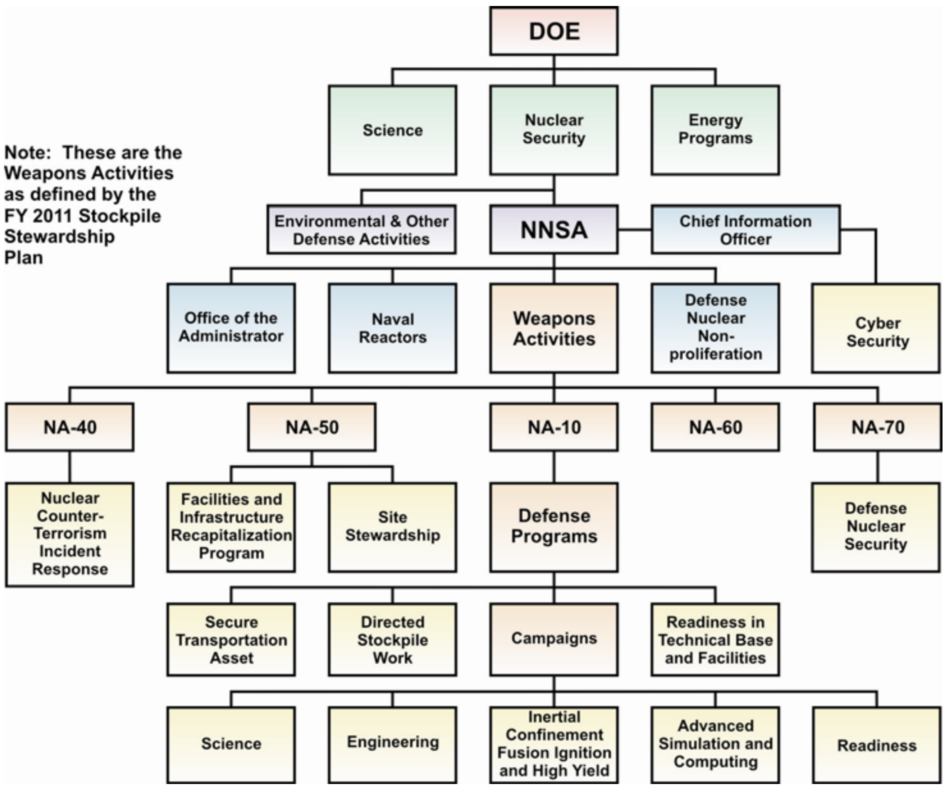

Figure A–1–4. The Department of Energy/NNSA Organization for the thirteen Weapons Activities that execute the Stockpile Stewardship and Management Program.

The thirteen constituent, yet interlinked Weapons Activities elements (of which the first eight are commonly categorized as the "Office of Defense Programs") include:

Directed Stockpile Work (DSW) (Chapter 2) maintains and enhances the safety, security, and effectiveness of the stockpile without underground tests. Subprograms deal with refurbishment warhead studies and the execution of life extension activities, the sustainment of present stockpile systems, weapons dismantlement and disposition, and other necessary services to support the stockpile.

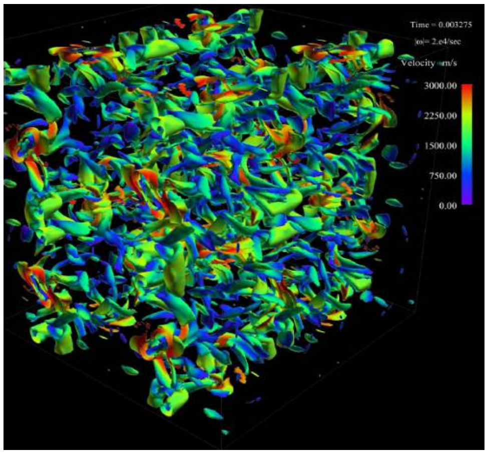

Figure A-1-5. RAMSES numerical code used to simulate the penetration and production of X-rays and electrons inside weapon systems.

Science Campaign (Chapter 3) supports the development of knowledge, tools, and methods to assess the performance of the nuclear explosive package incorporated in nuclear warheads. The campaign includes five sub-activities: advanced certification, primary assessment technologies, dynamic materials properties, advanced radiography and transformational technologies, and secondary assessment technologies.

Engineering Campaign (Chapter 4) provides modern components and engineering science capabilities to ensure the safety, security, reliability, and performance of the stockpile. It includes four sub-activities: enhanced surety, weapons systems engineering assessment technology, nuclear survivability, and enhanced surveillance.

Inertial Confinement Fusion Ignition and High Yield Campaign (ICF) (Chapter 5) constructed the National Ignition Facility and continues to provide scientific understanding of the high-energy-density physics necessary to assess the nuclear stockpile.

Advanced Simulation and Computing (ASC) Campaign (Chapter 6) provides the computational science and simulation tools to understand behaviors and effects of nuclear weapons, as well as national security scenarios.

Readiness Campaign (Chapter 7), with major emphasis on tritium readiness, develops and delivers design-to-manufacturing capabilities to meet the evolving and urgent needs of the stockpile with shorter cycle times and lower operating costs.

Figure A-1-6. Readiness Campaign achieved operational deployment of Multi-Axis Orbital Machining Center at Y-12 to support annual certification requirements.

Readiness in Technical Base and Facilities Program (RTBF) (Chapter 8) provides state-of-the-art facilities and infrastructure supported by advanced scientific and technical tools as required.

Secure Transportation Asset (STA) Program (Chapter 9) ensures that all critical shipments for the weapons and military installations are completed safely and securely, without a compromise or loss of cargo, or radiological release.

Nuclear Counterterrorism Incident Response Program (NCTIR) (Chapter 10) responds to and mitigates nuclear and radiological incidents worldwide.

Facilities and Infrastructure Recapitalization Program (FIRP) (Chapter 11) restores, rebuilds, and revitalizes the physical infrastructure.

Site Stewardship Program (Chapter 12) ensures environmental compliance and energy and operational efficiency throughout the nuclear security complex, while modernizing, streamlining, consolidating, and sustaining the stewardship and vitality of the sites as they transition in accordance with NNSA's plans.

Defense Nuclear Security Program (Chapter 13) protects NNSA personnel, facilities, nuclear weapons and materials, and classified and sensitive information from a full spectrum of threats.

Cyber Security Program (Chapter 14) ensures the deployment of appropriate information technologies and information management security safeguards throughout the NNSA security complex.

The Defense Nuclear Security and Cyber Security programs became individual Weapons Activities two years ago. In the FY 2009 Congressional budget request, these efforts were part of the combined Safeguards and Security activity which was then comprised of two major subprograms.

Strategic Capability Support for Broader Security Missions is a category of work, included in NNSA's Weapons Activities, that utilizes unique science, technology, and engineering capabilities to support national security missions at other Federal agencies. In FY 2009, Congress appropriated a $30 million supplement to strengthen capabilities necessary for analysis of foreign weapons designs. The President's FY 2011 budget (see Section 1.D—*Historical Funding Summaries for Weapons Activities* in this document) includes $20 million request for this category to perform work in accordance with a memorandum of understanding (MOU) between NNSA and the Defense Threat Reduction Agency (DTRA). Because these efforts involve endeavors in areas outside the U.S. nuclear stockpile, it is not discussed further in the present Annex-A *FY 2011 Stockpile Stewardship Plan*.

Today's Sites

The unique capabilities of the Stockpile Stewardship and Management portion of the NNSA complex are incorporated at three national laboratories, one national test site, and four sites dedicated to production as depicted in Figure A–1–7. It is these eight government-owned, contractor-operated entities that conceive, design, simulate, test, qualify, manufacture, assemble, store, dismantle, dispose of, refurbish, reuse, and modify the nuclear weapons product. These agencies also execute unique scientific and technical assessments in the interest of national security, additional significant deliverables. NNSA interconnects these physical sites as well as DoD facilities through the operation of a continental transportation network for the secure movements of critical assets.

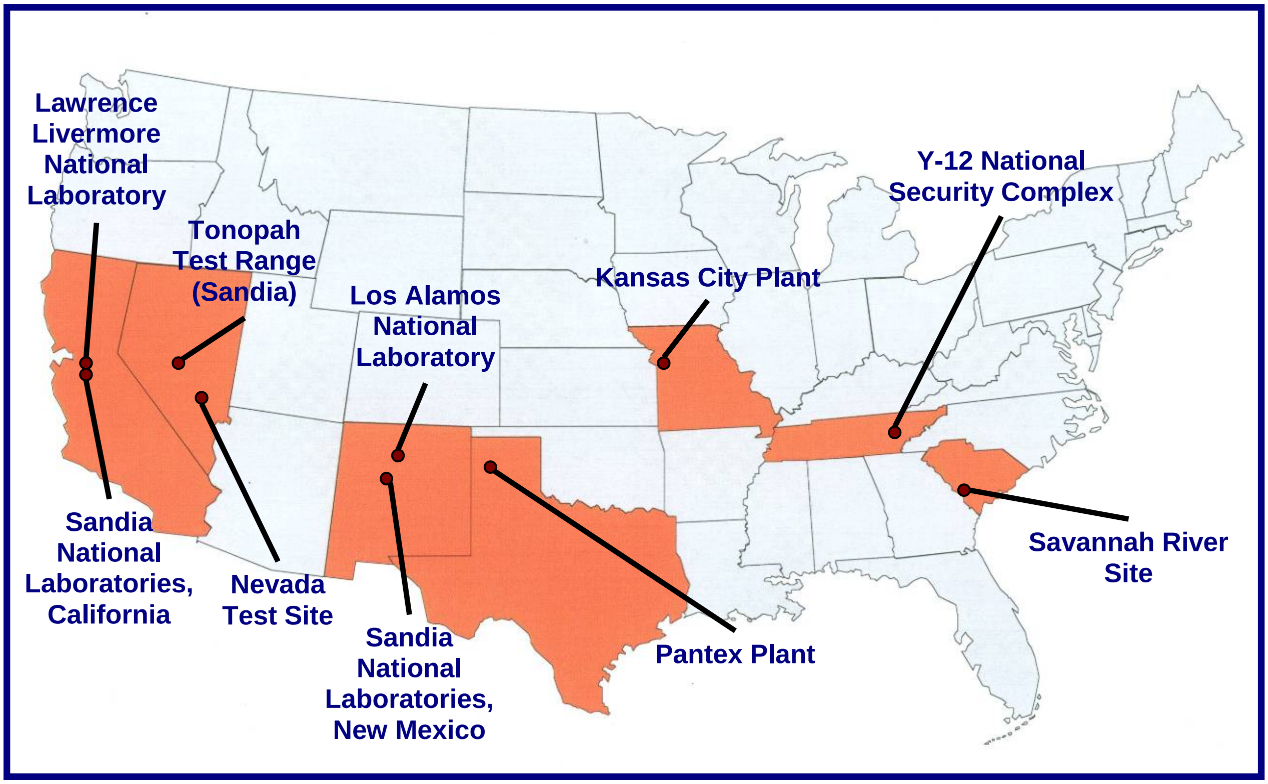

Figure A–1–7. Major Facilities of the NNSA Nuclear Security Complex are Distributed Throughout Seven States.

Expanded descriptions of these national assets are provided below.

Los Alamos National Laboratory (LANL)

Mission: Design agency and certification authority for nuclear explosive packages and other nuclear weapon components involving research, development, manufacturing, and assessment activities. The laboratory provides science-based engineering by combining fundamental science, high-performance computing, and unique experimental facilities to understand, predict, and verify warhead performance. Major participant in the annual stockpile assessment process and peer-review process. Responsibilities for the performance, safety, and reliability of nuclear warheads. Provide unique capabilities in high performance scientific computing, neutron scattering, enhanced surveillance, radiography, plutonium science and engineering, beryllium technology, and manufacturing of plutonium components and energetic devices. Support surveillance, assessments, and stockpile life extensions. Perform high-explosives research and development (R&D).

Location: Los Alamos, New Mexico.

Workforce (Full-Time-Equivalents)		
Total on NNSA funded activities		Total on Weapons Activities
at end of FY 2009	Projected at end of FY 2011	at end of FY 2009
5,876	6,134	5,135

Managed and Operated by: Los Alamos National Security, LLC, which is comprised of four U.S. organizations—Bechtel National, University of California, the Babcock and Wilcox Company, and the Washington Division of URS.

Additional: LANL designs and tests advanced technology concepts; provides safety, security, reliability assessments and certification of stockpile weapons; maintains production capabilities for limited quantities of plutonium components (i.e., pits) for delivery to the stockpile; manufactures nuclear weapon detonators; conducts plutonium and high-explosives R&D, hydrodynamic tests; and maintains Category I/II quantities of SNM. NNSA recognizes LANL to be a Center of Excellence for Nuclear Design and Engineering and for Plutonium, and a host site for supercomputing platforms at the Metropolis Center.

Lawrence Livermore National Laboratory (LLNL)

Mission: Design agency and certification authority for nuclear explosive packages and other nuclear weapon components involving research, development, manufacturing, and assessment activities. The laboratory provides science-based engineering by combining fundamental science, high-performance computing, and unique experimental facilities to understand, predict, and verify warhead performance. Major participant in the annual stockpile assessment process and peer-review process. Responsibilities for the performance, safety, and reliability of nuclear warheads. Support surveillance, assessments, and stockpile life extensions. Possess and employ high-energy-density physics capabilities and unique high-performance, scientific computing assets. Perform high explosives R&D.

Location: Livermore, California.

Workforce (Full-Time-Equivalents)		
Total on NNSA funded activities		Total on Weapons Activities
at end of FY 2009	Projected at end of FY 2011	at end of FY 2009
4,217	4,241	3,922

Managed and Operated by: Lawrence Livermore National Security, LLC which is comprised of a corporate management team that includes Bechtel National, University of California, Babcock and Wilcox, the Washington Division of URS Corporation, and Battelle.

Additional: LLNL designs and tests advanced technology concepts; provides safety, security, and reliability assessments and certification of stockpile weapons; conducts plutonium and high explosives R&D, and hydrodynamic tests. NNSA recognizes LLNL to be a Center of Excellence for Nuclear Design and Engineering, High-explosives R&D, High-energy-density Physics at the National Ignition Facility, and as a supercomputing platform site at the Terascale Simulation Facility.

Sandia National Laboratories (SNL)

Mission: Design agency and certification authority for warhead systems engineering and integration, non-nuclear warhead components, and quality assurance. The laboratories provide science-based engineering by combining fundamental science, high-performance computing, and unique experimental facilities to understand, predict, and verify warhead performance. Major participant in the annual stockpile assessment process and peer-review process. Responsible for arming, fuzing, and firing systems; neutron generators; gas transfer systems; electronic and mechanical interfaces; safing and security of devices; power sources; aerodynamic casings and parachutes. Research, development, and production of specialized non-nuclear components and their integration with nuclear explosive packages and military delivery systems. Provide safety, security, and reliability assessments of the stockpile. Conduct stockpile-to-target sequence tests for normal, abnormal, and hostile environments. Perform high-explosives R&D.

Locations: Albuquerque, New Mexico; Livermore, California; Amarillo, Texas; and Tonopah, Nevada.

Workforce (Full-Time-Equivalents)		
Total on NNSA funded activities		Total on Weapons Activities
at end of FY 2009	Projected at end of FY 2011	at end of FY 2009
4,151	4,431	3,615

Managed and Operated by: Sandia Corporation, a subsidiary of Lockheed Martin Corporation.

Additional: Sandia operates the Tonopah Test Range for in-flight and impact evaluations of aircraft delivered nuclear weapon systems. It operates the Microelectronics and Engineering Science Applications complex to design and fabricate custom radiation-hardened semiconductor components and electro-mechanical devices in support of nuclear stockpile needs. Sandia maintains and operates a suite of pulsed power systems supporting design and certification activities under hostile environments, for precise high-strain-rate material property measurements, and for inertial confinement fusion research. Sandia is the manufacturer of neutron generators. Sandia also develops safe and secure transportation systems and storage facilities for nuclear weapons and materials.

Nevada Test Site (NTS)

National Security Technologies LLC
Vision • Service • Partnership

Mission: Safe conduct of high-hazard operations, tests, and training in support of NNSA, DoD, and other federal agencies. NTS provides the government with the capability to return to underground nuclear testing should the President deem it necessary. NNSA envisions NTS to be the preferred site for conducting high-energy release events that involve high-hazard materials (e.g., open air explosive hydrodynamic tests).

Location: approximately 65 miles northwest of Las Vegas, Nevada.

Workforce (Full-Time-Equivalents)		
Total on NNSA funded activities		Total on Weapons Activities
at end of FY 2009	Projected at end of FY 2011	at end of FY 2009
1,633	1,521	1,544

In addition to this workforce, approximately 383 security guards (Wackenhut Services, Inc. employees) are also engaged.

Managed and Operated by: National Security Technologies, LLC, a joint venture between Northrop Grumman Corporation, AECOM, CH2M Hill, and Nuclear Fuel Services.

Additional: Capability to conduct hazardous experiments which combine nuclear materials and high explosives; disposition a damaged nuclear weapon or improvised nuclear device; conduct non-nuclear experiments; conduct hydrodynamic tests and high-explosive tests; conduct research and training on nuclear safeguards, criticality safety, and emergency response; and maintains Category I/II quantities of SNM.

Pantex Plant

Mission: Assembling high-explosive, nuclear and non-nuclear components into nuclear weapons. In addition, Pantex is responsible for the fabrication of chemical high-explosive components and related R&D work in support of the design laboratories, as well as disassembly, testing, quality assurance, repair, refurbishment, retirement, and final disposition of nuclear weapon assemblies, components, and materials.

Location: Amarillo, Texas.

Workforce (Headcount)		
Total on NNSA funded activities		Total on Weapons Activities
at end of FY 2009	Projected at end of FY 2011	at end of FY 2009
3,196	3,019	3,191

Managed and Operated by: Babcock & Wilcox Technical Services Pantex, LLC, (B&W Pantex) a limited liability corporation formed specifically to operate the Pantex Plant. Its Members are BWX Technologies, Inc., Honeywell International, Inc. and Bechtel National, Inc.

Additional: Pantex maintains Category I/II quantities of SNM for the weapons program and stores SNM in the form of surplus plutonium pits pending transfer to the Savannah River Site for disposition. Non-intrusive pit modifications are also performed at Pantex.

Y-12 National Security Complex (Y-12)

Mission: Fabrication and assembly of precision parts and components incorporating SNM and other materials for nuclear weapons. Conducts HEU R&D activities.

Location: Oak Ridge, Tennessee.

Workforce (Headcount)		
Total on NNSA funded activities		Total on Weapons Activities
at end of FY 2009	Projected at end of FY 2011	at end of FY 2009
3,831	3,785	3,574

In addition to this workforce, approximately 595 security guards (Wackenhut Services, Inc employees) are also engaged.

Managed and Operated by: Babcock & Wilcox Technical Services Y-12, LLC (B&W Y-12), a limited liability corporation of B&W (Babcock & Wilcox Technical Services Group, Inc. headquartered in Lynchburg, Virginia) and Bechtel National Inc.

Additional: Y-12 manufactures uranium components, cases, and other nuclear weapons components; evaluates and tests these components; maintains Category I/II quantities of HEU; conducts component dismantlement, storage, and disposition of their nuclear materials; and supplies HEU for use in naval reactors.

Kansas City Plant (KCP)

Mission: Manufacture and procure nonnuclear components for nuclear weapons. This includes electrical, electronic, electromechanical, mechanical, plastic, and non-fissionable metal components.

Location: Kansas City, Missouri.

Workforce (Headcount)		
Total on NNSA funded activities		Total on Weapons Activities
at end of FY 2009	Projected at end of FY 2011	at end of FY 2009
1,883	1,859	1,666

Managed and Operated by: Honeywell Federal Manufacturing and Technologies.

Additional: KCP specializes in manufacturing and procurement processes and is responsible for the evaluation and testing of non-nuclear weapon components. KCP does not handle or store SNM.

Savannah River Site (SRS)

Mission: Manage tritium inventories and facilities. Load tritium and non-tritium reservoirs to meet requirements of the Nuclear Weapons Stockpile Plan (NWSP). Conduct reservoir surveillance operations; test gas transfer systems; and perform tritium R&D functions. Under the NNSA Defense Nuclear Nonproliferation appropriation (not a Weapons Activities), construct and operate the Mixed Oxide Fuel Fabrication Facility for the disposition of plutonium.

Location: Aiken, South Carolina.

Workforce (Headcount)		
Total on NNSA funded activities		Total on Weapons Activities
at end of FY 2009	Projected at end of FY 2011	at end of FY 2009
1,507	1,344	1,330

Managed and Operated by: Savannah River Nuclear Solutions, LLC, a partnership formed by the Fluor Corporation with Northrop Grumman and Honeywell and subcontractors Lockheed Martin and Nuclear Fuel Services.

Additional: SRS maintains Category I/II quantities of special nuclear materials.

Overall Program Direction

Assignment of Roles, Allocation of Workload

NNSA assigns roles to each of the Nuclear Security sites in accordance with the mission and essential capabilities assigned to each respective location, thereby using the unique competencies available there to accomplish the work required by the Stockpile Stewardship and Management Program. The mission at each site and the critical capabilities found there were summarized in the previous section of this document. They are covered in more extensive details in a companion plan that focuses on the intellectual and physical infrastructure of the complex.[1]

The primary goal for the allocation of workload across all sites is to balance the effort in a manner that best matches existing resources and capacities at a given facility. NNSA allocates work by first prioritizing major design, qualification, production, assembly, disassembly and inspection efforts, then shifting schedules for work to time periods of lesser demand. Activity peaks and valleys are, therefore, minimized and made smoother. The outcomes from these extensive workload optimization exercises, fully negotiated with the DoD, are reflected in the Production and Planning Directive (P&PD), which is discussed later in this document.

Program Management Approaches

Instruments for the management of performance, costs, and schedules to oversee the project deliverables demanded by Stockpile Stewardship have been deployed. The linkage of programs to higher strategies, and the application of uniform program management approaches across most Weapons Activities, ensure that the stockpile stewardship endeavor is integrated both programmatically and geographically across the breadth of the complex.

Integrated Priority List — An integrated priority list has been created for all of the efforts encompassed in the thirteen NNSA Weapons Activities. This Integrated Priority List provides management a tool to help inform budget allocation decisions. The list is dynamic, allowing priorities to be altered in response to events and evolving national strategies.

National Work Breakdown Structure — A national work breakdown structure has been generated for all Defense Programs efforts. It is being deployed in stages and will be fully implemented by January 2011. The subdivisions of the work that the structure provides serve to organize a major portion of the Stockpile Stewardship and Management endeavor across the breadth of the nuclear security complex. By developing the national work breakdown structure in complete alignment with budget funding categories, the structure not only serves to organize the scope of performance but is also intrinsically linked with financial tracking systems, thus enabling effective cost management with clarity in expenditure categories.

Both, the Integrated Priority List and the National Work Breakdown Structure, provide a consistent framework for planning, programming, budgeting, and evaluation of work required

[1] "*ANNEX C: FY 2011 Biennial Plan and Budget Assessment on the Modernization and Refurbishment of the Nuclear Security Complex*"; National Nuclear Security Administration; May 2010.

to execute the Stockpile Stewardship and Management mission. The list provides senior NNSA management a basis for high-level strategic decisions.

Additional instruments to manage performance, costs, and schedules are discussed at a more detailed level later in this chapter.

1.D. Historical Funding Summaries for Weapons Activities

The NNSA Weapons Activities were recently funded by the U.S. Congress at an appropriations level of:

- $6,302 million (FY 2008),
- $6,410 million (FY 2009), and
- $6,384 million (current FY 2010).

These amounts include supplements granted by Congress (e.g., strategic capability support for broader security missions in FY 2009), Congressionally Directed Projects, and use/rescission of prior-year balances.

For the subset of Weapons Activities that comprise the NNSA Office of Defense Programs, the amounts were:

- $5,124 million (FY 2008),
- $5,099 million (FY 2009), and
- $5,155 million (current FY 2010).

The President's budget request submitted to Congress for FY 2011 includes $7,009 million for Weapons Activities ($5,712 million in Defense Programs managed programs and campaigns). Between FY 2010 and FY 2011 in Weapons activities, this corresponds to a 9.8 percent increase and in Defense Programs, this corresponds to a 10.8 percent increase. Figure A-1-8 compares the FY 2010 appropriated and FY 2011 requested amounts and reflect that:

- Two programs constitute the largest dollar efforts: the RTBF ($1,843 million-FY 2010 and $1,849 million-FY 2011), and DSW ($1,506 million-FY 2010 and $1,898 million-FY 2011).
- These two are followed in size by the DNS program (DNS: $769 million FY 2010 and $720 million-FY 2011), the ASC campaign ($568 million-FY 2010 and $616 million-FY 2011), and the ICF campaign ($458 million-FY 2010 and $482 million-FY 2011).

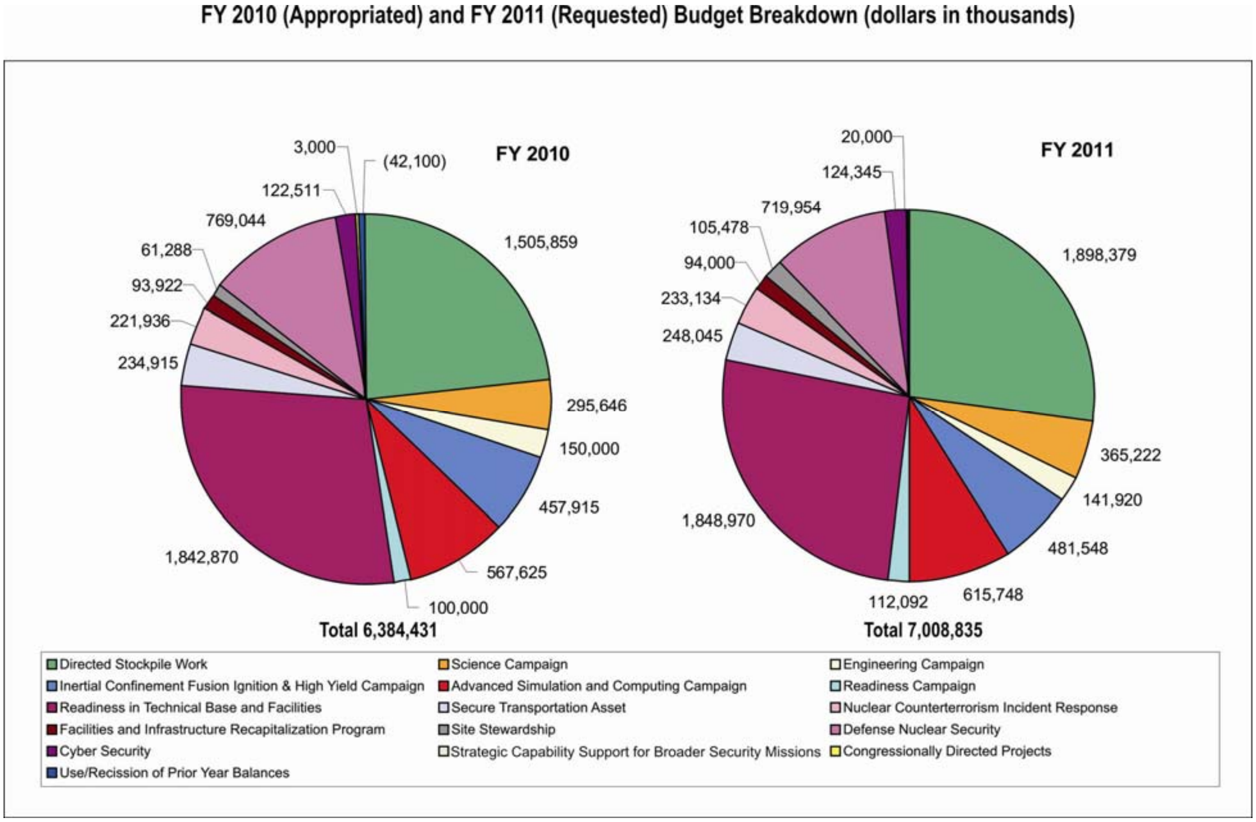

Figure A–1–8. Funding levels for the Weapon Activities that comprise the Stockpile Stewardship and Management Program.

The historically appropriated and Presidential requested Stockpile Stewardship expenditures from FY 2005 through FY 2015 are shown in Figure A–1–9 — note that dollar amounts are actual year quantities not adjusted for inflation. Some points to be noted:

- The overall appropriated amounts for Weapons Activities, since FY 2005 to the current FY 2010, have moderately declined by approximately 4 percent even without an inflation adjustment.

- In the post September 11th era, between FY 2005 and FY 2010, the amounts appropriated for the nuclear security posture increased dramatically. DNS grew by ~24 percent, Cyber Security by ~23 percent, and NCTIR by ~126 percent (this latter number is partially affected by changes to the budget structure during the time interval).

- By contrast, during the same period, DSW, the Science campaign, and RTBF investments in critical facilities and other capabilities grew by less than ~12 percent, Advanced Simulation and Computing became smaller by over ~18 percent, and the Engineering and Readiness campaigns shrank ~42 and ~62 percent, respectively.

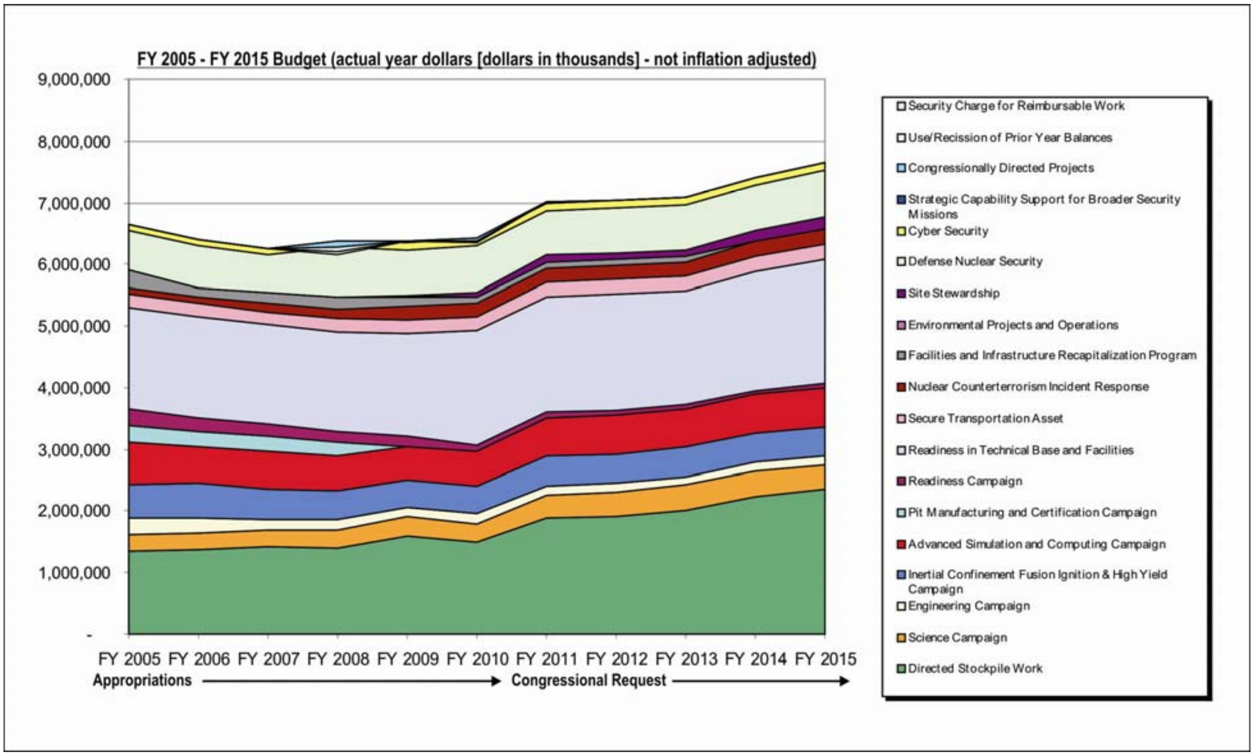

Figure A–1–9. Historical and requested funding levels over a ten year span: FY 2005 to FY 2015.

1.E. Recent Key Accomplishments

Since the previous Stockpile Stewardship Plan was published, significant events have occurred which are collectively summarized in Table A–1–1, *Key Recent Accomplishments*. The table makes apparent that all Weapons Activities serve vital roles in performing the NNSA mission and the coordinated implementation of its higher level strategy. The table conveys impressive accomplishments attained in all priority areas and involve the refurbishment and sustainment of stockpile warheads; dismantlement of retired systems; improvements and utilization of ST&E capabilities; right-sizing and modernizing the infrastructure; reduction and disposition of nuclear materials; and the use of computational simulations to assist broader national security needs. The list of accomplishments is not exhaustive. Many other important results were also achieved during this time period. But the table attempts to highlight important products of the Stockpile Stewardship endeavor.

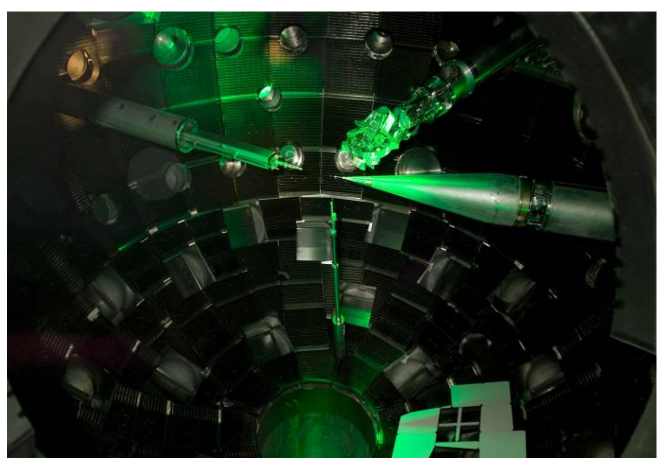

Figure A-1-10. Construction of the National Ignition Facility was completed in 2009.

1.F. Current and Future Stockpile

The companion "*FY 2011 Annex B Stockpile Management Plan*," which is a classified Secret Restricted Data document, provides extensive details on the current stockpile, associated issues, and future direction. Another companion document, the "*FY 2011 Stockpile Stewardship and Management Report*," provides an unclassified summary of many of the same items. This latter report includes an outline of known concerns that exist with the existing stockpile, and an abbreviated overview of the expected future state for the nation's nuclear arsenal.

Figure A–1–11. Joint NNSA/DoD Minuteman-III missile flight test with denuclearized Mk21/W87 test warhead.

The nation's current active nuclear stockpile consists of:

- The W76/Mk4 and W88/Mk5 Reentry Body Warheads carried on U.S. Navy submarine launched ballistic missiles.
- The W62/Mk12, W78/Mk12A, and W87/Mk21 Reentry Vehicle Warheads carried on U.S. Air Force intercontinental ballistic missiles.
- The W80-0 warhead carried on the U.S. Navy Tomahawk Land Attack Missile-Nuclear, and the W80-1 warhead carried on the U.S. Air Force Air Launched Cruise Missile.
- The B61-7/11 and B83-1 strategic nuclear bombs delivered by the U.S. Air Force B-2 or B-52 bombers.
- The B61-3/4 non-strategic nuclear bombs delivered by a family of U.S. Air Force and North Atlantic Treaty Organization certified aircraft.

Table A-1-1 Key Recent Accomplishments	Directed Stockpile Work	Science Campaign	Engineering Campaign	ICF Campaign	ASC Campaign	Readiness Campaign	RTBF	STA	NCTIR	FIRP	Site Stewardship	Defense Nuclear Security	Cyber Security
Sustain a Safe, Secure, and Effective Stockpile without Nuclear Testing.													
Completed FY 2009 Annual Assessment of the Stockpile evaluating its safety, security and effectiveness. Determined no underground nuclear test is required.	✓	✓	✓		✓							✓	
W76-1 reentry body warhead: Full Scale Production/Stockpile Maintenance and Evaluation phase approved by Nuclear Weapons Council. Although original Initial Operational Capability date was not met, a corrective action plan has been implemented.	✓		✓		✓	✓	✓	✓				✓	✓
Initiated DoD/NNSA B61-3/4/7/10 Phase 6.2/2A Refurbishment Options Study; successfully achieved joint approval of Integrated Phase Gate A (Definition of Source Requirements).	✓		✓		✓	✓	✓	✓				✓	✓
Alteration-357 of the B61-7/11 strategic bombs was completed one month ahead of schedule (11-26-2008) — an 8-year, multi-site effort to refurbish canned sub-assemblies.	✓		✓		✓	✓	✓	✓				✓	✓
Completed W78/Mk12A Extended Range Flight Test and W87/Mk21 JTA4 First Production Unit and First Flight Test.	✓		✓			✓	✓	✓				✓	✓
FY 2009: Delivered all scheduled Limited Life Components (LLC) and alteration kits to DoD.	✓		✓			✓	✓	✓				✓	✓
FY 2009: Exceeded scheduled Canned Subassembly dismantlement quantities (Y-12); and weapons dismantlement quantities (Pantex).	✓		✓			✓	✓	✓				✓	✓
Maintain a Vigorous Science, Technology, and Engineering Foundation (All Capabilities, Including People)													
In January 2010, the National Ignition Facility delivered an unprecedented amount of laser energy (greater than 1 mega joule, over a few billionths of a second) onto a target demonstrating drive conditions required to achieve ignition.	✓	✓		✓	✓								
In FY 2009, full capability of the refurbished Z machine was demonstrated and an annual shot rate of ~200 was achieved. Annual average number of hours to prepare for a shot was decreased to 8.2, exceeding efficiency target.	✓	✓	✓	✓	✓		✓					✓	✓
October 2009—World's fastest supercomputer, Roadrunner, completed its initial "shakedown" phase doing accelerated petascale computer modeling and simulations of a variety of unclassified, fundamental science projects.		✓			✓								✓

Table A-1-1 Key Recent Accomplishments	Directed Stockpile Work	Science Campaign	Engineering Campaign	ICF Campaign	ASC Campaign	Readiness Campaign	RTBF	STA	NCTIR	FIRP	Site Stewardship	Defense Nuclear Security	Cyber Security
On December 2009 the Dual Axis Radiographic Hydrodynamic Test facility fired its first-ever two-axis hydrodynamic test of a mock, imploding nuclear weapon.	✓	✓	✓		✓		✓					✓	✓
Right-Size, Modernize, and Sustain the Infrastructure (Physical Facilities and Human Talent)													
"Complex Transformation Supplemental Programmatic Environmental Impact Statement" released (10/24/08); entered into Federal Register 30 days later. Two records of decision followed (12/16/08): "Operations Involving Plutonium, Uranium and Assy/Disassembly of Nuclear Weapons," and "Tritium R&D, Flight Test Ops and Major Environmental Test Facilities."	✓	✓	✓				✓				✓	✓	
Highly Enriched Uranium Materials Facility (HEUMF) became operational in January 2010, a major milestone for the 21st Century.							✓					✓	✓
A contracting and acquisition strategy for Management and Operating arrangements was developed by May 2009; publicly announced on 3/26/10: intent to manage Y-12, Pantex, and perhaps portions of SRS under a single M&O contract; and all complex-wide construction projects in another.	✓	✓	✓				✓				✓		
Multi-site agreement to achieve $100 million efficiencies by accomplishing Accelerated Complex Transformation activities in progress.	✓						✓	✓		✓			
Completed special nuclear materials shipments for the Hanford de-inventory campaign and moved 8 metric tons of SNM from NNSA sites.							✓	✓				✓	
Help Solve a Broad Range of National Security Challenges.													
Deliver a new forensics capability in our ASC weapons simulation codes to interpret radioactive debris from a potential nuclear event.		✓			✓				✓				✓
Deployed multiple field teams to protect special events and respond to elevated threats including 34 high profile special events and 47 emergency responses around the world.									✓				
National Security Computing Center user facility for top-secret applications that require high performance computing dedicated (February 2010). Unique capabilities to address cyber defense, vulnerability assessments, informatics (network discovery), space systems threats and situational awareness.			✓		✓				✓				✓

A table on the inside rear cover of this document provides a pictorial summary of today's stockpile.

While the stockpile today provides a reliable nuclear deterrent, changes due to aging components have required modifications to some original Military Characteristics requirements defined by the DoD. The Life Extension Program process is necessary to counter such degradations and retain an enduring, robust nuclear deterrent.

The nuclear stockpile Production and Planning Directive, discussed in a later section of this document, will be extensively updated as a consequence of the changes that will emanate from the 2010 Nuclear Posture Review. The P&PD will incorporate new schedules for life extension programs through FY 2040 (see Figure A–1–12). The directive covers major activities that require operations at the Pantex and Y-12 production facilities, minor refurbishments that also need to be conducted at Pantex, and other refurbishments that may be executed in the field (e.g., at U.S. Navy or Air Force facilities).

One system, the W76, is currently undergoing life extension. A joint DoD/NNSA feasibility study (Phase 6.2/2A) was initiated in September 2008 (following Nuclear Weapons Council approval in March 2008) to define a suite of options for extending the life of the B61-3/4/7/10 family of nuclear bombs. The ongoing study will define potential designs, investigate their feasibility, and generate detailed cost estimates in time to support DoD requirements for first production units in the FY 2017 timeframe. Similar "suite-of-options" studies are expected to begin in the near future for the W78 reentry vehicle in accordance with policy outlined in the Nuclear Posture Review.

Concurrent with the life extension activities described above, NNSA continues the ongoing work of disassembling and dismantling retired stockpile weapons. The intent is to complete, no later than FY 2022, the dismantlement of all systems retired prior to FY 2009.

1.G. Instruments for Stockpile Stewardship and Management

The Nuclear Weapons Assessment Process

Some of the most important products of the Stockpile Stewardship and Management program are the science and engineering assessments performed on the nation's nuclear stockpile. Principal among these are the substantial annual studies that ascertain the present ability of nuclear weapon systems to perform effectively, and the current condition of the safety designs incorporated into that stockpile. Continuous evaluations culminate once a year in the publication of reports on the overall status of each warhead or bomb system in the arsenal. These assessments have been issued by LANL/SNL and LLNL/SNL since 1996. The documents provide results of safety, reliability and performance appraisals based on cumulative evaluations of stockpile surveillance data, investigations of significant findings discovered in weapons, targeted peer reviews and the results of experimental and computational simulation activities conducted under the Stockpile Stewardship and Management Program.

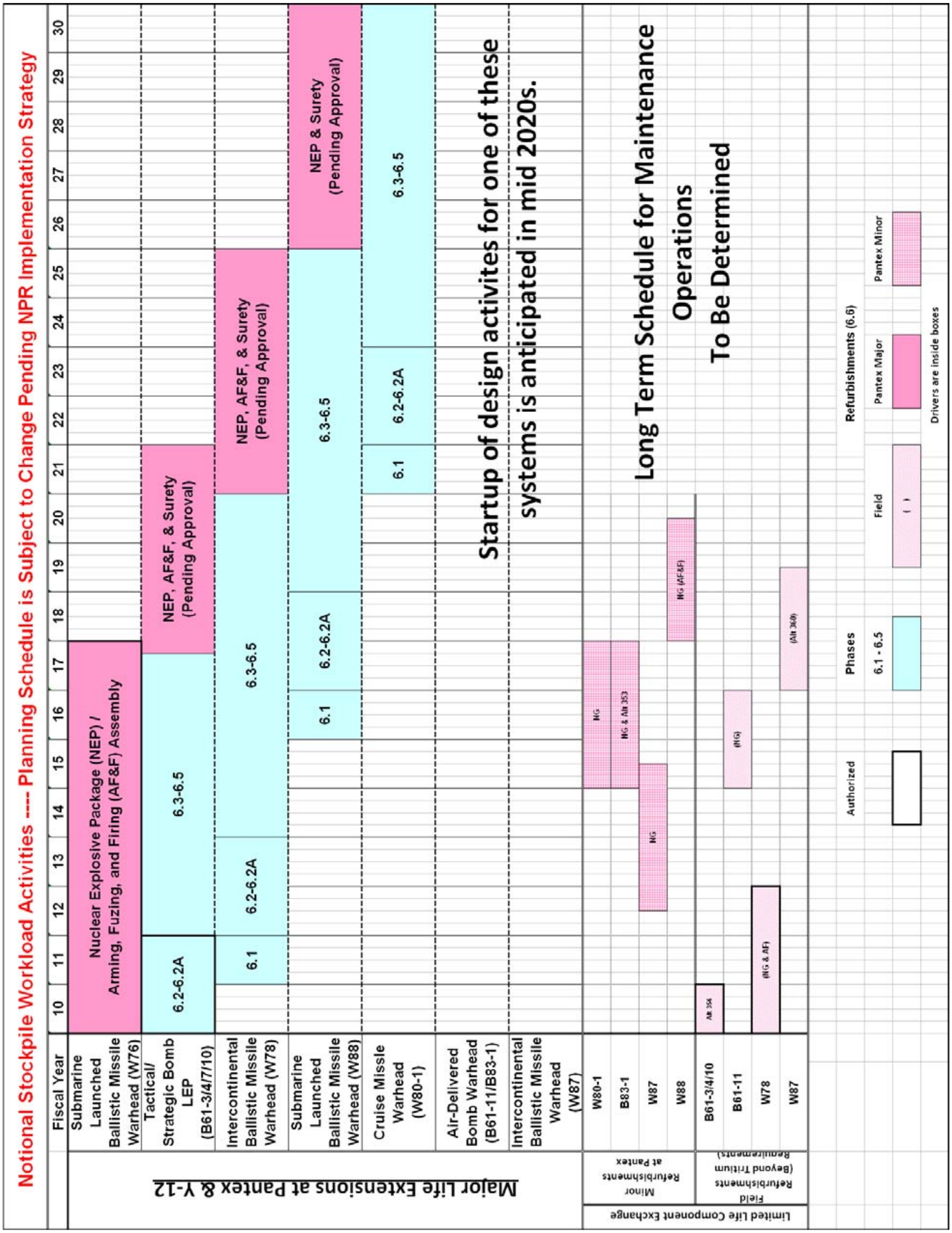

Figure A–1–12. Schedules for Extending the Life of the Nation's Nuclear Deterrent (extensive revisions to this schedule, as a consequence of the 2010 Nuclear Posture Review process, are in progress).

In the FY 2003 National Defense Authorization Act, Congress stipulated the establishment of independent "Red Teams" to review and challenge the content of the assessments conducted by the weapon design teams at each of the laboratories. The results of this separate activity help inform the directors of the national laboratories as they appraise the stockpile.

In May 2009, the Department of Energy Secretary approved a memorandum[2] outlining requirements and expectations for how annual assessments of the nuclear stockpile should continue to avail themselves of rigorous independent reviews. The memorandum, in its summary section, states; "*In a world without nuclear weapons testing, the assessment process is a complex evaluation of risks. All of the facets of these complex evaluations converge at the (NNSA) Lab(oratory) Directors as the integrator. All contributions to this assessment need to be as transparent as possible to contribute to credibility. The enhanced laboratory review and the external expert review will support the credibility of the product for the Secretaries of Energy and Defense.*" With memorandum approval the Secretary established a departmental policy that "*…an independent assessment of the warhead condition (be conducted) relative to its system requirements by a laboratory challenge team not responsible for fielding the warhead. This independent assessment would be provided to the laboratory directors responsible for the system and would be used as part of their annual assessment or certification process.*"

Consequently, NNSA tasked the national laboratories to formulate a plan, pursuant to the Secretary's memo, allowing laboratory peers to independently evaluate the condition of the stockpile. The implementation approach[3] crafted by the three national laboratories empowers the independent teams to not only assess past and current data (e.g., results of legacy nuclear test results and recent weapon surveillance findings), but also conduct separate analyses, if needed, involving experiments and/or calculational models to better understand the characteristics of essential components affecting the performance of each stockpile weapon system. Some aspects involved in this process are sometimes referred to as a "dual validation" of performance, a terminology that is more indicative of past efforts with some shared similarities. These previous efforts do not reflect all that is entailed in the modern approach for conducting reviews. So future appraisals will be more correctly described as "independent assessments within the annual nuclear weapons assessment" process.

Under this newly conceived Independent Nuclear Weapons Assessment Process, employing Independent Nuclear Weapon Assessment Teams (INWATs), baseline models will be developed beginning in FY 2010. Initial independent assessment results are anticipated in FY 2012.

Performance, Costs, and Schedules

>Production and Planning Directive (P&PD) — Including Life Extension Programs
>Master Nuclear Schedule and Limited Life Components
>Program Control Document

[2] Action memorandum from Thomas P. D'Agostino, NNSA Administrator to the Secretary; Subject: "*Action-Peer Review within Warhead Assessments*"; dated March 18, 2009; approved by Department of Energy Secretary on May 10, 2009.
[3] Department of Energy/NNSA Defense Programs Document: "*FY 2010 – 2014 Implementation Plan for Independent Assessments within Annual Weapons Assessment.*"

Once a year, after jointly developing a detailed long-term Requirements and Planning Document for the nation's nuclear stockpile, the Secretaries of Defense and Energy send the President a Nuclear Weapons Stockpile Memorandum proposing that a Presidential Directive be issued defining the present and future configuration of the U.S. nuclear deterrent. When signed by the President, the directive results in a Nuclear Weapons Stockpile Plan (NWSP).

NNSA, in compliance with the NWSP, generates a P&PD. This document guides the NNSA complex to produce, surveil, refurbish, retire, and subsequently dismantle nuclear warheads and bombs. The P&PD plan covers a forward looking time span of approximately 30 years divided into two parts: the first part deals with the weapons deployment period of 6-years authorized by the President in the NWSP and the second part of the plan addresses an additional, projected period beyond those authorized in the NWSP to enable the formulation of long term strategies.

The P&PD document also incorporates a schedule for life extension options to plan for its potential future through 2040. The schedule anticipates major Life Extension Programs (LEP), an important portion of the Stockpile Stewardship endeavor. The intended purpose for LEPs is to extend the expected stockpile lifetime expectancies of a warhead type or warhead components by at least 20 years, with a goal of 30 years if feasible. LEPs involve a series of coordinated nuclear weapon design and manufacturing activities that are individually studied, options proposed and costed, then subjected to rigorous approval processes. If approved, a LEP is performed according to master schedules and proceeds to modify nuclear and/or non-nuclear components through alterations that eliminate known defects or anomalies, correct shortfalls in the ability to meet existing military requirements, deal with obsolescent technologies, or address known deterioration issues associated with aging. When an LEP process begins, it benefits from technology maturation efforts that have been previously funded by Weapons Activities campaigns (e.g., Engineering Campaign, Readiness Campaign, etc., which advance technologies with general applicability) or by DSW (which advances technologies applicable to the existing stockpile). These maturation efforts advance technologies to higher readiness levels so as to meet anticipated future needs by later LEPs.

In alignment with the policy articulated in the 2010 Nuclear Posture Review, NNSA will not develop new nuclear warheads, nor provide systems with new military capabilities. NNSA will, instead, study a spectrum of options for extending the life of existing warheads to improve and assure their continued safety, security, and effectiveness. The outcome of such studies will be presented to national leaders and provided to the President for consideration. Service life extension options, if deemed necessary by policy makers and approved, will not require in any case a resumption of underground nuclear tests. The full-scale production (LEP Phase 6.6) of W76-1 Navy reentry body warheads, and the options study for the B61 bomb family are the only two LEP activities presently underway. The latter effort is identifying the feasibility, design definition specifics, and detailed costs (Phase 6.2/2A) for possible options for the Air Force's B61-3/4/7/10 non-strategic and strategic bombs. Pending authorization of development engineering activities (Phase 6.3), the B61 Phase 6.2/2A study is being funded under the Directed Stockpile Work/Stockpile Systems efforts further discussed in Chapter 2. Potential future studies may involve options for extending the life of the W78 reentry vehicle warhead.

Specific weapon plans and directives come from the P&PD in accordance with the "Master Nuclear Schedule and Limited Life Components" section of the "Development and Production Manual"[4]. These specific weapon documents include Program Control Documents (PCD) and limited life component exchange specifications which provide detailed requirements for the activities demanded by the P&PD. The PCD also provides comprehensive interagency coordination information and the authorizations necessary to accomplish large portions of the Stockpile Stewardship Plan. It is the role of the Program Control Document to translate the high-level requirements, outlined in the P&PD, into the specifics of what product needs to be produced, disassembled, inspected, subjected to surveillance procedures, or dismantled, where these activities will occur, and in adherence with accomplishment schedules.

>Development and Production Plans
>Master Integrated Schedules — Phase 6.2A and Beyond
>Integrated Phase Gates

Major conceptual, development, and manufacturing efforts to extend the service life of nuclear weapon systems and components through refurbishment programs are conducted under rigorously defined project phases, which are defined in the Development and Production Manual. These extend from the beginning of an effort when initial concepts are assessed, to intermediate phases when development and production engineering activities are executed, to final phases when full production and maintenance of the product are performed.

An integrated phase gates approach has been implemented to oversee and control how these development and production efforts move from one phase to the next. This integrated phase gates process stresses an early, clear, and exhaustive definition of technical and programmatic requirements, an emphasis on the use of technologies only after they are sufficiently mature to warrant incorporation into product with acceptable risk, maximum coordination between design agencies and production agencies at all stages to reduce the possibility of late risks, and extensive use of reviews, with management gatekeepers making informed and clearly documented decisions before a project is allowed to progress through an approval gate to a subsequent phase.

A detailed design definition and a rigorous cost estimate study are conducted early in such projects (during a Phase 6.2A – in accordance with the previously cited Development and Production Manual). A master integrated schedule, describing how the entire complex will support an LEP or warhead modification effort, is also generated during this phase. The integrated phase gates process extensively monitors the advancements of the project from this point forward using the baseline cost estimate and master schedules as metrics for acceptable progress.

>Program Management Manual
>Individual Weapons Activities Program Plans

[4] *"Development and Production Manual"*; Revision 2; 3/31/04; U.S. Department of Energy, National Nuclear Security Administration.

The "NA-10 Defense Programs–Program Management Manual"[5] defines the activities in the Stockpile Stewardship endeavor subject to the standards of the manual, and establishes requirements for how these activities will be managed. An ongoing initiative, the Requirements Modernization and Integration effort, will eventually subsume the elements of the management manual into a new venue. The Requirements Modernization and Integration project should complete its process by 2011.

Each of the thirteen Weapons Activities elements (covered in Chapters 2 through 14) oversee respective implementation plans. Specifics (such as goals and priorities; milestones; baseline scope, schedules and costs; risk identification and mitigation strategies; and resolution of outstanding issues) outlined in these plans provide a basis by which the programs and campaigns direct and manage the activities under their purview.

1.H. Current and Future State of Science, Technology, and Engineering Foundation – Role in Stockpile Stewardship and Management Plan

One of NNSA's essential capabilities is the ST&E base that enables the annual assessment of the status of the stockpile, resolves significant finding investigations (discovered departures from design and/or manufacturing specifications in stockpiled weapons), extends nuclear weapon lifetimes, and accelerates the dismantlement of retired systems. By solving daunting technical challenges, such as fundamental understanding of "boost," previously discussed in this document or achieving fusion ignition, thereby producing conditions in the laboratory now only found in galactic stars, the ST&E endeavor provides a primary path for retaining and exercising critical skills required for national nuclear security. These same capabilities are the means by which other security issues beyond the nuclear stockpile can also be addressed.

The Stockpile Stewardship Program requires: validated science and engineering models to predict weapon behavior across the entire stockpile-to-target sequence of environments; sustained competencies in the physics-phenomenology, radiation science, and materials science areas (including shock and high-energy density physics, nuclear science and radiography); advanced computational platforms and algorithms; engineering sciences including microelectronics and micro-systems; environmental testing, and a full stockpile surveillance program. A key enabler is the Predictive Capability Framework which provides a cross programmatic roadmap for predictions to be utilized in support of stockpile stewardship.

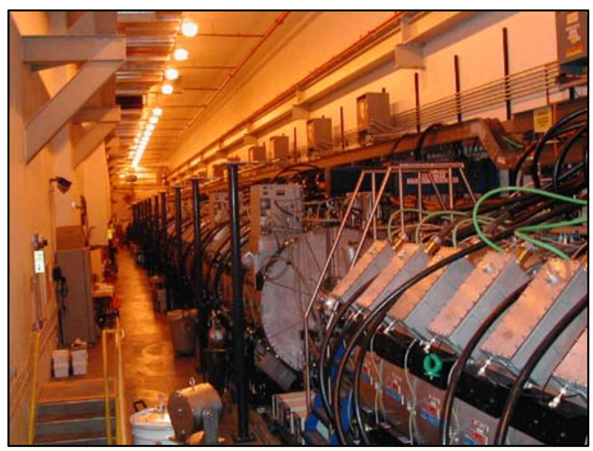

Figure A-1-13. Example of key ST&E capabilities – the electron accelerator hall at the Dual-Axis Radiographic Hydrodynamic Test facility.

[5] *"NA-10 Defense Programs –Program Management Manual"*; Document No. NA14-PMM-08-0001; Revision 0 – 2/26/2009.

The companion document, the "*FY 2011 Stockpile Stewardship and Management Summary*," provides an unclassified status overview of the ST&E endeavor, as well as an outline for a series of planned ST&E achievements over the next ten years necessary to accomplish the Stockpile Stewardship and Management requirements listed above. A second companion document, the "Annex C — *FY 2011 Science, Technology and Engineering (ST&E): Report on Stockpile Stewardship Criteria and Assessment of Stockpile Stewardship Program,*" which is a classified Secret Restricted Data document, provides much more extensive details on the current state of the NNSA ST&E complex, the ST&E tools that are employed in support of the stockpile, associated issues (such as gaps in capabilities), and plans for the future direction of ST&E efforts and desired state.

1.I. Current and Future Infrastructure (Physical and Intellectual) – Enabling the Stockpile Stewardship and Management Plan

The Stockpile Stewardship Program requires access to essential research, development, and production capabilities to support its:

- ST&E foundation,
- Plutonium products,
- Highly enriched uranium products,
- Tritium products,
- High-explosives products and the assembly/disassembly of nuclear weapons,
- Non-nuclear components and systems,
- Secure transportation of critical assets,
- Secure storage requirements, and
- Readiness to resume underground nuclear tests if directed by the President.

Additionally, a successful Stockpile Stewardship endeavor requires a workforce with fully exercised critical skills and a dependable pipeline of motivated talent, as well as a cost-effective complex that can deliver the necessary products.

The companion "Annex D — *FY 2011 Biennial Plan and Budget Assessment on the Modernization and Refurbishment of the Nuclear Security Complex*" document makes available extensive details on the current status of the infrastructure, associated issues, and future direction. This Annex D also provides plans with actions and schedules to achieve the desired prioritized future state.

1.J. Future Complex Deliverables

In subsequent chapters of this document, each of the Weapons Activities is described, including its mission, an overview of the structure of the program, goals, strategies, challenges, recent accomplishments in the past one to two years, future schedules of key milestones, and funding specifics. The reader will witness examples throughout for how programs or campaigns responded to the overarching requirement of the Stockpile Stewardship and Management Program, and the results and accomplishments provided by each of the activities.

The multitude of near-future deliverables makes it difficult to develop a brief list of highlights. But the performance of several key actions has the focus and attention at the highest levels of the complex, and it is these highlights that are provided in Table A–1–2. The list also demonstrates how the thirteen Weapons Activities are interlinked through collaborative actions.

1.K. Future Funding for Weapons Activities

The President's FY 2011 Budget Request submitted to Congress emphasizes the importance of NNSA's defense non-proliferation activities in support of our nation's nuclear security. The request incorporated increases for Weapons Activities as well — more than $7 billion (up $624 million relative to FY 2010 appropriated levels, for an approximate 10 percent increase) including:

- more than $2.0 billion for Stockpile Support activities (up $405 million, or 25 percent),
- $1.6 billion for science, technology, and engineering (up $153 million, or 10.4 percent), and
- nearly $2.3 billion for infrastructure (up $102.6 million, or 4.7 percent) – including funding for major long-term construction projects to replace aging and expensive-to-maintain buildings that house critical capabilities for plutonium and uranium.

As shown in Figure A–1–14, the President's FY 2011 submittal to Congress also contains information from FY 2011 through FY 2015 (a five year timeframe denoted as the Future-Years Nuclear Security Program [FYNSP]). When the amounts appropriated for the current FY 2010 are compared to the expected budget requirements in FY 2015, the following observations may be made:

- The yearly amount for all Weapons Activities would experience a substantial increase (~20 percent) through the FYNSP period.
- Directed Stockpile Work would dramatically rise by over 55 percent; the Science Campaign by ~34 percent; and the ASC Campaign by ~12 percent. Site Stewardship would more than triple (from $61.3 to $205.8 million, or ~236 percent).
- RTBF investments would increase by over 8 percent. Secure Transportation Asset would also rise (~11 percent).
- Moderate increases are seen for NCTIR (~7 percent), the ICF (~6 percent), and Cyber Security (~4 percent).
- During the same time period, moderate declines would occur in the Engineering Campaign (~3 percent) and Defense Nuclear Security (~4 percent). The Readiness Campaign would

experience larger declines (~27 percent). The FIRP will be brought to a close at the end of FY 2013.

Table A-1-2 Key Near-Future Deliverables (FY 2010–FY 2013)	Directed Stockpile Work	Science Campaign	Engineering Campaign	ICF Campaign	ASC Campaign	Readiness Campaign	RTBF	STA	NCTIR	FIRP	Site Stewardship	Defense Nuclear Security	Cyber Security
Sustain a Safe, Secure, and Effective Stockpile without Nuclear Testing.													
Collaborate with DoD, providing technical and production inputs, to enable policy decisions flowing from 2010 Nuclear Posture and Quadrennial Defense Reviews.	✓	✓	✓		✓		✓	✓					
Deliver W76-1/Mk4A Reentry Body Assemblies for Initial Operational Capability.	✓		✓		✓	✓	✓	✓				✓	✓
Complete joint DoD/NNSA B61-3/4/7/10 LEP suite-of-options study that meet mission effectiveness, treaty obligations, and enhanced safety and security goals by end of FY 2011.	✓	✓	✓		✓	✓							
Continue commitment to retire and dismantle nuclear weapons. Reduce stockpile by 2012 to one-quarter of the size it was at end of Cold War.	✓		✓		✓			✓			✓	✓	✓
Respond to recommendations of the Independent Review Team on Control and Accountability of Weapons and Weapons Related Material.	✓								✓			✓	✓
Demonstrate technologies required to field an integrated surety system by September 2010.	✓	✓	✓		✓	✓			✓			✓	✓
Maintain a Vigorous Science, Technology, and Engineering Foundation (All Capabilities, Including People)													
National Ignition Campaign will begin in FY 2010 the first integrated ignition experiments in NIF, attempting to compress, implode, and ignite a layered-fuel capsule with a ~1.0 megajoule energy pulse.		✓	✓	✓	✓								
Develop, implement, and apply a suite of physics-based models and high-fidelity databases to enable predictive simulation of the initial conditions for secondary performance.	✓	✓	✓	✓	✓		✓					✓	✓
Deliver solutions to the energy balance issue.		✓		✓	✓								
Demonstrate baseline Uncertainty Quantification aggregation methodology for full system weapon performance prediction; provide a new Sequoia Platform computational capability.		✓	✓		✓							✓	✓
Right-Size, Modernize, and Sustain the Infrastructure (Physical Facilities and Human Talent)													
Continue design activities for the Uranium Processing Facility at Y-12, the CMRR Facility at LANL, and the High Explosives Pressing Facility at Pantex.	✓	✓	✓				✓			✓	✓	✓	
Finalize KCRIMS facility lease, begin construction by September 2010. Continue process for orderly migration of missions to a smaller/flexible KCP.	✓					✓	✓				✓	✓	
Achieve Critical Decision-2 (Performance Baseline Approval) to provide Plutonium disposition and conversion capability at SRS.							✓						

Table A-1-2 Key Near-Future Deliverables (FY 2010–FY 2013)	Directed Stockpile Work	Science Campaign	Engineering Campaign	ICF Campaign	ASC Campaign	Readiness Campaign	RTBF	STA	NCTIR	FIRP	Site Stewardship	Defense Nuclear Security	Cyber Security
Complete construction of LANL's Radiological Laboratory in FY 2010.	✓	✓					✓						
Complete HEUMF initial load by April 2010.	✓						✓				✓		
Complete transfer of Critical Experiments Facility capabilities from LANL to NTS by July 2010	✓						✓				✓		
Support Area G closure at LANL complete CD-1 alternatives selection and cost estimate phase by September 2010 (which will address continuity of radioactive solid waste capabilities).	✓						✓				✓		
Achieve significant efficiencies through multi-site agreement to accomplish Accelerated Complex Transformation activities.	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Develop and execute a tailored governance plan that applies industrial/commercial approaches to non-nuclear operations by September 2010.	✓						✓						
Reduce number of locations with security Category I/II SNM, including all removal from LLNL by the end of 2012.							✓	✓			✓	✓	✓
Implement program to support sustainability and energy goals.											✓		
Help Solve a Broad Range of National Security Challenges.													
Involve next generation of our nation's scientific, engineering, and technical professionals in a broad scope of security technical challenges.	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
Continue Global Initiative to Combat Nuclear Terrorism through outreach efforts and support interagency and international efforts designed to improve capabilities of participant nations to respond, mitigate, and investigate terrorist uses of nuclear and radioactive materials.									✓				

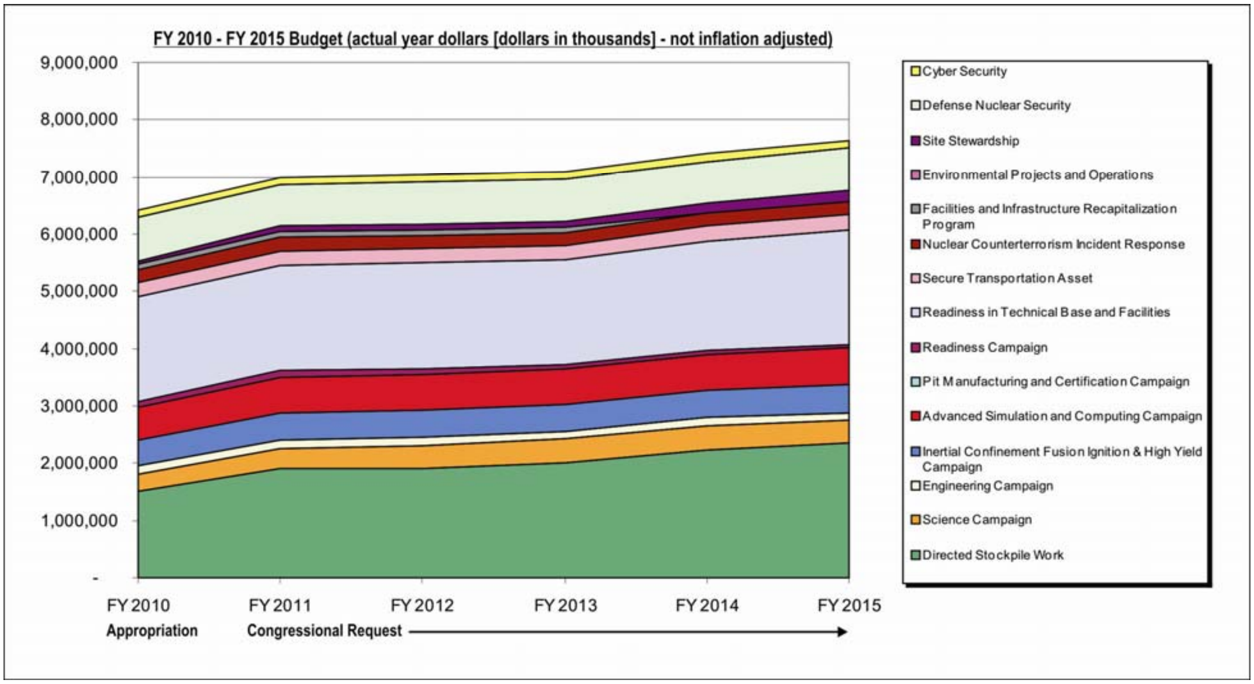

Figure A–1–14. Budget requirements through FY 2015.

The future budget requirements for Weapons Activities envisioned in the President's FY 2011 request demonstrate a commitment to address all facets of NNSA's mission priorities for nuclear security: the stockpile, the physical and intellectual infrastructure, and the essential ST&E capabilities.

1.L. Challenges – Approaches for Meeting these Challenges

The Stockpile Stewardship Program confronts many challenges. The challenges, and strategies and approaches for overcoming or mitigating them include:

- Future Configuration of Stockpile and Aging Concerns

The future viability of the national deterrent will be sustained through multiple life extension options that our country's leadership may consider and potentially choose to pursue. Options may involve refurbishment of existing warheads, reuse of nuclear components from different warheads, or if necessary replacement of nuclear components in accordance with the guidelines set forth in the 2010 Nuclear Posture Review. Life extension programs will use only nuclear components based on previously tested designs. NNSA will not develop new nuclear warheads, nor support new military missions, nor provide new military capabilities. NNSA plans also include a vigorous pursuit of the dismantlement of unneeded warheads, and effective maintenance of the non-refurbished stockpile.

- Achieve a Correctly-Sized, Capabilities-Based Infrastructure

NNSA has defined specific actions to be taken, and has moved forward to further transform its security complex in a pursuit of modern facilities and operational configurations that are responsive to national needs while becoming less costly to operate and secure.

Consolidation of ST&E and manufacturing functions will occur with corresponding reductions in the overall square footage of buildings. Cold War buildings will continue to be decommissioned, decontaminated, and dispositioned through the demolition of excess property or by the transfer of process-contaminated assets to the DOE Office of Environmental Management for final disposal. Essential capabilities will be retained at one complex location as a minimum. Processes, capabilities, and materials (particularly SNM requiring high levels of security) will be consolidated into centers of excellence. Many of these actions regarding physical infrastructure will be based on the 2008 Records of Decision[6, 7] that resulted from the *Complex Transformation Supplemental Programmatic Environmental Impact Statement* process.

- Manage Funding Profiles and Increasing Cost of Doing Business, while Achieving Operational Efficiencies

Escalating costs have, and will continue to have, major impacts on the price of doing business. These include personnel medical plans, the comprehensive funding of existing pension plans, and expenses associated with post September 11th heightened levels of security. As the nation deals with the aftermath of the global financial crisis, pressures on funding profiles will be unremitting.

Consequent demands to improve its operational effectiveness will be met through the implementation of business efficiencies and from less tangible approaches such as avoidance of unnecessary costs. A primary focus will be the reduction of indirect or support costs throughout the complex. The alignment of management and operator contracts and incentives with operational efficiency goals are also being pursued. Consolidation of testing capabilities to eliminate redundancy and establish shared interdependent centers of excellence are being evaluated. Initiatives are looking to change how risk is managed at locations, including differentiating between nuclear and non-nuclear operations, and to streamline and standardize the manner in which econometric databases are generated and managed. Other initiatives aim at how cost estimates are produced, how starting conditions become defined as baselines for completion metrics, how to improve the manner in which construction projects are managed, and the disposition of facilities deemed excess for the mission that must be pursued.

- Sustain an Effective Federal and Contractor Workforce – Retain and Exercise the Critical Competencies of the NNSA's Human Talent

The NNSA has specific actions in progress to identify the present and future technical and supportive complex critical skills. This activity also wrestles with difficulties that extend beyond taking inventory and cataloguing today's and tomorrow's critical talent needs. Actions will have to implement processes by which the human talent is recruited, mentored, retained, properly exercised and invigorated through solutions to national security challenges. The complex will need to monitor and maintain a level of future responsiveness so that the NNSA mission can be fully executed, and cannot simply address the human capital at management and operating contractors, but must also effectively realign the Federal workforce for business efficiencies that its endeavor will demand.

[6] Federal Register 73 FR 77644; Vol. 73, No. 245; Friday, December 19, 2008.
[7] Federal Register 73 FR 77656; Vol. 73, No. 245; Friday, December 19, 2008.

The NNSA also needs to contend with a broader national security outlook. This will also serve the purpose for energizing its human talent. Through development of new scientific tools such as the NIF, which is poised on the threshold of producing stellar fusion conditions inside a laboratory, confronting new challenges to detect smuggled uranium and plutonium threats by adversaries, or modernizing capabilities like the Chemistry and Metallurgy Research Replacement–Nuclear Facility, the NNSA intends to attract bright technical minds committed to serving our country. Such responses to a wide spectrum of national security challenges not only take steps toward making the country more secure, but also provide a key ingredient to motivate young scientists and engineers to join its Stockpile Stewardship mission. A word of caution: to maintain a competent stockpile stewardship and management workforce, activities addressing other national security needs do not provide a complete substitute for active nuclear weapons life extension design, qualification, and production efforts and assessment projects that are seen through completion.

- Remove Institutional Impediments so that a Broad Range of National Security Issues Can Be Effectively Solved

The United States faces a diverse set of national challenges including terrorism, the potential for technological surprises from our adversaries, unrealized opportunities to improve the nuclear non-proliferation situation throughout the world, and major energy production and distribution issues. The motivation, retention, and meaningful employment of the human talent critical for the success will only be fully achieved if NNSA involves these unique skills to not only address nuclear weapons issues, but also confront and overcome a broad spectrum of national ST&E needs outside of the direct sphere of nuclear weapons.

NNSA has defined a forward path that includes the facilitation of work with other federal agencies in a manner that does not conflict with the core nuclear weapons mission, enhances the ability of other federal agencies to establish strategic partnerships with NNSA to attack national problems in common, simplifies business rules that cover work with other agencies, and establishes guidance for effective national security partnerships.

1.M. In Summary

Since October 1993 when the Stockpile Stewardship Program was established by a Presidential Decision Directive and authorized by Congress, the endeavor has successfully sustained the safety and reliability of the nation's nuclear arsenal without returning to the use of nuclear testing. This success now provides the foundation from which NNSA can manage the ongoing transition from the Cold War-era stockpile to a smaller, safer, and more secure future nuclear deterrent. The NNSA is delivering a future propelled by strategies that include the correct sizing of its complex based on the sustainment of critical capabilities irrespective of the exact size and configuration of the stockpile. Major challenges remain, and are being confronted. Preeminent amongst them is preserving and energizing the critical skills workforce upon whose intellect and talents our nation's nuclear deterrent rests. Additionally, the NNSA has successfully engaged its unique ST&E capabilities to address national challenges in a multitude of areas found beyond the immediate confines of the nuclear weapons stockpile, including the detection and mitigation of chemical, biological and radiological threats; the protection of vital facilities and infrastructure; furtherance of our basic understanding of the natural world that surrounds us through the application of nationally critical capabilities in physics, chemistry, materials, and computational simulations; and others too numerous to list.

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Chapter 2. Directed Stockpile Work

2.A. Highlights

The Directed Stockpile Work (DSW) program is designed to meet the Nation's need for assuring the reliability, maintainability, and operational capability of the Nation's nuclear weapons stockpile. In FY 2009, the program accomplished a number of significant activities in support of its mission. Some key highlights include:

- Delivered B61-7/11 Alt-357 LEP units with refurbished canned sub-assemblies (CSA's) to the U.S. Air Force and completed all planned retrofits at Pantex and all production activities at Y-12,
- Initiated the B61 Phase 6.2/2A Refurbishment Study and achieved joint DoD and NNSA approval of Integrated Phase Gate A (Definition of Source Requirements),
- Completed First Production Unit of W76-1 LEP;
- Completed scheduled Canned Subassembly dismantlement quantities at Y-12 and completed scheduled disposition of weapons parts at the Kansas City Plant and Pantex, and
- Completed production of five War Reserve W88 pits.

Additional FY 2009 accomplishments are included in Section 2.G of this chapter.

2.B. Mission

The DSW program is responsible for maintaining and enhancing the safety, security, and reliability of the U.S. nuclear weapons stockpile without using underground testing. To meet this goal, the DSW program provides nuclear warheads and bombs to the DoD in accordance with the Nuclear Weapons Stockpile Plan. This plan specifies the number and type of weapons needed to maintain and ensure a credible deterrent.

DSW provides evidence of the health of the nuclear weapons stockpile through bi-annual weapons reliability reports to the DoD and annually assesses the safety, security, and reliability of the nuclear weapons stockpile through the Annual Assessment process. DSW also supports nonproliferation goals and international commitments to eliminate nuclear materials through the dismantlement and disposition of retired weapons and weapons components and is responsible for sustaining the Nation's plutonium infrastructure.

2.C. Program Structure

To meet its overarching mission, the DSW program is comprised of four major subprograms. These subprogram are: (1) LEPs, (2) Stockpile Systems, (3) Weapons Dismantlement, and Disposition (WDD); and (4) Stockpile Services.

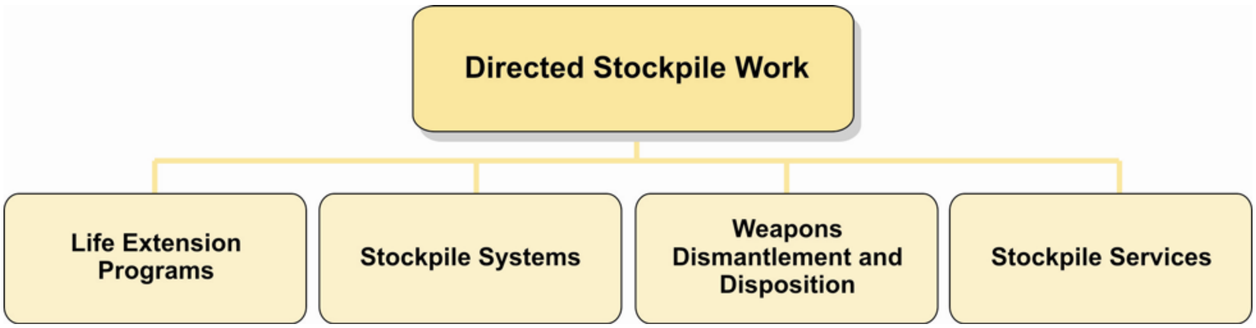

Figure A–2–1. Subprograms of DSW in FY 2011.

LEPs

LEPs are major program activities responsible for extending the lifetime of warheads and warhead components for an additional 20 to 30 years beyond their original design. LEP activities include research, development, and production work required to ensure that weapon systems continue to meet national security requirements. In addition, LEPs provide the opportunity to install enhanced safety and security features in existing weapons without developing new weapon systems.

Currently, the W76 LEP is underway and is contributing significantly to the long-term viability of the W76 nuclear warhead. This LEP is expected to extend the life of the W76 for an additional 30 years and will enable the NNSA and the DoD to refurbish the warhead without reliance on underground testing. The first production unit for the W76 LEP was completed in FY 2008.

Stockpile Systems

The Stockpile Systems subprogram is responsible for executing weapon-specific assessment and certification activities; weapons component qualification activities; limited life component exchange activities; surveillance activities; maintenance activities; feasibility and safety studies; and military liaison work for each weapon system. Stockpile Systems also includes non-LEP limited weapon refurbishments.

Weapons surveillance activities continue to be a high priority within Stockpile Systems. These surveillance activities provide increased data to aid in the knowledge and understanding of weapons physics and establish a credible baseline for determining the health of a weapon.

Experiments—such as thermal, mechanical, shock and hydrodynamic—are performed for each weapon system and are used in surveillance, resolution of significant finding investigations, development for limited-life components and any required certification and/or qualification activities.

Weapons Dismantlement and Disposition (WDD)

WDD is a critical element of NNSA's integrated effort to transform the infrastructure and stockpile. This subprogram allows for the elimination of retired weapons and weapons components while reducing the security and maintenance burden of legacy warheads and bombs. Specific WDD activities include weapons dismantlement, characterization of components, disposition of retired warhead system components, and surveillance of selected components from retired warheads. Other supporting activities include conducting hazard assessments, issuing safety analysis reports, conducting laboratory and production plant safety studies, procuring shipping and storage equipment, and supporting tri-laboratory efforts on dismantlement activities. Success of the WDD program relies heavily on the Office of Secure Transportation, Production Support, and the RTBF program to provide the base capability for all WDD activities.

Figure A–2–2. B61 bombs represent some of the oldest designs in the active nuclear weapons stockpile. Recent alterations continue the process of extending service lifetime by refurbishing spin rocket motors and some canned sub-assemblies.

Stockpile Services

Stockpile Services provides the foundation for the R&D and production capability and capacity within the complex. Specifically, Stockpile Services provides research, development, and production activities that support two or more weapon types; certification and safety efforts; base hydrodynamic capabilities; sub critical experiment; hydrodynamic experiments for multiple weapon systems; quality engineering and plant management, technology, maintenance and replacement of weapons related equipment; production services; and all other work not identified or allocated to a specific weapon type. Stockpile Services also invests in plutonium sustainment to achieve a cost-effective, modern plutonium capability. Stockpile Services includes the following sub-elements which are discussed in more detail below: Production Support; R&D Support; R&D Certification and Safety; Management, Technology, and Production; and Plutonium Sustainment.

- Production Support maintains site-specific production activities across the complex. This sub-element focuses on site-specific personnel and routine functional activities associated with maintaining the basic capability and work capacity to meet current production requirements. In addition, Production Support modernizes the production capabilities to meet future requirements.

Figure A–2–3. Technicians attach instrumentation to the exterior of a W80 Environmental Test Unit.

- R&D Support includes activities that directly support the design laboratory site-specific R&D mission. These activities include programmatic work that provides necessary administrative and organizational infrastructure needed to support internal laboratory R&D activities.

- R&D Certification and Safety provides the core competencies and capabilities for R&D efforts not directly attributable to a single specific warhead system. These activities include the basic research required for developing components (such as neutron generators and gas transfer systems); assessments; surveillance; and base capabilities for conducting hydrodynamic experiments. An experimental program for sub-critical experiments is also included within this sub-element.

- Management, Technology, and Production activities sustain and improve stockpile management; develop and deliver weapon use control technologies; conduct studies and assessments with respect to nuclear operation safety; and produce weapon components for use in multiple weapons systems. Unlike Production Support, which benefits site-specific production missions, this sub-element focuses on activities that benefit the overall NNSA mission.

- Plutonium Sustainment activities are focused on sustaining the pit manufacturing infrastructure and the manufacturing of W88 pits to meet stockpile surveillance requirements. This sub-element is responsible for the upgrade of equipment and technology development needed to support pit manufacturing and other plutonium programs. Plutonium Sustainment also supports plutonium facilities at Los Alamos National Laboratory that are not supported by the RTBF program.

2.D. Program Goals

Subprogram	Program Goals
Life Extension Programs	Achieve full scale production for the W76-1 LEP by the end of FY 2013.
	Contingent on national leadership authorization, initiate Phase 6.3 for the B61-3/4/7/10 LEP.
	Provide laboratory and management support to the Project Officers Group and DoD Safety Studies and support resolution of Significant Finding Investigations for the W76 LEP.
Stockpile Systems	Provide the Weapons Reliability Report to DoD on a semi-annual basis.
	Maintain the nuclear weapons stockpile as directed in the NNSA Production and Planning Directive and the Requirements and Planning Document. Produce new or refurbished components and subsystems as directed.
	Meet material, stockpile flight, laboratory, and component testing requirements according to surveillance transformation evaluation methodologies.
	Issue laboratory signed Annual Stockpile Assessment Reports and Nuclear Weapons Stockpile Surety Assessments.
	Close out high-priority Significant Finding Investigations per action plans and complete baseline hydro-tests and subcritical experiments.
	Complete non-strategic B61-3/4 spin rocket motor refurbishment (Alt 356) in FY 2012.
	Provide field-engineering support to ensure safe maintenance operations with nuclear weapons.
	Conduct continuing nuclear weapons training and prepare required technical publications.
	Produce new or refurbished components and subsystems for required warhead modifications (Mods), alterations (Alts), repairs, and rebuilds.
	Conduct advanced non-destructive evaluation diagnostic testing to screen pits and CSAs to select weapons for annual destructive evaluation.
	Provide limited-life components necessary to ensure that stockpiled warheads remain operational.
	As part of surveillance, continue to determine the optimum annual sampling quantity, selection methodology, and testing for each weapon type to achieve the objectives of the stockpile evaluation program.
	Continue to develop and mature embedded sensor technologies for use in future refurbishment weapon designs for surveillance transformation.
	Utilize advanced non-destructive evaluation diagnostics to baseline new production weapons as they are delivered.
Weapons Dismantlement and Disposition	Continue to meet or exceed CSA scheduled dismantlement quantities at Y-12.
	Continue to meet or exceed weapon dismantlement quantities at Pantex.
	Complete approved weapon-specific Seamless Safety in the 21st Century (SS-21) process improvements and hazard analysis reports.
Stockpile Services	Provide the necessary planning and scheduling support; quality supervision and control; electronic flow of information; and purchasing, manufacturing, and engineering resources necessary to implement non-weapon specific activities to support the DSW mission.
	Conduct necessary plant and laboratory activities to accomplish the non-weapon-type specific production readiness and R&D support to provide high quality deliverables to the nuclear weapons stockpile.
	Maintain the scientific-base and R&D capabilities to support a safe, secure, and effective nuclear weapons stockpile.
	Implement Product Realization Integrated Digital Enterprise.
	Continue Requirements Modernization Integration (RMI) business transformation.
	Provide the necessary infrastructure and capability to support non-weapon-type specific activities.
	Implement flexible, agile, and affordable manufacturing processes in the plants.
	Increase automated engineering and models-based design and development.
	Provide the required technology maturation for future system LEPs.
	Provide the necessary base hydrodynamic capability to perform single- and multi-system hydrodynamic experiments.
	Provide sub-critical experiment capability.
	Implement greater production and test-readiness responsiveness through a more integrated and fully collaborative complex.
	Improve design, engineering, and computer-aided manufacturing processes across the complex.

Subprogram	Program Goals
	Work toward integration and optimization of a design-to-delivery "complex model."
	Preserve the scientific-base and R&D capabilities to support a safe, secure, and effective nuclear weapons stockpile.
	Implement efficient business practices in support of an integrated and interdependent complex.
	Establish long-term manufacturing support for producing 50-80 pit capacity per year.

2.E. Strategy

DSW establishes its nuclear weapons stockpile requirements from the President's Nuclear Weapons Stockpile Plan which is developed through the Nuclear Weapons Council. This Plan defines ongoing maintenance activities, warhead life extension needs, stockpile surveillance and assessment, and R&D of new technologies needed to support the current and future stockpile.

DSW coordinates with the DoD to: (1) provide unique people, skills, equipment, testers, and logistics support to perform nuclear weapons operations; (2) produce and replace limited life components; (3) conduct scheduled weapons maintenance; (4) conduct surveillance and evaluations to assess weapons reliability and detect and anticipate potential weapon issues; (5) quantify margins and uncertainties in order to better assess and certify the nuclear stockpile; (6) develop options for enhanced safety, security, and effectiveness for insertion into LEPs, modifications, and alterations; (7) extend the life of existing weapons systems through authorized modifications to correct technical issues and enhance safety, security, and effectiveness; (8) provide dismantlement and disposition of weapons and components for retired stockpile systems; and (9) sustain a plutonium infrastructure that meets national requirements.

Figure A–2–4. A Sandia Distinguished Member of Technical Staff examines the nose cone of a B61-11 display/trainer unit.

To meet its mission objectives, DSW has developed interrelationships with other program offices within the Office of Defense Programs. DSW routinely interfaces with the Science Campaign, the Engineering Campaign, the ICF, the Readiness Campaign, and the Advanced Simulation and Computing Campaign. Additionally, the RTBF program supports DSW infrastructure sustainment and facility modifications and the STA program supports DSW through the movement of weapons and components. These interfaces provide the necessary tools and capabilities needed to assess the reliability and performance of the aging stockpile.

DSW works with Defense Nuclear Security to ensure that personnel, facilities, and nuclear weapons remain protected from a full spectrum of threats. Similarly, the Cyber Security program implements a flexible, comprehensive, and risk-based approach to protecting NNSA information and information assets. The crosscutting mission of DSW increases the need for interrelationships beyond those within Defense Programs including Nonproliferation, Nuclear Energy, Environmental Management, and Homeland Security.

Part of the interrelationship between DSW and other programs is the sustainment of a plutonium and highly enriched uranium infrastructure that provides the integrated planning of programs, campaigns, facilities, and the technical base (personnel and skills) associated with the use of these special nuclear materials. DSW sustains and retains the technical skills and infrastructure critical to the Nation's ability to work with plutonium and enriched uranium materials across a spectrum of applications. These include programs such as Plutonium-238 Heat Source production for the National Aeronautics and Space Administration; Advanced Nuclear Fuels development; production of parts and shapes for scientific experimental purposes; highly enriched uranium feed streams for nuclear reactors aboard U.S. Navy ships; nuclear forensics support; weapons dismantlement demonstration related to Mixed Oxide feed for plutonium disposition; and support to International Standards. These programs serve broad national purposes and rely upon the skills and infrastructure historically retained by the weapons program.

2.F. Challenges

Subprogram	Challenges
Life Extension Programs	Ramp up and support the W76 LEP production.
	Achieve reduction in W76 warheads costs per warhead from an established validated baseline.
Stockpile Systems	Complete feasibility and cost analysis associated with B61 6.2/2A LEP options study to potentially extend service life of existing B61-3/4/7/10
	Complete non-strategic B61-3/4 spin rocket motor refurbishment (Alt 356) on schedule in FY 2012.
	Maintain W78 stockpile systems workload schedule including MC 4381 Neutron Generators and the LF7A Gas Transfer System reservoir production.
Weapons Dismantlement and Disposition	Prioritize future dismantlement activities for retired weapons. Exceed dismantlement schedules whenever feasible.
	Establish timely cost effective safety bases for required dismantlement operations.
	Balance capability and capacity at Pantex to conduct simultaneous disassembly and inspections, surveillance, LEP workload, and dismantlement's.
Stockpile Services	Achieve cost recovery funding critical to supporting plutonium sustainment infrastructure investments.
	Loss of R&D and production personnel (critical skills).
	The capability and capacity to produce critical components or refurbish components for the stockpile (new neutron generators, multiple gas transfer designs, CSA materials, surety components).
	Disposition of pits and resulting plutonium material reliance on sustained plutonium infrastructure and the technical capabilities being retained under the Plutonium Sustainment program.

2.G. Recent Accomplishments

LEPs

- Delivered B61-7/11 Alt-357 LEP units with refurbished canned sub-assemblies to the Air Force on time having completed 100 percent of planned retrofits for FY 2009 at Pantex and 100 percent of production activity at Y-12 and Kansas City Plant for the program.

- Completed W76-1 DoD Design Review and Acceptance Group.

- Completed W76-1 Seamless Safety-21 (SS-21) Authorization activities for disassemblies and inspections and assembly operations in a 5 kilo Volt environment at Pantex.

- Achieved First Production Unit of the W76-1/Mk4A telemetered Joint Test Assembly 1.

- Received W76-1 Phase 6.6 (full production) authorization.

Stockpile Systems

- Within all Systems (B61, W76, W78, W80, B83, W87, W88):

  - Delivered all scheduled limited-life components and alteration kits to the DoD;
  - Produced 979 reservoirs at Kansas City Plant;
  - Filled 825 reservoirs at the Savannah River Site;
  - Produced 356 neutron generators at Sandia National Laboratories;
  - Shipped 1524 Group Ten kits to DoD used in field maintenance;
  - Shipped 793 Alt 900 kits for reservoir removal;
  - Completed all Annual Assessment Reports and Laboratory Director letters; and
  - Completed sufficient requirements for assessment of the stockpile without nuclear testing.

- Initiated B61 Phase 6.2/2A Refurbishment Study and successfully achieved joint DoD and NNSA approval of Integrated Phase Gate A (Source Requirements).

- Exceeded B61-3/4 Alt 356 production quantities of new spin rocket motors by 12 percent and completed 100 percent of planned spin rocket motor retrofits for B61-7/11 Alt 358.

- Completed W78 Extended Range Flight Test.

- Completed W87 Joint Test Assembly 4 First Production Unit and First Flight Test.

- Completed Nuclear Explosive Safety Study and Reauthorization of W88 SS-21 Bay operations.

- Completed rebuilds of four W88s as a result of the Cell Operations Restart Project.

- Achieved approval of W88 Seamless Safety-21 Cell Hazard Analysis Report.

- Completed SS-21 process implementation and Nuclear Explosive Safety authorization, improving safety for the disassembly of the W76-0/Mk4 at Pantex, providing improved safety for electro-static discharge scenarios (5kV environment).

- Delivered four Los Alamos National Laboratory W88/Mk5 Type 126 pits to Pantex.

Weapons Dismantlement and Disposition

- Exceeded scheduled CSA dismantlement quantities at Y-12.

- Exceeded scheduled weapons dismantlement quantities at Pantex.

- Completed scheduled disposition of weapons parts at the Kansas City Plant and Pantex.

- Completed scheduled SS-21 activities for the W84.

- Developed shipping options for the B83 components going to Y-12.

- Completed Heritage Program scheduled activities (museum reviews and resolved technical issues).

- Refurbished all required museum items.

- Issued 219 museum inspection reports to eliminate the previous backlog and remain current on reporting.

Stockpile Services

- Met scheduled surveillance requirements:

  - Completed 90 percent of Pantex surveillance plan (50 assembly/disassembly, 24 Joint Test Assemblies, 19 test-bed builds),
  - Successfully conducted computer tomography of two anomalous Pits,
  - Completed 100 percent of scheduled Pit Non-Destructive Laser Gas Samplings at Pantex for the W76 and the W78,
  - Conducted 96 percent of planned Joint Flight Tests with the DoD (27 Joint Test Assemblies tested),
  - Conducted 66 percent of annual test-bed evaluations (21) at Sandia despite 8 month explosive safety stand down of test facilities,
  - Completed 97 percent of planned CSA destructive (7) and non-destructive (23) evaluations at Y-12, and
  - Completed 100 percent of planned gas transfer system evaluations (28) at the Savannah River Site.

- Conducted 66 percent of planned Pit Destructive Evaluations (4) at Los Alamos National Laboratory and Lawrence Livermore National Laboratory.

- Completed Product Realization Integrated Digital Enterprise key deliverables:

  - System of Record declared for the Weapons Information System stockpile database removing the application from an antiquated International Business Machines Corporation (IBM) mainframe computer and placing it on more secure and efficient Sun V880 clustered servers;
  - Delivered the Quality Evaluation Requirements Tracking System (first application to become operational within NNSA's new Enterprise Secure Network,
  - Established Sigma 15 classified system network capability at Pantex,
  - Delivered replacement Master Nuclear Schedule limited-life components application, and
  - Delivered a classified commonly-configured, complex-wide model-based mechanical computer aided design production capability.

- Tonopah Test Range Operations restarted after explosive safety stand down.
- The RMI project completed NNSA supplemental directive (Defense Programs Business Requirements and Processes Manual, NAM 452.3-1) replacing the NNSA Supplemental Directive 56XB, Revision 2, Nuclear Weapons Development and Production.
- Established RMI Content Lead Teams streamlining and converting paper based requirements documents into web based requirements:
  - Completed 29 RMI Gate 1 reviews enable conversion of paper requirements into web based requirements and processes.
- Completed 25 RMI Gate 2 reviews enable the formal complex-wide review and edit resolution of the converted content from Gate 1.
- Completed production of 5 War Reserve W88 pits.
- Completed design for a new machining lathe with multiple process capabilities.
- Completed equipment upgrades on plutonium welding and gauging equipment.
- Demonstrated new casting process which can provide for reduced costs in wastes and increased efficiency.

2.H. DSW Milestones and Future Plans

DSW will continue to provide a safe, secure, and effective stockpile by providing major deliverables including: full production of W76-1 LEP reentry body warheads; complete the B61 Spin Rocket Motor Refurbishment efforts; and, explore life extension options for the B61-3/4/7/10 family of bombs and the W78 reentry vehicle warhead, consistent with the principles of the Stockpile Management Program. DSW, if authorized, will conduct Phase 6.3 engineering development activities to complete refurbishment of the non-nuclear components of the B61 and execute the nuclear refurbishment scope. If a life extension for the B61 is approved and directed by the Nuclear Weapons Council, funding requested currently in the out years under the B61 Stockpile Systems will then be transferred and requested as an element under the Life Extension subprogram. Stockpile assessment and sustainment activities, as well as complex capabilities sustainment, must continue in order to annually assess the stockpile and meet international obligations. These activities and capabilities provide the improved confidence in the safety, security, and effectiveness of the stockpile without the need to conduct underground nuclear tests. In addition, DSW will continue the reduction of nuclear weapons through the dismantlement and disposition of retired weapons.

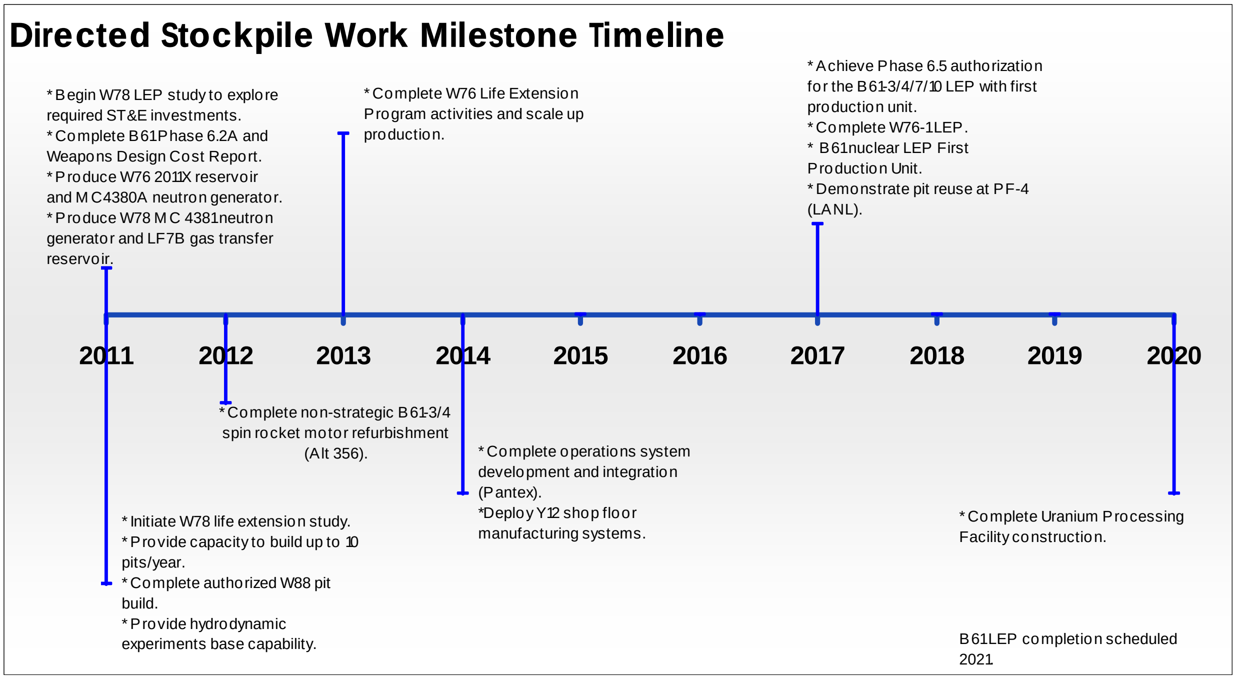

Figure A–2–5. DSW Milestones Timeline.

The following activities are ongoing or performed annually and do not appear on the milestone timeline above. They supplement the program goals for scheduled activities to support successful execution of the program.

- Complete Annual Assessment process for each system,
- Maintain the throughput of weapons dismantlement's at Pantex and CSA disassembly at Y-12,
- Component/CSA disassembly and disposition to reduce the footprint for enriched uranium storage and processing,
- Support the recycling, recovery, and storage of nuclear material,
- Provide the capacity to build up to 10 pits per year and complete the authorized W88 pit build,
- Improve safety and use control technologies,
- Provide base capability for to perform hydrodynamic experiments,
- Perform R&D studies and weapons effects studies,
- Perform sub-critical experiments,
- Continue component development (such as neutron generators, gas transfer systems, and power supplies),
- Sustain and modernize engineering and manufacturing operations at the Kansas City Plant,

- Meet all scheduled program deliverables under the Product Realization Integrated Digital Enterprise program.
- Meet all RMI project deliverables as scheduled.

2.I. Funding Schedule

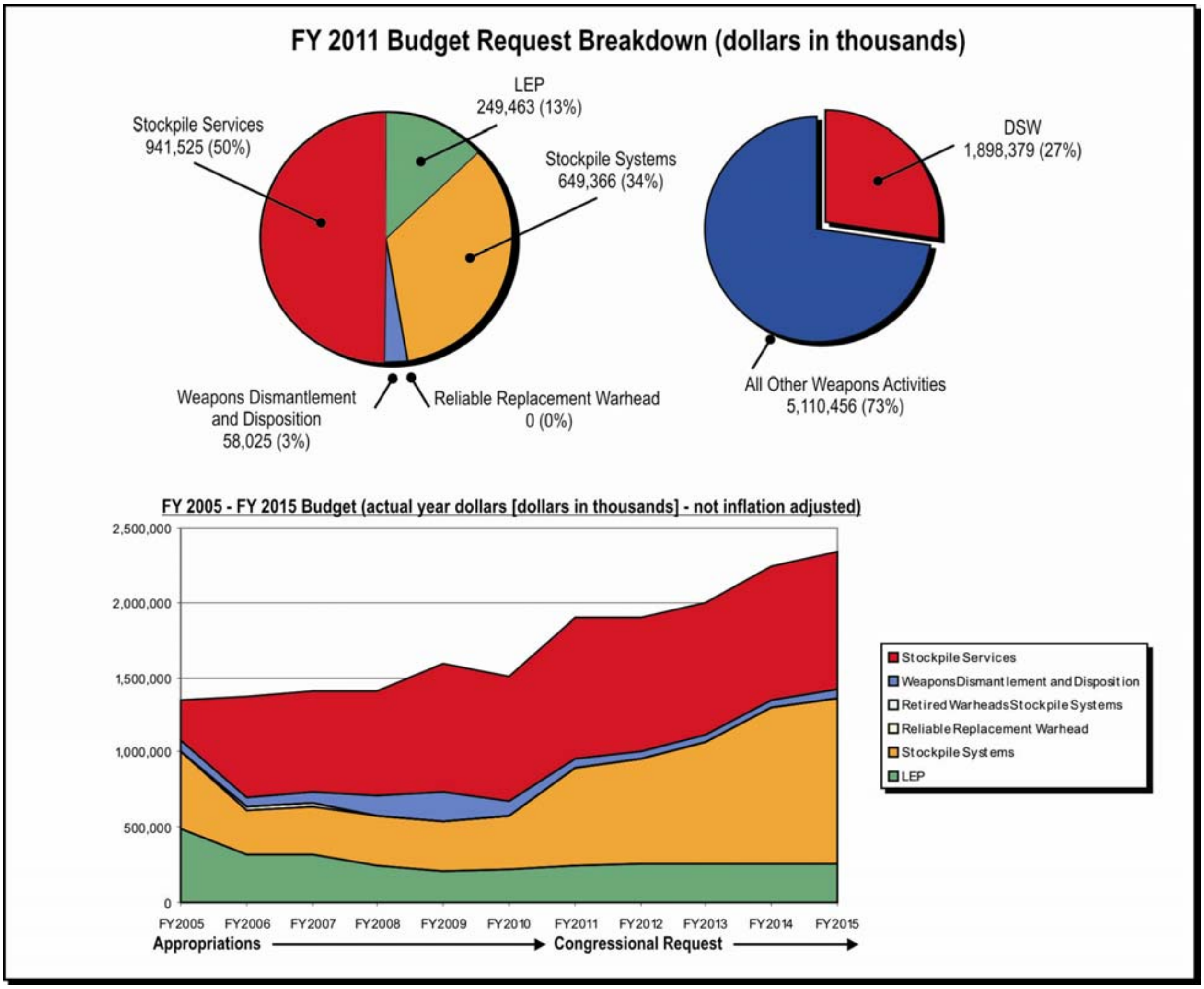

Figure A–2–6. DSW Funding Schedule.

Chapter 3. Science Campaign

3.A. Highlights

The Science Campaign provides tools and capabilities enabling assessment of weapons performance in the absence of nuclear testing. The principle highlight from this Campaign is its contribution to the successful record of certification in the Science-Based Stockpile Stewardship program. As well, capabilities provided through the Science Campaign have broadened the range of options available in life extension programs. These increased options allow cost savings and adoption of modern technologies for improving weapons safety and security.

Capabilities for certification and cogent assessment of options for maintaining the stockpile rest on the science describing the extraordinary conditions achieved in nuclear weapons. A number of accomplishments in the last few years have provided significant advancements. The National Ignition Facility is now complete and was used to conduct a series of important Stockpile Stewardship experiments at uniquely high energy density. Experiments studying the implosion of mock primaries made of non-fissile material were conducted at the Dual Axis Radiographic Hydro Test facility. These provide exquisite validation of our ability to certify weapons in the presence of complex features associated with aging or new safety systems. The national boost initiative, now in its third year, has provided new understanding of the boost process. This process is central to the performance of our entire stockpile and represents a key uncertainty in certification of modified or aged systems. Recent experiments at the refurbished Z machine have provided a new and surprising understanding of how materials behave at the extreme pressures in weapons.

3.B. Mission

The Science Campaign supports the development of the knowledge, tools, and methods used to assess the performance of the nuclear explosive package of a nuclear warhead. The Science Campaign efforts are geared towards advancing the general understanding of all systems, as opposed to any particular system. These tools and methods support critical stockpile decisions, such as those relating to the impact of significant finding investigations on nuclear safety and performance or those affecting the annual assessment and certification processes. They also provide indispensible technical and scientific resources required to carry out DSW support for each warhead type and to help maintain the nation’s ability to respond quickly and flexibly to changing requirements as set forth in both the Nuclear Posture Review and the Stockpile Strategic Capabilities Assessment.

In pursuit of its goals, the Science Campaign will continue to maintain the intellectual vitality of the NNSA's national laboratories; will recruit, train, and retain a technical and design staff capable of developing the improved predictive capabilities necessary to support and maintain confidence in the stockpile into the future; and will contribute to the capability to conduct an underground nuclear test if directed to do so by the President.

3.C. Program Structure

In FY 2002, as a major step toward developing a common assessment framework, the nuclear design laboratories agreed upon a set of definitions and protocols referred to as Quantification of Margins and Uncertainties (QMU). The goal of this ongoing effort is to provide quantitative metrics to assess the sufficiency of warhead design margins while accounting for uncertainties in understanding, and to provide confidence that the warhead will, if operating, perform within designed and tested "regimes" and away from known failure modes of the system. As work progresses in this area, the laboratories continue to perform research to establish potential failure modes and to achieve consensus on the physical conditions required to assure adequate weapon performance. The goal is to quantify, and, where possible, reduce the principal sources of uncertainty in the ability to assess warhead system performance. This work is divided into the following five subprograms: Primary Assessment Technologies, Dynamic Materials Properties, Advanced Radiography, Secondary Assessment Technologies, and Advanced Certification. The Predictive Capability Framework provides a roadmap that identifies long-term stockpile predictive capability goals requiring tight integration between the Science, ASC, ICF, Readiness, Engineering Campaigns, and DSW research and development. Academic Alliance efforts, which support the High Energy Density Laboratory Plasmas Program and the Stewardship Science Graduate Fellowship Program, are distributed across the subprogram elements.

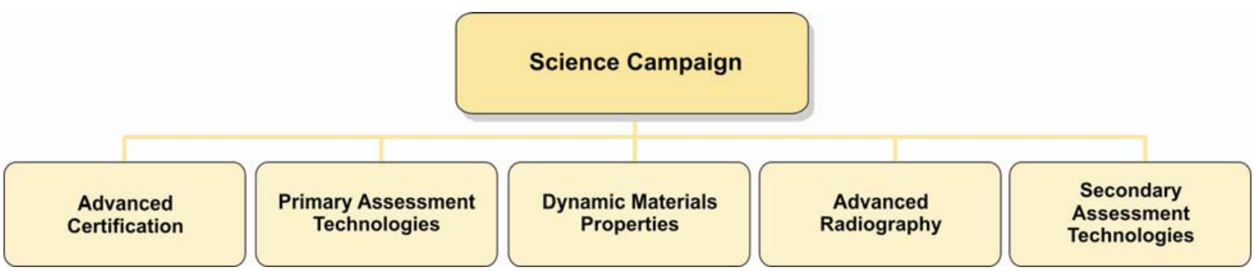

Figure A–3–1. Subprograms of the Science Campaign in FY 2011.

Primary Assessment Technologies

The Primary Assessment Technologies subprogram is responsible for the development and implementation of QMU methodology for primaries. Primary Assessment Technologies provides the experimental capabilities which support, along with ASC, the development of analytic tools and methodologies required to certify the nuclear safety and performance of any aged or rebuilt primary without nuclear testing. The National Boost Initiative is coordinated through an element of the Primary Assessment Technologies subprogram, and aims to address the key challenge of achieving predictive understanding of the physics of nuclear weapons by applying the tools developed by the entire Stockpile Stewardship Program. Since FY 2009, the plutonium aging experiments are conducted in the Primary Assessment subprogram.

Figure A–3–2. Cygnus dual-beam radiographic source enables X-ray imaging of Subcritical experiments.

Dynamic Materials Properties

The Dynamic Materials Properties subprogram provides experimental data to support the development of improved materials models in nuclear weapons primaries and secondaries. Models of materials behavior under the extreme conditions of implosion and nuclear explosion of a weapon are a principal source of uncertainty in simulations of nuclear performance and safety. This subprogram is critical to meeting requirements for experimental validation of improved materials models that need to be incorporated into ASC codes, including plutonium, uranium, high-explosives, polymers and other materials of relevance. Knowledge of the initial conditions of plutonium, energetic materials, and other materials required for understanding boost physics are assessed through these activities. Finally, in FY 2010, the Dynamic Plutonium Experiments subprogram was integrated into the Dynamic Materials Properties subprogram.

Figure A–3–3. Proton Radiography (PRad) Facility at the Los Alamos Neutron Science Center (LANSCE).

Advanced Radiography and Transformational Technologies

The Advanced Radiography subprogram develops the improved hydrotest and radiographic capabilities used to infer the integral performance of a nuclear weapon during the primary implosion phase in order to assure the continuing reliability and safety of the stockpile. This subprogram develops technologies for three-dimensional imaging of imploding mock primaries with sufficient spatial and temporal resolution to experimentally validate computer simulations of the implosion process as well as to verify our understanding of prior data obtained from full-scale underground tests. This subprogram also develops the associated image analysis and metrics required to fully utilize the data obtained from radiographic experiments.

Secondary Assessment Technologies

The Secondary Assessment Technologies subprogram advances the assessment of the thermonuclear stage of a nuclear weapon. Los Alamos National Laboratory and Lawrence Livermore National Laboratory develop modern tools and methods of analysis needed to identify and delineate failure modes, performance gates, and margins that are relevant to stockpile systems. This subprogram also develops the tools, methods, and knowledge required to assess and certify the nuclear performance of secondaries without nuclear testing.

Advanced Certification

The Advanced Certification subprogram leverages the results of stockpile stewardship activities within the Science, ASC and ICF Campaigns, and DSW to eliminate systemic gaps in the NNSA certification process. It integrates the scientific and technological advances from stockpile stewardship to improve the weapons certification process, advance the physical understanding of surety mechanisms, understand failure modes, and assess new manufacturing processes. The focus is on large changes, or aggregations of smaller changes in the future stockpile, as opposed to the individual small changes already capably assessed by current programs. Advanced Certification develops rigorous methods of assessing the performance effects that result from changes to the basic system such as component alterations or modifications. Examples of specific activities include experiments and analysis addressing failure modes, developing quantified understanding of the significance of changes in margin or uncertainty, and peer review and evaluation of the performance of proposed surety technologies.

3.D. Program Goals

Subprogram	Program Goals
Program-wide activities	Provide a science basis sufficient to ensure continued certification of the stockpile without the need for underground testing.
	Maintain a pool of talent to ensure the continued availability of a high-quality workforce to the Stockpile Stewardship Program, trained in such areas as modern materials science, physics and engineering.
Primary Assessment Technologies	Implement QMU, with a principal focus on boost physics and near term certification programs.
	Integrate improved materials and high-explosives burn models from Dynamic Materials Properties.
	Conduct experiments to validate key physics.
	Develop a predictive understanding of the materials contribution of initial conditions for boost.
	Minimize uncertainties of concern to the primary weapon design community.
	Continue to develop experimental and analytical understanding of the effects of plutonium aging on Primary performance.
Dynamic Materials Properties	Determine the constitutive properties of other relevant warhead materials.
	Develop a detonation and burn description of energetic materials.
	Determine of the properties of polymers and foams as these materials relate to significant findings investigations and stockpile options.
	Supply material property and performance data as set forth in the future requirements and priorities of DSW, assessment campaigns, and ASC.
	Conduct experiments to validate key physics.

Subprogram	Program Goals
Advanced Radiography	Metrics and analysis.
	Develop and verify computational models supporting the DARHT Facility experiments.
	Identify and evaluate potential future needs for radiography devices.
	Ensure radiography capability to support the Stockpile Stewardship Program.
Secondary Assessment Technologies	Reduce uncertainties in primary emission via reevaluation of underground test data.
	Characterize the materials properties of the radiation cases of stockpile devices.
	Develop a validated, three-dimensional, predictive design capability for assessing secondary performance.
	Investigate radiation flow, plasma hydrodynamics and other relevant phenomena in the parameter space that will become accessible with fusion ignition on the NIF.
Advanced Certification	Address questions raised in the JASON review of the Reliable Replacement Warhead.
	Develop a path-forward for certification of any required change to the nuclear physics package.
	Develop a rigorous model of the effects of changes (e.g., due to pit modification, or changes to components or their manufacturing methods).
	Develop a comprehensive understanding of failure modes, thresholds and metrics.
	Continue to develop advanced QMU methodology.

3.E. Strategy

As mentioned above, the Science Campaign supports the Stockpile Stewardship mission by developing the knowledge, tools, and methods to assess with confidence the safety, reliability, and performance of the nuclear explosive package portion of weapons without further underground testing; by developing new materials and technologies that are required to solve identified stockpile issues, particularly for the nuclear explosive package; and by developing and maintaining essential scientific capabilities and infrastructure in nuclear weapons-unique technologies.

Figure A–3–4. The Science Campaign works with NIF to develop a better understand of weapons physics.

The Science Campaign works strategically with other NNSA programs, including DSW and the ICF, Engineering, Readiness, and ASC Campaigns. Key predictive capability activities and their timelines are captured in the predictive capability framework, which serves a cross-programmatic roadmap for delivery of validated tools to support stockpile needs. The Science Campaign provides the experimental data to validate the models in the ASC simulation codes, as well as numerical methodologies to use in the codes. These physical data and methodologies lend confidence to calculations performed to meet DSW commitments to understand the impact of aging on weapons systems, close significant findings investigations, to perform annual assessments and certifications, and to analyze stockpile options, as required. In FY 2011, the pace of work under the Science Campaign is timed, through the predictive capability framework, to support ASC Campaign milestones to complete substantially improved simulation codes for primaries and secondaries. This milestone will require the incorporation of improved physics understanding and experimental validation, both provided by the Science Campaign.

The Science Campaign supports scientific research activities in partnership with other national and international sponsors. During FY 2009, the Science Campaign pursued various collaborations, such as with the DOE Office of Science's Basic Energy Sciences for the application of the Advanced Photon Source, and the Linear Accelerator Coherent Light Source for stockpile-relevant science. This approach has and will continue to extend our responsive science capability without requiring major investments in new facilities.

3.F. Challenges

Subprogram	Challenges
Program-wide	Loss of experienced personnel.
	Mentoring.
	Growing the program to a size sufficient to provide future scientific leadership in Stockpile Stewardship.
	Ensuring the availability of our platforms to generate plutonium data in support of our data generation needs (Joint Actinide Shock Physics Experimental Research Facility (JASPER), U1a, etc).
	Balancing nearer-term returns to the stockpile stewardship program, while implementing long-term investments in predictive capabilities for future annual assessments and advanced certification needs.
	Meeting needs of facility operations for experimental platforms, including budget, safety and maintenance issues (Z, Los Alamos Neutron Science Center, DARHT, other).
	The moderate-to-high technical risk associated with scientific undertakings implies associated uncertainty in the projected total costs and endpoint dates. (Generally applicable over all subprograms).
Primary Assessment Technologies	Developing predictive models for boost physics.
Dynamic Materials Properties	Availability of plutonium samples for materials experiments.
	Facility costs to provide high-pressure plutonium data.
Advanced Radiography	Minimize equipment downtime at DARHT facility.
	Developing quantitative methodologies for radiographic analysis.
Secondary Assessment Technologies	Conducting a High Energy Density Physics Program that meets weapon physics requirements.
	Meeting the goals that lead to improved physics-based models for secondary performance in 2020.
Advanced Certification	Success in developing validated physical models of sufficient accuracy to meet the certification goals of stockpile stewardship is not assured until complete.
	Ability to reduce uncertainties to required levels.
	Surety science challenges.

Technical program objectives are chosen because they will have high payoff in contributing to the goal of maintaining a credible weapons assessment and certification process without further underground testing. It is of high consequence that we meet the goals associated with the technical deliverables of the Science Campaign because a successful Stockpile Stewardship Program relies on experimental data, validation and associated expertise.

There are two general categories of risk associated with the Science Campaign. The first relates to the risk in conducting any program of research. Success in developing validated models of physical properties and processes of sufficient accuracy to meet the assessment and certification needs of stockpile stewardship is not assured until complete. A moderate-to-high technical risk is, therefore, associated with most of the scientific undertakings of the Science Campaign. While there is a reasonable basis for belief that the goals can be met, the effort required to meet them can only be estimated. As a result, there is a relatively high risk associated with the projected total costs and endpoint dates for meeting these goals.

The role of management in minimizing the technical risk noted above must be to track progress, identify areas that are likely to fall short of their goals, and identify alternative approaches. In science, the most effective means of assessing progress and developing corrective actions is through periodic peer review of the work being done. Few products of the Science Campaign involve the repetition of specific operations whose costs can be monitored effectively as a measure of performance. As in any field of scientific endeavor, scientific review by qualified technical peers at appropriate stages in the program is an effective means of assessing progress.

From its inception, the ultimate fallback of stockpile stewardship has been to maintain readiness to resume a limited number of underground tests if irresolvable issues should arise that call into question the national nuclear deterrent. Because of this, our ability to maintain the expertise must be assured. In the absence of such testing, and in the face of the loss of most of the personnel who have actually taken part in nuclear test operations, maintaining an appropriate level of readiness will be a challenge. Pursuit of a sustainable and robust experimental program, such as that undertaken in the Science Campaign, will increase the likelihood of meeting this challenge.

3.G. Recent Accomplishments

Primary Assessment Technology

- 2 PHOENIX shots were conducted at Nevada Test Site (NTS).
- Full Toss experiment was performed at NTS with a large suite of measurements and studies.
- Proton radiography at Los Alamos Neutron Science Center was used to develop instability data.
- FY 2009 Congressional increase initiated or accelerated projects to obtain plutonium nuclear and hydrodynamic data at NTS and the Laboratories.

Dynamic Materials Properties

- Equation-of-State data of mixtures was obtained from Z experiments at Sandia National Laboratories.
- Plutonium aging data was obtained and analyzed as input to the FY 2009 pit lifetime assessments.
- Completed preliminary Equation-of-State experiments.

- Inserted new physics model into baseline codes.
- Measured infrared reflectivity of shocked tin samples above and below the solid-liquid phase boundary through Dynamic Shock Experiments at the Special Technologies Laboratory.
- Accelerated flyer plate to over 100,000 mph on Z Facility and performed equation-of-state studies to 20 Mbar.
- Employed new preheating technology at Sandia Dynamic Integrated Compression Experimental facility for phase boundary.

Advanced Radiography

- Applied image metrics to hydrodynamic and nuclear data to help evaluate new models.
- Conducted four major proton radiography (pRad) experiments at Los Alamos Neutron Science Center.

Secondary Assessment Technologies

- Executed the first NIF experiments for stockpile stewardship mission.
- Demonstrated the ability to calculate system output with uncertainty quantification within predefined ranges of data.
- Demonstrated a new compact x-ray source on Z for use as an above ground experiment (AGEX) platform driver in support of the Stockpile Stewardship Program.

Figure A–3–5. DARHT.

Test Readiness

- Completed Full Toss experiments.

Advanced Certification

- Completed design of surety experiments.
- Demonstrated the quantitative effect of model form uncertainty on prediction uncertainty.
- Completed a Catalog of Observed Failures at NTS and the First Generation of Mechanisms, Metrics, and Thresholds.

3.H. Science Milestones and Future Plans

The Science Campaign will improve predictive capability sufficient for analyzing performance of nuclear explosive package in the current stockpile by FY 2020. The major steps on this path include: fundamental multi-phase plutonium equation-of-state and constitutive properties models for primary implosions; models for full primary operation; and models of full secondary performance. The FY 2011 increase to Advanced Certification includes the accomplishment of additional experiments at the NTS, DARHT and other experimental facilities that contribute to analysis and modeling of failure modes and margin-to-failure. The additional efforts will also be extended to regimes that are relevant to analysis of proliferant technical capability and other factors of broader national nuclear security interest.

The Science Campaign is planning future integrated activities to answer key questions on time scales consistent with complex transformation. NNSA is reviewing several outstanding high-level issues, such as: LANSCE refurbishment; the challenging program related to initial conditions for boost; a critical decision point for whether to execute Dynamic Experimentation (DynEx) project; continuation of JASPER and other operations at NTS; the requirement to maintain test readiness capabilities as directed by Congress; activities affected by complex transformation (i.e., high-explosives research across the complex; plutonium R&D activities in Superblock at Lawrence Livermore National Laboratory; and managing the balance between research and manufacturing activities at TA-55).

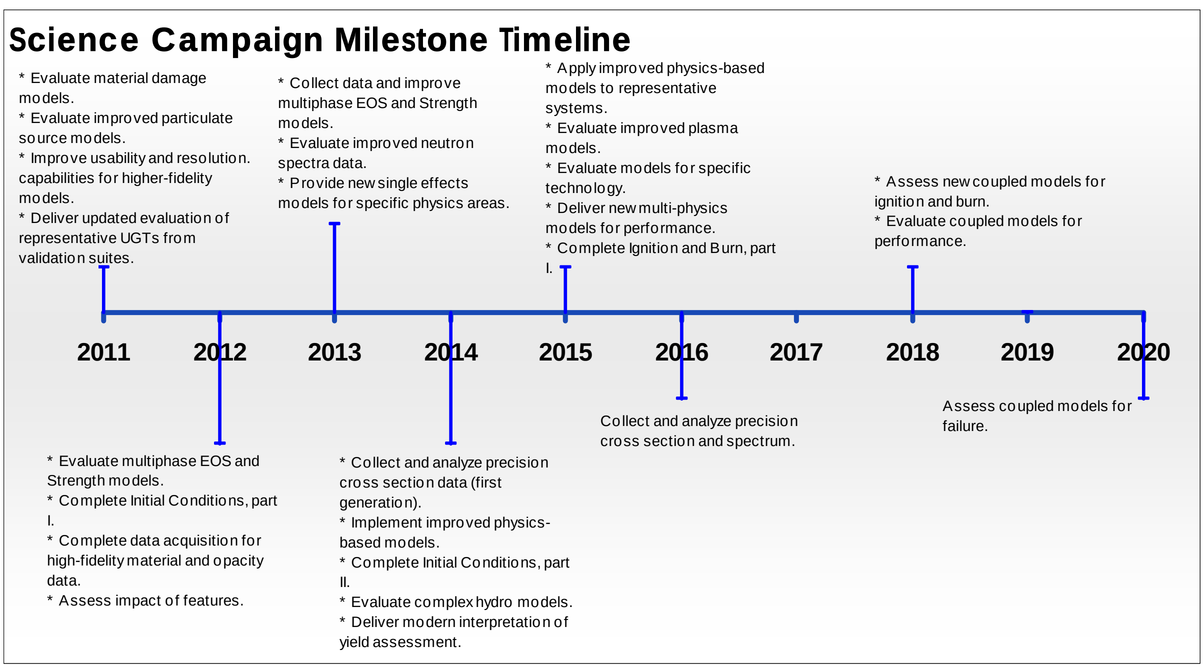

Figure A–3–6. Science Campaign Milestone Timeline.

Additional ongoing activities, which also support successful execution of the program, are included in the previous Program Goals section of this chapter.

3.I. Funding Schedule

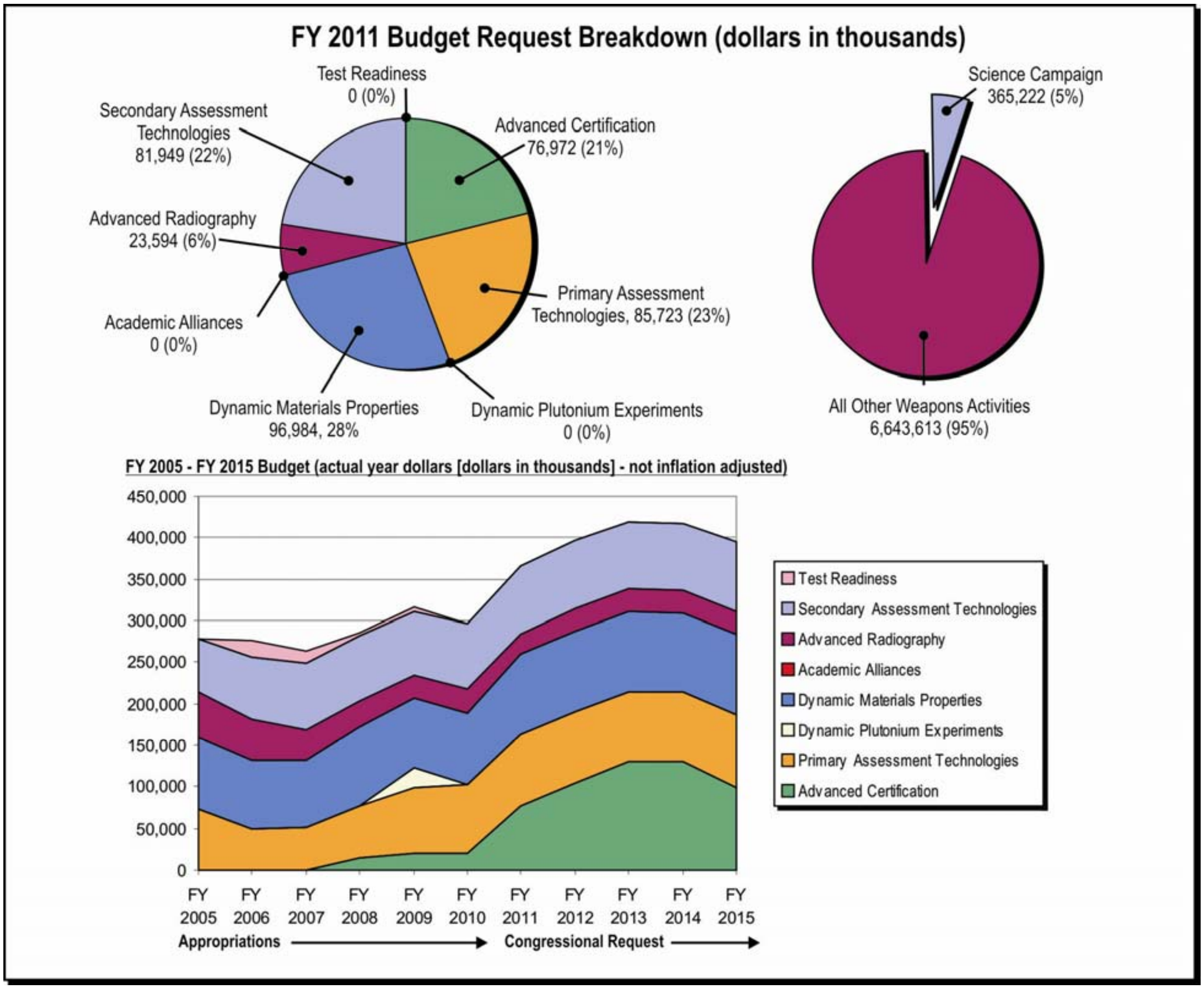

Figure A–3–7. Science Campaign Funding Schedule.

Chapter 4. Engineering Campaign

4.A. Highlights

The Engineering Campaign has produced a number of significant accomplishments in FY 2009 that support the Stockpile Stewardship Program. Key highlights include:

- The Enhanced Surety subprogram has demonstrated high priority surety sensor technologies against a subset of relevant Stockpile-to-Target-Sequence environments;
- The Weapons Systems Engineering Assessment Technology subprogram has completed the initial development and demonstration of the 6 Degrees-of-Freedom vibration test capability for component;
- The Nuclear Survivability subprogram has assessed Quantification of Margins and Uncertainties (QMU) techniques and methods used by DSW and determined their applicability to the methods and procedures used in assessing the survivability of U.S. nuclear weapon systems; and
- The Enhanced Surveillance subprogram has completed the development of a W78 firing set structural dynamic model which will be used for identifying transfer functions needed for mechanical margin and robustness testing.

Additional accomplishments for FY 2009 are included in section 4.G of this chapter.

4.B. Mission

The goal for the Engineering Campaign is to develop capabilities to assess and improve the safety, effectiveness, and performance of the nuclear explosive package and non-nuclear engineering components throughout a nuclear weapon's lifetime without further underground testing. Additionally, the purpose is to increase the ability to predict the response and have confidence in the design of all components and subsystems to external stimuli (large thermal, mechanical, and combined forces and extremely high radiation fields); the effects of aging; and to develop essential engineering capabilities and infrastructure.

The Engineering Campaign provides the complex with modern tools and capabilities in engineering sciences and technologies to ensure the safety, security, effectiveness and performance of the current and future U.S. nuclear weapon stockpile without further underground testing, and provides a sustained basis for stockpile certification and assessments throughout the lifecycle of each weapon. Specific Campaign objectives are enabled by the improved capability for weapon design and engineering assessment including:

- Incorporation of enhanced surety features, independent of any threat scenario, meeting the requirements of National Security Presidential Directive 28 (NSPD-28).
- QMU, using state-of-the-art design and assessment tools that rely on Advanced Simulation and Computing codes and experimental facilities acquired in support of the Stockpile Stewardship Program.
- Predictive capability for the effect of aging on performance and lifetime assessments.
- Consolidation of Category I/II Special Nuclear Material (SNM) is supported by providing alternative capabilities and tools.
- Qualification Alternatives to the Sandia Pulse Reactor (QASPR) project to evaluate threats or vulnerabilities more responsively than traditional radiation testing.
- Establishment of responsive lifecycle engineering at demonstrated lower costs.
- World class staff and program in engineering science R&D.

4.C. Program Structure

The Engineering Campaign is comprised of four focused subprograms: (1) Enhanced Surety; (2) Weapon Systems Engineering Assessment Technology (WSEAT); (3) Nuclear Survivability; and (4) Enhanced Surveillance (ESV). Each of these subprograms provides unique contributions to the Stockpile Stewardship Program. Figure A–4–1 shows the organizational structure of the Engineering Campaign.

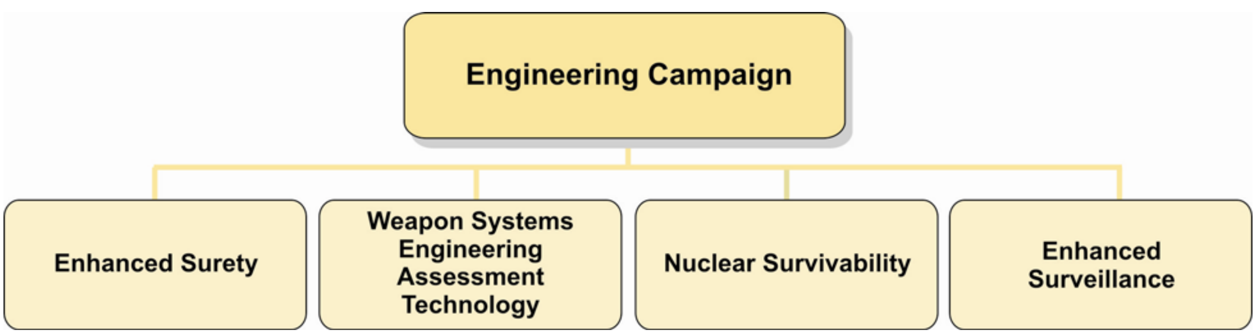

Figure A–4–1. Subprograms of the Engineering Campaign in FY 2011.

Enhanced Surety

The Enhanced Surety subprogram (ESS) is designed to mature surety technologies that will enable a transformed nuclear weapon stockpile to fully meet modern nuclear safety standards and achieve new levels of use control/denial performance. This activity underpins the surety improvements being pursued by the current stockpile life extension program (LEP) under clear guidance.

Advanced high explosive initiation technology matured under the ESS supports the implementation of a nuclear safety architecture wherein a weapon will remain impervious to potential electrical and mechanical insults associated with sever accident scenarios. The subprogram is also pursuing use-denial technologies to protect future weapons against the full spectrum of malevolent threat environments.

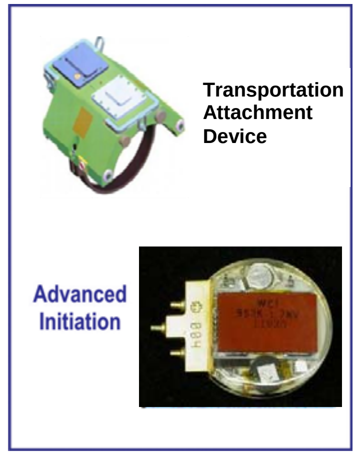

Figure A–4–2. Enhanced Surety develops, validates and demonstrates advanced initiation and use-denial options for insertion into the stockpile.

Weapon Systems Engineering Assessment Technology

Figure A-4-3. Nuclear Survivability provides tools to design and certify components and assemblies for meeting survivability requirements and for predicting weapon effectiveness.

The Weapon Systems Engineering Assessment Technology (WSEAT) subprogram develops the experimental capabilities and generates test data needed to enable responsive engineering assessments in support of NNSA stockpile management and transformation. Full scale system tests will likely be reduced as the development cycle for future weapons is compressed. Therefore prediction simulations, validated by WSEAT-based experimental data, will be increasingly important.

The WSEAT subprogram works closely with DSW and the ASC to advance the weapons qualifications process and optimize the use of modeling and simulation tools. Additionally, the WSEAT subprogram is planning increased integration and collaboration efforts with other elements of the Engineering Campaign, especially Enhanced Surveillance and Enhanced Surety subprograms to provide an enhanced focus on future stockpile requirements.

Nuclear Survivability

The Nuclear Survivability subprogram develops and stewards the nuclear survivability capabilities that reduce the risk to the nation's nuclear deterrence from radiation environments. This subprogram enables the continuing certification of nuclear survivability and effectiveness of the enduring and evolving stockpile through an engineering R&D program. This R&D program integrates computational capabilities, experimental capabilities, new assessment methodologies, and further development of radiation-hardened technologies.

The Nuclear Survivability subprogram will support the survivability requirements of the enduring and evolving stockpile, its certification and LEPs, without relying on underground testing. Furthermore, its primary purpose is the development of data to minimize dependence on highly enriched uranium laboratory sources through alternative irradiation testing, modeling and validation. The subprogram will develop assessment tools to evaluate threat nuclear weapon radiation environments and system radiation responses, develop radiation-hardened technologies, and improve radiation sources and diagnostics. In response to NNSA guidance, a major focus of this subprogram has emphasized the support of developing a new approach to qualification and production of radiation hardened integrated circuits without the use of the Sandia Pulsed Reactor.

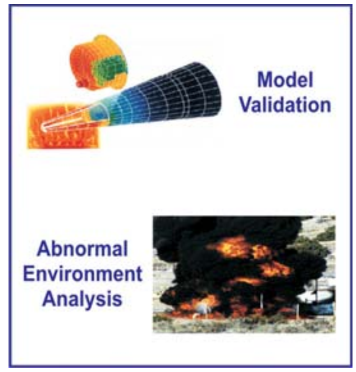

Figure A-4-4. WSEAT provides experimental data to develop and validate advanced engineering computational models and simulation tools.

Enhanced Surveillance

The Enhanced Surveillance (ESV) subprogram helps assess the impact of material behavior changes on weapon performance and safety. This is a joint science and engineering effort that provides material, component, and subsystem lifetime assessments and develops predictive capabilities for early identification and assessment of stockpile aging concerns. ESV identifies aging issues with sufficient lead-time to ensure that NNSA can have the refurbishment capability and capacity in place when required. The strategy emphasizes more robust stockpile surveillance for early problem identification, because any future problems would have a greater relative impact on the effectiveness of a smaller nuclear deterrent.

Typically, ESV lifetime assessments include efforts to develop an understanding of the basic aging mechanisms and interactions of materials in components, sub-assemblies and assemblies. Accelerated aging experiments are used to obtain data beyond that available from traditional stockpile surveillance. Experiments are also used to validate broader age-aware models that are developed to support lifetime assessments and predictions pertinent to LEPs. ESV also provides new or improved diagnostic techniques for detection and quantification of aging degradation and other potential defects in the stockpile.

ESV works with DSW to deploy new diagnostic tests that enable surveillance to be more sensitive and precise in finding defects in weapons sampled from the stockpile. Lifetime assessments provided by ESV also support planning for the NNSA facilities and infrastructure needed to replace aging components or to transform surveillance. The subprogram contributes current weapon aging information for completing the Annual Assessment Reports to certify to the President that the stockpile is safe and effective. The subprogram also establishes expiration dates (and the uncertainties thereon) for materials, components, and subsystems in the stockpile. These estimates are entered into the Technical Basis for Stockpile Transformation Planning document

Figure A–4–5. Enhanced Surveillance provides tools to predict or detect precursors of age-related defects and to provide estimates of component or system lifetimes.

that replaces the Life Extension Options document for scheduling and planning future refurbishments of the stockpile.

4.D. Program Goals

Subprogram	Goals
Enhanced Surety	Mature advanced initiation technologies including new concepts in stronglinks, optical firing sets, and detonator safing for weapon refurbishments beginning in FY 2010 or later.
	Mature advanced use-denial technologies, internal or external to the weapon, for use in future weapons or weapon refurbishments.
	Pursue system concept feasibility demonstration for effective, affordable use denial options that address 21st century treats.
	Mature long-range, high-payoff technologies such as Multi-Point safety for future insertion opportunities.
Weapon Systems Engineering Assessment Technology	Support the W76-1 refurbishment qualification strategy by investing in experimental data to develop and validate models.
	Develop an experimental test suite that can be used to validate predictions of the transmission of mechanical energy through a broad class of joints found in reentry vehicles.
	Develop an experimental test suite that can be used to validate predictions of the performance of weapon-systems in abnormal environments.
Nuclear Survivability	Improve understanding and tools for calculation of warhead outputs and effects.
	Improve understanding of radiation effects for all environments in aged nuclear explosive package (NEP) materials.
	Improve tools for nuclear survivability qualification of limited life components.
	Develop radiation-hard microelectronics for the B61 refurbishment and prepare for production to meet necessary requirements.
	Assess utility of Defense Threat Reduction Agency weapon effects tools for design applications.
	Quantify uncertainties in warhead outputs calculations.
	Validate tools for nuclear survivability qualification of nonnuclear components (NNCs) for application to B61 refurbishment.
	Outputs manual for non-standard nuclear explosive devices.
	Validate tools for nuclear survivability qualification of aged NEPs.
	Validate tools for nuclear survivability qualification of new technology NNCs.
	Improve high-fidelity physics-based model and simulation tools for design-to-effects.
Enhanced Surveillance	Provide aging and lifetime assessments of stockpile components and materials to support annual assessment, refurbishment decisions, and future production complex planning.
	Deliver information to current LEPs to support age-aware materials selection, process development, and certification to ensure sufficient longevity of the sustainable stockpile.
	Complete the development of a NNC surveillance program and the modernization of system-level testing at the Weapons Evaluation Test Laboratory.
	Demonstrate embedded stockpile evaluation technologies for more timely, less invasive, and more cost effective surveillance and assessment.
	Deliver information to future LEPs to support age-aware materials selection, process development, and certification to ensure sufficient longevity of the sustainable stockpile.
	Deliver new non-destructive imaging capability for surveillance and screening of NEP components.
	Provide stockpile evaluation technologies and methodologies needed to support stockpile transformation.
	Provide predictive aging modeling, experimental, and analytical capabilities for improved detection, prediction, assessment, and investigations of weapon aging degradation.

4.E. Strategy

The Engineering Campaign is a long-term program that contributes to meeting current (or short-term) defense program deliverables and is paced by the actualized and anticipated needs of DSW. The Engineering Campaign connects the fundamental science and engineering base to stockpile applications as depicted in the Figure A-4-6 below. The Campaign directly supports DSW needs by contributing to technical activities at all levels of maturity. It identifies emerging trends and addresses specific needs and concerns that may affect performance from both an engineering and material-based perspective.

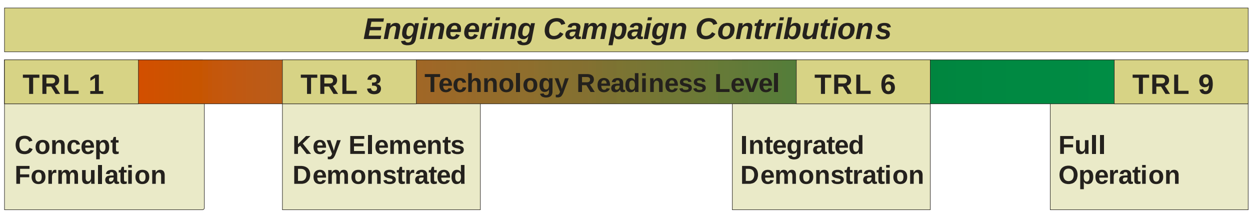

Figure A–4–6. The Engineering Campaign connects the fundamental science and engineering base to stockpile applications

The diversity of Engineering Campaign contributions at various levels of maturity can be illustrated by considering the Technology Readiness Level (TRL) graphic above. Specifically, at the left end of the scale (TRL 1) that primarily addresses research activities, the Campaign provides the engineering R&D and predictive tools necessary to comprehend and assess the responses of weapon materials, components, subsystems, and systems. Nearer the center portion of the TRL scale, the Campaign contributes to maturing technologies, capabilities, and facilities to support insertion opportunities. Proceeding toward the right-hand side of the scale, the Campaign provides the engineering basis and expertise to maintain confidence in the stockpile and respond rapidly to issues.

The strategies for achieving these goals are the guiding principles for organization and management of the program elements. A number of the highest-level strategies are highlighted below:

- Provide a bridge between the broad spectrum of R&D investment in the laboratories and weapon system and subsystem needs, ensuring an effective transition from initial or laboratory demonstration to qualified application or product.

- Promote the use of advanced engineering sciences through the application of validated modeling and simulation and enable concurrent engineering throughout a weapon system's life cycle.

- Seek proper balance between contributing to near-term needs of the Stockpile Stewardship Program, e.g., Stockpile LEP and Significant Finding Investigation resolution, and to enhancing the technical foundations of nuclear weapon engineering and material science.

- Populate the R&D investment portfolio with projects at all levels of maturity to ensure a consistent, timely flow of technological innovation in response to stockpile needs.

- Structure and manage the technical activities to allow the phased deployment of the results, in a timeframe consistent with DSW needs.
- Enhance engineering capabilities for validation experiments and coordinate with modeling and simulation development activities to provide the methodology and capabilities for the better quantification of uncertainties and engineering margins.
- Develop engineering assessment methodology for all levels of integration in support of systems engineering concepts.

As critical contributors to the viability of the Stockpile Stewardship Program, Engineering Campaign activities are closely integrated not only with DSW, but also with the ASC, Readiness, Science, ICF, and the RTBF program. For instance, DSW provides the requirements for modeling and simulation capability and establishes the corresponding schedule for Engineering Campaign deliverables that support the LEPs. Related to the interface with DSW, many of the scientific models recommended for development or improvement by the ASC Campaign come as input from the engineering research within the Engineering Campaign. The ASC Campaign also provides the validation and verification (V&V) requirements for the advanced codes so the Engineering Campaign can properly design and conduct the required experiment to validate the computational model. The engineering science basis for enhanced surveillance and nuclear survivability assessments depends on data on aging and relevant changes in material properties data provided by the Dynamic Materials Properties subprogram of the Science Campaign. Along with baseline data and related test and analysis methods, the Science Campaign input includes margin/uncertainty criteria and sensitivities of performance to material properties used to develop aging models and lifetime assessment tools. Integration of the Engineering Campaign and RTBF is vital to ensure that the proper investment is made in experimental and computational infrastructure needed to meet the Campaign's milestones. Examples of these facilities include the Test Capability Revitalization, the Ion Beam Laboratory, and the Microsystems and Engineering Sciences Application facility.

4.F. Challenges

Subprogram	Issues
Enhanced Surety	The major challenge in implementing improved stockpile surety capabilities is the high cost and long time frames associated with integrating, qualifying, and certifying deeply buried surety subsystems through the LEP process. Innovative technologies and system concepts are key enablers for both near term risk mitigation and ultimate solutions.
Weapons Systems Engineering Assessment Technology	This activity is paced by the availability of ASC tools and platforms and the schedule and scope of stockpile refurbishments for the B61, and other Stockpile Stewardship activities. The ongoing Test Capability Revitalization, Phase II project will provide essential capabilities in support of this activity.
Nuclear Survivability	Both the Ion Beam Laboratory and the Annular Core Research Reactor are currently needed for survivability qualification of nuclear warheads, to develop and validate nuclear survivability tools, and to understand the energy and temporal dependence of neutron and gamma effects of new technologies introduced into the stockpile. The Qualification Alternatives to the Sandia Pulse Reactor project is also needed to support future component qualification in the fast-neutron environment. Security and operations costs for the reactors have escalated significantly; options to reduce costs of research reactors must be developed and evaluated.
	Understanding the relationships of warhead design features to lethality and other nuclear weapon effects (NWEs) is essential for evaluating design and modification options. Current plans for this activity do not address the full spectrum of NWE capabilities needed to support the Nuclear Posture Review; planning to develop and steward improved NWE predictive capabilities is underway.
	Risk that unknown aging problems will not be identified with sufficient lead-time to respond prior to significant impacts to stockpile effectiveness, safety, or performance.
Enhanced Surveillance	Risk that insufficient component lifetime data will be available for making decisions concerning weapon alterations or modifications, resulting in unnecessary or premature expenditures for exchanges of components.
	Risk that a lack of information on warhead aging will result in an inability to continue to assess that the stockpile is safe and effective without nuclear testing.
	Resources have been allocated to work on the highest priority components; however, aging risks are not being assessed for numerous other important components and materials that are critical for safe and effective warheads.
	The time that existing components will endure in the stockpile goes beyond our experience for aged warhead materials.

4.G. Recent Accomplishments

Enhanced Surety

- Demonstrated all of the components of an advanced initiation system.
- Demonstrated highest priority surety sensor technologies against a subset of relevant Stockpile-to-Target Sequence (STS) environments.
- Filled a tritium prototype unit at Savannah River National Laboratory, which records weekly validating data in support of advanced technology development.
- Completed a feasibility study exploring fast initiation of new energetic materials and system power and response time requirements.
- Conducted parametric material studies on Multi-Point Safety (MPS) options at Los Alamos National Laboratory and Lawrence Livermore National Laboratory through collaboration with the United Kingdom in efforts to bracket technologies supporting NSPD-28.
- Demonstrated system implementation of verifiable execution on a single prototype unit.

Weapon Systems Engineering Assessment Technology

- ❍ Completed initial development and demonstration of the 6-DOF (Degrees-of-Freedom) vibration test capability for component testing utilizing a DSW relevant configuration.
- ❍ Completed initial validation experiments of spatial correlation of wall pressure fluctuations in a supersonic turbulent boundary layer, relevant to Re-entry Vehicles/Re-entry Bodies (RV/RB).
- ❍ Characterized the as-built stress state of a high-fidelity high-explosive system.

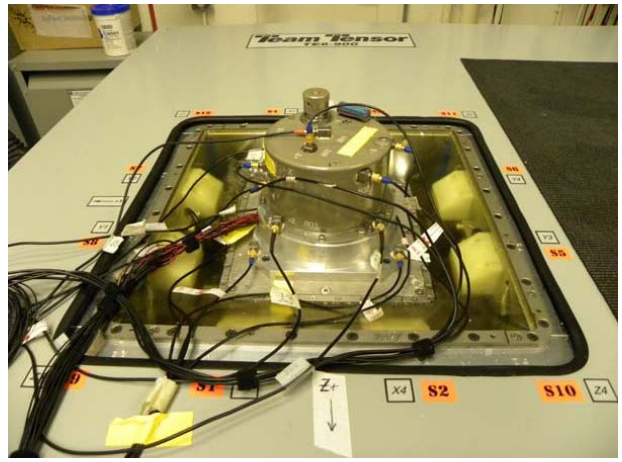

Figure A-4-7. 6-DOF vibration tester.

Nuclear Survivability

- ❍ Modeled and calculated appropriate scenarios for the two specific threats (NWM21-4 and NWM21-6) for the W87 Nuclear Explosive Package.
- ❍ Assessed QMU techniques and methods used by DSW and determined their applicability to the methods and procedures used in assessing the survivability of U.S. nuclear weapon systems.
- ❍ Installed and began using the InRad test stand in the plutonium facility.
- ❍ Reviewed system thermal response to neutron environment study.
- ❍ Completed and documented the Qualification Alternatives to the Sandia Pulse Reactor (QASPR) silicon circuit prototype exercise.
- ❍ Further development and utilization of techniques to measure impulse generation in materials due to x-ray deposition.

Enhanced Surveillance

- ❍ Provided input for the annual certification on component and material aging for each weapon system.
- ❍ Demonstrated new capabilities for the next system tester (W78 and W87) at the Weapons Evaluation Test Laboratory.
- ❍ Completed the development of a W78 firing set structural dynamic model to be used for identifying transfer functions needed for mechanical margin and robustness testing.
- ❍ The maturation of built-in self test hardware is proceeding to the desired Technical Readiness Level – 6 (TRL-6) sufficient for LEP consideration.

- Improved component aging models for Canned Sub-Assemblies (CSA), polymers, high explosives (HE), and initiation systems were developed or used to support lifetime assessments and developed initial framework for inputting aging signatures into quantitative predictive models for assessing uncertainties.

- Updated and completed, the component lifetime, aging, compatibility, and reuse assessments for the CSA, metals, polymers, and ceramic materials in non-nuclear components, mechanical safing and arming devices, getters, silicone elastomers and polyurethane for NEPs, firesets, environmental sensing devices (ESDs), lightning arrestor components (LACs), polymers, diagnostics, O-rings, materials and electronic interfaces.

- Completed Qualified Engineering Release (QER) of Off-line Solid Phase Micro Extraction (SPME) and transferred the diagnostics to core surveillance.

- Evaluated Nuclear Magnetic Resonance (NMR) ProFiler for surveillance of silicone pad and cushion.

- Demonstrated development of the enhanced onionskin test for HE.

- Completed Acoustic Resonance Spectroscopy (ARS) testing and analysis for potential implementation by core surveillance.

- Documented software utilization and improvements for application to computed tomography efforts in core surveillance.

- Documented development and fabrication of Schlieren diagnostic including additional hardware selection and procurement.

- Developed methods for ultrasonic inspection of W80 and W78 reservoirs to TRL-7.

- Completed installation at Pantex of 1-2 mil resolution computer aided tomography hardware for evaluating pits.

4.H. Engineering Campaign Milestones and Future Plans

Out year requirements for the Engineering Campaign reflect reallocation of funds to better support existing priorities within the Stockpile Stewardship Program. Completion of QASPR, which was originally scheduled for FY 2014, may be extended due to budget priorities. Priority will be given to surety and surveillance activities to support future LEPs, alterations, and modifications.

Out year priorities will also include the accomplishment of technologies and tools in support of nuclear survivability efforts related to alterations/modifications and LEPs. The nuclear survivability of weapons requires R&D efforts in developing and qualifying technologies and associated tools and materials to ensure designs are in place when required. The Engineering Campaign will continue to transform surveillance, including the methodology for detecting aging signatures through advanced diagnostics.

Enhanced Surety will focus in the near future on four multi-site development efforts: continue to mature power management options with the intent to deliver a near-term viable alternative for LEPs; prototypical hardware production of security sensor technologies; continued maturation of integrated surety solutions, which integrates external surety elements with the weapon, thus allowing a capability to better react to external activities addressing current and evolving threat scenarios; development of Multi Point Safety options for the next insertion opportunity will continue, and will include enhanced collaborations with United Kingdom designers.

The Weapon Systems Engineering Assessment Technology (WSEAT) subprogram will focus in the near-future on producing data sets for model validation in support of current weapon alterations and modifications and legacy stockpile support. Combined efforts between the ASC Campaign Verification and Validation, and Physics and Engineering Models programs is a key principle of WSEAT, and provides validated modeling and simulation capability for multi-scale and multi-physics problems encountered in qualification and certification activities. Work will continue at a decelerated rate on non-intrusive instrumentation and high explosive structural property measurements supporting model development for improved assessments of structural response, and margins for insensitive high explosive main charge materials.

The Nuclear Survivability subprogram near-future planned activities include continued development of tools and technologies to support QASPR. These tools will support alterations/modifications to the enduring stockpile (or future strategic systems) and will assist in the development of scientific models for understanding radiation effects phenomenology and generating experimental data to validate computational tools. In addition, the subprogram will develop technologies and tools required to support the next reentry system LEP and/or AF&F replacement per the P&PD. Similarly, major R&D efforts are required for system generated electromagnetic pulse phenomena design and qualification tools; technology development for hardening materials; as well as development of qualification tools for those materials in areas of thermomechanical shock, thermostructural response, and impulse generation; and circuit response predictive capabilities.

The funding profile for Enhanced Surveillance reflects a manageable curtailment in the development of certain stockpile surveillance diagnostics, non-destructive techniques, component and material evaluation methods, joint test assembly technology, and embedded evaluation sensors and instrumentation. Additionally, some aging and lifetime studies will be re-scoped to protect the quality of information necessary to support ongoing LEP activities.

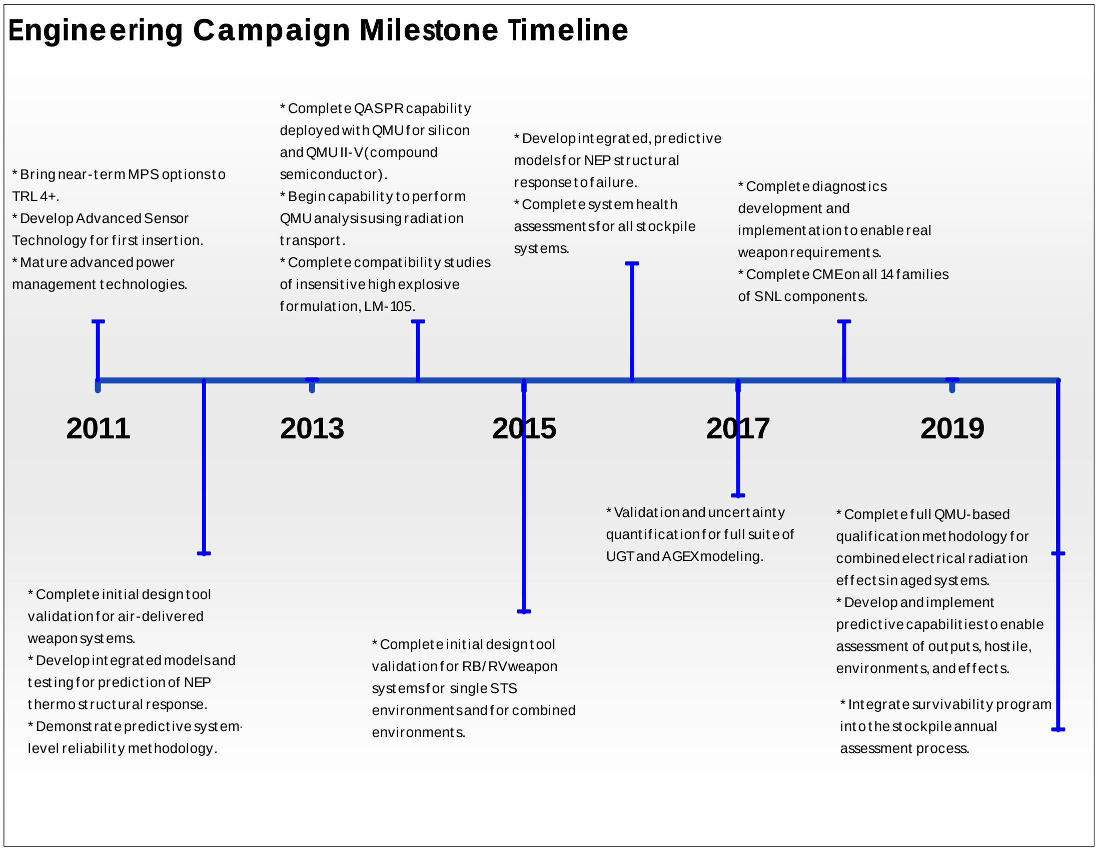

Figure A–4–8. Engineering Campaign Milestones Timeline.

The following activity is ongoing and performed annually, so it does not appear on the milestone time line above. It supplements the program goals for scheduled activities to support successful execution of the program:

- The Engineering Campaign provides input on components and material aging for each weapon system in support of the annual certification process.

4.I. Funding Schedule

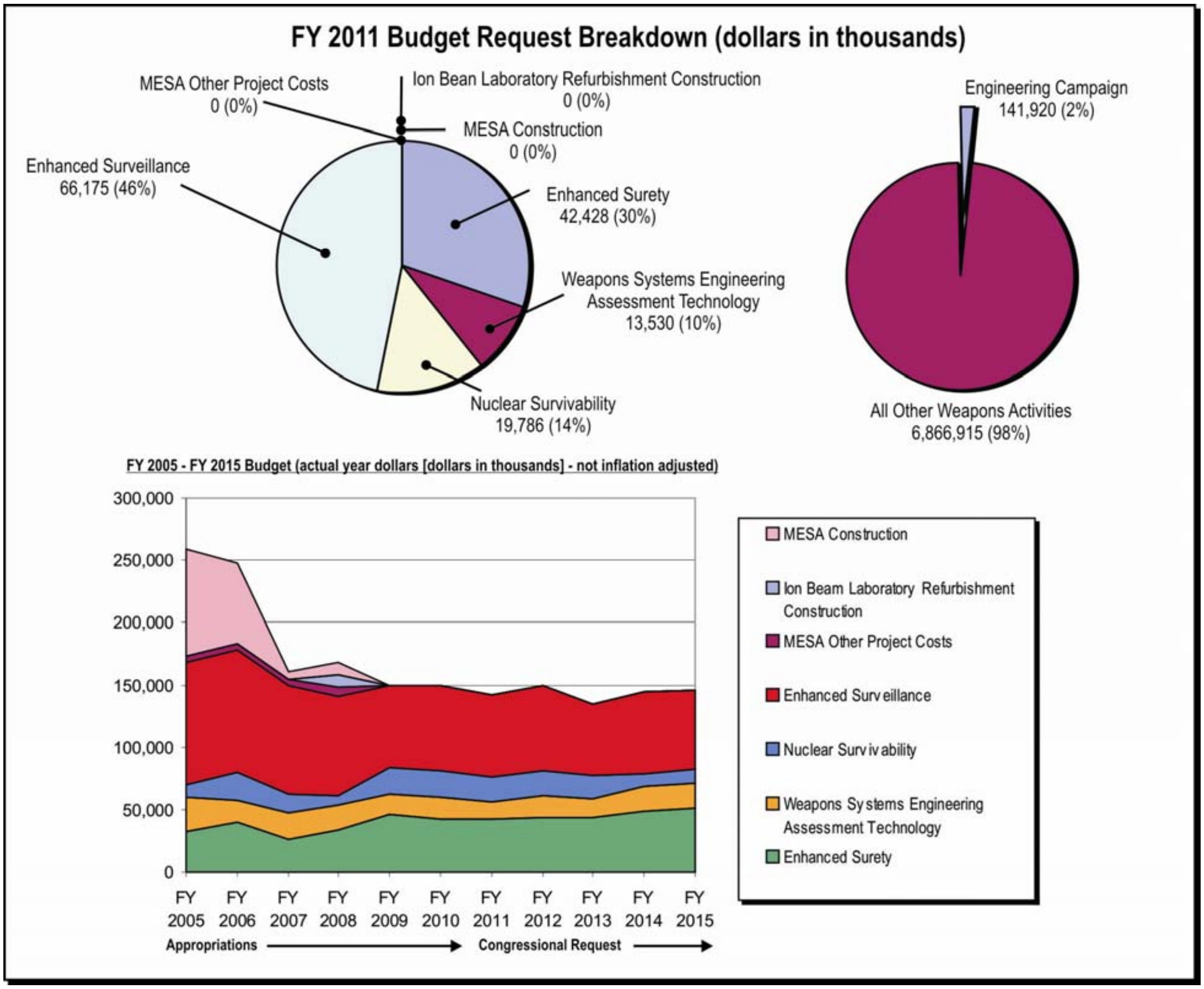

Figure A–4–9. Engineering Campaign Funding Schedule.

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Chapter 5. Inertial Confinement Fusion Campaign

5.A. Highlights

The Inertial Confinement Fusion (ICF) Campaign provides the scientific understanding of high energy density physics that is necessary to maintain a safe, secure, and reliable nuclear weapons stockpile without underground testing, using a unique set of experimental and theoretical capabilities. A major focus of the ICF Program over the last decade has been the construction of the National Ignition Facility (NIF), that met all of its Project Completion Criteria in March 2009.

The National Ignition Campaign (NIC), the largest program element within the ICF Program, has two major goals: execution of inertial confinement fusion ignition campaigns starting in FY 2010, and development of a reliable and repeatable ignition platform by the end of FY 2012 for use in the Stockpile Stewardship Program (SSP) experiments. The NIC comprises a series of experiments using the NIF laser and other ICF High Energy Density (HED) facilities leading to the demonstration of fusion ignition and thermonuclear burn in the laboratory. The plan integrates experiments, diagnostics, targets, numerical simulations, and operational capabilities. In FY 2009 and Q1 FY 2010, the NIC began the first phase of its NIF experimental campaign, towards the first integrated ignition experiment by the end of FY 2010. The FY 2010 "tuning" experiments are supported by commissioning of the diagnostics, targets, and experimental techniques required to optimize the laser and target characteristics.

The NIC energetics campaign successfully commissioned a 300 electron volt (eV) plastic shell point design hohlraum with laser energies up to 1.2 megajoules on the NIF. Significant effort was devoted to installing and commissioning the diagnostics and other equipment required for the first NIC experiments. The NIF cryogenic ignition target production capability was fully qualified, demonstrating high precision targets meeting the point design specifications. Cryogenic layered implosion experiments on the OMEGA Laser Facility have produced the highest deuterium-tritium (DT) areal density measured in the laboratory to date, 0.3 gm/cm^2, providing increased confidence in the baseline ignition designs.

A JASON review of the NIC conducted in January 2009 concluded that impressive, steady progress has been made but suggested that substantial scientific and technical challenges remain.

Full capability of the refurbished Z machine at SNL has been demonstrated. High-quality radiographic images of the evolution of instabilities in z-pinch plasmas were obtained that agreed with pre-shot simulations. The first cryogenic experiments with fusion fuel were performed on the refurbished Z facility providing excellent results.

In FY 2011, the ICF Program will continue to emphasize the development of a robust ignition platform on the NIF and the safe operation of its suite of HED facilities. These facilities allow the physics studies that are required to deliver on NNSA's mission needs in this area.

5.B. Mission

The mission of the ICF Ignition and High Yield Program is to provide the experimental capabilities and scientific understanding in high-energy density physics (HEDP) necessary to maintain a safe, secure, and reliable nuclear weapons stockpile without underground testing. The Campaign has three strategic objectives: (1) achieve thermonuclear ignition in the laboratory and develop it as a routine scientific tool to support stockpile stewardship; (2) develop advanced capabilities including facilities, diagnostics, and experimental methods that access the HED regimes of extreme temperature, pressure, and density required to assess the nuclear stockpile; and (3) maintain the United States preeminence in HED science and support broader national science goals.

Virtually all of the energy from a nuclear weapon is generated while in the HED state. HEDP experiments on ICF facilities are required to validate the advanced theoretical models used to assess and certify the stockpile without nuclear testing. The NIF will extend HEDP experiments to thermonuclear burn conditions in the laboratory, a unique and unprecedented scientific achievement. The ICF Campaign provides this capability through the development and use of advanced experimental tools, including state-of-the-art laser and pulsed power facilities. Science-based weapons assessments and certification requires these advanced experimental tools to create and study matter under extreme conditions that approach the HED environments found in a nuclear explosion.

5.C. Program Structure

The ICF Campaign has six major components: (1) the NIC; (2) support of stockpile stewardship through HED weapons physics experiments; (3) development of pulsed power ICF; (4) development of high energy petawatt lasers; (5) inertial fusion technology; and (6) the Joint Program in High Energy Density Laboratory Plasmas. These major components are funded under eight technical subprograms or Major Technical Efforts (MTEs): (1) Ignition; (2) Support of Other Stockpile Programs; (3) NIF Diagnostics, Cryogenics, and Experimental Support; (4) Pulsed Power Inertial Confinement Fusion; (5) Joint Program in High Energy Density Laboratory Plasmas; (6) Facility Operations and Target Production; (7) Inertial Fusion Technology; and (8) High-Energy Petawatt Laser Development.

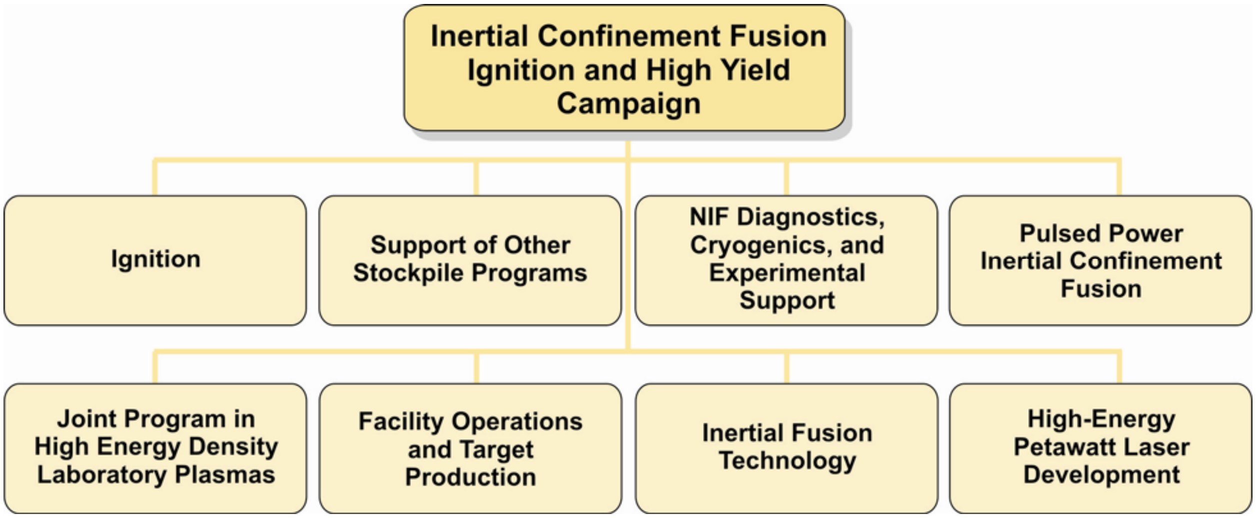

Figure A–5–1. Subprograms of the ICF Campaign in FY 2011.

The structure of the ICF Campaign is unique and significantly different than most of the other NNSA campaigns that participate in the Stockpile Stewardship activities. The ICF Campaign does not have "subprograms." The ICF Campaign is organized, funded, and managed around MTEs. Changes to these MTEs require Congressional concurrence. In this chapter the ICF Campaign has used the word "subprogram" to maintain consistency with the other chapters in the Plan. The "subprograms" displayed and discussed below are the ICF Campaign MTEs. All the MTEs are fully integrated within the ICF Program. The completion of all the MTEs is necessary to meet the three ICF strategic objectives.

Ignition

The Ignition subprogram supports research activities that optimize prospects for achieving inertial confinement fusion ignition on the NIF and the development and use of a robust ignition platform. This includes experiments on NNSA's HED facilities, advanced theoretical modeling, target design, development of ignition target fabrication and assembly methods, development of target diagnostic techniques, and systems engineering improvements essential to ignition efforts. The emphasis of this subprogram is on those activities required to achieve indirect-drive ignition on the NIF. In anticipation of the achievement of ignition, the ICF Campaign is developing a plan for application of ignition conditions to crucial weapons physics experiments.

Figure A–5-2. The NIF was completed in the second quarter of FY 2009.

Support of Other Stockpile Programs

The Support of Other Stockpile Programs subprogram develops experimental capabilities and diagnostics, performs experiments, and uses analytic and computational tools to help resolve important stockpile questions. This subprogram was funded through FY 2007. Since FY 2008, no funding has been requested for this subprogram. Starting in FY 2012, funding is requested for this subprogram to support planned uses of ignition for Stockpile Stewardship applications.

NIF Diagnostics, Cryogenics, and Experimental Support

The NIF Diagnostics, Cryogenics, and Experimental Support subprogram provides experimental infrastructure and equipment, including target diagnostics, engineering and construction systems, beam conditioning optics, systems to field cryogenic targets, and shielding to protect personnel and the environment.

Pulsed Power Inertial Confinement Fusion

The Pulsed Power Inertial Confinement Fusion subprogram supports target design, experiments, and experimental infrastructure to assess pulsed power as a driver for achieving fusion ignition and high yield. This subprogram advances the science and technology of multi-megajoule-class pulsed power systems to improve efficiency, reliability, precision, repetition rate, and to reduce costs.

Joint Program in High Energy Density Laboratory Plasmas

The Joint Program in High-Energy Density Laboratory Plasmas subprogram funds activities with the Office of Science to effectively steward the study of HED laboratory plasmas within the DOE. This includes individual investigator (grants) and research center activities (cooperative agreements) under the NNSA Stewardship Science Academic Alliances Program and the National Laser Users' Facility program at the University of Rochester. The intent of the Joint Program in High-Energy Density Laboratory Plasmas is to effectively engage the broad scientific community in HED science and to provide a broad spectrum of HED capabilities for weapons applications.

Facility Operations and Target Production

The Facility Operations and Target Production subprogram supports operations at the NIF, OMEGA, and Z in a safe, secure manner. This subprogram supports the target fabrication subcontractor(s) activities including ICF target production and delivery, data collection and archiving, routine facility maintenance, and engineering support for facility-supplied diagnostics. The ICF Campaign is implementing its vision that all of its facilities, including the NIF, be national users' facilities and is preparing them for use by a broader scientific community.

Inertial Fusion Technology

The Inertial Fusion Technology subprogram supports the development of high repetition rate laser and pulsed power devices and associated technologies required to conduct experiments that advance inertial fusion energy. This subprogram funded the High Average Power Laser (HAPL) program.

High-Energy Petawatt Laser Development

The High-Energy Petawatt Laser Development subprogram supports technology development for and construction of high-energy, short pulse (petawatt) lasers. The construction of the OMEGA EP was funded within this subprogram.

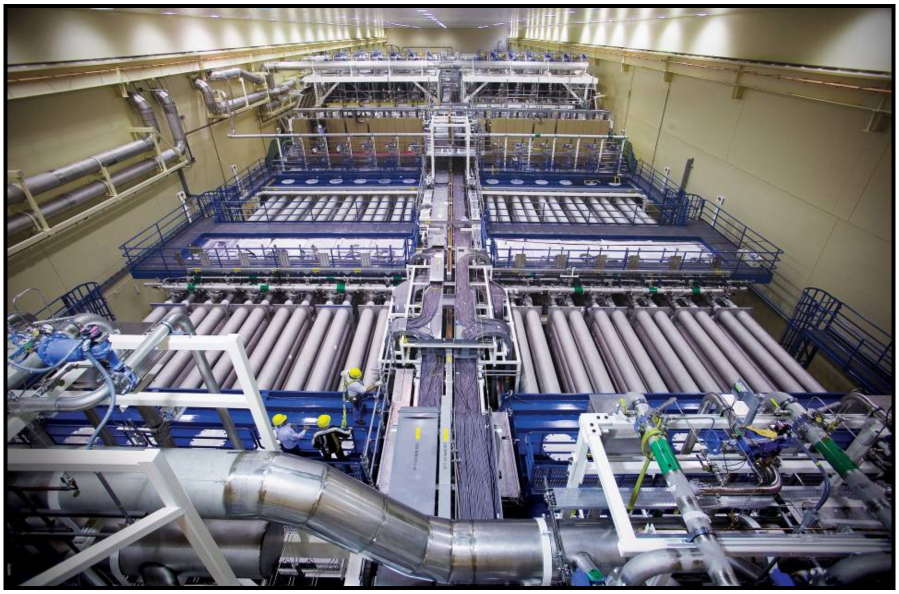

Figure A–5–3. One of two identical NIF laser bays, viewed from above.
Each laser bay has two clusters of 48 beamlines.

5.D. Program Goals

As previously mentioned, the subprograms discussed in the following table are the elements of the ICF Campaign structure, the MTEs. Due to this structure, many of the goals identified in the table below pertain to the entire ICF Program, rather than only to the subprogram. Other goals, more focused towards the subprogram, are specific milestones.

	Subprogram Goals
Ignition	Begin first integrated ignition experiments in FY 2010.
	Demonstrate thermonuclear ignition in the laboratory using the NIF.
	Develop an ignition platform that provides an effective tool for studying boost and radiation transport issues of relevance to the stockpile.
	Use OMEGA/OMEGA EP and Z to study ICF physics and as staging facilities to cost effectively develop experimental platforms for the NIF.
	Use ignition and non-ignition experimental platforms to enable replacement of key empirical parameters in the nuclear explosive package assessment with first principles physics models.
Support of Other Stockpile Programs	Define requirements for an ignition platform to enable Science-based Stockpile Stewardship experiments jointly with the Science Campaigns.
	Apply HED data from NIF, OMEGA, and Z experiments to stockpile stewardship issues including support of the Predictive Capability Framework (PCF) and the Boost Initiative.
	Provide a formal assessment (including potential for selection and development) of options for future SSP fusion-based initiatives beyond baseline NIF capabilities.
NIF Diagnostics, Cryogenics, and Experimental Support	Complete all required target diagnostics, Personnel and Environmental Protection Systems, Tritium Processing System, and User Optics needed to support ignition activities in FY 2010.
	Complete operational qualification of cryogenic system on the NIF.
	Develop supporting experimental and target fabrication technologies required for ignition on NIF.
	Complete Advanced Radiographic Capability for the NIF.
	Complete initial set of radiation hardened diagnostics.
	Complete Personnel and Environmental Protection System commissioning for routine yield operations on the NIF.

	Subprogram Goals
	Define requirements for diagnostics and support HED weapons physics experiments as required by the PCF.
Pulsed Power Inertial Confinement Fusion	Determine the physics requirements and feasibility of high yield fusion using z-pinch technology.
	Demonstrate a 100 kilojoules deuterium/tritium fusion yield on Z.
	Develop the pulsed power architecture and demonstrate technologies necessary for a 100 megajoule-class drive for fusion, dynamic material properties, and radiation sciences.
Joint Program in High Energy Density Laboratory Plasmas	Advance the basic science that underlies nuclear weapons and inertial fusion energy, strengthen ties with academia, grow critical skills, and train students in critical skills.
	Effectively steward the field of High Energy Density Laser Plasmas within the Department of Energy (DOE), while maintaining the interdisciplinary nature of this area of science.
	Conduct solicitations with the Office of Science to support basic HEDP research and for the National Laser Users' Facility to provide User access to OMEGA/OMEGA EP.
Facility Operations and Target Production	Support operations at all ICF facilities, NIF, OMEGA, and Z, in a safe, secure manner.
	Supply needed target components and assembled targets to support experiments on ICF facilities.
	Support execution of HEDP weapons physics experiments required for stockpile stewardship in conjunction with the Science Campaign and the Advanced Simulation and Computing Campaign at NIF, OMEGA, and Z.
	Complete transition of the NIF to routine operations in support of SSP, including classified operations in FY 2012.
Inertial Fusion Technology	Supports development of technologies for inertial fusion energy, including high average power lasers and pulsed power devices and associated technologies required to conduct experiments with these drivers. No activity under this subprogram is currently planned and no funds are requested.
High-Energy Petawatt Laser Development	Supports development of high-energy Petawatt short-pulse laser technology, including compression gratings, to support the Stockpile Stewardship Program, including determining the requirements for the next generation of such systems, and developing proof of concepts as appropriate. OMEGA EP was completed in FY 2008. No activity under this subprogram is currently planned and no funds are requested.

* The contents of this chapter reflect the FY 2010 President's Budget request, which is based on an MTE structure that has been approved by Congress. This MTE structure is displayed in the above table, even though some of the MTEs have no requested funding in FY 2011.

5.E. Strategy

The ICF Campaign will accomplish its mission using its unique experimental facilities, diagnostic techniques, and computational tools to create and measure high energy density conditions similar to those that are crucial to the performance of nuclear weapons. This will include:

- Demonstration of thermonuclear ignition in the laboratory and its development as a tool for weapons assessment

- Performance of a wide variety of HED experiments whose data can be scaled to weapon-relevant parameters

With the main objective of achieving thermonuclear ignition in the laboratory, a major focus of the ICF Campaign over the past decade has been the construction of the NIF. The NIF, located at the LLNL, is a 192-beam, high-energy, high-power laser system capable of delivering up to 1.8 megajoules of ultraviolet energy in a single pulse. The NIF construction project was completed in March 2009 and provides NNSA extraordinary opportunities for scientific progress and discovery in the areas of thermonuclear ignition and matter under extreme conditions. Creating laboratory conditions of extreme densities and temperatures relevant to HED phenomena occurring in nuclear detonation is one of the most challenging requirements for science-based weapons certification.

Figure A–5–4. A view of the OMEGA EP laser bay at the University of Rochester during a shot. The beamline structures are illuminated by a small amount of flash-lamp light that leaks out of the laser amplifiers.

Other advanced HED experimental capabilities within the ICF Campaign include the pulsed power Z machine at SNL and the OMEGA Laser Facility at the University of Rochester's Laboratory for Laser Energetics (LLE). Both facilities have recently undergone significant improvements, completed in FY 2007 and FY 2008, respectively. At SNL, the Z machine was refurbished and upgraded to provide more shot capacity and higher peak current, improved current reproducibility, and more flexible pulse shaping. At LLE, a high-energy, short-pulse capability, the OMEGA EP laser, was added to the existing 60-beam, 30-kilojoule ultraviolet OMEGA compression laser system. The OMEGA EP laser system includes four NIF-like beamlines that can produce up to 6.5 kilojoules of energy in 10-nanosecond-long ultraviolet pulses. Two of these beamlines can be operated as high-energy, short-pulse lasers producing up to 2.6 kilojoules of infrared energy in a 10 picosecond pulse. OMEGA EP can be used to produce high energy x-rays for the advanced radiography capability needed for many weapons physics experiments.

The demonstration of thermonuclear ignition in the laboratory is the highest priority of the ICF Campaign and a major goal for NNSA and DOE. In 2005, the ICF Campaign established a multi-site integrated effort, the NIC, to focus on achieving ignition and thermonuclear burn in the laboratory. The partners in the NIC are LLNL, LLE, LANL, SNL, and General Atomics. The NIC has two primary objectives: (1) perform the first integrated ignition experiment on the NIF beginning in FY 2010, and (2) transition the NIF from project completion to routine facility operations by the end of FY 2012. The NIC comprises a series of experiments using the NIF laser and other ICF facilities that are designed to lead to the demonstration of fusion ignition and thermonuclear burn in the laboratory. The experimental plan integrates facility operations, diagnostic development, and advanced target fabrication in order to perform a complex series of experiments. These experiments systematically reduce the physics uncertainties in the computational models used to predict the conditions needed for ignition. These computational tools then guide the final sequence of experiments leading to igniting conditions.

NNSA designated the NIC as an Enhanced Management Program requiring adherence to a rigorous set of project management standards including a formal execution plan. The execution plan describes the multi-year NIC scope, schedule, and budget baseline. Project milestones, earned value reporting, and a formal change control process are among the management tools used to track progress against the NIC baseline.

There is close collaboration and coordination among the ICF Campaign and other stockpile stewardship programs, especially the Science Campaign with which there are several joint milestones and performance measures. The ICF Campaign relies on the advanced simulation and computing expertise of the ASC Campaign for its subprogram activities in both ignition and HEDP. ICF experimental results, in turn, are used to validate and support ASC computational capabilities and simulations for subsequent application to warhead analysis. The Predictive Capability Framework (PCF) is a vital tool in linking ICF Campaign activities to weapons program requirements in a number of areas: (1) advanced theoretical model development; (2) measurement of physical properties of matter under extreme conditions; and (3) testing of specific weapons phenomena. The ICF Campaign is actively engaged in the development and use of the PCF.

The ICF Program, with the Science Campaign, provides experimental data required to validate weapons-relevant physics models that form the basis of weapons simulation design codes. These codes, along with the advanced, high-performance computing platforms developed within the ASC Campaign, are used within the SSP for the required annual assessment and certification of the U.S. nuclear stockpile. Coordination of the efforts of the Science, ICF, and ASC Campaigns is achieved through the PCF planning tool used by the Office of Defense Programs to prioritize and schedule activities.

The data, methodologies, models, and simulation codes developed by the Defense Programs' science effort lend confidence in and support for the calculations performed to meet DSW commitments, including understanding the impact of aging weapon systems, closing Significant Findings Investigations identified from surveillance or other sources, and certifying refurbished devices resulting from life extension programs.

NNSA and the Office of Science established a joint program in high-energy density laboratory plasmas to maintain the U.S. preeminence in HED science and support broader national science goals. The joint program effectively stewards the field of high-energy density laboratory plasmas within DOE while maintaining the interdisciplinary nature of this science and engaging members of the broader scientific community in these efforts. This program provides university user access to the OMEGA Laser Facility through the National Laser Users' Facility. NNSA's HED experimental capabilities serve DOE's missions to develop advanced energy systems (Office of Fusion Energy Sciences) and to further our understanding of fundamental science (Office of Basic Energy Sciences).

5.F. Challenges

Subprogram	Issue
Ignition	Development of an ignition platform that meets NNSA's weapons program needs for gain and reproducibility, as defined by the PCF and other tools, and ensuring that cross-campaign support efforts remain well integrated.
	Development of risk reduction options to meet the ignition needs of NNSA's weapons program that would provide higher gains, if required. Approaches include innovative indirect-drive target designs, direct drive illumination using indirect drive beam geometry, mitigating stimulated scattering of incident laser energy, and the use of second harmonic (2ω, green) laser light. This requires continued experiments on NNSA's suite of HED facilities.
Support of Other Stockpile Programs	Development of advanced experimental techniques and capabilities, including modifications to current ICF facilities or the addition of new facilities, that expand the parameter space for HEDP stockpile support experiments, in support NNSA's weapons physics needs and consistent with the PCF, Boost Initiative, etc.
	Maintenance of a robust research environment for training the next generation of weapons scientists, engineers, and program managers that can identify HED science technology and resource requirements to meet future SSP needs.
NIF Diagnostics, Cryogenics, and Experimental Support	Completion of the development and installation of diagnostics required for the understanding of ignition and near-ignition conditions on the NIF.
	Development of new diagnostics for HEDP experiments on NIF, OMEGA, and Z, including those that function during the ignition process.
Pulsed Power Inertial Confinement Fusion	Understanding the science and developing the technology of pulsed power so that it could be used to achieve thermonuclear fusion in a pulsed power device.
Joint Program in High Energy Density Laboratory Plasmas	Stewarding HEDP to maintain the U.S. preeminence in HED science, support broader national science goals with the Office of Science, and ensure that critical skill needs are met for the SSP.
Facility Operations and Target Production	Balancing capability, capacity, and program needs among the ICF HED facilities and reducing operating costs through efficiency gains.
	Transitioning NNSA's ICF/HED facilities to user facilities, including strategies to ensure adequate university and outside user participation.
Inertial Fusion Technology	Developing an inertial fusion energy program in partnership with the Office of Science that leverages NNSA's ICF/HED facilities.
High-Energy Petawatt Laser Development	Developing techniques to use NNSA's current and near-term high-energy Petawatt lasers to support the SSP, determining the requirements for the next generation of such systems, and developing proof of concepts as appropriate.

5.G. Recent Accomplishments

National Ignition Campaign (NIC)

NIF laser performance that meets the NIC ignition point design requirements was demonstrated; including the performance of all beam conditioning techniques simultaneously, the required power balance, synchronization, and pointing accuracy for all beams. The ability to precisely tune the laser pulse shape, beam delay times, and relative beam wavelengths (used to transfer energy between beams to control the shape of the capsule implosion) was demonstrated.

In December 2009 the NIC hohlraum energetics campaign completed its first phase. The experiments commissioned the diagnostics to characterize the laser-hohlraum coupling that creates the x-ray drive used to compress the fuel capsule to ignition conditions. Laser Plasma Instability (LPI) predictive capability was verified in NIF-scale targets. This resulted in the successful commissioning of a 300 eV plastic shell point design hohlraum for the 2010 experiments. The NIC has experimentally demonstrated the required hohlraum energetics at the point design scale (5.4 millimeter diameter) with laser energies up to 1.2 megajoules. This is extremely encouraging progress towards meeting the ignition requirements.

NIF indirect-drive experiments using up to 1 megajoule of laser energy have shown that capsule implosion symmetry can be tuned by varying the wavelength of the inner and outer cone beams. Capsule implosions with good symmetry were demonstrated.

Cryogenic implosion experiments on the OMEGA Laser Facility have produced the highest areal density from imploded layered cryogenic DT targets measured in the laboratory, 0.3 gm/cm^2. This is 50 percent greater than the areal densities measured to complete an NNSA 2007 stretch milestone. These experiments are being used to understand compression physics and develop advanced areal density diagnostics for the NIF.

A triple picket Polar Drive target design was shown to have comparable laser imprint levels to the previous continuous pulse design. The triple picket pulse shape is advantageous in that the multi-shock timing can be readily tuned using the NIF technique developed by LLE, LLNL, and SNL. Polar drive, a type of direct drive, uses direct laser illumination of the target with no intermediate generation of x-rays as in indirect drive. The polar drive approach was developed to allow uniform illumination of a target with laser beams in the current NIF configuration.

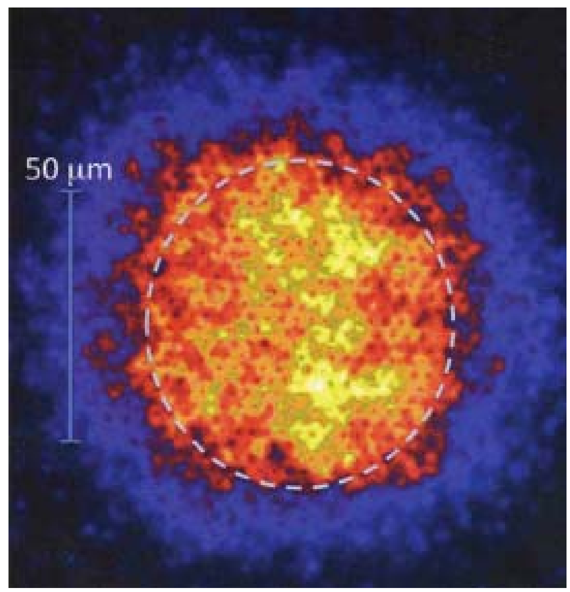

Figure A–5–5. Image of an imploded capsule showing good symmetry from NIF using around 1 megajoules of laser energy.

NIC Diagnostic Installation

Significant effort was focused on installing and commissioning diagnostics and other equipment required for the first NIC experiments, including: Dante soft x-ray spectrometer, FFLEX hard x-ray spectrometer, Full Aperture Backscatter System, and the Near Backscatter Imager. The first of a suite of neutron Time-of-Flight detectors that will measure the neutron yield, bang time, and down-scattered neutron spectrum was installed on the NIF target chamber. Bang time, a term commonly used within the ICF community, is generally defined as the time interval from the beginning of the driver-generated laser pulse to the time of maximum neutron generation.

A Magnetic Recoil Spectrometer, developed and designed through a collaboration between the Massachusetts Institute of Technology, LLE, and LLNL, has been manufactured and delivered for installation on the NIF. It will be used to measure the areal density in cryogenic target implosions during the NIF ignition campaign.

Figure A–5–6. The Magnetic Recoil Spectrometer that has been delivered to LLNL for installation on the NIF. It will measure the neutron energy spectrum that will be used to determine the areal density of implosions during the ignition campaigns. Left panel: assembled diagnostic weighing 9000 lbs, shown with team members from Massachusetts Institute of Technology and LLE. Right panel: interior of the diagnostic.

NIC Ignition Diagnostic Development

The first short pulse x-ray radiograph of an imploding cryogenic DT target was obtained, using radiation generated by a short pulse from an OMEGA EP beam interacting with an aluminum target. Radiographic images showed the evolution of the shell compression near peak burn along with the core self emission. This provides important validation of some diagnostic methods that will be applied in ignition experiments on the NIF.

A Polar Drive exploding pusher experimental campaign was designed for the NIF by LLE. This approach provides a simple way to produce a pre-determined range of neutron yields to commission the nuclear diagnostics. The initial experimental shots of this campaign produced the required neutron yields, in agreement with two-dimensional simulations.

A new liquid scintillator detector was developed on OMEGA. It has a fast decay time and will allow a neutron time-of-flight measurement of the downscattered neutron spectrum that will be used to infer the areal density from cryogenic implosions during the ignition campaign. LANL scientists fielded a gamma ray detector on OMEGA that will be used to measure the time of fusion burn on the NIF.

NIC Target Development and Production

The cryogenic ignition target production capability was fully qualified, demonstrating high precision targets meeting the point design specifications in quantities consistent with the experimental schedule. Cryogenic layers meeting ignition requirements were formed using a cryogenic mixture of hydrogen and tritium.

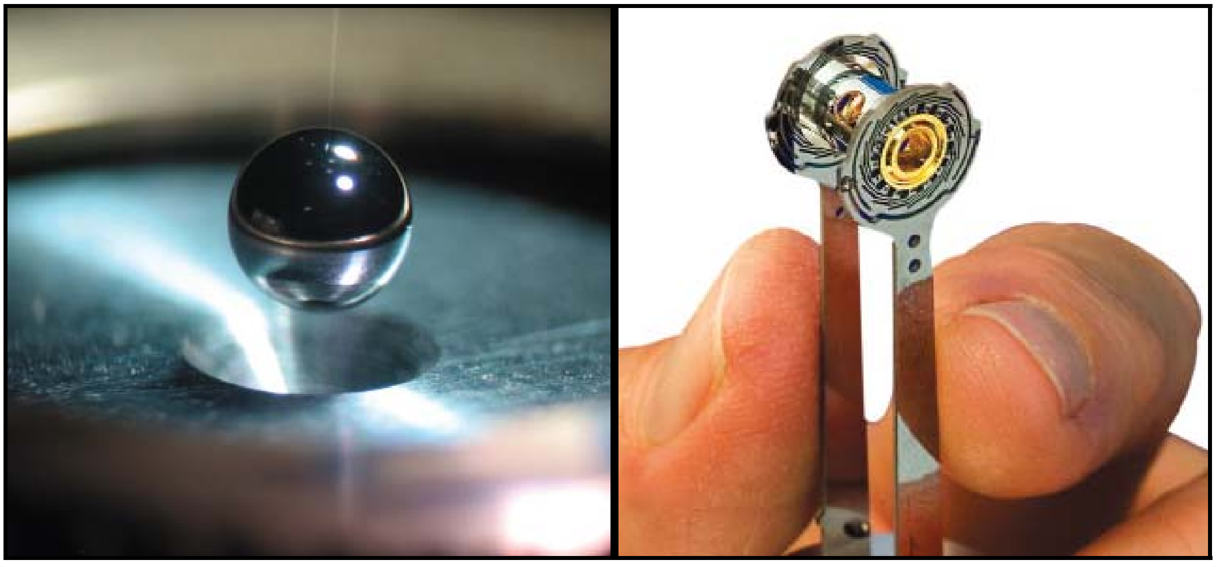

Figure A–5–7. ICF Target components. Left panel: The polished beryllium capsule is 2 millimeters in diameter and holds the cryogenic DT fuel. The 10-micrometer fill tube attached to the top of the capsule is barely visible. Right panel: The thermomechanical package for the hohlraum–capsule assembly.

NIC Ignition Planning and Review

A JASON review of the NIC was conducted in January 2009. The review provided an assessment of the progress of the NIC and its readiness to perform the crucial upcoming ignition experiments in FY 2010. The review concluded that impressive, steady progress has been made but suggested that substantial scientific and technical challenges remain.

NIF Project

The NIF was completed in accordance with its approved baseline on March 27, 2009. All Project Completion Criteria were met.

The NIF performed a 192-beamline shot in March 2009 that produced a (then) record 1.1 megajoules of ultraviolet (3ω) light.

OMEGA Laser Facility

The OMEGA Laser Facility performed 1,446 effective target shots in FY 2009 and 352 effective target shots during the first quarter of FY 2010. Users included scientists from LANL, LLE, LLNL, SNL and various universities, as well as Atomic Weapons Establishment (United Kingdom) and Commissariat a l'Energie Atomique (France).

The OMEGA EP laser, completed in FY 2008, has produced up to 2.1 kilojoules of laser energy on target in a 10 picosecond laser pulse, four times more energy than any other high-energy Petawatt laser system. In FY 2009, the OMEGA EP laser transitioned to operation as a National User Facility.

The first OMEGA Laser Facility User's Group Workshop was held at LLE in April 2009 with one hundred scientists from twenty nine universities and laboratories, four countries, and NNSA attending. The workshop facilitated communication among the users and with the facility and provided feedback on ways to improve operations and capabilities for users. This workshop was an important component of the ICF Program's plan to evolve all its facilities into national user capabilities. There are currently more than 160 OMEGA Laser Facility User's Group members.

A basic science experiment using OMEGA EP produced a positron jet with a beam energy of 19 mega-electron volts containing approximately 10^{12} positrons. This is the highest positron production rate observed in the laboratory to date. The jet of relativistic positrons was emitted from a millimeter-thick gold target when hit with 1 kilojoule of laser energy in a 10 picosecond laser pulse.

Initial nuclear physics experiments on OMEGA, taking advantage of the advanced nuclear diagnostic development for the NIF, have included measurements of nuclear fusion and neutron scattering cross-sections relevant to astrophysics. The results from an National Laser Users' Facility (NLUF) basic science experiment on OMEGA were used to obtain observational time on the Hubble Space Telescope.

Z Facility

Full capability of the refurbished Z machine has been demonstrated. The maximum current was increased from 18 to 26 mega-amperes, the shot-to-shot reproducibility has improved (within +/- 0.5 percent for the current pulse shape), and more precise current shaping and a longer, variable pulse length were provided.

The shot rate at Z nearly tripled between the first quarter and fourth quarter of FY 2009, demonstrating an annual shot rate capability of around 200. This represents a dramatic increase in shot rate from FY 2008. The annual average number of operational crew hours to prepare for a Z shot was decreased to 8.17 hours, exceeding the national ICF efficiency end target that was set in 2004 to reduce the average crew hours on Z to 9 hours by the end of FY 2009. Two- and three-dimensional electromagnetic, magnetohydrodynamic, and mechanical models developed in FY 2009 were used to gain a better understanding of pulsed power science and technology.

In FY 2009, Z was operated as a shared national facility with mission-related shots allocated through a formal proposal-based process. For FY 2010, 43 proposals were received and shot time has been allocated for 28 of these proposals.

An advanced current monitor was designed and implemented in FY 2010 that can measure the current 6 centimeters from the axis of a load to which Z has delivered as much as 26 mega-amperes and 2 megajoules. At these currents and energies, electrons striking a standard current monitor had caused the probe to stop working 40 nanoseconds into the pulse. The redesigned monitor has reduced the electron energy deposition by as much as a factor of five compared to the standard monitor, and the new monitor can track the current for more than 120 nanoseconds.

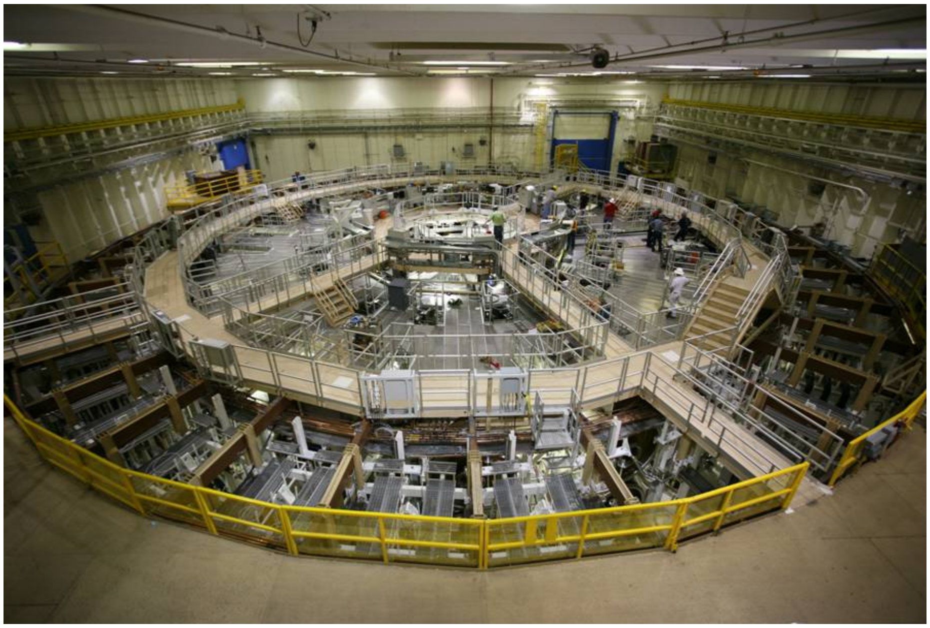

Figure A–5–8. Overhead view of the gymnasium-sized Z Pulsed Power Facility at SNL.

High-quality radiographic images of the evolution of instabilities in z-pinch plasmas were obtained. The radiographs were obtained with two-frame, x-ray images (x-ray images at two different times) and two-color images (images at two different x-ray energies) using the Z-beamlet laser. The images agree with pre-shot simulations and illustrate why instability control is critical for uniform implosions.

Isentropic compression experiments have demonstrated magnetic drive pressures of 6 megabars. Magnetically accelerated flyer plates have been used to perform equation-of-state studies in quartz and sapphire to pressures of 16 and 21 megabars, respectively.

X-ray sources were developed for important radiation effects testing experiments to be performed in 2011. These sources had greater than 50 percent more x-ray fluence than had been possible on Z before the refurbishment. In collaboration with LANL, experiments to study the x-ray opacity of materials were performed. These experiments demonstrated both 30 percent higher temperatures and 300 percent higher densities than had been obtained previously.

Pulsed Power ICF

Advanced ICF pulsed power concepts have been tested in experiments and several measurements were performed for the first time. The first cryogenic experiments with fusion fuel were performed on the refurbished Z facility and excellent results were obtained. This cryogenic capability enabled dynamic materials experiments to be performed on a cryogenically-cooled gas, and provided data that showed two commonly used equation-of-state models were incorrect. These tests provided information directly relevant to an important weapons issue. The first neutron image of a fusion plasma on Z was acquired in FY 2010.

A new approach to achieving fusion on Z that significantly relaxes the pressure requirements was proposed. The Magnetized Liner Inertial Fusion (MagLIF) approach relies on a high energy laser to heat the fusion fuel and the presence of an axial magnetic field to enable the fuel to be heated to fusion temperatures. Initial experiments to study the magneto-Rayleigh-Taylor instability in MagLIF relevant configurations were performed.

The first fully kinetic, collisional, electromagnetic simulations of the time evolution of imploding z-pinch plasma have been conducted with a particle-in-cell code. Significant differences are seen between magnetohydrodynamic codes and particle-in-cell simulations of deuterium gas-puff z-pinch experiments. The particle-in-cell simulations produced a more realistic time evolution of the pinch and demonstrate that both thermonuclear and beam-target neutrons are generated.

Other ICF Accomplishments

The Naval Research Laboratory demonstrated continuous operation of Electra, the electron beam pumped krypton fluoride (KrF) laser, for 90,000 shots at 2.5 hertz (10 hours) and 50,000 shots at 5 hertz. The total number of shots with Electra now exceeds 1 million. Electra is an important prototype that could be used in an Inertial Fusion Energy (IFE) experiment.

Progress has been made on a pulsed power system that can repetitively generate the electron beam that excites the KrF (lasing) medium. The Naval Research Laboratory built an all solid state 250 kilovolt pulsed power system that ran continuously for 11.5 million shots at 10 hertz (319 hours) with greater than 80 percent electrical efficiency. A full-sized system based on this prototype will be deployed on Electra.

In a joint experiment with the Institute of Laser Engineering, Osaka University (Japan), researchers at the Naval Research Laboratory accelerated thin plastic targets to ultra-high velocities using the deep ultraviolet light from the Nike KrF laser. The high pressures, approaching 1 billion atmospheres, and temperatures above 20 million degrees obtained upon colliding hyper-velocity deuterated plastic targets with stationary foils produced thermonuclear reactions. The ultra-high velocities are of interest to produce such extreme conditions, and are a proposed means to ignite compressed pellets containing deuterium and tritium.

LLNL operated the front-end laser on their diode-pumped, solid-state Mercury laser system in an autonomous mode (computer-controlled and diagnosed) for over 15 million shots.

Joint Program in High Energy Density Laboratory Plasmas

The joint program issued a solicitation that supports academic and national laboratory research in HEDP in FY 2008. Over 135 proposals were received indicating a strong interest in the field and in FY 2009 24 of the proposals were selected for funding. A competitive solicitation will be issued in FY 2010 for the National Laser Users' Facility (NLUF) which provides experimental time on the OMEGA Laser Facility and funding for university and private industry users.

5.H. ICF Campaign Milestones and Future Plans

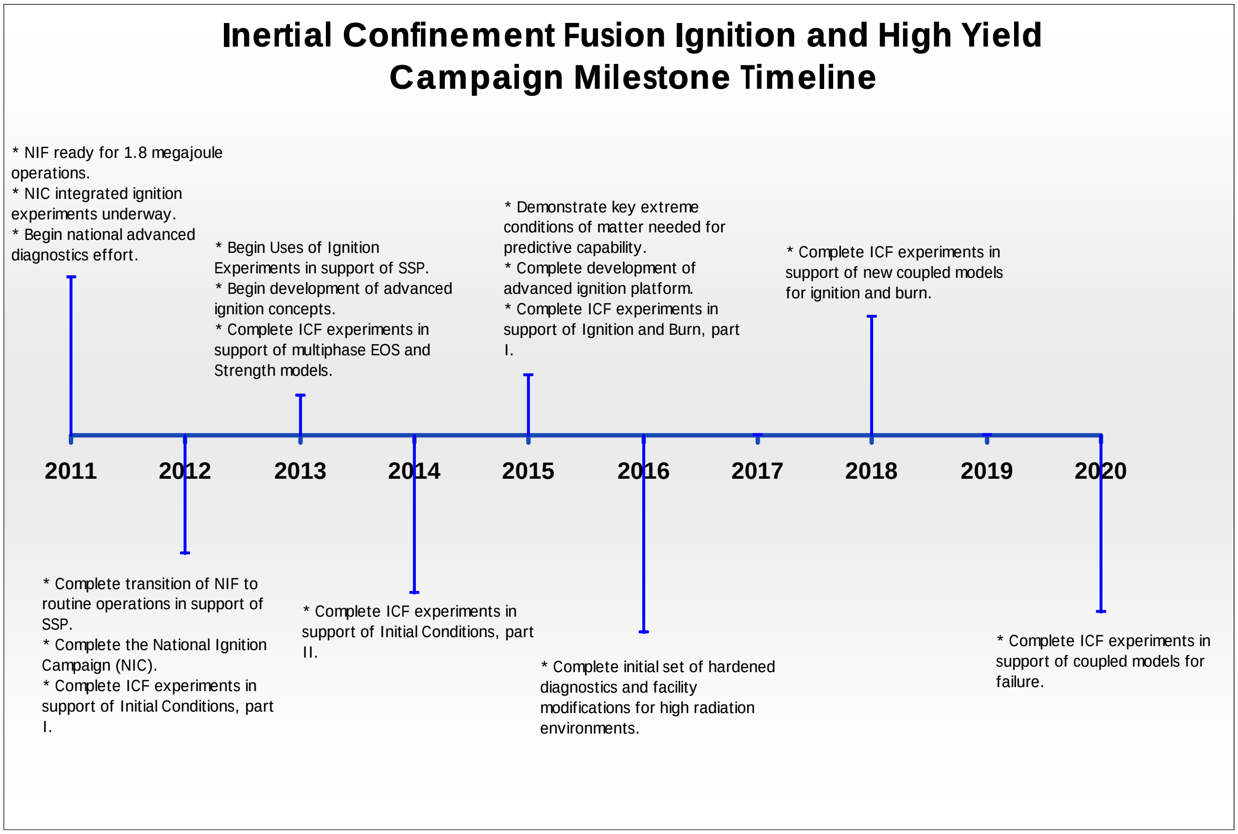

Figure A–5-9. ICF Milestones Timeline.

The achievement of ignition and thermonuclear burn and its application to the major unresolved issues in weapons physics is the highest priority within the ICF Program and is a major goal of the SSP. Once ignition and thermonuclear burn in the laboratory has been successfully demonstrated, experiments will be designed to provide a reproducible ignition platform that can be exploited by the SSP to address important weapons physics questions.

For the remainder of FY 2010, the NIC will perform experiments on the NIF to commission diagnostics and to tune implosion performance by adjusting laser parameters, target characteristics, and experimental techniques. These tuning experiments will optimize the performance of the capsule during its implosion through control of symmetry, fuel pressure, velocity, and fuel-ablator mix. Next, fully integrated tests will be conducted using tritium-rich tritium, hydrogen, and deuterium (THD) fuel layers. The THD targets allow diagnosis of implosion conditions without significant neutron yield and alpha particle deposition. The THD experiments are planned for the second half of FY 2010. Ultimately implosion-optimized targets with deuterium-tritium (DT) fuel layers will be used in the initial attempts to demonstrate ignition and thermonuclear burn on the NIF by the end of FY 2010.

In FY 2011 and FY 2012, the NIC will continue to execute a mix of energetics, tuning, and THD/DT experimental campaigns. The goal of these experiments is to produce a reliable and repeatable ignition platform with as large a performance margin as possible. This higher margin target will be used in ignition applications experiments in support of SSP planned for

FY 2013 and beyond. These applications experiments will include the controlled degradation of ignition conditions.

Figure A–5-10. A view inside the OMEGA EP Grating Compression Chamber at the University of Rochester. The chamber houses the optics including the tiled grating assemblies that can compress two of the EP beams to short pulse (1 to 100 picoseconds).

Cryogenic target implosions will continue on the OMEGA Laser Facility with the goal of maintaining the high areal densities observed and increasing the ion temperature, hence the neutron yield. This will be beneficial for understanding cryogenic target implosion physics and the continued development of advanced areal density diagnostics, such as Compton Radiography. Improvements to the OMEGA laser beam smoothing that will be implemented in FY 2010 are expected to help meet the goal.

The OMEGA Laser Facility is operated as a National User Facility for NNSA mission-driven and basic science research. In FY 2011, it is anticipated that OMEGA will provide more than 1,200 target shots with approximately 30 percent of the facility time available for basic science experiments.

The Z Facility will continue to be operated as a shared national facility and will build upon the improved efficiency and performance that has been demonstrated by the refurbished Z. Experiments in support of the SSP will continue to focus on materials properties, such as equation of state and opacity, to improve and validate computer codes and to respond to the needs of the stockpile. Development of new approaches to achieving ignition on Z through pursuit of advanced pulsed power concepts will continue.

The diagnostics required to provide the key data to assess and tune ignition and to use ignition conditions for HED experiments will continue to be developed, built, and commissioned for the NIF, including the development of Polar Drive implosions for nuclear diagnostic commissioning and HED experiments. A national effort to develop advanced diagnostics for the post-NIC era to support a broad range of users will commence in FY 2011. This effort is aimed at developing novel diagnostics that may include radiation-hardened diagnostics capable of functioning in the harsh radiation and particle environment created by igniting plasmas, advanced imaging diagnostics, and neutron diagnostics.

Key SSP radiation transport experiments that began on the NIF in late FY 2009 will continue in FY 2010, culminating in a validated radiation transport model and the accomplishment of a NNSA Level 1 milestone. Non-ignition SSP experiments in FY 2011 and FY 2012 will focus on materials properties (equation of state and strength) and the behavior of complex hydrodynamic features. Design and preparatory work will be done for initial ignition applications experiments, including degradation of ignition conditions, planned for FY 2013 and beyond.

After completion of the NIC in FY 2012, the NIF will support routine operations for ignition and other HED experiments in support of Stockpile Stewardship. Capabilities will include: certified data systems supporting experimental operations; optics and targets management systems; target production capability for the baseline ignition platform and some HED targets for stewardship experiments; a second operational cryogenic target positioner; an initial set of radiation-hardened diagnostics; and a third set of continuous phase plates.

In FY 2013 and beyond, the ICF Program will pursue an increasingly broad range of HED experiments (both ignition and non-ignition) required by the weapons certification process. The ICF Program will continue to provide some funding for the operations of its HED physics capabilities (facilities and technical expertise) to support emerging and future needs of the NNSA's national security mission. These needs may include advanced ignition concepts (such as fast ignition or various forms of direct drive) or other HED capabilities. This modest commitment to the basic science of HED may expand in response to the nation's priorities, such as energy initiatives. Following the achievement of thermonuclear ignition, the Department anticipates that the relative importance of these potential missions and the role of the various ICF program elements and facilities supporting these missions will be reevaluated and modified to meet national needs and priorities.

Upcoming and key ICF Program milestones are summarized below.

Subprogram	Key Milestone	Schedule
Ignition	Begin first integrated ignition experiments on the NIF: The first ignition campaign will attempt to compress, implode, and ignite a layered DT capsule with a ~1.3 megajoule energy pulse.	Q4 FY 2010
	National Ignition Campaign (NIC) complete.	Q4 FY 2012
Support of Other Stockpile Programs	Complete a cumulative 60 percent progress in replacing key empirical parameters with improved physical data and physics-based models – joint with the Science Campaign.	Q4 FY 2010
	Place the design of an initial application of ignition experiment supporting a DSW issue under change control – joint with the Science Campaign.	Q4 FY 2010
NIF Diagnostics, Cryogenics and Experimental Support	Complete installation qualification (IQ) of Personnel and Environmental Protection Systems (PEPS) for first ignition experiments.	Q4 FY 2010
	Complete NIC baseline configuration diagnostics.	Q2 FY 2012
	Complete initial set of radiation-hardened diagnostics for ignition applications.	Q4 FY 2012
Pulsed Power Inertial Confinement Fusion	Make spectroscopic measurements on a pulsed power load on Z and complete preliminary analysis of the plasma conditions.	Q4 FY 2010

Subprogram	Key Milestone	Schedule
	Develop a more accurate current probe to measure the current delivered to z-pinch loads on Z.	Q3 FY 2010
Facility Operations and Target Production	Conduct 160 experiments on Z for the ICF, Science and Engineering Campaigns.	Q4 FY 2010
	Provide 1,000 or more effective target shots on the OMEGA Laser Facility.	Q4 FY 2010
	NIF ready for 1.8 megajoule operations.	Q2 FY 2011
	Issue NIF Users Facility Guide.	Q1 FY 2012
	Provide 700 shot/year capability on the NIF.	1Q FY 2012
	Complete transition of NIF to routine operations in support of the SSP.	Q4 FY 2012

The following activities are ongoing or performed annually and do not appear on the milestone time line above. They supplement the program goals for scheduled activities to support successful execution of the program.

Ignition

- Develop ignition and non-ignition experimental platforms to enable replacement of key empirical parameters in nuclear explosive package assessment with first principles physics models.

Support of Other Stockpile Programs

- Apply HED data from NIF, OMEGA and Z experiments to stockpile stewardship issues including support of the PCF and the Boost Initiative.

NIF Diagnostics, Cryogenics and Experimental Support

- Define requirements, design, build, and commission diagnostics in support of HED weapons physics experiments, advanced ignition, basic science, and materials experiments on the HED facilities.

Pulsed Power Inertial Confinement Fusion

- Improve efficiency, reliability, precision and repetition rate, and reduce system costs of megajoule-class pulsed power systems.

- Perform computational models of target design, experiments, and experimental infrastructure to assess pulsed power as a means to achieve thermonuclear fusion in the laboratory.

- Determine the physics requirements and feasibility of high yield fusion using z-pinch technology.

- Develop the pulsed power architecture and demonstrate technologies necessary for a 100-megajoule class drive for fusion, dynamic material properties, and radiation sciences.

Joint Program in High Energy Density Laboratory Plasmas

- Advance the basic science that underlies nuclear weapons and inertial fusion energy, strengthen ties with academia, grow critical skills, and train students in critical skills.

- Conduct solicitations with the Office of Science to support basic HEDP research and for the NLUF to provide User access to the OMEGA Laser Facility.

Facility Operations and Target Production

- Operate ICF facilities including NIF, OMEGA, and Z in a safe and secure manner. Support execution of HEDP weapons physics experiments required for stockpile stewardship in conjunction with the Science Campaign and the ASC Campaign. Improve efficiency of HED facility operations to reduce operational costs.

- Supply needed target components and assembled targets to support experiments on ICF facilities. Build capability in target technology and fabrication as needed.

- Advance and develop the technology of optics, materials, and components for laser systems to improve current systems and for future systems.

5.I. Funding Schedule

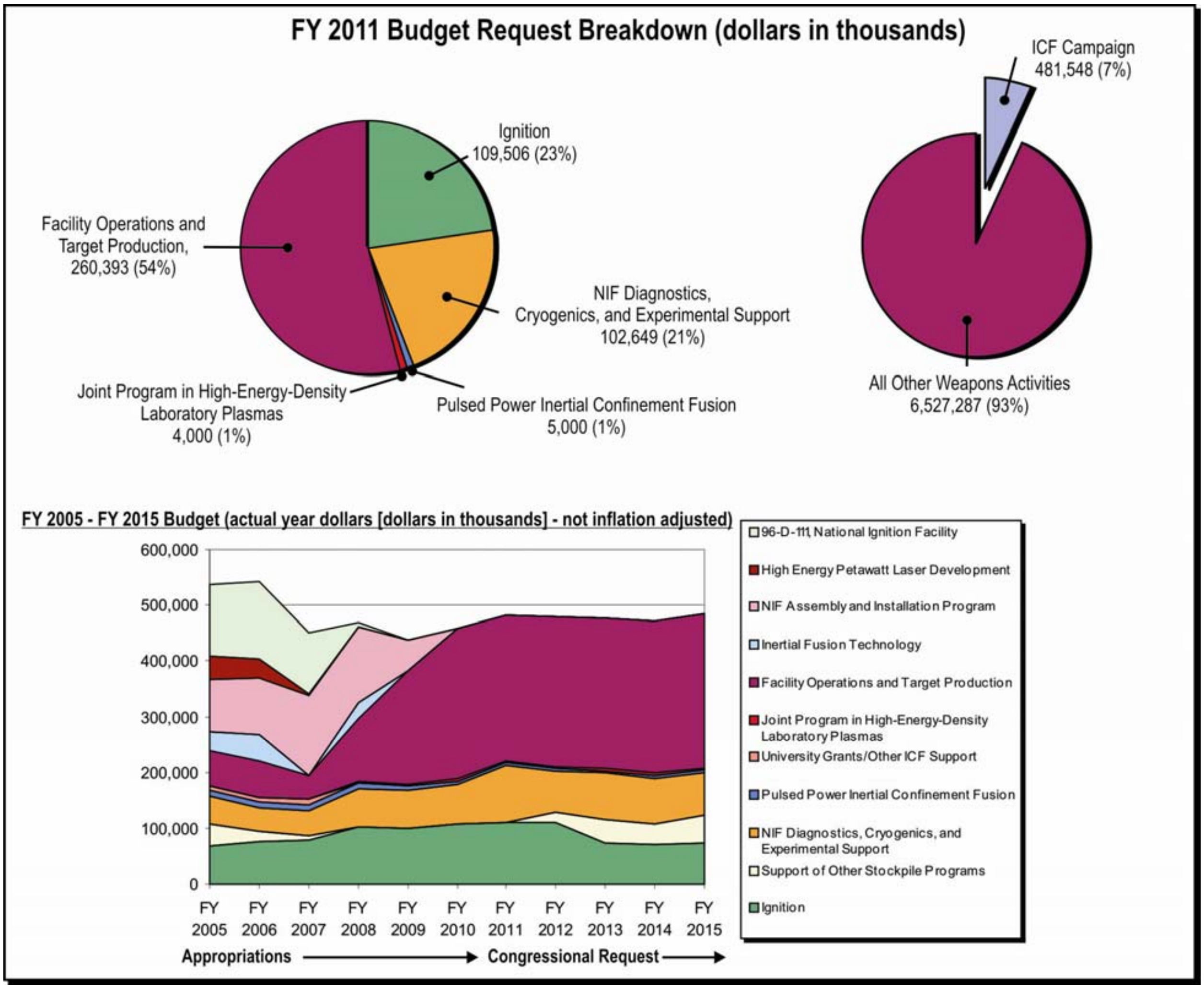

Figure A–5–11. ICF Funding Schedule.

Chapter 6. Advanced Simulation and Computing Campaign

6.A. Highlights

The Advanced Simulation and Computing (ASC) Campaign has consistently provided leading-edge simulation capabilities to support the annual stockpile certification process. ASC's High Performance Computing (HPC) technology investments allow an unprecedented level of computing capability and advanced weapons codes in support of the NNSA mission.

In light of the Comprehensive Test Ban Treaty, ASC serves as the computational surrogate for nuclear testing to predict weapon behavior. ASC and other Campaigns are being integrated through the Predictive Capability Framework, a tool for improving and validating our fundamental understanding of nuclear weapon physics and engineering, and coordinating the development of predictive capability into our modeling and simulation tools. ASC's collaboration with the other Campaigns, Directed Stockpile Work, and DOE's Office of Science is a major strength of the SSP and is instrumental to increasing predictive capability for the complex.

One of the major processes significantly affecting the performance of a weapon, but which is inadequately understood, is "boost." It represents a grand challenge of weapons science. Several long-term integrated goals in the Predictive Capability Framework are related to improving the understanding of "boost." ASC is contributing to the understanding of this phenomenon at unprecedented levels of fidelity by leveraging computing platform capabilities and improving new physical models that are incorporated into ASC simulation codes. Multidisciplinary teams of physical and computational scientists are being engaged to finally make progress on this long-standing challenge due to the level of capability recently achieved by ASC platforms.

Considerable progress has been made by establishing two user facilities for production capability computing for the complex. One of these facilities is located at LLNL and the other is established through the Alliance for Computing at Extreme Scales (ACES) between SNL and LANL. The establishment of these two centers facilitates a synergistic approach to servicing the high-performance computing needs.

The ASC Campaign's simulation tools are also used to address areas of national security beyond the U.S. nuclear stockpile. Through coordination with other government agencies, ASC plays an important role in supporting nonproliferation, emergency response, nuclear forensics, and attribution activities. Resources have been used to characterize SNM and devices via post-detonation analysis and ASC simulation capabilities have been to assess security-related mitigation strategies.

6.B. Mission

The ASC Campaign's mission is to provide leading-edge, high end simulation capabilities needed to meet weapons assessment and certification requirements and to predict, with confidence, the behavior of nuclear weapons through comprehensive, science-based simulations.

6.C. Program Structure

To meet its mission, the ASC Campaign consists of five subprograms. These subprograms include: (1) Integrated Codes (IC); (2) Physics and Engineering Models (PEM); (3) Verification and Validation (V&V); (4) Computational Systems and Software Environment (CSSE); and (5) Facility Operations and User Support (FOUS).

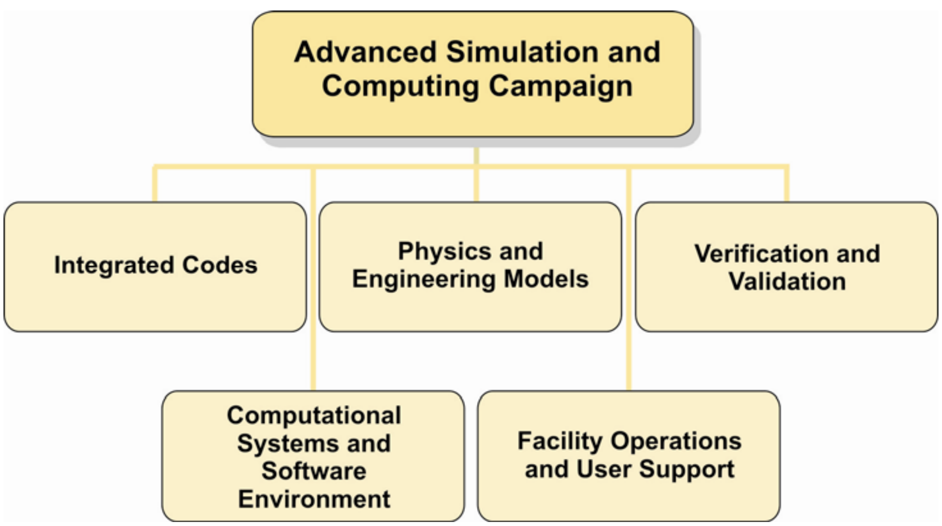

Figure A–6–1. Subprograms of the ASC Campaign in FY 2011.

Integrated Codes (IC)

The IC subprogram produces large-scale integrated simulation codes that are needed for stockpile maintenance, LEPs, Significant Finding Investigation (SFIs), and weapons dismantlement. It also maintains selected legacy codes and has responsibility for the engineering, emerging, and specialized codes. Predictive capability and the pursuit of national security missions will be accomplished through advances realized in these codes.

Figure A–6–2. IC produces weapons simulation codes

The DSW program is an immediate customer of the IC subprogram, using IC codes directly for the full range of stockpile assessment and certification objectives. In turn, DSW requirements drive near-term code activities and longer-term development of new capabilities. The NIC also uses the codes to meet its mission goals, including the NIF. The Science and Engineering Campaigns are both customers and suppliers for the IC and PEM subprograms, as they use these codes to design and analyze stockpile-relevant experiments, to advance fundamental understanding of weapons physics and engineering, and to provide scientific discovery, physical data, and certification methodologies used to improve the codes. An example of how ASC, the Campaigns, and DSW collaborate to tackle problems when a significant fraction of the Red Storm compute time in FY 2008 was instrumental in planning a Navy operation to destroy an errant satellite, which posed a terrestrial threat if allowed to reenter the Earth's atmosphere in an uncontrolled manner. ASC provided the needed computational and simulation resources. The Engineering Campaign provided phenomenology experiments and diagnostics for sub-scale validation tests. DSW/STA funded the test hardware. Critical contributions from each of these programs resulted in a successful proof of concept, with rapid design and fabrication of prototype hardware.

Physics and Engineering Models

This subprogram develops microscopic and macroscopic models of physics and material properties, as well as special purpose physics codes required for investigating specific physical phenomena in detail. This subprogram works with the IC subprogram to perform initial validation and to incorporate new models into the integrated codes.

There is extensive integration between the PEM subprogram and the SSP experimental programs executed by the Science Campaign, the ICF Campaign, and the Engineering Campaign.

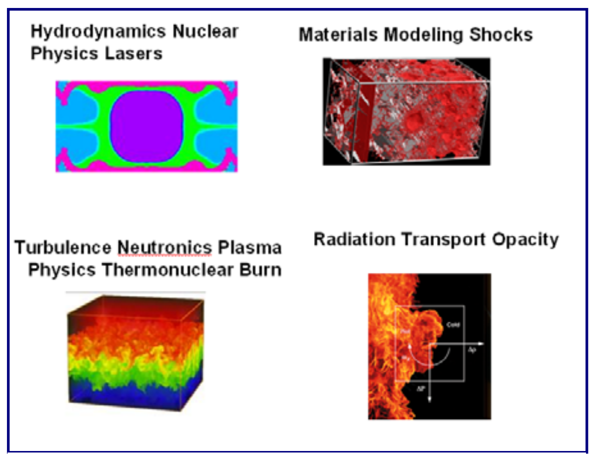

Figure A–6–3. PEM develops microscopic and macroscopic models of physics and material properties.

Verification and Validation

Verification activities demonstrate that the weapons codes are correctly solving equations related to physics and engineering models. Validation activities ensure that the weapons codes are solving the correct equations, that is, that the physics and engineering models themselves are correct. Together, V&V provide a technically rigorous foundation of credibility for computational science and engineering calculations by developing and implementing tools that document confidence in simulations of high-consequence nuclear stockpile problems. The V&V subprogram is developing and implementing Uncertainty Quantification (UQ) methodologies as a building block in the foundation to the Quantification of Margins and Uncertainties (QMU) in weapons assessment and certification.

Today's Top 12 supercomputers depended on NNSA investments. Roadrunner was named the world's fastest computer for breaking the petaflop barrier in May 2008.

Figure A–6–4. CSSE builds integrated, balanced, and scalable computational capabilities to meet simulation requirements.

Computational Systems and Software Environment

This subprogram builds integrated, balanced, and scalable computational capabilities to meet simulation and computing requirements. The complexity and scale of nuclear weapons simulations require ASC to lead the mainstream high-performance computing community, primarily by investing in, and influencing the evolution of computing environments. CSSE must also provide the stability that ensures productive system use and protects the NNSA investment in secure simulation codes.

In the next decade, the enhancement of future predictive capabilities, the delivery of quantified margins and uncertainties, and the achievement of DSW simulation deliverables will demand even more powerful and sophisticated simulation environments which are expected to reach exascale, or one million trillion mathematical calculations per second, within the next decade. Significant technology shifts in HPC have begun towards Exascale in the supercomputing industry and the CSSE subprogram is actively engaged in preparing for these changes. CSSE will continue to provide mission-responsive computational environments for the acquisition and implementation of capability, capacity, and advanced computing systems, such as the Tri-lab Linux Capacity Clusters (TLCCs), Blue Gene/L, RoadRunner, Cielo, and Sequoia.

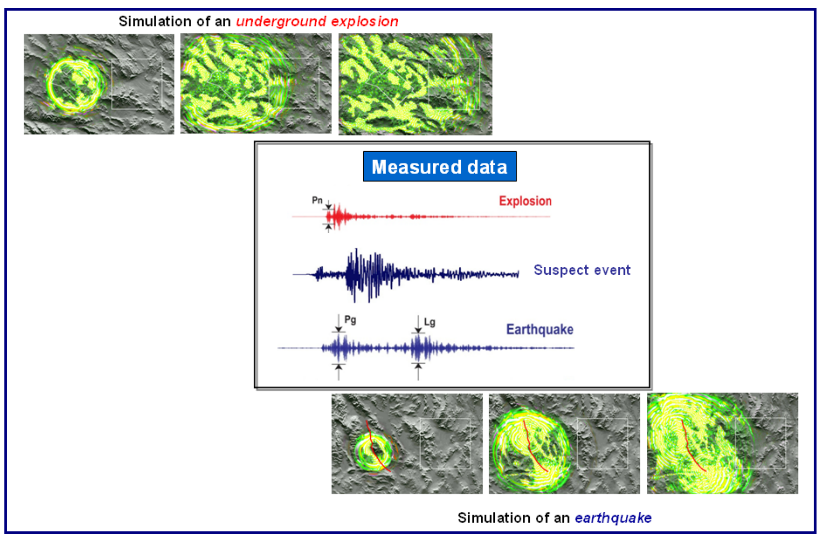

Figure A–6–5. V&V demonstrates that weapons codes are correctly solving physics and engineering problems.

Facility Operations and User Support

This subprogram provides physical facility and operational support for production computing, storage, and services that enable effective use of ASC Tri-Laboratory computing resources. The designers, analysts, and code and model developers provide functional and operational requirements for FOUS.

FOUS provides the necessary physical facility, user services, and operational support for reliable production computing and storage environments. The scope of facility operations includes planning, integration, and deployment; continuing product support; software license and maintenance fees; procurement of operational equipment and media; quality and reliability activities; and collaborations. Facility Operations also cover physical space, power, and Local Area Network/Wide Area Network networking for local and remote access. Projects and technologies include computer center hotline and help-desk services, account management, web-based system documentation, system status information tools, user training, trouble-ticketing systems, and application analyst support.

6.D. Program Goals

The ASC Campaign's overarching goal is to deliver accurate simulation and modeling tools, supported by necessary computing resources, to maintain nuclear deterrence.

Subprogram	Goals
Integrated Codes	Test capability to address emerging threats, effects, and attribution in FY 2012.
	Improve setup-to-solution time for SFI simulations (FY 2013).
Physics and Engineering Models	Develop a science-based replacement for "knobs" (ad hoc models) of a particular weapons physics phenomenon (FY 2010).
	Develop science-based models for neutron tube simulations (FY 2010).
	Develop science-based models for fire-excitation simulations (FY 2014).
	Develop special-purpose physics codes and direct numerical simulation capabilities to investigate complex physical phenomena.
Verification and Validation	Compile code development and experimental data requirements for V&V (FY 2011).
	Implement UQ methodology for QMU-based certification (FY 2012).
	Deliver simulation suites for evaluation of simulation uncertainty (FY 2013).
Computational Systems and Software Environment	Develop and implement seamless user environment for capability computing (FY 2013).
	Initiate gathering of user requirements and develop technology roadmaps for exascale computing.
Facility Operations and User Support	Ensure that the labs have sufficient space, power, cooling and infrastructural resources to support future computing systems.
	Develop and maintain a distance computing infrastructure that enables remote users to access petascale systems.
	Continue to provide user services and helpdesks for ASC users.

6.E. Strategy

The ASC strategy has a short-term component, which is to meet the continuing and time-constrained needs of stockpile stewardship, and a long-term component which is to ensure movement toward science-based predictive capability that will enhance confidence in the simulation results. ASC sees integration vital to achieve the next level of predictive capability.

To that end, ASC activities are coordinated with Science, Engineering, ICF Campaigns, and DSW through the Predictive Capability Framework.

To ensure its ability to respond to stockpile needs and deliver accurate simulation and modeling tools, ASC's strategic goals for the next ten years are focused on:

- Improving the confidence in prediction through simulations,
- Integrating the ASC program with certification methodologies,
- Developing the ability to quantify uncertainty and confidence bounds for simulation results,
- Increasing predictive capability through tighter integration of simulation and experimental activities, and
- Providing the necessary computing capability to code users, in collaboration with industrial partners, academia, and government agencies.

The products of ASC serve as the integrators for all aspects of the complex, from assisting the manufacturing plants to the full stockpile life cycle. The ASC tools also provide capabilities for studies and assessments of proliferant devices and their effects, as well as advanced weapon concepts that could respond to possible new threats. As shown in Figure 6-6, simulation and experiments have been critical for assessing the effect of aging due to self-irradiation in weapons materials. In this instance, the helium bubbles in 36 year-old plutonium can be viewed with simulation at an unprecedented scale.

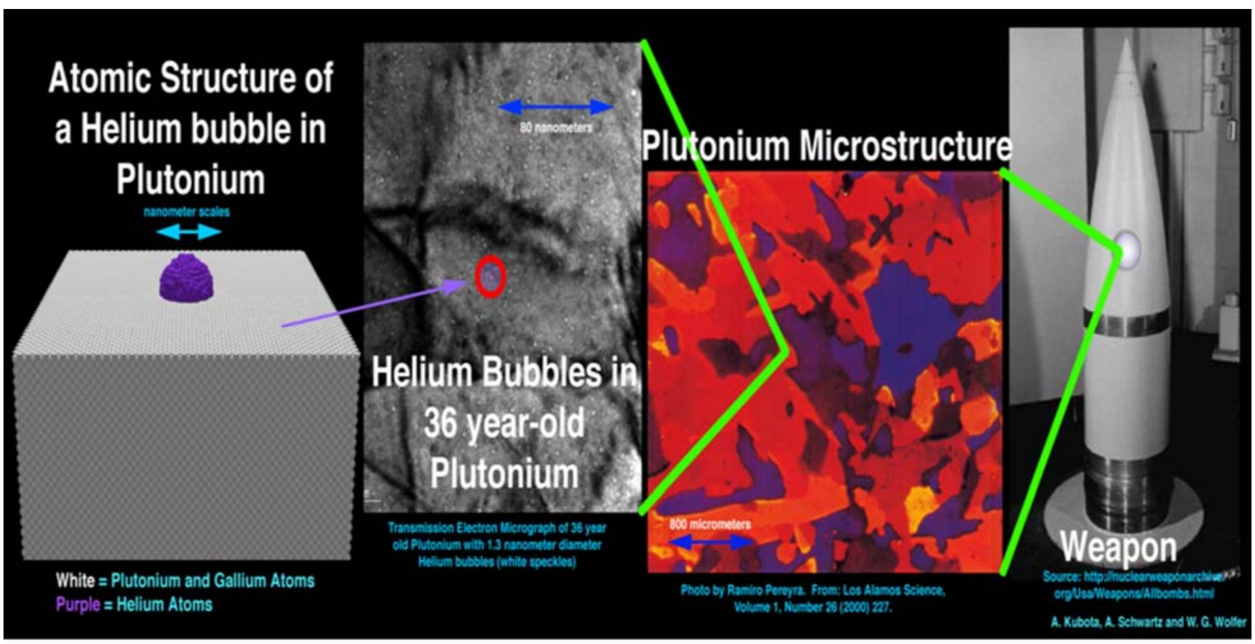

Figure A–6–6. Understanding Science from the Microscale to Macroscale through Simulation.

6.F. Challenges

Subprogram	Issues
Integrated Codes	Achieving predictive capability in weapons physics and engineering requires scientific breakthrough and discovery, which is an inherently uncertain process.
	Effectively exploiting the hardware delivered by the supercomputing industry may require redesign of weapons physics and engineering simulation codes.
Physics and Engineering Models	Establishing physics and engineering models for IC is a process dependent on other experimental science programs.
Verification and Validation	V&V requirements and projected workload exceed the computational capacity currently available.
Computational Systems and Software Environment	Future architecture paths in the supercomputing industry are uncertain, which will likely require changes to existing programming models to leverage the new architectures.
Facility Operations and User Support	Projected power consumption and high failure rates increase as HPC systems grow, requiring innovative solutions.

6.G. Recent Accomplishments

Annual Performance Metrics

- 80 percent of simulation runs utilize modern ASC-developed codes on ASC computing platforms, (cumulatively measured against the total of legacy and ASC codes used for stockpile stewardship activities). The long-term target is for ASC-developed modern codes to be used on all simulations on ASC platforms by 2013.
- 25 percent cumulative reduction in the use of calibration "knobs" to successfully simulate nuclear weapons performance. The long-term target is for several major calibration knobs will have been replaced by science-based, predictive phenomenological models by 2024.
- 50 percent SFIs resolved through the use of modern ASC codes (cumulatively measured against all codes used for SFI resolution). The long-term target is for ASC codes to be the principal tools for resolution of all SFIs by 2015.
- 13 percent cumulative reduction in simulation turnaround time while using modern ASC codes. The long-term target is to achieve, by 2015, a 50 percent reduction in turnaround time, as measured by a series of benchmark calculations for the most heavily used ASC codes.

Predictive Capability

- An ASC tri-lab team completed a multiyear effort to identify and develop verification test problems to assess the numerical performance of models and algorithms implemented in ASC codes to demonstrate whether the numerical results of the discretization algorithms in physics and engineering simulation codes provide correct solutions of the corresponding continuum equations.

- Large, fully resolved simulations of turbulence mixing have exercised the ASC Program's scientific and computational science capabilities, revealing new and unexpected physics in the study of mixing.

Simulation for the Stockpile

- The Los Alamos forensics team successfully identified a device in a blind nuclear forensics exercise organized by the Nuclear Weapons Incident Response's (NWIR's) Office of Emergency Response and the Defense Threat Reduction Agency (DTRA) in October 2008. This success was enabled by use of validated Los Alamos ASC codes and new metrics to guide identification of the device technology.

- Sandia's SIERRA software was used to simulate the first ever T-bone crash at 55 mph involving two Safe Guards Tractor/Armored Trailer vehicles. This study leveraged ASC computers and codes to study a broader class of national security applications beyond traditional weapons performance assessments.

High-Performance Computer Platforms

- Dawn, the initial delivery system of the Sequoia contract, was delivered to LLNL on March 27, 2009. The equipment for this 500-teraflop BlueGene/P system was fully delivered, installed, configured, and executed via a synthetic workload well under 3 months.

- The RoadRunner petascale machine was accredited in the classified environment in February 2010. Prior to accreditation, 10 high-impact Open Science projects were chosen from 29 proposals to use RoadRunner during the system-and-code-stabilization phase. The Open Science runs will increase the number of codes that can take advantage of the RoadRunner hybrid architecture, and will be the driver for many other applications worldwide.

ASC Collaborations

- ASC and the Advanced Scientific Computing Research (ASCR) program in the Office of Science are currently working out a research, development and engineering collaboration to usher in Exascale computing at the end of the new decade. The ASC program is also engaged in the Scientific Discovery through Advanced Computing (SciDAC) program to capitalize on the Office of Science investments in new science advanced by academia and other laboratories.

- ASC established the NNSA Alliance for Computing at Extreme Scale (ACES) between LANL and SNL, devoted to providing high performance capability computing assets required by NNSA's stockpile stewardship mission. SNL and Oak Ridge National Laboratory are also collaborating through the Institute for Advanced Architectures and Algorithms (IAA), aimed at maintaining our global leadership in science and technology, and future competitiveness. Finally, the Argonne, Berkeley and Livermore Exascale (ABLE) Institute has been proposed; focused on building advanced architecture systems based on a low-power, highly usable and efficient applications approach

Integrated Codes

- The SIERRA engineering simulation framework has been instrumental in KCP's W76 applications as part of their production build schedule. KCP is using ASC codes on its new Linux system acquired through the ASC Tri-Lab Capacity Cluster procurement process in support of various Defense Programs applications.
- ASC delivered the codes for experiment and diagnostic design to support the CD-4 approval on the NIF.
- A model was developed and implemented for LLNL's modern full-system capability to support energy balance resolution.

Physics and Engineering Models

- Delivered a materials model to a modern code, in order to support a physical model for initial conditions for boost.
- Implemented relevant physics and engineering models needed in support of safety calculations of a weapon in a fire.
- Assessed the predictive capability of advance material damage models by comparison with small scale data from subcritical plutonium experiments.

Verification and Validation

- Developed a strategy for large-scale debugging to ensure LLNL applications can run correctly on petascale platforms.
- Assessed the ability of weapons physics performance codes to predict late implosion behavior via comparison to relevant non-nuclear and underground test experimental data.
- Received the DOE Award of Excellence for work on the tri-lab verification suite.
- Established a formal process for assessing and measuring progress related to the development of Predictive Capability.

Computational Systems and Software Environment

- RoadRunner, an advanced architecture platform sited at LANL, became the first supercomputer capable of sustained 1-petaFLOP performance in May 2008. RoadRunner continues as the #1 computing platform on the June 2009 Top 500 list.
- The Hyperion Project is operational. This is a collaborative (co-funded) project between NNSA and industry to create a hardware and software scaling environment. This directly supports vendors' ability to create next-generation systems for NNSA and the nation. Successful completion directly supports improved US economic competitiveness.

Facility Operations and User Support

- Implemented Tripod operating system software and Tri-Lab Linux Capacity Cluster hardware, resulting in common capacity computing hardware and system software at all three labs. This is important as it continues to reduce the total cost of ownership associated with maintaining existing systems.
- Mission need for Cielo, the next ASC production capability system was approved.
- The National Security Computing Center user facility for top-secret applications that require high performance computing was dedicated in February 2010, making Red Storm and its supercomputing capabilities available to national security mission applications beyond stockpile stewardship.

6.H. ASC Campaign Milestones and Future Plans

ASC will continue to support annual assessments, certification, and SFI resolution through provision of simulation codes and high-performance computing resources. The acquisition process will continue for existing platforms procurements. To make reliable progress in the predictive capability necessary for addressing stockpile aging issues, the laboratories will continue to incorporate V&V activities to support stockpile assessments and predictive capability with QMU.

Developing robust peer review among the national security laboratories is essential to the continued pursuit of the Comprehensive Test Ban Treaty (CTBT). In the next decade, predictive capability and DSW simulation deliverables will demand ever more powerful and sophisticated simulation environments. This request will position the national security laboratories to take advantage of future platform architectures to provide more efficient stockpile stewardship.

The following chart displays ASC targets in the out-years, as documented in the ASC Roadmap publication:

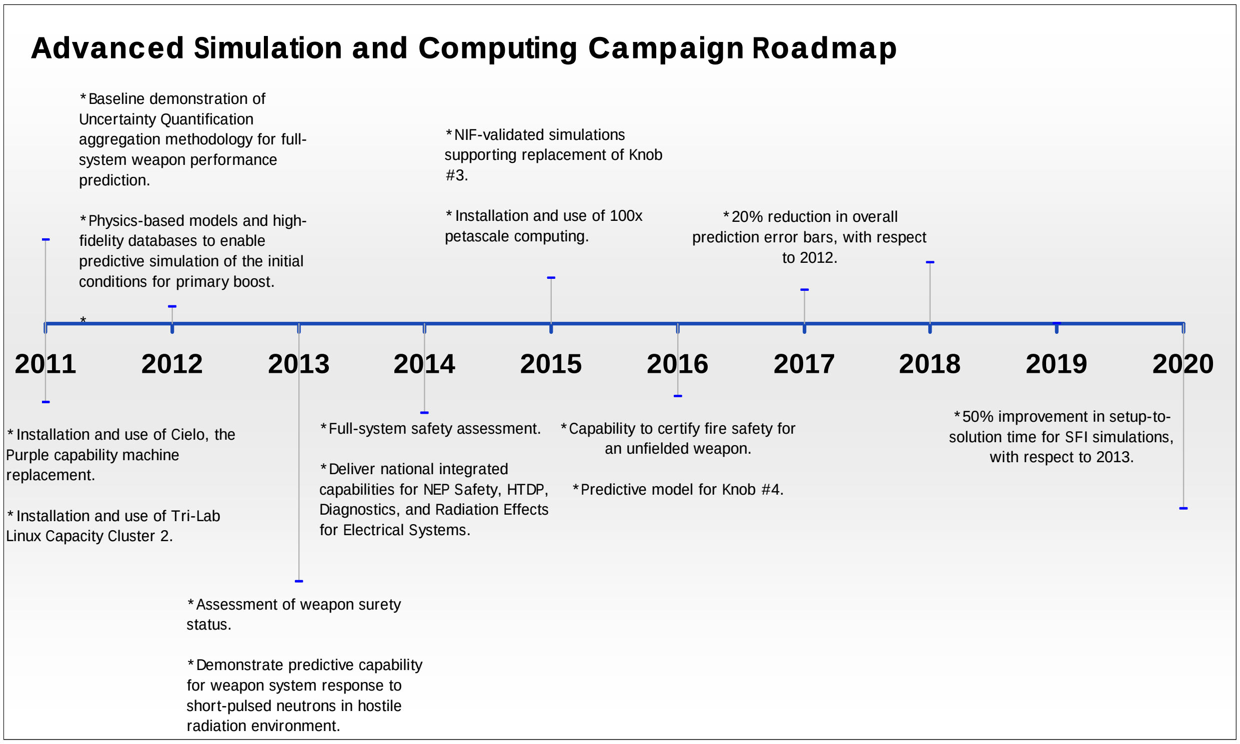

Figure A–6–7. ASC Milestones Timeline.

6.I. Funding Schedule

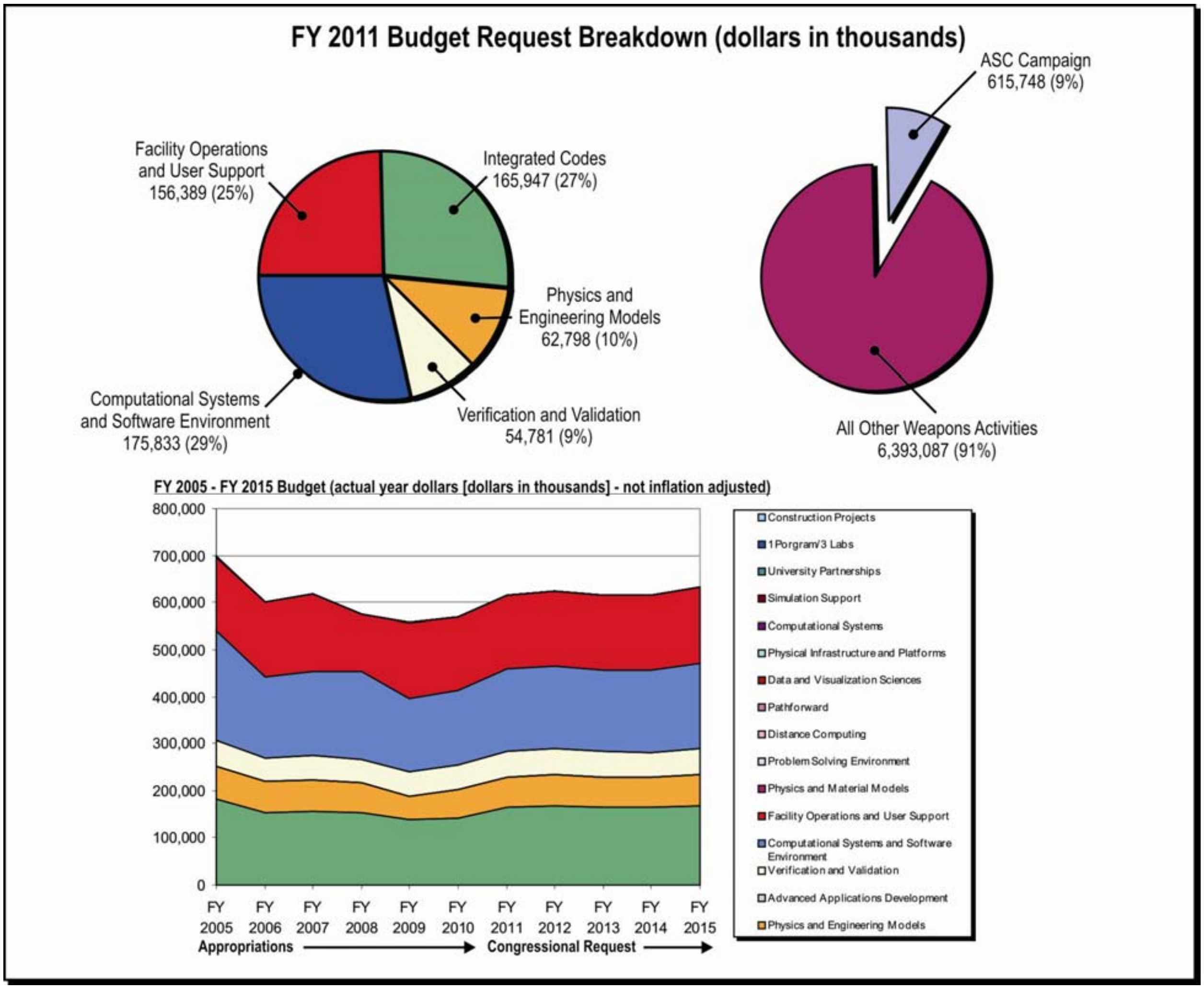

Figure A–6–8. ASC Funding Schedule.

Chapter 7. Readiness Campaign

7.A. Highlights

Investments in the Readiness Campaign have developed and deployed innovative new enabling technologies, including lithium manufacturing capability for direct manufacturing reuse, improvement of the materials inventory and management system using radio frequency identification, and completion of irradiation Tritium Producing Absorber Rods during Tennessee Valley Authority's Watts Bar Cycle 9. The campaign also continues to implement improved business practices that reduce costs, optimize resources and ensure on-time deliveries that benefit DSW across the board.

7.B. Mission

The Readiness Campaign identifies, develops, and deploys new or enhanced processes, technologies, and capabilities to meet current nuclear weapon design, production, and dismantlement needs and provides quick responses to national security requirements. The complex benefits from the Readiness Campaign activities in two unique ways. First, manufacturing capabilities developed and deployed with Readiness Campaign funding satisfy requirements for multiple weapon systems. Second, the Readiness Campaign program selection criteria includes consideration of reduced production cycle times and manufacturing costs for a near-term return on investment and measureable advancement toward a newly responsive nuclear weapons infrastructure. The Readiness Campaign funded projects are coordinated with other Campaign and Program investments to bring advanced technology to the NNSA sites in response to DoD requirements and SSP criteria for sustaining a safe, secure, and reliable stockpile.

7.C. Program Structure

The Readiness Campaign includes five subprograms: Advanced Design and Production Technologies, High Explosives and Weapons Operations, Nonnuclear Readiness, Stockpile Readiness, and Tritium Readiness. Collectively, these five subprograms provide key technology-based capabilities to design, manufacture, and dismantle nuclear weapons and to sustain the infrastructure to do so over time. Figure A–7–1 shows the work breakdown structure for the Readiness Campaign.

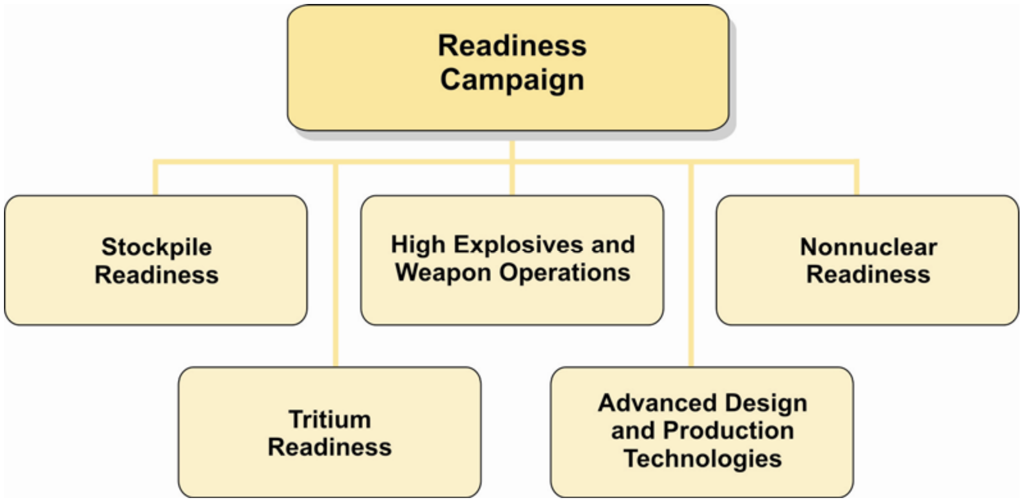

Figure A–7–1. Subprograms of the Readiness Campaign in FY 2011.

Advanced Design and Production Technologies

Advanced Design and Production Technologies develops complex-wide technology-based capabilities that underpin a responsive and agile production complex, applies component manufacturing materials and techniques across multiple systems, and provides foundational support to ongoing production operations. Foundational support includes activities for final product acceptance, in-process monitoring for quality control, establishing integrated manufacture-to-design and vendor qualification systems, and resource planning-type systems for production sites.

High Explosives and Weapons Operations

High Explosives and Weapons Operations develops, enhances, and deploys capabilities for the production of high explosive and other energetic components, the requalification of weapons components for assembly, and the assembly and disassembly of war reserve nuclear weapons.

Nonnuclear Readiness

Nonnuclear Readiness develops and deploys new capabilities to manufacture electrical, electronic, electromechanical, and other nonnuclear components that synchronize and initiate weapon detonation when required, while preventing unauthorized and inadvertent activation to enhance weapon surety.

Stockpile Readiness

Stockpile Readiness develops and deploys manufacturing capabilities and special processes for components containing special materials and advanced component qualification and acceptance.

Tritium Readiness

Tritium Readiness reestablished and operates the tritium production capability to sustain the nuclear weapons stockpile. The Tritium Readiness subprogram funds all of the activities, including Tritium Extraction Facility costs, associated with the production of tritium to meet all defense program demands for tritium including production, research and development, and required reserves. The subprogram continues testing and design development and tritium release management activities to increase production capacity to planned levels.

7.D. Program Goals

Subprogram	Program Goals
Advanced Design and Production Technologies	LLNL will complete the Advanced Initiation Systems Detonator Design and Prototype in FY 2011.
	SNL will continue the Multi-site Tester Architecture in FY 2011.
	SRS will continue the Industrial Wireless Sensor Hardware Standard in FY 2011.
	LANL will commence the Advanced High Resolution Digital Panels project to support component acceptance in FY 2011.
	LANL will commence the Nuclear Explosives Package Primary Components Manufacturing and Assembly in FY 2011.
	KCP will commence the Non-Destructive Evaluation Test Objects in FY 2011.
	Y-12 National Security Complex will commence the Strategic Non-Destructive Evaluation for Nuclear Explosives Package Part Geometry in FY 2011.
	SNL will commence the Supply Chain Development/Evaluation Methods and Tools in FY 2011.
	LLNL will commence the Collaborative Authorization and Safety bases Total Lifecycle Environment – Nuclear Explosives Operations Procedures in FY 2011.
	SRS will commence the Digital Imaging and Communication in Nondestructive Evaluation Implementation and Data Fusion in FY 2012.
	LANL will commence the Computer Aided Tomography- Non-Destructive Evaluation Modeling in FY 2012.
	SNL will commence the Computer Aided Tomography – Digital Radiography and Computed Tomography Maturation in FY 2012.
	SNL will commence the Computed Tomography Algorithms in FY 2012.
	LLNL will commence the Follow-on Advanced Initiation in FY 2012.
	Y-12 National Security Complex will commence the Computer Aided Tomography-Ultrasonic Development in FY 2012.
	LLNL will commence the Weapons Assembly/Disassembly Q/A In-Situ Measurements in FY 2012.
	Y-12 National Security Complex will commence the Multi-Site Knowledge and Retrieval in FY 2012.
	SNL will continue the Improved X-ray Scintillators in FY 2012.
High Explosives and Weapons Operations	Pantex Plant will continue the High Explosives Certification Qualification and Acceptance for High-Explosives Center of Excellence in FY 2011.
	Pantex Plant will commence the Versatile Pit Technologies in FY 2011.
	Pantex Plant will commence the Reclamation and Reformulation of Main Charge in FY 2011.
Nonnuclear Readiness	KCP will complete the Rapid Design Commercial Off The Shelf system project in FY 2011.
	KCP will complete the Production Tester Readiness for the B61 in FY 2011.
	SNL will complete the Multi-layer Process for Ceramic Current Stack project in FY 2011.
	SNL will complete the Neutron Generator Testers – Capability Readiness in FY 2011.
	SNL will continue the Process Development for Concurrent Design and Manufacturing Products – Future Systems in FY 2011.
	KCP will continue the Precision Mechanical Devices Future System Readiness in FY 2011.
	KCP will continue the Advanced Plastics Technologies in FY 2011.
	SNL will continue the Electronic Neutron Generator Process Development in FY 2011.

Subprogram	Program Goals
	SNL will commence the Strategic Approach for Externally-Produced Concurrent Design and Manufacturing Technologies in FY 2012.
	KCP will continue the Major Component Assembly in FY 2012.
	KCP will continue the Electrical Component Assembly in FY 2012.
	KCP will commence the Mechanical Assembly Production Readiness in FY 2012.
	KCP will commence the Surety and Use Control projects in FY 2012.
	KCP will commence the Foundational Manufacturing Capabilities for Nonnuclear Products in FY 2012.
	SNL will commence the Electrical Computer-Aided Design Configuration Management in FY 2012.
	SNL will commence the Cables and Interconnects for Future Systems in FY 2012.
	SNL will commence the Advanced Manufacturing of Thin-film Thermal Batteries in FY 2012.
	SNL will commence the Manufacturing Transformations in Neutron Generator Production in FY 2012.
Stockpile Readiness	Y-12 National Security Complex will complete the Electronic Bomb Book in FY 2011.
	LANL will complete the Improved Component Testing in FY 2011.
	SRS will commence the Reservoir Processing and Development in FY 2011.
	SRS will commence the Tritium Processing and System Development in FY 2011.
	SRS will commence the Analytical Instrumentation for Tritium Processing in FY 2011.
	Y-12 National Security Complex will continue the Processing Parameter Support for Special Material in FY 2011.
	Y-12 National Security Complex will commence the Lithium Oxide Conversion in FY 2011.
	Y-12 National Security Complex will commence the Uranium Processing Facility Phase II – Technology Maturation in FY 2012.
	Y-12 National Security Complex will continue the Advanced Lithium Technologies in FY 2011.
	SRS will commence the Automated Rapid Beryllium Analyzer in FY 2012.
	SRS will commence the Modeling for Tritium Systems and Processes in FY 2012.
	SRS will commence the Reservoir Process in FY 2012.
	Y-12 National Security Complex will commence the Wet Chemistry Replacement in FY 2012.
Tritium Readiness	Complete fabrication of tritium-producing burnable absorber rods for Cycle 11 in FY 2011.
	Complete irradiation of 240 tritium-producing burnable absorber rods in Cycle 10, consolidate and ship tritium-producing burnable absorber rods to the Tritium Extraction Facility, and dispose of base plate and thimble plug waste at Nevada Test Site in FY 2011.
	Commence irradiation of 576 tritium producing burnable absorber rods at Watts Bar Unit 1 for Cycle 11 in FY 2011.
	Continue preparations with Tennessee Valley Authority and AREVA for startup of Sequoyah Unit 1 for tritium producing burnable absorber rods in FY 2011.
	Tritium Extraction Facility will continue in Responsive Operations mode and conduct one extraction for Cycle 9b in FY 2011.
	Provide design support for tritium producing burnable absorber rods planned for Watts Bar Unit 1 Cycle 12 and Sequoyah Unit 1 in FY 2011.
	Begin fabricating tritium producing burnable absorber rods for Sequoyah Unit 1 Cycle 19, if scheduled, in FY 2011.
	Fabricate test fixtures and samples for tritium materials irradiation separate-effects test 3 on pellet performance in FY 2011.
	Complete qualification of powder and pellet production and commence production in FY 2011.

7.E. Strategy

The goal of the Readiness Campaign program is to develop and deliver design-to-manufacture capabilities to meet the evolving and urgent needs of the stockpile and support the transformation of the complex into an agile and more responsive complex including shorter cycle times and lower operating costs. In addition, the Readiness Campaign will target technology investments toward national security solutions. The Readiness Campaign program addresses the following strategic objectives:

- Identify, evaluate, select, direct, institute, and lead innovative solutions to support the National Nuclear Security Administration Strategic Planning Guidance;
- Provide operationally ready capabilities by developing technologies and their associated technical business practices, business systems, design, engineering, and manufacturing methods;
- Reduce lead time and process cycle time for DSW and Readiness in Technical Base and Facilities operations;
- Increase integration and coordination among facilities, operations, processes, and management;

Figure A–7–2. Coordinate Measuring Machine in glove box is used for machining and inspecting parts.

- Reduce waste streams, energy consumption, and maintenance costs, when possible;
- Provide technical solutions that will lead to reduced manpower and facility footprint requirements;
- Ensure cost-effective capabilities (i.e., material, processes, machines, and people) are operationally ready to support base workload and Life Extension Programs;
- Advance activities to establish and maintain a flexible, responsive, and robust infrastructure with integrated lifecycle capabilities as directed in the Defense Programs Program and Resource Guidance;
- Support NNSA goals directed at improved program and project management; and
- Integrate project management best practices throughout NNSA by Special Focus Areas.

Readiness Campaign capabilities are essential to completing weapons system component design and manufacturing and dismantlement. In response to DoD requirements and SSP criteria, the Readiness Campaign, the Engineering Campaign, the ASC Campaign, and the Science Campaign coordinate investments at the highest level to bring advanced technology that sustains a safe, secure, and reliable stockpile. The Tritium Readiness subprogram provides tritium production to support DSW and DoD commitments. Tritium Readiness coordinates with: the RTBF program (facilities infrastructure support for the Tritium Extraction Facility at the SRS); the Office of Secure Transportation (movement of irradiated tritium producing burnable absorber rods; the Pacific Northwest National Laboratory (design); and Department of Energy Chicago Operations (contract management). Tritium Readiness obtains irradiation from the Tennessee Valley Authority through multi-year fixed priced contracts, thus the funding for the Tritium Readiness subprogram funding is cyclical based upon the length of these contracts requiring funding for other Readiness Campaign subprograms to be adjusted accordingly.

Figure A–7–3. W88 JTA2 Refresh improves reliability and design while reducing cycle time.

The Readiness Campaign Director also leads the materials management organization responsible for establishing the life cycle management of accountable nuclear materials by identifying, assessing, and prioritizing material needs and availability for use in meeting strategic defense goals. Materials management identifies shortfalls as well as efficiencies and productivity improvements in material processing capabilities that are required to support material feed requirements. The Readiness Campaign program, through its interaction with the materials management organization, addresses deployment of technology development investments needed for such requirements.

7.F. Challenges

Subprogram	Challenges
Advanced Design and Production Technologies, High Explosives and Weapons Operations, Nonnuclear Readiness, and Stockpile Readiness	Capability to define Readiness Campaign interfaces with major DSW, Readiness in Technical Base and Facilities, and construction projects to assure that capabilities are planned, delivered, and deployed consistent with customer requirements. Readiness Campaign plans to mitigate this challenge by strengthening staff relationships, improving project coordination and driving productivity.
	Assuring that adequate requirement, deployment, and interface agreements are in place for Readiness Campaign projects. The mitigation plan for this challenge is to strengthen staff relationships and knowledge of the projects during planning, execution and post deployment.
	As efforts are redirected to concentrate exclusively on tritium readiness by FY 2012, the Campaign must transfer vital projects to other Defense Programs accounts to ensure the required capabilities provided by these subprograms continue to be addressed and supported.
Tritium Readiness	Maintaining out-year tritium reserve inventory levels. The mitigation plan for this challenge is to continuously monitor inventories and ramp up production to meet inventory requirements, as well as to continue development to increase the allowable production rate from each nuclear reactor.

7.G. Recent Accomplishments

Advanced Design and Production Technologies

- W88 Joint Test Assembly 2 Refresh Test Works—cross-complex, high-performing team identified innovative practices to reduce Joint Test Assembly design to manufacture and deploy time by up to half (from 7 to 3.5 years). The test works project will enable production of the first accepted unit this calendar year. For Advanced Design and Production Technologies, completed a cross-complex plan to propagate the innovations that lead to cycle time reduction.

- Optical Detonator Manufacturing—developed capability to manufacture alternate detonator systems for firing site use and potential future weapon system applications.

- Science Based Manufacturing—to reduce recycle or waste of expensive high-explosives processing materials; three nondestructive evaluation projects were completed to enhance weapon operations at the Pantex Plant.

- Micro-Modular Telemetry—to increase cross-platform and common module Joint Test Assembly components, reduced supply chain and system development costs, developed and pre-qualified a set of Micro-Modular Telemetry modules for future use in Joint Test Assembly telemetry systems.

- Development of Electrical Assemblies—to streamline production and processing time impact to current production, and to enable W76-1/Mk4A LEP First Production Unit. This project supported risk mitigation actions to reduce defects and improve marginal processes for weapons such as the W76 or W88. An 11 percent reduction in processing hours, per component, was achieved, as well as approximately $1.1 million in documented savings.

- Component Development for Radar, Fireset, and Telemetry Applications—to enable vastly improved capabilities for next system arming, fuzing, and firing and/or Radar componentry, as well as miniaturization of vital, space limited systems. Provided advances in miniature high-voltage ceramic capacitors; ceramics fabrication and testing capability; micro-electrical and mechanical systems optical three-dimensional packaging; semiconductor encapsulation; radio frequency micro-electrical and mechanical systems packaging; and advanced semiconductor packaging technology.

- Completed a cross-complex plan to propagate the W88 Joint Test Assembly 2 Refresh (W88 Joint Test Assembly 2 Refresh) Testworks innovations, paving the way for improved Joint Test Assembly reliability and mechanical robustness in design, while also reducing development cycle time and costs, simplifying assembly processes and testing requirements, and reducing expensive qualification testing.

- Established Collaborative Authorization for Safety-basis Total Lifecycle Environment (CASTLE) as the software tool to electronically facilitate standardized Seamless Safety for the 21st Century processes at Pantex, including data management and the development of safety-basis documentation. CASTLE supported the B53 and W84 Seamless Safety for the 21st Century processes.

High Explosives and Weapons Operations

- W88 Solvent Substitution—perform compatibility testing of HFE-71IPA with materials in the W88 program.

- Non-Destructive Incremental Density Determination—allows the density of high-value components to be determined non-destructively using ultrasound technology.

Nonnuclear Readiness

- Integrated High-Output Power Amplifiers Development for Nuclear Weapons Radars—leveraged industrial and SNL emerging power amplifier technologies to develop partially or fully integrated radio frequency integrated circuits.

- Warhead Refurbishment—Materials—provided key materials needed for W76 components including establishing an in-house resin production capability for a product no longer available commercially.

- Neutron Generator Testers—completed new electronic neutron generator acceptance tester (first use—electronic neutron generator shelf-life testing).

- Agile Machining and Inspection—expanded the use of machine gauging to allow machinists immediate visual feedback for many weapons programs.

Stockpile Readiness

- Computer Numerically Controlled Machining Center, a mill and lathe operated in separate inert gloveboxes connected by a transfer box, was deployed. The Computer Numerically Controlled Machining Center contains material handling features to machine-critical parts for war reserve designs adding manufacturing flexibility to quickly produce special material part changes. The Computer Numerically Controlled Machining Center will rely on computer-driven controllers to do this task resulting in faster process time and higher part acceptance rates.

- Multi-Axis Orbital Machining Center was deployed into production on schedule to support DSW program schedule requirements. This capability enhances efficiency by combining multiple operations onto a single machine.

- Lithium Mass Spectrometer replaces an obsolete single point of failure and identifies all lithium isotopes necessary for LEP operations. The current lithium mass spectrometer is 25 years old and a single point of failure with no vendor or repair support.

Tritium Readiness

The Tritium Readiness Subprogram accomplishments include:

- Completed fabrication of 368 MK 9.2 tritium producing absorber rods, delivered to Tennessee Valley Authority, and began irradiation in Cycle 9 at Watts Bar;

- Completed extraction of 215 Cycle 6 tritium producing absorber rods, completed extraction of 240 tritium producing absorber rods from Cycle 7, and completed extraction of 240 tritium producing absorber rods from Cycle 8 in FY 2009;

- Developed an improved design tritium-producing absorber rod and completed the 50 percent design review for Watts Bar Cycle 10;

- Obtained most major components to support fabrication of Cycle 10 tritium producing absorber rods;

- Completed irradiation of 240 tritium producing absorber rods in Watts Bar Cycle 8, consolidated tritium producing absorber rods and shipped to the Savannah River Site; and completed extraction of those rods at the Savannah River Site in FY 2009;

- Began irradiation of oxidation experiment test fixtures in the Advance Test Reactor;

- Completed the post-irradiation examination of lead test assembly rods compared to Cycle 6 rods;

- Awarded 5-year contract option to NAC, Inc. for transportation of irradiated tritium producing absorber rods; and

- Continued fabrication technology transfer to establish vendor relationships between WesDyne and key suppliers. Delivered the ninth production run of tritium producing absorber rods to the Tennessee Valley Authority's Watts Bar nuclear plant to replace the rods irradiated during FY 2008.

7.H. Readiness Campaign Milestones and Future Plans

- Support meeting Dismantlement Plan through infrastructure enhancements.
- Support production and delivery of W76-1 life extensions refurbishment to DoD.

The following activities are ongoing or performed annually. They supplement the program goals for scheduled activities to support successful execution of the program.

- The Tritium Readiness subprogram will produce tritium to meet inventory requirements, as well as continue development to increase the allowable production rate from each nuclear reactor.
- While there is no outyear funding for non-tritium subprograms, the plans for technology maturation for production capabilities such as those traditionally developed and deployed by the Readiness Campaign are currently being reviewed to plan support for these activities. The outyear funding plan for the Tritium Readiness subprogram is being developed based on analysis of ongoing work and status of contracts for manufacturing, irradiation, transportation, and extraction.

7.I. Funding Schedule

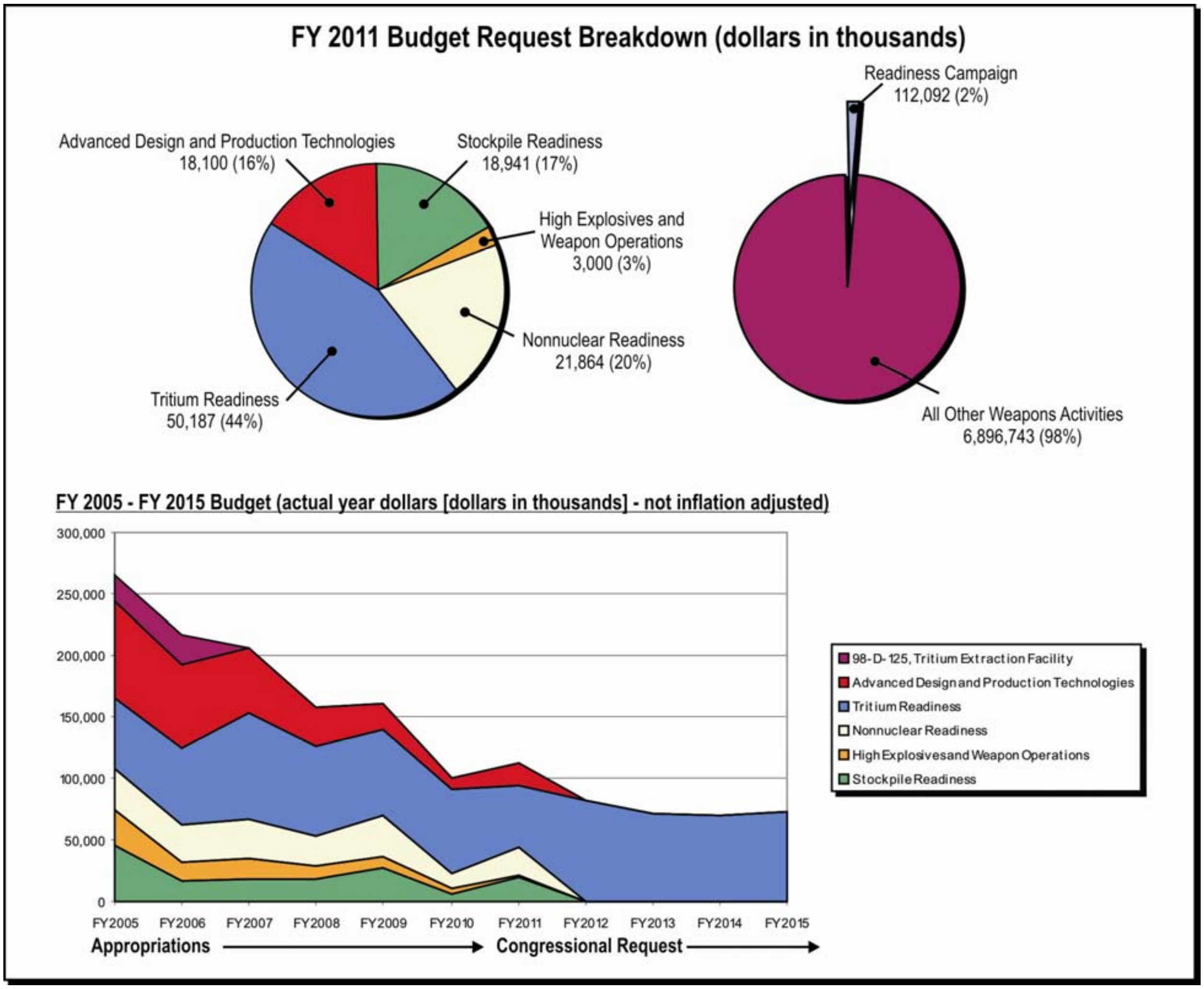

Figure A–7–4. Readiness Campaign Funding.

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Chapter 8. Readiness in Technical Base and Facilities

8.A. Highlights

In FY 2009, the construction of the Highly Enriched Uranium Materials Facility (HEUMF) at Y-12 and the Tritium Facility Modernization Project at LLNL were completed. In FY 2010, Test Readiness has been moved from the Science Campaign into RTBF, under the Program Readiness subprogram. Also as part of Program Readiness, the Nuclear Criticality Safety Program continued its successful experiment and training partnership with France.

8.B. Mission

The goal of the RTBF program is to operate and maintain NNSA program facilities in a safe, secure, efficient, reliable, and compliant condition. RTBF includes: 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); environmental, safety, and health (ES&H) costs; and the costs to plan, prioritize, and construct state-of-the-art facilities, infrastructure, and scientific tools within approved baseline costs and schedule.

8.C. Program Structure

To accomplish its overall mission, the RTBF program provides the physical and operational infrastructure at the eight NNSA sites: NTS, three NNSA national security laboratories, and four production sites. RTBF funds the specific facilities that are required to conduct the scientific, research, development, and testing activities of the SSP. The RTBF program encompasses two major program activities: (1) Operations and Maintenance, and (2) Construction. Operations and Maintenance is comprised of Operations of Facilities, Program Readiness, Material Recycle and Recovery, Containers, and Storage.

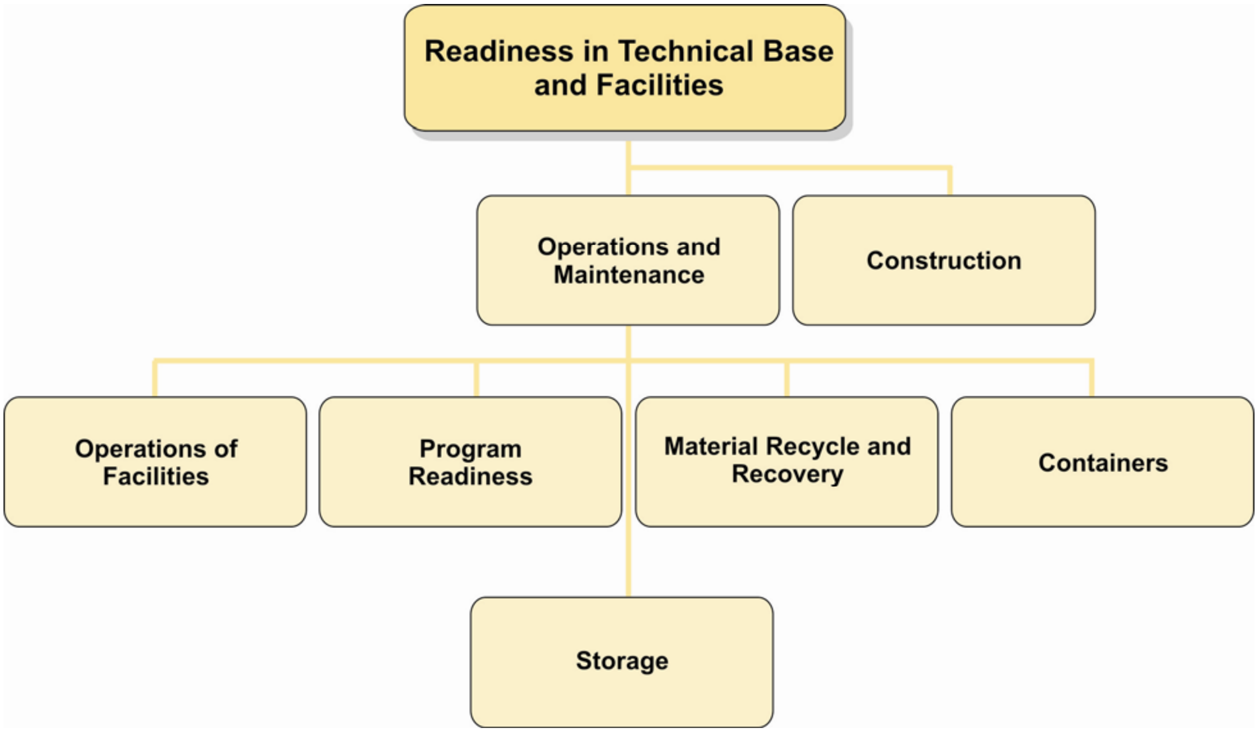

Figure A-8-1. Subprograms of Readiness in Technical Base and Facilities for FY 2011.

Operations and Maintenance

The Operation and Maintenance portion is divided into five subprograms. These subprograms are described in detail below.

Operations of Facilities

Operations of Facilities operates and maintains "NNSA-owned" programmatic capabilities in a state of readiness, thus ensuring each capability (workforce and facility) is operationally ready to execute programmatic tasks identified by the Campaigns or DSW. This subprogram funds activities to operate the physical infrastructure and facilities in a safe, secure, and reliable manner, and to sustain a defined state of readiness at all needed facilities. It seeks cost efficiencies through the consolidation of facilities and functions, supports integrated maintenance programs for routine maintenance activities, and supports construction (line item Other Project Costs [OPCs]).

Program Readiness

Program Readiness supports selected activities that sponsor more than one facility, Campaign, or DSW activity, and are essential to achieving the objectives of the SSP. Ongoing activities include manufacturing process capabilities, critical skill needs, the Nuclear Criticality Safety Program, pulsed power science and technology, and Test Readiness activities.

Material Recycle and Recovery

Material Recycle and Recovery is responsible for the recycling and recovery of: plutonium, enriched uranium, heavy water, and tritium from fabrication and assembly operations; recycling of limited life components; and, component disposition from the dismantlement of weapons. It supports the implementation of new processes or improvements to existing processes for fabrication and recovery operations and for material stabilization, conversion, and storage. It also supports the recycling and purifying of the above materials to meet specifications for safe, secure, and environmentally acceptable storage, including tritium reservoir refills. Material Recycle and Recovery includes the Central Scrap Management Office that manages the receipt, storage, and shipment of enriched uranium scrap; and the Precious Metals Business Center, which provides a cost effective service to many users within the DOE.

Figure A-8-2. Material Recycle and Recovery is responsible for the recycling and recovery of: plutonium, enriched uranium, heavy water, and tritium from fabrication and assembly operations.

Containers

The Containers subprogram provides directive-approved containerization research and development, design, certification, recertification, test and evaluation, production and procurement, fielding and maintenance, decontamination and disposal, and offsite transportation authorization of nuclear materials and component transportation containers. This subprogram does not include those containers associated with specific DSW or warhead systems.

Storage

The Storage subprogram provides effective storage and management of strategic reserve and surplus pits, HEU, and other weapons and nuclear materials in compliance with NNSA requirements. This includes the cost of receipt, storage, and inventory of nuclear materials, nonnuclear materials, HEU, lithium, and components from dismantled warheads. It does not include the cost of temporary storage of materials awaiting processing, staging for dismantlement, or any other interim storage. The storage program also provides programmatic planning for nuclear material requirements, including analysis, forecasting, and reporting functions, as well as on-demand analysis for nuclear materials as designated by the NNSA or other programmatic drivers.

Construction

Construction consists of new and ongoing line item construction projects that support the complex, not including line-item projects directly associated with specific campaigns, the Facilities and Infrastructure Recapitalization Program (FIRP), or Defense Nuclear Security. The RTBF Construction program is focused on two primary objectives: (1) identification, planning, and prioritization of the projects required to support the weapons programs, and (2) development and execution of these projects within approved cost and schedule baselines. Both are critical to ensure a reliable nuclear stockpile.

8.D. Program Goals

Subprogram	Program Goals
Operations of Facilities	Ensure mission-critical facilities are available to support program work at least 95 percent of schedule days.
	Maintain the aggregate complex-wide facility condition index (FCI) for mission-critical facilities at 5 percent or less.
	Improve the complex-wide mission-dependent, not critical facilities and infrastructure to an FCI level of 8 percent or less.
	Annually, prepare and execute an integrated, comprehensive RTBF/FIRP plan consistent with the NNSA Strategy to ensure a flexible, responsive, and robust infrastructure.
Program Readiness	Leverage validation activities to ensure that an underground nuclear test can be executed as directed by Presidential Directive.
	Implement a strategy to provide capabilities (skilled worker expertise, advanced technologies, and innovative approaches) that support the Campaigns and DSW aspects of Stockpile Stewardship.
Material Recycle and Recovery	Continue Uranium stabilization, decontamination, and repackaging, and tritium recycling in support of LEPs and the limited life program.
Containers	Support nuclear material consolidation, and de-inventory activities to ensure needed transportation containers are certified and available to accommodate proposed material movements.
	Support de-inventory of LLNL Security Category I and II nuclear materials by supplying containers and completing evaluations of Safety Analysis Report for Packages (SARP) and addendum development to include material not covered by existing SARPs.
Storage	Support the Storage program by providing effective storage and management of national security and surplus pits, HEU, and other weapons and nuclear materials.
Construction	Continue efforts to revitalize and consolidate the uranium infrastructure at the Y-12 National Security Complex by bringing the HEUMF into operation in FY 2010; by completing the design, construction, and startup of the Uranium Processing Facility by approximately 2022; and by completing other selected projects to allow a reduction of most of the footprint of the secure area at the site. As an interim measure, support the Nuclear Facilities Risk Reduction Project to ensure safe operations of Buildings 9212 and 9204-2E until consolidation can be accomplished.

Subprogram	Program Goals
	At LANL ensure continuing capabilities for plutonium-related operations as well as other radioactive materials by completing the following projects: - Radioactive Liquid Waste Treatment Facility Upgrade at LANL which replaces a system that is over 40 years old and with diminishing reliability. - Transuranic Waste Treatment Facility Replacement Project will facilitate the closure of Material Disposition Area G in accordance with the consent order with the State of New Mexico. - Chemistry and Metallurgy Research Replacement Facility at LANL which provides mission –critical analytical chemistry, material characterization, and actinide and development activities that directly support Stockpile Stewardship and other programs. Technical Area 55 (TA-55) Reinvestment Projects (Phases I and II) to replace, revitalize, or refurbish facility and infrastructure systems in this 40-year old center of excellence for plutonium research and development.
	Complete the Criticality Experiments Facility in FY 2010 to consolidate criticality experiments in a single location at the NTS to provide research, development, and training capabilities.
	Replace Fire Stations #1 and #2 to correct current inadequacies in the protection of 1,375 square miles at the Nevada Test Site.
	Replace Zone 12 High Pressure Fire Loop at Pantex to ensure continuous operations of weapons assembly and disassembly operations.

8.E. Strategy

Operations and Maintenance provides for NNSA's share of the cost to maintain and operate its facilities in a state of readiness to execute programmatic tasks. In support of RTBF objectives, the primary goal for Operations and Maintenance is to provide program facilities and infrastructure that are operated and maintained in a safe, secure, efficient, reliable, and compliant condition.

In order to improve efficiency, RTBF utilized activity-based costing principles to baseline the operating costs of selected program facilities throughout the complex. A more detailed national work breakdown structure will capture validated baseline cost information. In addition, RTBF intends to manage available infrastructure support resources to prioritize and fund selected projects that will consolidate program activities, reduce program footprint, and refurbish scientific process equipment as needed to support priority program work.

Figure A-8-3. Containers support RTBF nuclear material consolidation, and de-inventory activities.

The RTBF program partners with FIRP to restore nuclear weapons complex facilities and infrastructure, at the right condition, consistent with mission requirements. The RTBF funds maintenance of the complex and makes capital investments to sustain the complex into the future. This ensures that facilities necessary for immediate programmatic workload are maintained sufficiently to support that workload. RTBF also prepares facilities that are no longer required by the program for disposition by FIRP or the Office of Environmental Management. RTBF partners with DSW by having the necessary facilities and capabilities in place to assure DSW Program work can be accomplished. RTBF will also prepare excess square footage for disposition.

8.F. Challenges

Subprogram	Challenges
Operations and Maintenance	The RTBF Program continues to be challenged by the aging of the NNSA complex and the escalating requirements and costs associated with nuclear facility safety and compliance. The future will bring increasing challenges as the NNSA continues to become more responsive to current and future national security challenges, which require revitalization of the nuclear weapons infrastructure. This challenge could be compounded by a vision requiring the continued maintenance of the present infrastructure while developing the infrastructure of the future. In order to address these challenges, RTBF will realize efficiencies through the use of activity-based costing principles for selected key facilities. In addition, RTBF intends to manage available infrastructure support resources to prioritize and fund selected projects that will consolidate program activities, reduce program footprint, and refurbish scientific process equipment as needed to support priority program work.
	NNSA is continuing implementation of an integrated maintenance program that includes elements of RTBF Operations and Maintenance for routine maintenance and the FIRP for backlog reduction and extraordinary maintenance items that are impacting cost and performance. In addition to providing new production facilities, engineering test facilities for assessment, and other needed capabilities, line-item projects in RTBF construction will be used to correct maintenance problems that exceed the capacity of routine or even extraordinary maintenance funding. This integration of maintenance activities across programs and funding types will be accomplished through the Ten Year Site Planning process. In addition, NNSA is developing disciplined corporate processes and resource estimates to maintain good facility conditions and required maintenance at mission-critical and mission dependent – not critical facilities after FIRP is completed, ensuring a smooth and appropriate transition that will avoid unacceptable deferred maintenance backlog in the future.
Construction	There are program and safety risks operating end-of-life plutonium and uranium facilities for another 8-10 years until modern replacement facilities are built and operational.
	The Chemistry and Metallurgy Research (CMR) Facility Replacement and Uranium Processing Facility (UPF) projects are large, one-of-a-kind facilities containing unique technical capabilities. Technical issues could arise.

8.G. Recent Accomplishments

Operations and Maintenance

- Exceeded corporate facility availability goals to support DSW and Campaign activities as RTBF facilities were available 97.5 percent of scheduled days.
- Exceeded the industry "best in class" target of 5 percent FCI for mission-critical facilities, resulting in increased operational effectiveness and efficiency.
- Provided transportation container support for DSW and NNSA missions to support LEP and NNSA programs.
- Downgraded 9201-5 and 9404-4 at Y-12 from a Category II nuclear facility to a chemically hazardous facility.

- Packaged 63 percent and shipped 55 percent of Category I/II materials from LLNL in support of nuclear material de-inventory goals.

- Received Certificate of Compliance for the new 9978 container that provides NNSA the ability to ship plutonium and other actinides in this Department of Transportation 6M Specification replacement container.

- Completed the Safety Analysis Report for Packaging (SARP) for a new Type A(F) container with the Office of Environmental Management.

Construction

- Completed the Tritium Facility Modernization Project at LLNL.

- Operations began in the HEUMF at Y-12 in FY 2010.

- Established the baseline and started acquisition and installation of equipment for the Chemistry and Metallurgy Research Replacement Radiological Laboratory Utility/Office Building (RLUOB) at LANL.

Figure A-8-4. Newly completed Highly Enriched Uranium Materials Facility (HEUMF) at Y-12.

8.H. RTBF Milestones and Future Plans

The RTBF program intends to make substantial investments in construction projects required to address the continued aging of the legacy NNSA nuclear security complex. This ongoing effort will be challenged by escalating nuclear facility safety and compliance requirements with attendant costs. To mitigate this challenge, the RTBF program will also reduce operational costs at LLNL through the de-inventory of Category I and II SNM, while assuring that a minimum set of scientific and technological capabilities will continue to exist at the NTS in support of Stockpile Stewardship activities. RTBF will additionally manage available infrastructure support resources to prioritize and fund selected projects and maintenance activities that will consolidate program activities, reduce program footprint, and replace/refurbish process equipment as needed to efficiently support the stewardship program.

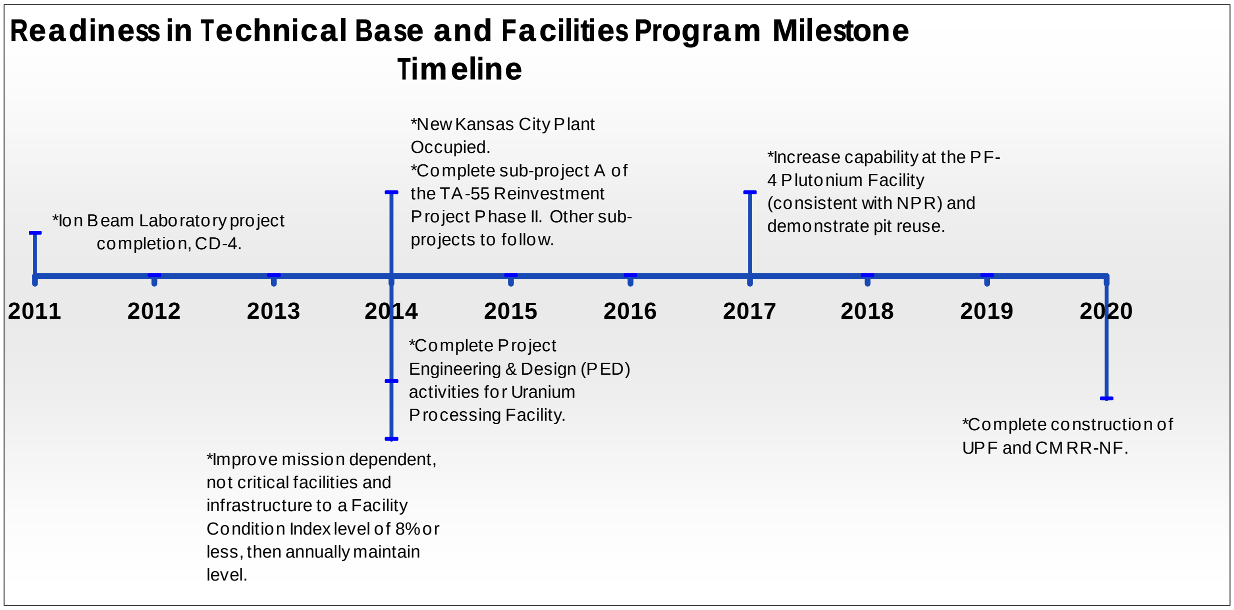

Figure A-8-5. RTBF Milestones Timeline.

The following activities are ongoing or performed annually and do not appear on the milestone time line above. They supplement the program goals for scheduled activities to support successful execution of the program.

- Continue to make sure that mission-critical and mission dependent facilities are available at least 95 percent of scheduled days. (Annual Outcome)

- Continue to maintain the mission-critical facilities and infrastructure at a Facility Condition Index level of 5 percent or less. (Annual Outcome)

8.I. Funding Schedule

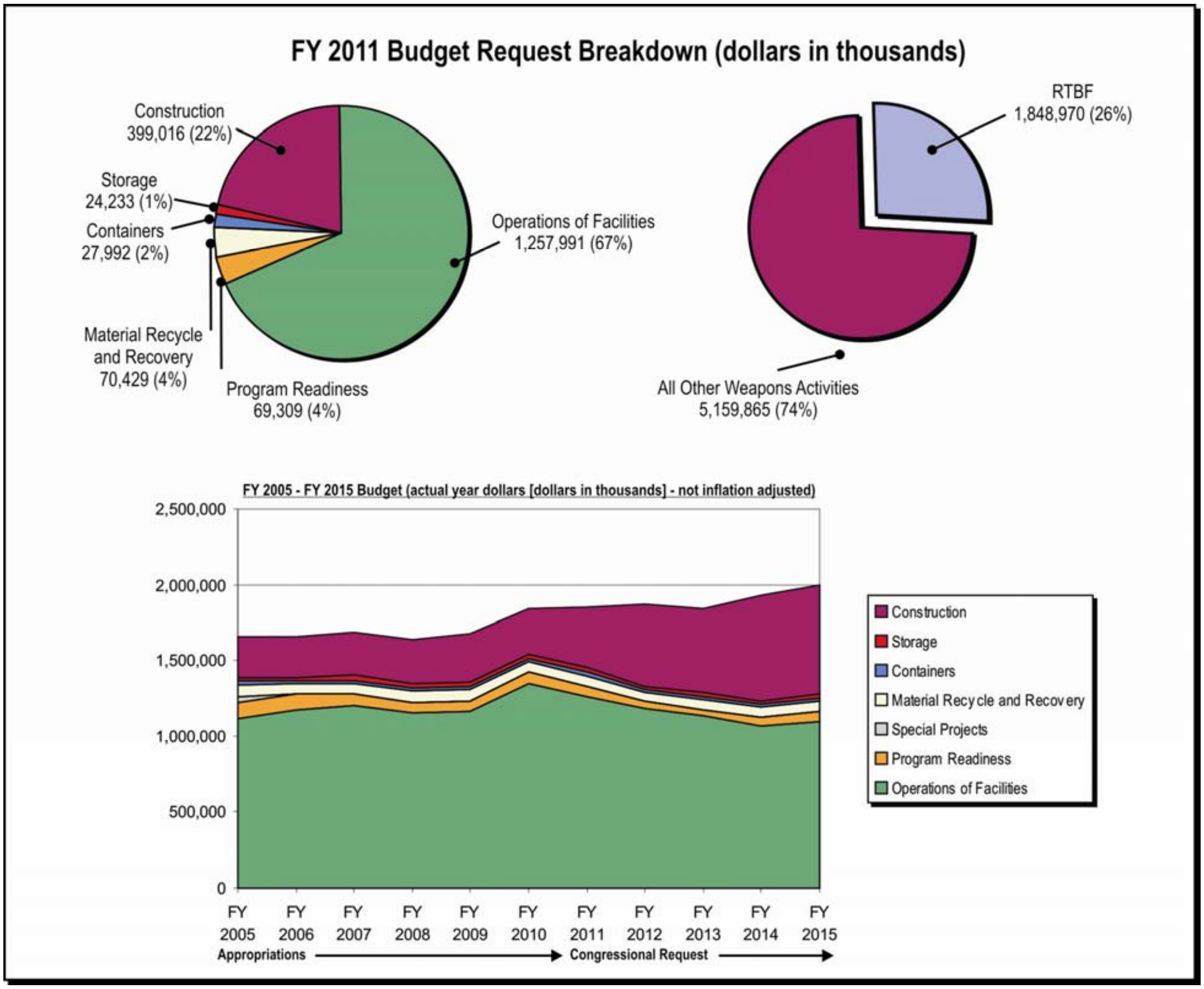

Figure A-8-6. RTBF Funding Schedule.

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Chapter 9. Secure Transportation Asset Program

9.A. Highlights

The second of three replacement aircraft will be procured in FY 2011 to replace the program's aging DC-9 fleet. These aircraft support the movement of Federal Agents, equipment, and Limited Life Components, as well as the requirement to maintain a continuous airlift capability for National Nuclear Security Administration (NNSA) nuclear incident response missions. The first replacement aircraft is scheduled to be procured by the end of FY 2010, the second in FY 2011, and the third replacement aircraft is scheduled to be procured in FY 2012. In FY 2011, the first replacement aircraft will be configured and modified for secure transport operations. In addition, escort vehicle replacements will continue in an effort to achieve the steady state/life cycle production.

9.B. Mission

The Secure Transportation Asset (STA) mission is to provide a capability for the safe and secure transport of nuclear warheads, components, and materials that will meet projected Department of Energy (DOE), Department of Defense (DoD), and other customer requirements. The STA Program directly supports the Secretarial Goal for Security by reducing the nuclear dangers and environmental risks associated with the transportation of nuclear cargo across the United States. The key outcome performance indicator of the Program, 100 percent safe and secure shipments, attests to the Program's commitment to perform this primary function. Since its formal creation in 1974, the Program has maintained its long legacy of no loss of cargo and no radiological release on any shipment.

9.C. Program Structure

Program Need

Refurbishments, Life Extensions, various test programs, nuclear weapon disassemblies, and nonproliferation initiatives of NNSA depend on the movement of material on schedule. The program addresses the specific need for scheduling, safety, and security concerns associated with the movement of nuclear weapons and components in a public environment. The program mitigates the national security risks associated with the seizure and use of a shipment by adversarial groups and individuals, as well as the release of radiation in the event of an accident. The typical cargos of STA are nuclear weapons, Joint Test Assemblies, Component Sub-Assemblies, tritium, gas generators, uranium solids, naval reactor fuel, enriched uranium oxides/metals, plutonium oxides, and Radioisotope Thermoelectric Generators.

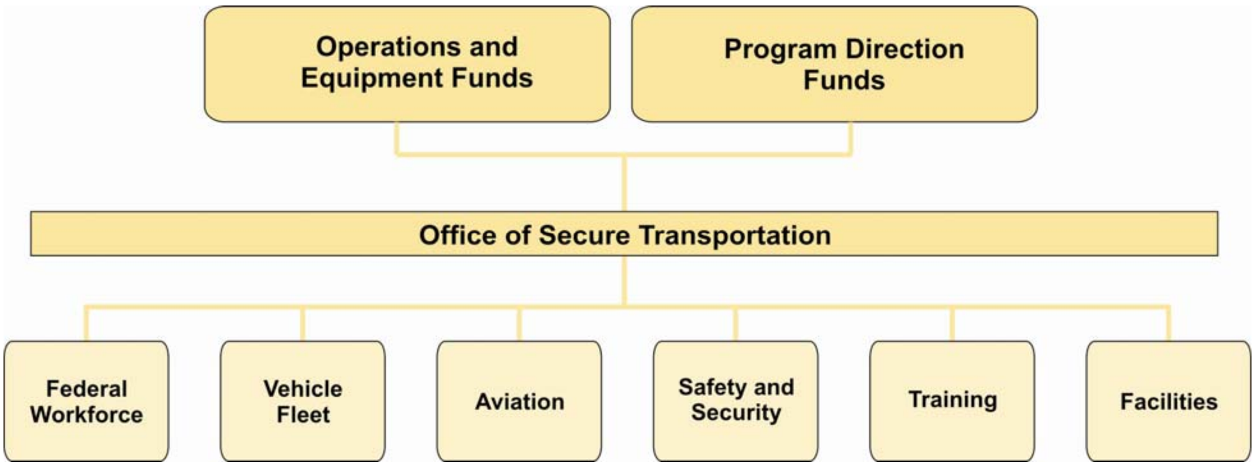

Figure A–9–1. Assets of the Office of Secure Transportation.

STA Uniqueness

No other federal agency, state, local or private effort is authorized to perform the full extent of the STA specialized work/mission. No other agency has the specialized equipment and infrastructure to regularly transport nuclear weapons and material. The Program is designed to conduct shipments across state jurisdictions. The shipments require the use of specialized trailers and vehicles, operated by armed, highly qualified and trained Federal Agents who are rigorously and repeatedly trained on various response situations and can enforce laws within the Atomic Energy Act of 1954, as amended.

Program Design

Due to the degree of control needed, the level of governmental coordination required, and the national security consequences involved, the STA is a direct federal/government-owned-government-operated program. The program is designed to be managed and executed by federal personnel with support from contractors. This design addresses the full mission spectrum through specialized Agent recruitment methods, development of unique and specialized training programs, and the assessment of all available intelligence information in support of the operationally-focused mission. It also includes research, development, and design of state-of-the art command and control systems and equipment. The Program was designed to bring all of the assets of a secure transportation system under a single manager that works within Defense Programs, its predominant customer.

Program Funding

STA consists of two funding sub-programs: Program Direction and Operations and Equipment. Although there are two funding subprograms, they are managed as one cohesive effort. The Program Direction funding is separate from the Office of the Administrator appropriation and provides for the federal workforce to manage, support, and execute the organizational missions (Salaries and Benefits, Travel, and Other Related Expenses). The Operations and Equipment funding provides for the infrastructure assets to support the organizational missions. It is divided into four Major Technical Efforts: 1) Mission Capacity, which addresses those resources that determine mission output (Special Transportation Fleet, Aviation); 2) Security and Safety Capability, which ensures that the transportation fleet and Agent training are designed and tested to meet the risks and emergencies associated with convoy operations (Safety and Security Systems, Training); 3) Infrastructure and Command, Control, Communications, Computers and Cyber (C5) Systems, which maintains and upgrades key equipment and facilities (Command and Control Systems, Facilities and Geographic Deployment); and 4) Program Management, which provides accountability, evaluation, integration, and oversight to all program elements. Currently, funding levels have been requested to sustain the current STA capacity while achieving a steady state/life cycle replacement of its transportation assets and modernizing its command and control.

Organization and Focus of Assets

STA organizes and concentrates its human capital and infrastructure assets along the following areas:

1. Management Staff—performs the accountability, evaluation, integration, oversight; and unification functions of an organization of approximately 637 federal employees. Support areas include human resource management, budgeting, contracting, property and procurements, engineering, information technology, aviation management, training, and logistics.

2. Direct Support Staff—performs the support functions directly related to the mission. Most of these positions are filled by experienced Federal Agents who can integrate mission and support efforts.

3. Federal Agent Force – performs the primary over-the-road mission by operating the convoy's vehicles and providing armed protection of the shipments. These Federal Agents are armed, highly trained, and equipped to defend a shipment from theft, hijacking, or armed attack. It takes 12 to 18 months from date of hire for a Federal Agent to be fully trained. Each year, Agents will spend a significant amount of their time in rigorous driving, firearms, tactical training, and various other training, addressing skills and knowledge needed for successful performance of Agent responsibilities.

4. Specialized Transportation Fleet—the STA executes convoys using specialized trailers and escort vehicles. A variety of escort vehicles are deployed to meet security and

convoy requirements. The Safeguards Transporter trailers are specially engineered to protect the contents and ensure the public's safety. These fleet assets require unique testing, maintenance, and upkeep to ensure their readiness during convoy operations.

5. Aviation—the STA aviation assets support Limited Life Component Exchange, Nuclear Counterterrorism Incident Response programs, Federal Agent transportation, and special cargo movements by air. The primary large-lift capability for STA will be 737 aircraft, once they are purchased and configured. A study is underway to determine the appropriate air assets to meet the other requirements of the organization.

6. Safety and Security Systems—the STA maintains an aggressive program for the review and testing of safety and security methods/equipment. Research and development activities pave the way for future STA operations. All new equipment, vehicles, and methods must undergo methodical testing and safety evaluation before being introduced into convoy operations. The security/safety emphasis is also present in the strict accountability procedures and radiological screening that occurs during shipments.

7. Training—the nature of convoy operations requires specialized and remote facilities to train the Federal Agents. The facilities must be able to support full-scale emergency and tactical operations scenarios, tactical driving techniques, and ranges for a variety of weapons and explosives. A permanent facility is maintained at Fort Chaffee, Arkansas, to support special weapons and tactics, general Agent training, and the Agent Candidate Training Academy. A satellite facility at the Nevada Test Site currently serves as a base for Operational Readiness Training scenarios over a large road network. The large area and complexity of these training events requires a large logistical and control staff. A special training fleet is maintained to support training realism.

8. Command and Control Systems—the STA utilizes satellite and relay stations to monitor and control convoys throughout the continental United States. Convoys are in constant communication with the Transportation and Emergency Control Center in Albuquerque, New Mexico. Communications between the convoy vehicles and the control center allows precise tracking, instantaneous alert of an emergency situation, immediate notification to state and local law enforcement officials, and activation of response organizations.

9. Facilities and Geographic Deployment—STA is the interconnecting link between the NNSA sites and military installations. To accomplish it missions, STA maintains over 80 distinct facilities across the United States to support communications, training, logistics, mission operations, and management oversight. Facilities are located in New Mexico, Texas, Tennessee, Maryland, Kansas, Idaho, South Carolina, Nevada, and Arkansas. With its primary headquarters in Albuquerque, New Mexico, STA has three Federal Agent Commands, each with training and vehicle maintenance facilities: Western Command in Albuquerque, New Mexico; Central Command in Amarillo, Texas; and Eastern Command in Oak Ridge, Tennessee.

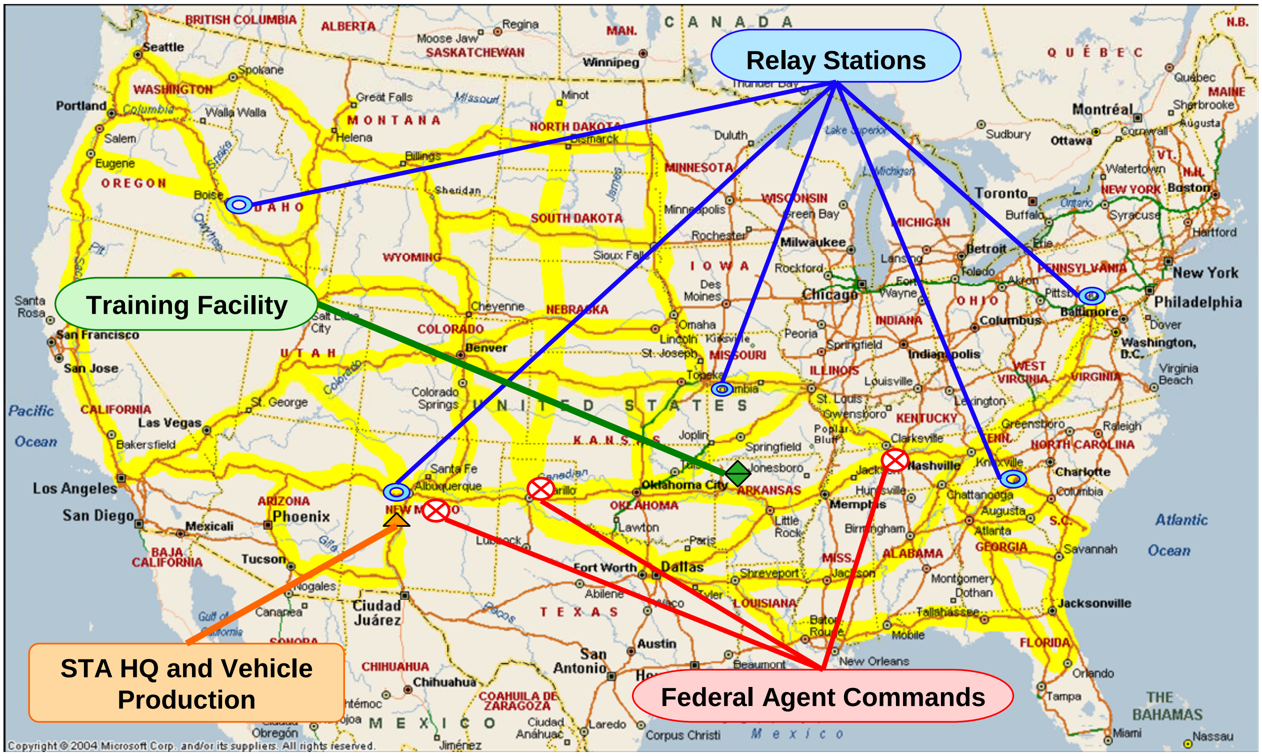

Figure A–9–2. STA's facilities and resources are geographically deployed along major transportation corridors to efficiently move cargo between the Site Offices and the Department of Defense.

9.D. Program Goals

Asset Area	Program Goals
Management and Direct Support Staff	By FY 2016, balance all of the elements of mission capacity (Agents, fleet, air, and technology) to ensure sustained, consistent, and efficient transport operations.
	Enhance the domain awareness along transportation corridors through intelligence and reconnaissance.
	Schedule and conduct independent audits that evaluate compliance and systemic effectiveness.
Federal Agent Force	Recruit, hire, train, and equip Federal Agent candidates each year to sustain an end-strength of 390.
	Continue to improve workload planning models and systems to enhance convoy efficiencies.
	A career development program for Federal Agents will be developed to ensure that senior Agents have the requisite training and skills to move into management and leadership positions within STA and ultimately NNSA.
Specialized Transportation Fleet	Maintain and upgrade the readiness of the transportation fleet (escort vehicles and armored tractors) to support 110 convoy mission-weeks per year.
	Maintain and refurbish an operational fleet of 46 Safeguard Transporters.
	Develop and field a replacement for the armored tractor that will support future initiatives throughout the complex.
	Design, test, build, and field replacement vehicles and tractors for the operational and training fleet.
Aviation	Replace the three DC-9 aircraft.
	Maintain an aircraft on continuous alert to support NNSA's Nuclear/Radiological Incident Response mission.
	Utilize air assets to move nuclear components and maximize resource time and availability.
Safety and Security Systems	Identify, design, and test technologies and tactics that will address evolving threats to the STA mission capability.
	Maintain the security and safety licenses to conduct operations.

Asset Area	Program Goals
	Continue the development and deployment of the Overland Palletized Unit Shipper Project to mitigate known safety and security risks.
	Maintain a validated Site Safeguards and Security Plan to meet the requirements of the Graded Security Protection Policy.
Training	Conduct Agent Candidate, Operational Readiness, Special Response Force, and Unit Training for Federal Agents to ensure operational proficiency.
	Continue to develop and identify training facilities that support collective and realistic training venues.
	Conduct Joint Testing Exercises with state and/or federal participation.
	Support nuclear non-proliferation and nuclear security efforts by providing training and expertise to foreign nations.
Command and Control Systems	Plan and field replacement components to sustain end-of life command and control communication systems, taking advantage of commercial technological advances to improve capabilities.
	Implement a steady-state, life-cycle for all command and control communications, computers, and cyber systems.
	A training/validation exercise for emergency management will be conducted each year.
	Secret Internet Protocol Router Network connectivity will be established at all Agent Operations Commands.
	Surveys and assessments will be conducted each year to ensure mission, training, and operations are executed safely and securely.
Facilities and Geographic Deployment	With the NNSA Service Center, identify and develop plans for the establishment of a new STA headquarters facility to consolidate STA functions. This will include replacement of deferred maintenance facilities that are co-located with the NNSA Service Center.

9.E. Strategy

The Program strategy is to meet customer transportation requirements, to achieve and maintain a Federal Agent end-strength of 390, and to recapitalize the vehicle and aviation fleet.

9.F. Challenges

Asset Area	Challenges
Management and Direct Support Staff	Since STA is a government operated program, it had to increase its management, oversight, and support staff to incorporate functions and business operations that control, assist and direct secure transportation operations.
Federal Agent Force	The high quality of training that Federal Agents receive makes them sought after by other federal law enforcement agencies. The challenge is to maintain comparable wages and a quality of life that will foster retention. A career development program is being established to retain Agent expertise and allow for a long term career progression.
Specialized Transportation Fleet	The implementation of a steady state fleet production cycle is necessary to meet mission and security requirements. Increased usage of the current fleet increases risks of downtime and decreased life span, mission capacity and security.
	The introduction of heavy-chassis vehicles to convoys will significantly increase maintenance and production costs.
Aviation	As aircraft replacements occur, an increase in costs occurs due to transition costs associated with maintenance activities in support of multiple aircraft types, aircraft cargo door modifications, and necessary tooling of new aircraft to meet payload configurations.
Safety and Security Systems	Full implementation of the Overland Palletized Unit Shipper Project will require extensive coordination with the Department of Defense and all NNSA sites.
Training	Locating and maintaining suitable training venues to meet diverse training requirements.
Command and Control Systems	Post 9/11 security requirements established the need for real-time operational intelligence and the technology to enhance situational awareness.
Facilities and Geographic Deployment	The focus to meet mission security and delivery requirements has diverted funding from facility maintenance and specific goals for energy efficiency. These neglected facilities will require increased funding in the out-years.

9.G. Recent Accomplishments (FY 2009)

- Safely and securely completed 100 percent of shipments without compromise/loss of nuclear weapons/components or a release of radioactive material.
- Completed the DOE Office of Health, Safety and Security independent oversight inspection, which included a Joint Testing Exercise at the Nevada Test Site. These inspections provide external validation of methods and processes to maintain security and safety standards.
- Delivered 13 Heavy Chassis Escort Vehicles, ahead of schedule and below cost. This marks the first production year for heavy chassis vehicles, which will provide an enhanced capability to convoy operations.

Figure A–9–3. STA employs a variety of specialized vehicles on convoys to meet protection requirements.

- Completed two Agent Candidate Training classes, with a total of 59 graduates, achieving an estimated Federal Agent end strength of 379. This is the last year that two classes will be conducted. One class of up to 40 candidates is expected to maintain end-strength.
- Produced 3 Safeguard Transporters for a total of 45. One additional trailer will be produced in FY 2010 to bring the trailer fleet to the optimum number of 46.
- All transportation requests for de-inventory of special nuclear material from Lawrence Livermore National Laboratory were completed on schedule.
- Completed 100 percent of the shipments necessary to de-inventory the special nuclear material from the Hanford Site. This was a four year transportation campaign that was completed in 18 months.
- Seven Operational Readiness Training exercises were completed during the year. These exercises are large-scale unit training events that stress team dynamics and synchronization.
- To strengthen external communication and control systems, STA participated in an interagency exercise with the Federal Bureau of Investigation's Weapons of Mass Destruction Directorate and all office representatives.
- Supported NNSA on a study of air transportation options with the Department of Defense, as congressionally-directed.
- Hosted a Russian training workshop at Fort Chaffee and completed a 5 week Train-the-Trainer Course for the Republic of Kazakhstan in Albuquerque. This training supported NNSA's nonproliferation mission.
- Participated in a Nuclear Command and Control System Comprehensive Review with the Department of Defense.
- Incorporated the Active Security Doctrine and the Graded Security Protection Policy into the STA Site Safeguards and Security Plan.
- Produced 24 Support Vehicles to replace over-mileage vehicles in the fleet. These vehicles provide specialized support to convoy operations with limited response capabilities.
- Updated the Memorandums of Understanding that STA has with the United States Northern Command and the Federal Bureau of Investigation.
- Established a collective training venue at the Nevada Test Site. This site was chosen because of its vast road network across a secure location.

9.H. STA Milestones and Future Plans

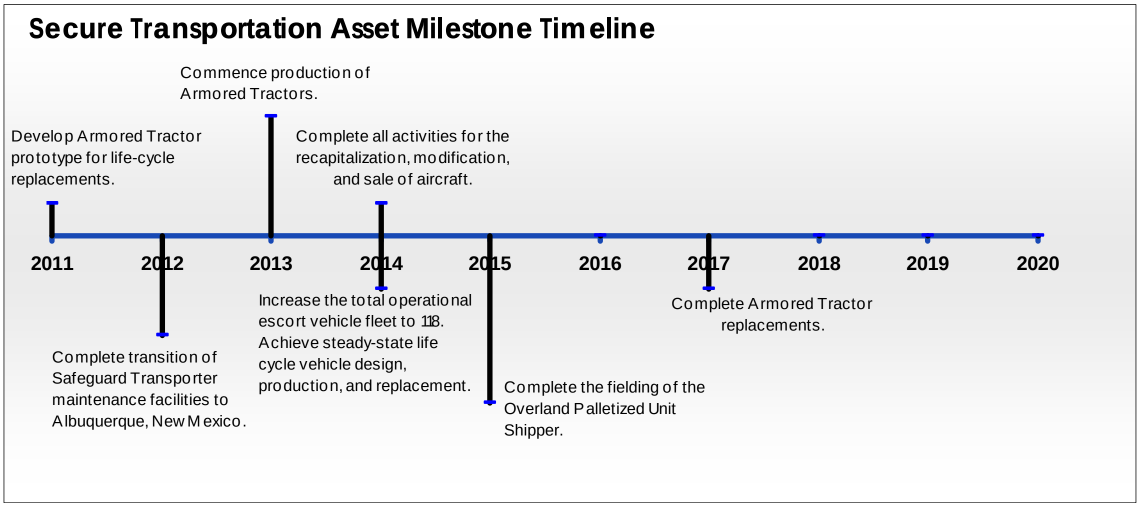

Figure A–9–4. STA Milestone Timeline Schedule.

STA's near-term milestones focus on balancing the organizational assets for long-term transportation operations. Beyond FY 2017, STA will continue to adapt and respond to the immediate needs of the stockpile, technological advancements, emerging threats, and public safety concerns. The following activities expand on or add to the milestone time line above. They supplement the program goals for scheduled activities to support successful execution of the program.

- Increase the cumulative number of Escort Vehicles in operation to a total of 118 by the end of FY 2014.
- Develop an Armored Tractor prototype in FY 2011 with production activities continuing throughout the Future-Years Nuclear Security Program. Armored Tractor production activities will commence in FY 2013 once the aircraft procurements and modifications are complete. Replacements should be completed by FY 2017.
- Initiate the design, engineering and fielding of a comprehensive and integrated Command and Control System to replace the current Transportation Command and Control System.
- Each year, a predictable mission schedule of not more than 110 unit-mission-convoy-weeks will be planned to support the transportation requirements for Weapons Activities, DOE and other agencies. Federal staffing levels will be maintained to meet the predictive schedule.
- Through FY 2013, continue the aircraft purchases and modifications to replace the DC-9 fleet. Complete the sale activities for the DC-9 fleet as the new aircraft are put into operation.
- By FY 2016, achieve a steady-state life cycle for vehicle design, production, and replacement.
- In FY 2012, complete the transition of Safeguard Transporter maintenance/refurbishment facilities to Albuquerque, New Mexico.

- By FY 2015, complete the fielding of the Overland Palletized Unit Shipper.
- Continue preparations to support the Departmental initiative to convert weapons-grade material to commercial reactor fuel by transporting weapon pits and fuel rods.

9.I. Funding Schedule

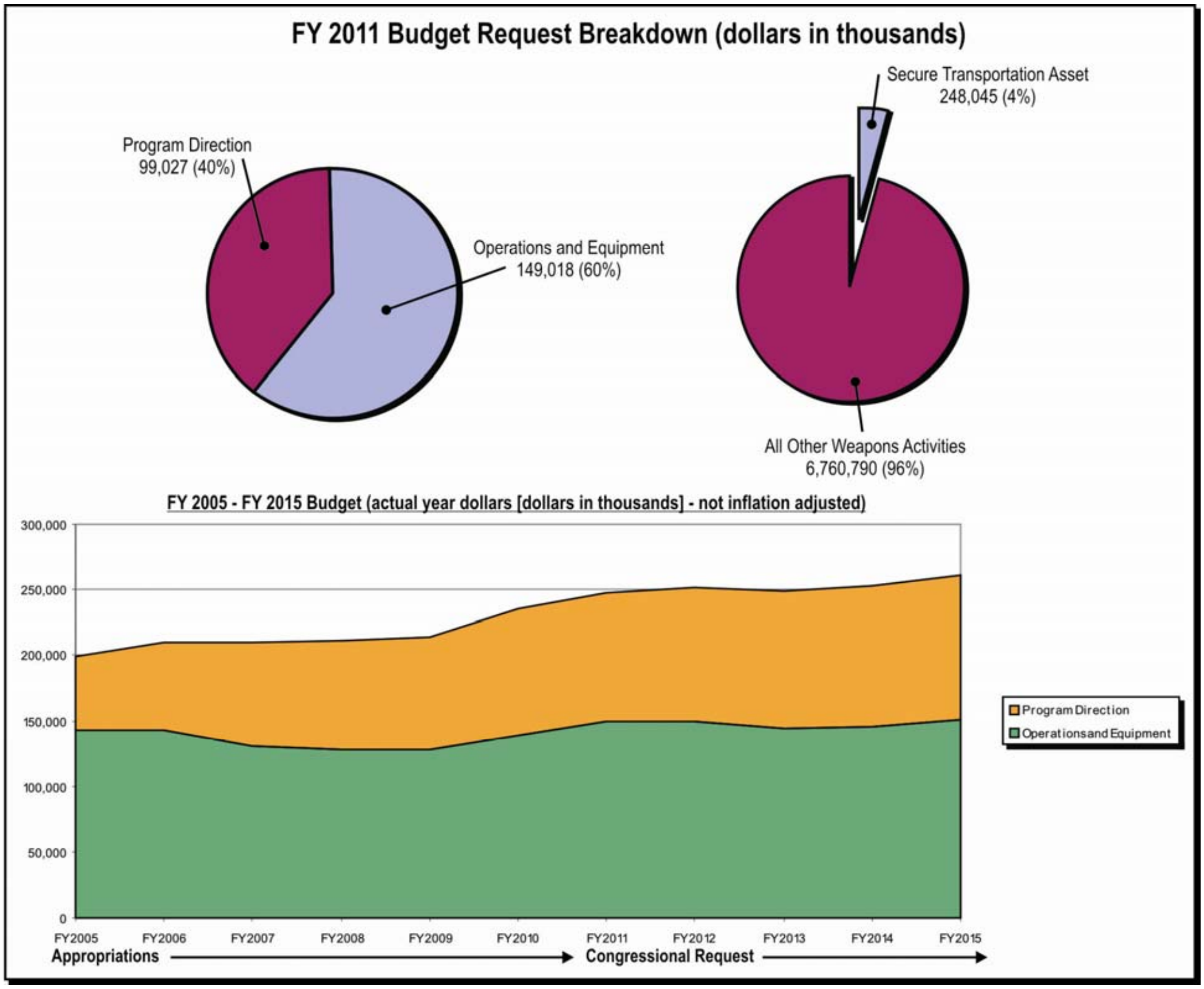

Figure A–9–5. Secure Transportation Asset Funding Schedule.

Chapter 10. Nuclear Counterterrorism Incident Response

10.A. Highlights

In FY 2009, the Nuclear Counterterrorism Incident Response (NCTIR) Program deployed multiple field teams to 34 high-profile special events and 47 emergency response events around the world. In addition, the NCTIR Program participated in 137 national and international counterterrorism exercises and continues to work closely with other government agencies.

10.B. Mission

The mission of the NCTIR Program is to ensure that capabilities are in place to respond to any Department of Energy (DOE)/National Nuclear Security Administration (NNSA) facility emergency, nuclear, or radiological incident within the United States or abroad, and to provide operational planning and training to counter both domestic and international nuclear terrorism and assure that DOE can carry out its mission-essential functions.

10.C. Program Structure

The NCTIR Program serves as the DOE/NNSA primary contact for all emergency management activities and has a leadership role in defending the Nation from the threat of nuclear terrorism. NCTIR administers and directs the emergency response programs that provide the capability to respond to and mitigate the effects of a nuclear or radiological incident or emergency within the U.S. and abroad. To meet its mission, the NCTIR Program is divided into seven subprograms: (1) Emergency Management; (2) Emergency Response; (3) NNSA Emergency Management Implementation; (4) Emergency Operations Support; (5) National Technical Nuclear Forensics; (6) International Emergency Management and Cooperation; and (7) Nuclear Counterterrorism (NCT).

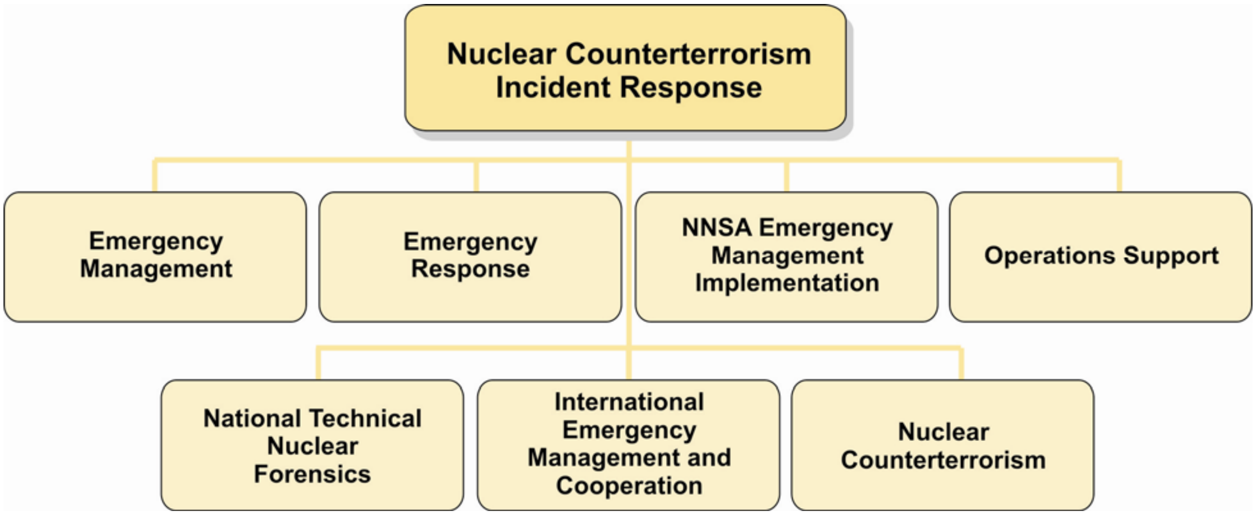

Figure A-10-1. Subprograms of the Nuclear Counterterrorism Incident Response program in FY 2011.

Emergency Management

Emergency Management develops and implements specific programs, plans, and systems to minimize the impacts of emergencies on worker and public health and safety, the environment, and national security. This is accomplished by promulgating appropriate Departmental requirements and implementing guidance; developing and conducting training and other emergency preparedness activities; supporting readiness assurance activities; participating in interagency activities; and conducting no-notice exercises at DOE facilities.

Figure A-10-2. NNSA Emergency Response teams protect the nation from nuclear incidents.

Emergency Response

Emergency Response serves as the last line of national defense in the face of a nuclear terrorist incident or other type of radiological accident. Its mission is to protect the public, environment, and the emergency responders from terrorist and non-terrorist events by providing a responsive, flexible, efficient, and effective radiological emergency response framework and range of capabilities.

NNSA Emergency Management Implementation

NNSA Emergency Management Implementation is responsible for implementing and coordinating emergency management policy, preparedness, and response activities with NNSA. This includes managing the NNSA Headquarters emergency preparedness and response effort and coordinating NNSA field and contractor implementation of DOE and NNSA emergency management policy. Office of Emergency Management serves as the single point of contact for coordinating among NNSA Headquarters offices, site offices, sites, facilities, and contractors to ensure compliance with, and implementation of, Departmental and NNSA-specific emergency management policy, plans and performance expectations. For budgetary purposes, this sub-activity is contained within the Emergency Management element above.

Emergency Operations Support

Emergency Operations Support operates the DOE Emergency Operations Centers and the Emergency Communications Network. The DOE Headquarters Emergency Operations Center provides the core functions of supporting Departmental command, control, communications, and situational intelligence requirements for all types of emergency situations. The goal of the Emergency Communications Network Program is to provide the DOE/NNSA national emergency response community a world-class, state-of-the-art, high speed, global emergency communications network to support the exchange of classified and unclassified voice, data, and video information.

National Technical Nuclear Forensics

National Technical Nuclear Forensics supports implementation of operations and research and development as well as builds upon current nuclear disposition activities. This subprogram aims to establish missions, institutionalize roles and responsibilities, and enable operational support for pre-detonation and post-detonation nuclear forensics and attribution programs, including training and exercises, equipment purchases and maintenance, logistics, and deployment readiness to support ground sample collection and Deployable Field Laboratory operations.

International Emergency Management and Cooperation

International Emergency Management and Cooperation conducts training, provides technical assistance, and develops programs, plans, and infrastructure to strengthen and harmonize emergency management systems worldwide. This is accomplished by working with other nations; participating in projects sponsored by international organizations such as the International Atomic Energy Agency, the European Union, the North Atlantic Treaty Organization, the G8, and Arctic Council; exhibiting leadership under assistance and cooperation agreements to provide consistent emergency plans and procedures, effective early warning and notification of nuclear/radiological incidents or accidents; and delivery of assistance to an affected nation should an incident/accident occur.

Nuclear Counterterrorism

This program serves as the single point of contact for NCT in the U.S. Government, directly supporting other agencies' needs relative to Improvised Nuclear Device design and assessment activities. NCT provides the necessary analysis of NNSA-specific data needed by other agencies to counter the threat of a terrorist nuclear device. The NCT program draws on the full range of tools, techniques, and expertise developed within the nuclear weapons design laboratories.

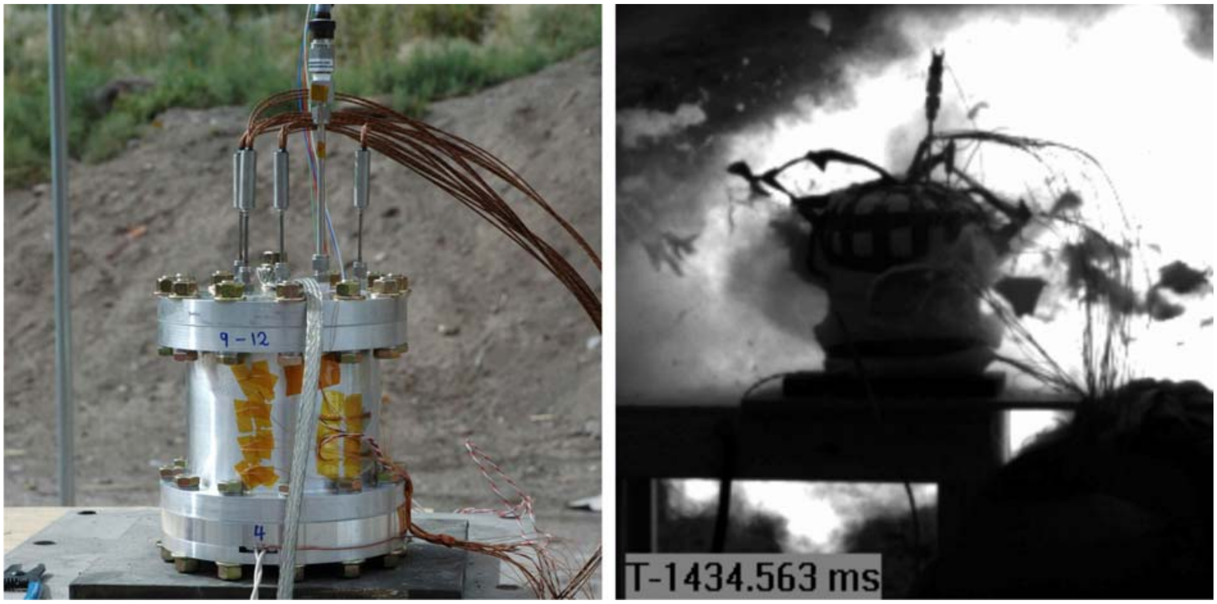

Figure A-10-3. The NCT program works with other agencies to prevent the threat of improvised nuclear devices.

10.D. Program Goals

Subprogram	Program Goals
Emergency Management	Continued use of technical assistance activities to foster improvements in emergency management programs at DOE/NNSA sites; continued development and application of chemical and biological protective action criteria, particularly through shared activities with the Environmental Protection Agency and the American Biological Safety Association; and ongoing coordination with the Department of Homeland Security and other agencies on integrated federal emergency management activities.
Emergency Response	Develop and implement a response capability for the National Security Presidential Directive-28 mission that: a) Facilitates early communication exchange with security forces; b) Leverages analytical ability of the Use Control community; c) Applies the existing capabilities of both the Joint Technical Operations Team and the Accident Response Group; d) Sets new training standards and mission essential task lists unique to this mission; and e) Establishes criteria to guide transition to each phase of the operation.
	Continue strategic partnerships with Departments of Homeland Security, Federal Emergency Management Agency, Defense, and State in the National Exercise Program to demonstrate operational readiness and control in executing DOE/NNSA's role as a Cooperating and Coordinating Agency under the National Response Framework.
	Support planned special events, including National Special Security Events, to ensure law enforcement and public safety agencies provide the best possible defense against any nuclear or radiological threats.
	Enhance and maintain a rapid nuclear/radiological first-responder counter-terrorism capability designed to improve readiness and response capabilities and coordination with Federal, state, and local assets.
	Complete development of stabilization technology and concept of operations for the deployment of equipment to prevent operation of an improvised nuclear device until national assets can arrive to conduct traditional render safe procedures.
	Execute an Equipment Recapitalization Program to the extent possible with available resources.
	Apply a systems wide approach to fielding stabilization equipment and logistics and develop classification guidance for stabilization technologies.
	Maximize outreach initiatives to coordinate with and educate other Federal, state, and local agencies on DOE/NNSA emergency response mission, assets and capabilities.
	Mission Set Procedures. Create timelines and deployment information based on mission sets to focus on gaps that occur when deploying and tracking multiple assets in response to a single event.
	Conduct an independent technical review of the Technology Integration Program.
	Execute a formalized test and evaluation program to support Technical Integration product development and delivery.

Subprogram	Program Goals
	Assist in establishing a consortium of genetic evaluators for the cytogenetic biodosimetry laboratory.
NNSA Emergency Management Implementation	Maintain effective and efficient emergency management programs at DOE/NNSA sites to demonstrate ongoing\improved performance with DOE and other federal emergency management requirements.
Emergency Operations Support	Continue to ensure that the appropriate infrastructure is in place to provide command, control, communications, coordination, and trained response personnel necessary to ensure the successful resolution of an emergency event.
National Technical Nuclear Forensics	Implement a pre- and post-detonation improvised nuclear devices and radiological dispersal device program for technical nuclear forensics support to the Federal Bureau of Investigation.
International Emergency Management and Cooperation	Continue to engage the international community to strengthen worldwide nuclear emergency management and response programs to counter nuclear terrorism and conduct exercises and training in support of the United States Government's Global Initiative to Combat Nuclear Terrorism.
	Develop process/procedures to allow both U.S. and foreign teams to train for diagnostic events in U.S. and foreign facilities.
	Develop and refine a robust low-cost worldwide effective emergency management system that ensures a response to mitigate the consequences of any nuclear or radiological event.
Nuclear Counterterrorism	Enhance interoperability, improve portable detection devices and training with interagency search, law enforcement, and inspection personnel.
	Continue specialized projects to ensure that response equipment is maintained as state-of-the-art to meet the unique challenges associated with a terrorist improvised nuclear devices or radiological dispersal device weapon of mass destruction.
	Continue robust research and development efforts to support the global nuclear detection architecture.
	Implement specialized projects derived from the Technical Integration Program to ensure that response equipment is maintained as state-of-the-art to meet the unique challenges associated with a terrorist improvised nuclear devices or radiological dispersal device event.

10.E. Strategy

The NNSA Emergency Operations program remains the U.S. Government's primary capability for radiological and nuclear emergency response and for providing security to our nation from the threat of nuclear terrorism. Through the development, implementation, and coordination of programs and systems designed to serve as a last line of defense in the event of a nuclear terrorist incident or other types of radiological accident, the Office of Emergency Operations maintains a high level of readiness for protecting and serving the United States and its allies—a readiness level that provides the U.S. Government with deployable, dedicated resources capable of responding rapidly and comprehensively to nuclear or radiological incidents worldwide. The September 11, 2001 attacks signaled a major change in both the intelligence picture and the tactics of terrorists. Accordingly, the country's, as well as NCTIR's, national response posture has changed to meet the new challenges in the war against terrorism, especially those related to countering nuclear terrorism. The result has been NCTIR's increasing focus on redefining relationships with old partners such as the Federal Bureau of Investigation, and defining relationships with new partners, such as the Department of Homeland Security. Even as basic emergency operations activities continue to increase, NCTIR increasingly serves as the Federal Government's comprehensive defense of the nation against the nuclear terrorism threat.

10.F. Challenges

Subprogram	Challenges
Emergency Management	Updating DOE emergency management directives for consistency with evolving Departmental policies (e.g., complying with DOE 2010 Safety and Security Reform Plan and participating in NNSA Governance Reform and contractor assurance activities) and homeland security documents and programs.
Emergency Response	Maintaining adequate support for Equipment Recapitalization efforts with increasing scope in other program areas.
NNSA Emergency Management Implementation	Continuing to provide technical support and assistance to NNSA sites for implementation of successful Emergency Management Programs.
Emergency Operations Support	Ensuring that the Emergency Communications Network can continue to meet DOE/NNSA operational requirements.
National Technical Nuclear Forensics	Continuing to maintain lab expertise in nuclear forensics and the central role in the U.S. Government capability for the DOE/NNSA evolving National Technical Nuclear Forensics program.
International Emergency Management and Cooperation	Maintaining momentum to sustain regional international capabilities to ensure world-wide response and strengthen our commitment to the Global Initiative to Combat Nuclear Terrorism.
Nuclear Counterterrorism	Maintaining program research and development balance along with loss of infrastructure necessary to accomplish R&D on non-stockpile nuclear devices.

10.G. Recent Accomplishments

- Deployed multiple field teams to conduct special events and elevated threats including 34 high profile special events and 47 emergency responses around the world in support of Homeland Security, Federal Bureau of Investigation and Department of State, including National Special Security Events, and National Security Events. These events included: State of the Union; Super Bowl; several NASCAR events; Papal visits to D.C. and New York; Annapolis Conference; Marine Corps Marathon; Republican and Democratic National Conventions; MLB and NBA All-Star Games; Rolling Thunder; U.N. General Assembly; New Years Eve support in various cities; and the 2009 Presidential Inauguration.

- Participated in 137 interagency national and international counterterrorism exercises, including: Marble Challenge (2); the Empire 2009 consequence management exercise, which was a Tier 2 National-Level exercise supported by Department of Homeland Security and other federal, state, and local agencies; and the Nuclear Weapons Accident Incident Exercise 2009 (NUWAIX 09).

- Participated in Eagle Horizon 09, a White House-directed interagency continuity exercise.

- Continued support to the Federal Bureau of Investigation for its render safe capability and completed the first-ever stabilization tool kit, for which field testing and training was conducted in FY 2009. As of March 2010, one Federal Bureau of Investigation-led stabilization team has received equipment and training.

- Executed the first-ever, end to end, post-detonation Improvised Nuclear Device nuclear forensics exercise, OAK PHOENIX, incorporating notification/deployment, sample collection, lab analysis, and data evaluation phases.

- Continued Global Initiative to Combat Nuclear Terrorism support through outreach, interagency, and international efforts designed to improve the capabilities of participant nations for response, mitigation, and investigation of terrorist use of nuclear and radioactive materials. Individual events with the Global Initiative included exercises in the Netherlands and Kazakhstan; conferences in the Netherlands; and workshops in Australia, the United Kingdom, and Morocco.

- Improved the capability of triage, a radiological reach-back capability, to provide first responders with expert analysis of detector readings and enhanced hands-on training and workshops.

10.H. NCTIR Milestones and Future Plans

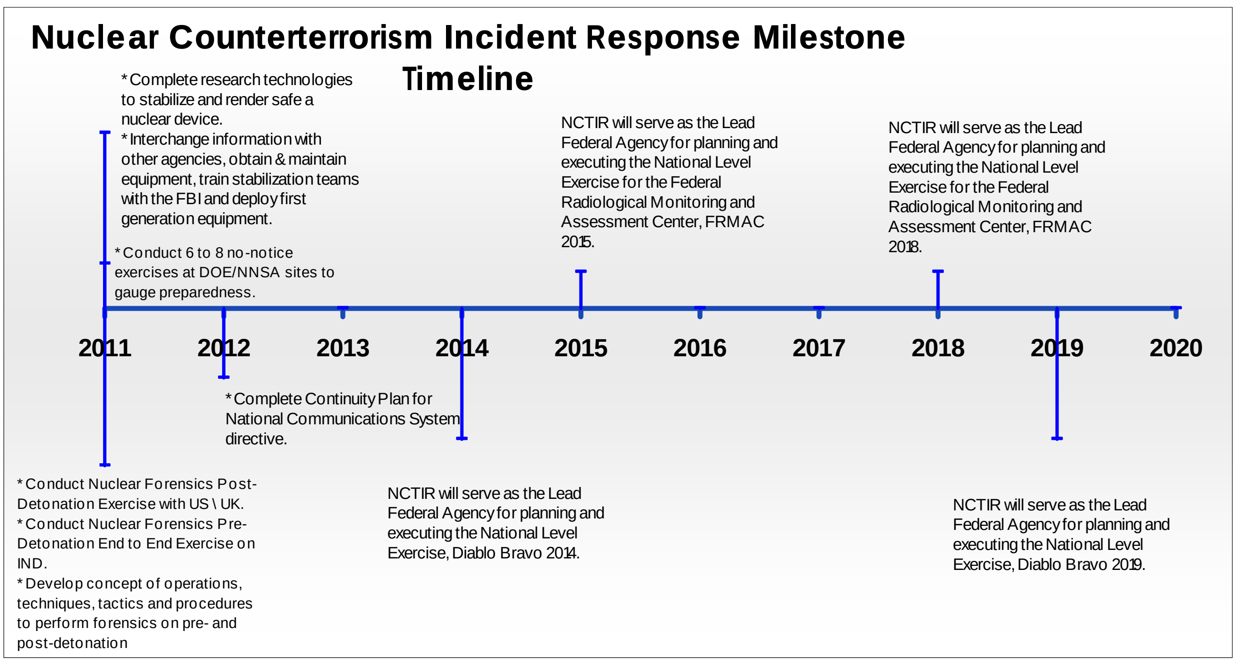

Figure A-10-4. NCTIR Milestone Timeline.

The following activities are ongoing or are performed annually and do not appear on the milestone timeline above. They supplement the program goals for scheduled activities to support successful execution of the program.

- Sustain Nuclear Emergency Support Teams. As necessary, respond to and assist in the search for, identification and characterization of and rendering safe and final disposition of any weapons of mass destruction device.

- Provide outreach and training and conduct exercises with locals, states, and other Federal agencies. Provide assistance in response to emergencies involving nuclear/radiological materials.
- Maintain G-Tunnel capability to support National Technical Nuclear Forensics.
- Manage the NNSA Headquarters emergency preparedness and response efforts.
- Operate the DOE Emergency Operations center.
- Provide the Secretary of Energy and national emergency community a world-class, state-of-the-art, high-speed, global communication network (classified and unclassified information).
- Continue Global Initiative to Combat Nuclear Terrorism through outreach efforts and support interagency and international efforts designed to improve capabilities of participant nations to respond, mitigate, and investigate terrorist uses of nuclear and radioactive materials.
- Develop program plans and infrastructure, provide technical assistance, and train personnel to strengthen and harmonize emergency management systems worldwide to protect people and the environment and to support the President's commitment of protecting our country from the spread of nuclear weapons to terrorists.
- Develop threat device disablement capabilities through advanced design, modeling, and testing programs.
- Perform assessments on nuclear materials and high explosives of interest.
- Generate capabilities to research non-stockpile nuclear weapons designs and laboratory analysis for the aftermath of a nuclear incident.

10.I. Funding Schedule

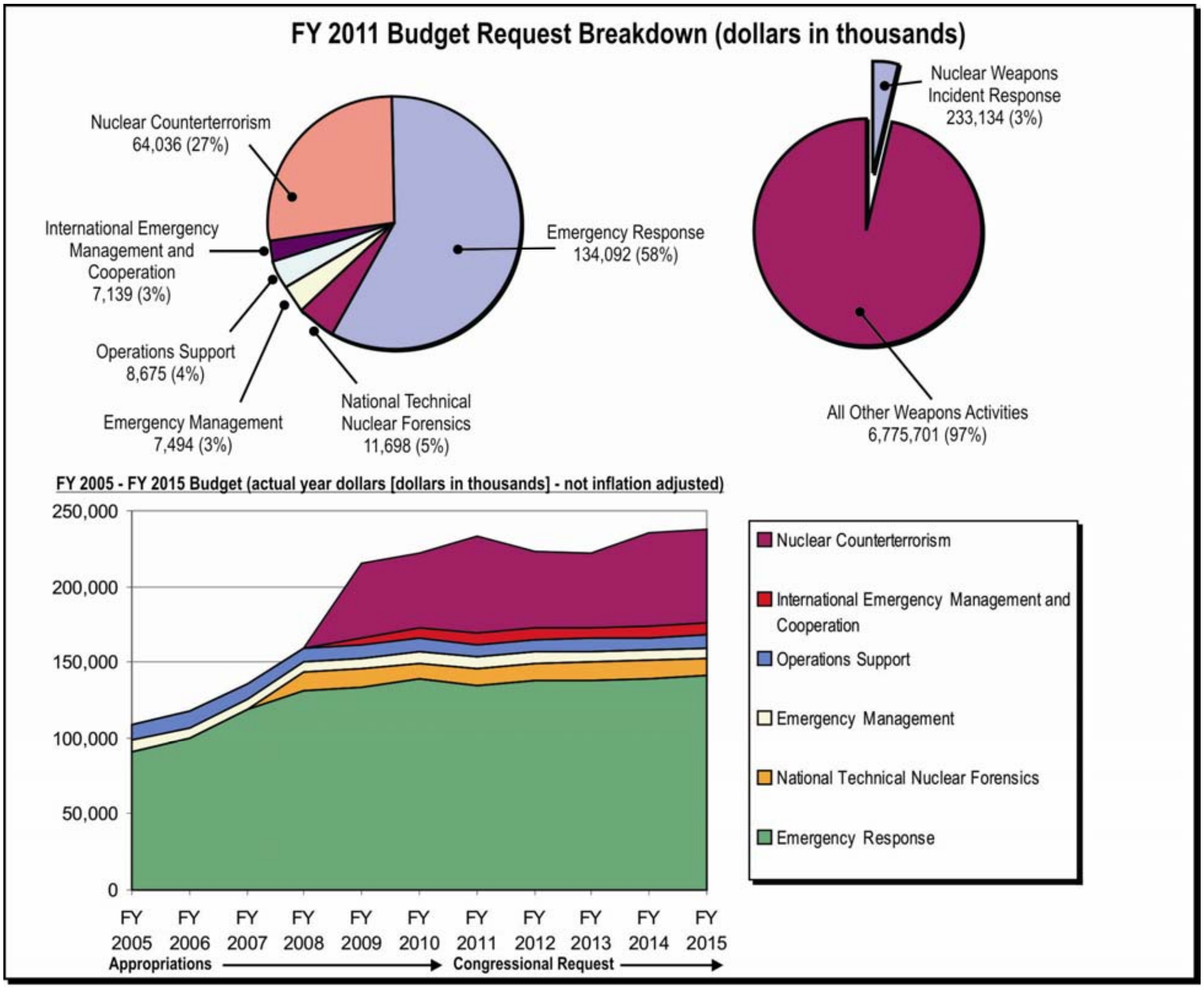

Figure A-10-5. NCTIR Funding Schedule.

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Chapter 11. Facilities and Infrastructure Recapitalization Program

11.A. Highlights

The Facilities and Infrastructure Recapitalization Program (FIRP)'s Facility Disposition subprogram demolished more than 3,000,000 gross square feet or 100+ percent of the cumulative FY 2009 established target goal. Facility Disposition achieved the FY 2009 goal one year early, in FY 2008. In addition, FIRP has achieved over 80 percent of its goal to fund $900 million of Legacy Deferred Maintenance (DM) Reduction. FIRP funded $75.7 million of Legacy DM Reduction in FY 2009 for high priority projects in mission critical facilities. All FIRP line item construction projects were rated as "Green" for cost and schedule by the Department of Energy's Office of Engineering and Construction Management.

The Roof Asset Management Program (RAMP) component of FIRP won the coveted first prize for Real Property Innovation, in the 2008 General Services Administration's annual Federal competition. Competing against 40 other federal candidates, the National Nuclear Security Administration's (NNSA's) five-year old innovative approach to repairing and restoring deteriorated roofs across the complex is both unique and remarkable. Among its key features is the use of a world class roof assets management contractor, Building Technology Associates, Inc. (BTA). Together, federal managers, management and operating contractors, and the BTA staff have added $22 million in value to date to the NNSA's roofing portfolio through life extending repairs, saved $7 million in construction costs, increased average remaining life of roof inventory by more than 25 percent, replaced 2.5 million square feet of roof with energy efficient sustainable materials, and eliminated over $50 million in deferred maintenance. RAMP has an exceptional safety record and best of all—the roofs don't leak.

11.B. Mission

The FIRP mission is to restore, rebuild, and revitalize the physical infrastructure. FIRP applies direct appropriations to address an integrated, prioritized series of repair and infrastructure projects focusing on completion of deferred maintenance that significantly increases operational efficiency and effectiveness of NNSA.

11.C. Program Structure

To achieve its mission, FIRP is broken down into four subprograms: (1) Recapitalization; (2) Facility Disposition; (3) Infrastructure Planning; and (4) Construction.

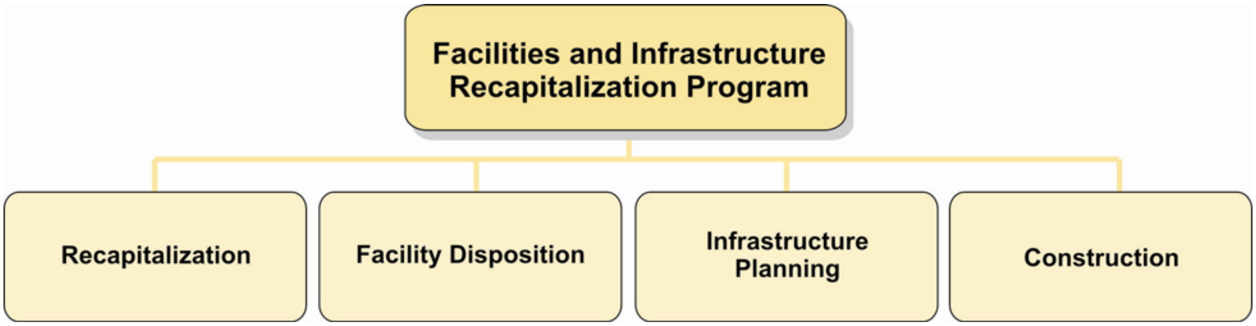

Figure A–11–1. Subprograms of FIRP in FY 2011.

Recapitalization

Figure A–11-2. Roof repairs on Building 9113 at Y-12. FIRP replaced 21,300 square feet of roofing on time and within budget.

Recapitalization funds capital renewal and sustainability projects, focusing on deferred maintenance reduction, required to restore the facilities and infrastructure to an acceptable condition, where necessary. NNSA established corporate commitments and performance goals to stabilize deferred maintenance in FY 2005 (achieved in FY 2004) and reduce the residual deferred maintenance to industry standards by FY 2009 (five percent or less of replacement plant value) for mission-critical facilities and infrastructure. Constrained outyear funding has required a restructuring of the Program. The primary executor of these corporate commitments and the recovery of the complex is the Recapitalization subprogram. Recapitalization funds projects in accordance with established criteria and priorities that target deferred maintenance reduction and repair (non-programmatic) of mission-critical facilities and infrastructure. These projects are essential to restoring the facilities that house the people, equipment, and material necessary to support scientific research, production, or testing to conduct the science-based Stockpile Stewardship Program, the primary NNSA mission. Recapitalization funds projects that directly support the Stockpile Stewardship mission and include, but are not limited to, projects supporting the Chemistry and Metallurgy Research Building and Technical Area 55 at the Los Alamos National Laboratory, Building 9212 at the Y-12 National Security Complex, Beta 4 Material Access Area at the Pantex

Plant, Technical Area 3 facilities at the Sandia National Laboratory in New Mexico, and other mission critical projects. Recapitalization also includes construction/renovation projects (non-programmatic) that modernize landlord or multi-program facilities, address adaptive reuse (conversion) or alterations to existing facilities, bring existing production and laboratory facilities into compliance with mandated codes and/or standards, or reduce the site landlord's total ownership costs of facilities and infrastructure. Among these is the RAMP. RAMP attacked a complex-wide problem—leaky roofs. RAMP's achievement has significantly improved the complex. The focus of the Recapitalization subprogram in FY 2011 will be on achieving NNSA's aggressive corporate goal to reduce complex-wide deferred maintenance to within industry standards for priority mission facilities and infrastructure. The NNSA has established its deferred maintenance baseline and will track progress against deferred maintenance reduction performance goals. The FY 2010 FIRP annual performance target is to fund projects to achieve a reduction to the NNSA deferred maintenance of $34.1 million, increasing the total deferred maintenance reduction to approximately 85.5 percent of the long term $900 million FIRP deferred maintenance reduction goal.

Figure A–11-3. Demolition of Building 9734 at Y-12 was completed in September 2008.

Facility Disposition

Facility Disposition provides funds to accomplish the decontamination, dismantlement, removal, and disposal of excess facilities that have been deactivated. This includes facilities that are excess to current and future NNSA mission requirements and are not contaminated by weapons processes. Facility Disposition activities reduce environmental, safety, health 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. FIRP Facility Disposition provides an economical approach to meeting the direction of Congress to rid the complex of excess facilities, and supports overall NNSA footprint reduction efforts. Recent reviews of disposition costs-to-date indicate that the unit costs (i.e., dollars per square foot) compare favorably with industry norms for the disposition of similar facilities. In FY 2008 FIRP achieved 100 percent of the initial target goal of 3,000,000 gross square-feet (gsf), one-year ahead of schedule. In FY 2010, Facility Disposition will resume funding a few disposition projects that reduce the legacy deferred maintenance backlog.

Infrastructure Planning

Infrastructure Planning supports planning activities for next year's Recapitalization projects. Its primary objective is to ensure that projects are adequately planned in advance of project start to permit the timely obligation of construction funds and effective project execution. The Infrastructure Planning subprogram supports the establishment of Recapitalization project baselines; planning and design for priority general infrastructure projects to include FIRP utility line items; and contract preparation and other activities necessary to ensure the readiness to obligate and execute funds. Infrastructure Planning also funds Other Project Costs in support of FIRP Project Engineering and Design and construction for FIRP utility line-items. Other key activities funded by this subprogram include assessments of the physical condition of the complex to aid in the prioritization of deferred maintenance reduction and facility consolidation efforts, and support for procurement of small business contracts.

FIRP Construction

FIRP Construction funds selected utility line-item construction projects to reduce the deferred maintenance backlog and satisfy a critical need for improvement to NNSA site utilities infrastructure. These projects are expected to result in increased efficiencies because it is often more cost-effective to replace, rather than maintain, aging utilities. Normally, the projects exceed the General Plant Project funding threshold and may include: electrical power distribution, central steam systems and distribution, central chilled water facilities and distribution, water supply systems, sanitary waste disposal systems, roadway reconstruction, and natural gas distribution systems. FIRP Construction also funds the Project Engineering and Design phase of utility line-item construction projects. FIRP will continue funding construction in FY 2010 for one remaining utility line item project, consistent with a submitted Congressional Project Data Sheet. This project will enhance program execution, satisfy a critical need for improvement to NNSA site utilities infrastructure, and make a contribution to the overall reduction of deferred maintenance. Initial planning and conceptual design activities for this FIRP utility line-item construction project (i.e., other project costs) was funded from the Infrastructure Planning subprogram. FIRP will also complete construction of other utility line item projects funded in prior fiscal years. These construction projects meet the criteria for funding within the FIRP Program and are managed in accordance with current DOE and NNSA orders and policies, including DOE Order 413.3A, "Program and Project Management for the Acquisition of Capital Assets."

11.D. Program Goals

Subprogram	Program Goals
Recapitalization	To execute reduction of legacy deferred maintenance of $24.7 million for FY 2011; $24.5 million for FY 2012; and $23.6 million for FY 2013, which will continue progress toward the overall program goal of $900 million by sunset of FIRP.
	The Infrastructure and Facility Management will continue to institutionalize responsible and accountable corporate facility management processes. This includes Ten-Year Site Plans, Facilities Information Management System, Condition Assessments, roofing best business practices, energy savings, corporate facility management policies, cost reduction initiatives, and benchmarking activities.
Facility Disposition	None. The program successfully achieved reduction of over 3,000,000 gsf of excess facilities in FY 2008 and will continue to execute a few disposition projects which will contribute to the deferred maintenance reduction program goal.
Infrastructure Planning	To plan and design all construction projects in the year prior to construction through FY 2012.
Construction	No construction is expected to be funded in FY 2011.

11.E. Strategy

Program Goals are achieved annually following the procedures provided by the FIRP Program Execution Plan, NNSA Ten Year Site Plans, and close coordination with the Office of Nuclear Safety and Operations (NA-17). FIRP is scheduled for completion in FY 2013.

11.F. Challenges

Subprogram	Challenges
All Subprograms	Assuming continued funding in accordance with budget requests, FIRP faces no major challenges on the glide path to program completion now scheduled for FY 2013.

11.G. Recent Accomplishments

Recapitalization

- Funded $75.7 million of Legacy Deferred Maintenance Reduction in FY 2009 for high priority projects in mission critical facilities. FIRP achieved over 80 percent of its goal to fund $900 million of Legacy Deferred Maintenance Reduction.

- The RAMP component of the FIRP won the coveted first prize for Real Property Innovation, in the 2008 General Services Administration's annual federal government competition. RAMP has added $22 million in value to date to the NNSA roofing portfolio through life extending repairs, saved $7 million in construction costs, increased average remaining life of roof inventory by more than 25 percent, replaced 2.5 million square feet of roof with energy efficient sustainable materials, and eliminated over $50 million in deferred maintenance.

Facility Disposition

- The Facility Disposition program demolished more than 3,000,000 gsf or 100+ percent of the cumulative FY 2009 established target goal. FIRP Facility Disposition achieved its initial goal in FY 2008, one year early.

Infrastructure Planning

- The construction project scheduled for FY 2010 was successfully planned and designed.

Construction

- All FIRP line item construction projects were rated as "Green" for cost and schedule by the DOE Office of Engineering and Construction Management (OECM).
- Completed the Electrical Distribution System Upgrade Project at the Pantex Plant.
- Completed construction for the Gas Main and Distribution System Upgrade Project at the Pantex Plant.
- Completed construction for Mercury Highway at the Nevada Test Site.

11.H. FIRP Milestones and Future Plans

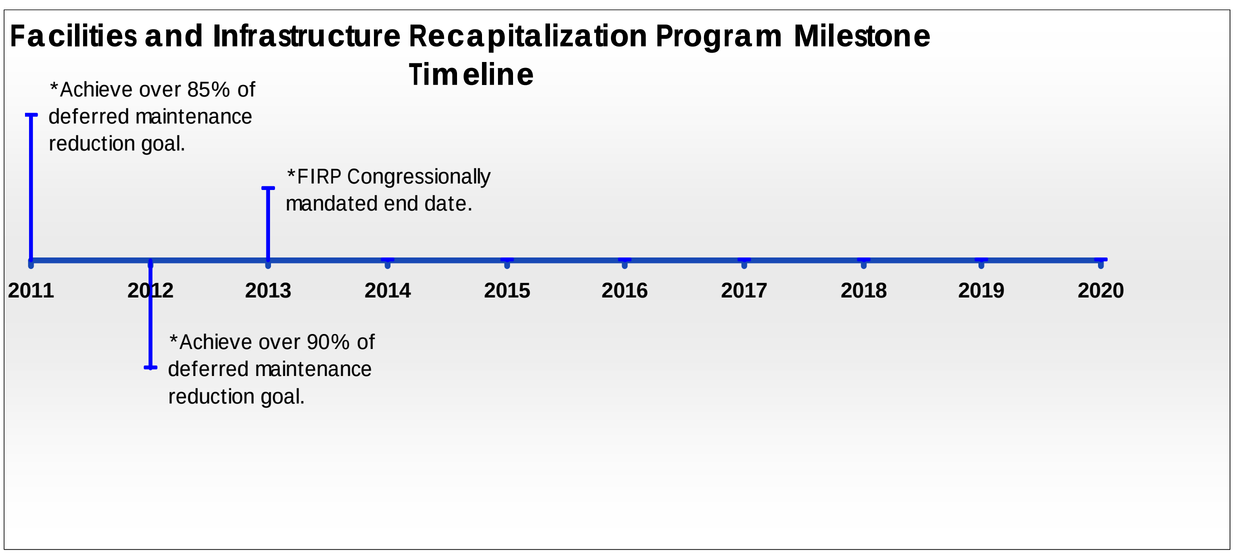

Figure A–11-4. FIRP Milestones Timeline.

FIRP is a finite program with a congressionally mandated end date of FY 2013. The program uses a prioritized project listing to fund legacy deferred maintenance reduction projects. These projects significantly reduce NNSA's deferred maintenance backlog to acceptable levels and support the Stockpile Stewardship Program mission and transformation. FIRP projects also improve safety by improving conditions for maintenance workers and the general laboratory and plant populations.

The following activities are ongoing or performed annually and do not appear on the milestone time line above. They supplement the program goals for scheduled activities to support successful execution of the program.

- Continue to fund capital renewal and sustainability projects through FY 2011 to restore facilities and infrastructure to an acceptable condition.
- Continue to fund the Roof Asset Management Program and maintain a corporate approach to manage NNSA's roofing assets through FY 2011.
- Continue to support establishment of Recapitalization project baselines, planning and design for general infrastructure projects according to priority, and contract preparation necessary to ensure readiness to obligate funds and execute work through FY 2011.
- Continue to contribute to the deferred maintenance reduction goal through FY 2011.

11.I. Funding Schedule

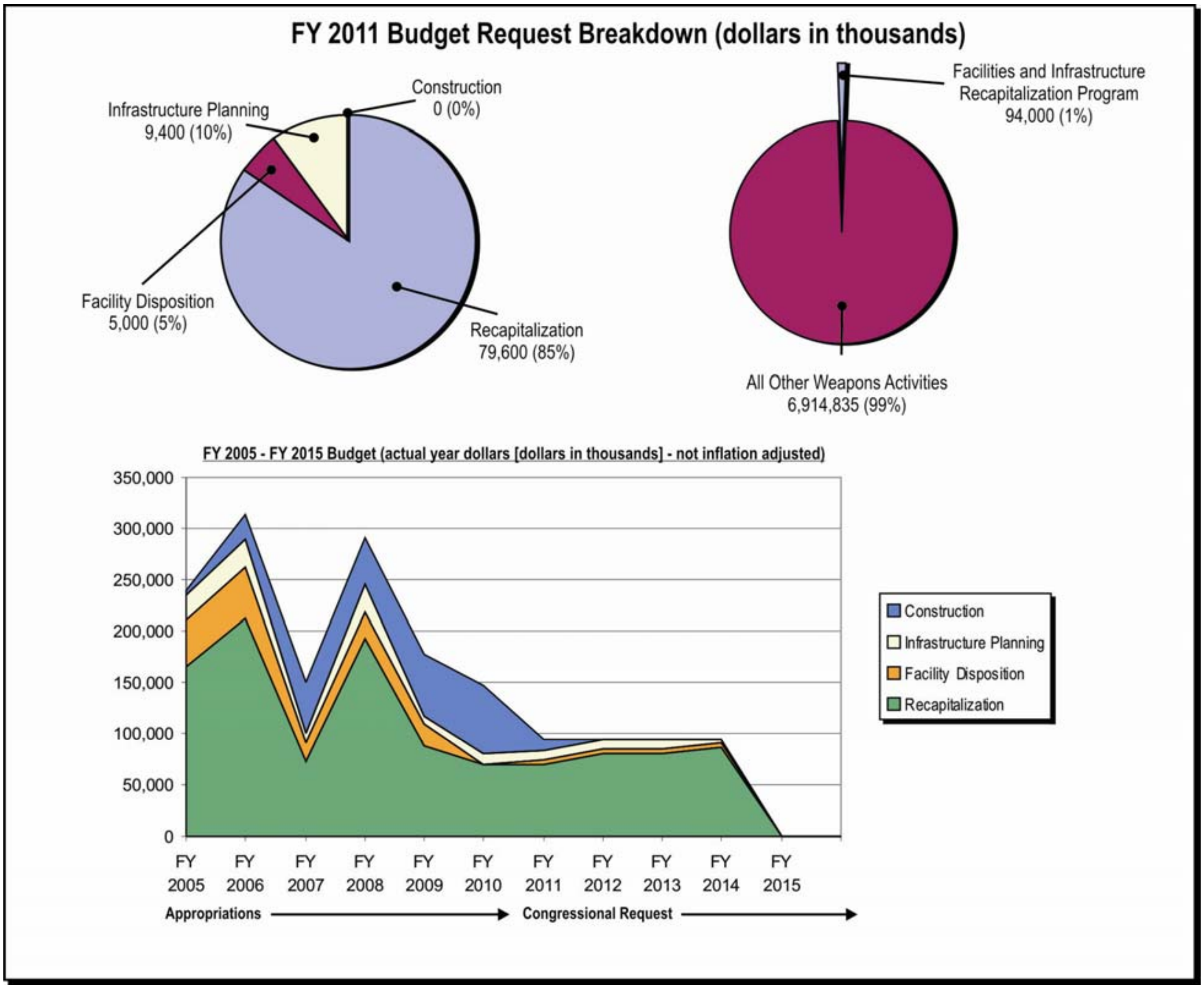

Figure A–11-5. FIRP Funding Schedule.

Chapter 12. Site Stewardship

12.A. Highlights

Site Stewardship consolidates activities managed by the Office of Infrastructure and Environment. Integration of these program responsibilities, functions, and funding into a single Government Performance and Results Act unit allows the Associate Administrator for Infrastructure and Environment to focus on meeting environmental compliance, sustainability, and energy and operational efficiency requirements, while modernizing, streamlining, consolidating, and sustaining the stewardship and vitality of the sites within the National Nuclear Security Administration's plans for transformation. This Government Performance and Results Act unit includes activities within the Environmental Projects and Operations and the Nuclear Materials Integration subprograms. Starting in FY 2011 Site Stewardship also includes the Energy Modernization and Investment Program and associated construction projects.

12.B. Mission

The goal of Site Stewardship is to ensure environmental compliance, sustainability, and energy and operational efficiency, while modernizing, streamlining, consolidating, and sustaining the stewardship and vitality of the sites as they transition within National Nuclear Security Administration (NNSA). The objective of Site Stewardship is to maintain facility and overall site stewardship to better focus resources in support of the overall NNSA missions by ensuring that all regulatory and energy efficiency requirements are met and ensuring effective and efficient life-cycle management of accountable nuclear and other materials with emphasis on consolidation and disposition of excess materials.

12.C. Program Structure

In order to achieve its mission, the Site Stewardship Program is structured into four subprograms. These subprograms are: (1) Environmental Projects and Operations (EPO); (2) Nuclear Materials Integration; (3) Energy Modernization and Investment Program (EMIP); and (4) Construction.

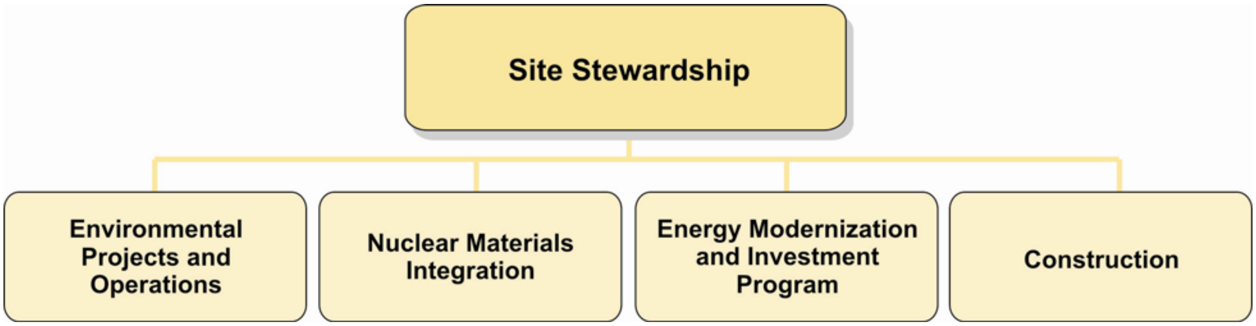

Figure A–12–1. Subprograms of Site Stewardship in FY 2011.

Environmental Projects and Operations

EPO is a regulatory driven subprogram that provides Long-Term Stewardship (LTS) at NNSA sites once the legacy environmental cleanup mission at an NNSA site has been completed by the Office of Environmental Management. It ensures NNSA is compliant with environmental policy requirements and regulations associated with federal, state, and local agencies at NNSA sites where there is an ongoing mission. The EPO subprogram operates and maintains environmental cleanup systems and facilities at NNSA sites, ensures that these systems and facilities continue to protect human health and the environment and meet regulatory compliance requirements, and performs long-term environmental monitoring activities and analyses.

Nuclear Materials Integration

The Nuclear Materials Integration subprogram provides focused attention on the stabilization, consolidation and disposition of specific NNSA nuclear and other materials and coordination and integration of multi-program initiatives to consolidate and/or dispose of materials. The subprogram includes the Inactive Actinides program that provides funding to sites to stabilize and package unneeded nuclear materials, and to ship the materials to an appropriate disposition processing site, or directly to a waste disposal site. The subprogram also includes funding dedicated to the stabilization, packaging, and removal of Special Nuclear Materials (SNM) from the Lawrence Livermore National Laboratory (LLNL).

Energy Modernization and Investment Program

The EMIP implements specific energy-savings projects to reduce greenhouse gas emissions, improve energy and water efficiency of enduring assets, contribute to high performance and sustainable building compliance requirements, and increase the generation and use of clean renewable energy. The EMIP directly supports Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management, Executive Order 13514, Federal Leadership in Environmental, Energy and Economic Performance, DOE orders, and regulatory requirements. The EMIP is a key component of NNSA's energy management strategy to promote sustainability and reduce energy usage and therefore costs, and complements other funding mechanisms.

Construction

Construction is responsible for the managing and funding of all construction projects within the Site Stewardship Program. Future construction projects will be identified and prioritized at each of the sites and will address environmental compliance, energy efficiency, consolidating and improving the efficiency of operations, and modernization projects.

12.D. Program Goals

Subprogram	Program Goals
Environmental Projects and Operations	Effectively manage the cost, scope, and schedule of Long-Term Stewardship activities at NNSA sites and continue risk reduction from legacy environmental contamination through operation and maintenance of installed remedies at five NNSA sites.
Nuclear Materials Integration	Complete the removal of category I and II SNM from LLNL.
	Process and disposition Sandia National Laboratories sodium debris bed material currently stored at the Idaho National Laboratory.
	At LANL, demonstrate cementation processing for material residues containing 10-30 percent SNM to expand disposition pathway to the Waste Isolation Pilot Plant for mixed Actinide materials.
	Continue disposal of low-equity Highly Enriched Uranium, currently stored at Y-12, to comply with Resource Conservation and Recovery Act milestone in the Site Treatment Plan with the state of Tennessee.
	Continue size reduction and consolidation of legacy highly enriched uranium metal components at Y-12, supporting transition to storage in Highly Enriched Uranium Materials Facility.
	Continue shipments of depleted uranium/normal uranium material from Y-12 to the NTS for disposal.
	NNSA is continuing to evaluate options for Site Stewardship in the outyears, including FY 2014, to ensure that attention continues to be directed toward maintaining the infrastructure complex-wide and to address NNSA near-term facility deactivation and demolition needs and energy requirements.
Energy Modernization and Investment Program	EMIP is NNSA's centrally managed, direct-funded program to support achievement of the following Executive and legislative sustainability goals: ▪ Greenhouse Gas Reduction: Reduce 28 percent by 2020 from 2008 baseline per year. ▪ Energy Intensity: Reduce 30 percent by 2015 from 2003 baseline. ▪ Water Intensity: Reduce 16 percent by 2015 from 2007 baseline. ▪ Renewable Energy: 7.5 percent electricity supplied from renewable sources. ▪ High Performance and Sustainable Buildings: Meet the Guiding Principles of High Performance and Sustainable Building (energy efficiency) for 15 percent of all current buildings by the end of 2015.
Construction	Sanitary Effluent Reclamation Facility (SERF) Expansion Project: The primary justification for the SERF project is to recycle 115 million gallons of water annually to support the goals of the Energy Management Executive Orders 13423 and 13514, which designate water conservation targets requiring a 16 percent reduction by 2015. This project will contribute 37 percent to achieving the goal.

12.E. Strategy

The Site Stewardship program integrates program elements that support the cost efficient and effective availability to accomplish the Department of Energy's (DOE's) diverse missions. Growth in FY 2011 supports an accelerated effort to consolidate and disposition nuclear materials and to initiate the Energy Modernization and Investment Program. NNSA is evaluating options for Site Stewardship in the outyears to ensure that attention continues to be directed toward maintaining the infrastructure complex-wide.

12.F. Challenges

Subprogram	Challenges
Environmental Projects and Operations	Long-term stewardship activities began at several NNSA sites beginning in FY 2007 (Kansas City Plant, Sandia National Laboratories, and LLNL Main Site) and was initiated at Pantex and at LLNL Site 300 in FY 2009. It will be necessary to refine the scope of NNSA's future environmental liabilities responsibilities and monitor/evaluate these activities for their potential impact on outyear funding requirements.
	The mission need for regulatory compliance and LTS activities at a number of NNSA sites will extend far into the future. Regulatory cleanup requirements and desired end-states can be expected to change as NNSA infrastructure requirements evolve, additional knowledge is gained concerning contaminants and risks to personnel and the environment and new detection and remediation technologies become available. It is likely that EPO will periodically require additional resources to adapt and implement evolving technological innovations for LTS system infrastructures at the various sites in order to meet regulator requirements and stakeholder expectations. Ongoing efforts to define the scope and schedule for NNSA's Complex Transformation can be expected to drive some significant changes to environmental program activities at some NNSA Sites.
Nuclear Materials Integration	Removal of the security category I/II special nuclear materials from the LLNL is dependent on the ongoing support provided to the Superblock facility by the RTBF Operations of Facilities account. It is necessary to coordinate with the RTBF program to ensure its level of support remains sufficient to support timely completion of the LLNL SNM de-inventory effort.
Energy Modernization and Investment Program	NNSA identified a significant performance gap to sustainability/energy goal achievement under E.O. 13423/DOE O 430.2B. The new E.O. 13514 includes additional requirements that make goal achievement and success more challenging.
Construction	Sanitary Effluent Reclamation Facility (SERF) Expansion Project at the LANL: LANL discharges more than 175 million gallons of treated wastewater each year through 15 permitted outfalls under its National Pollution Discharge Elimination System (NPDES) permit. These outfalls support mission-critical research and development and waste management operations at LANL. In August 2007 LANL was issued a new NPDES Outfall permit by the U.S. Environmental Protection Agency (EPA). Stricter effluent limitations along with July 2010 and July 2012 compliance deadlines will result in compliance issues for LANL if present discharges are not addressed. The stricter effluent limitations contained in the new permit cannot be met with existing treatment facilities at the Laboratory. Failure to resolve these compliance issues by the compliance deadlines could disrupt Laboratory operations and possibly expose NNSA and LANL to civil and criminal liability. Fines and penalties of $25,000/day for each violation could be imposed by the EPA.

12.G. Recent Accomplishments

Environmental Projects and Operations

- LLNL exceeded groundwater and soil vapor treatment facility restart milestones contained in a March 2009 Federal Facility Agreement Consensus Statement among Laboratory and Federal and State regulators. Some 23 of these facilities were scheduled to be restarted by March 31, 2010, but this was accomplished more than 6 months in advance of the regulatory milestones.

- Initiated long term environmental stewardship at an additional two NNSA sites following completion of legacy environmental cleanup at the Pantex Plant and at LLNL's Site 300. This brings the number of sites in long term stewardship to five.

- Submitted all regulatory documents on time for all five NNSA sites that had LTS activities and funding in FY 2009.

Nuclear Materials Integration

- ❍ As of December 31, 2009, 69 percent of the security category I/II special nuclear material at LLNL had been processed, packaged, and removed from the site.
- ❍ In March 2009, Y-12 certified completion of removal of nuclear materials from Building 9204-4, six months ahead of schedule, allowing the elimination of safety basis and security requirements, and making the facility available for decommissioning.
- ❍ Retrieved SNM from a U.S. Army site for disposition. Material was received at NTS for staging in the Device Assembly Facility in 2009. The material will be re-sized at LANL and then shipped to SRS for disposition through the H-Canyon.
- ❍ Met goal to remove 8 metric tons of special nuclear materials from NNSA sites in FY 2009.
- ❍ Established policy for life-cycle management of accountable nuclear materials. DOE Order 410.2 was approved by the Deputy Secretary on August 17, 2009.

Energy Modernization and Investment Program and Construction

- ❍ These Site Stewardship subprograms will begin in FY 2011.

12.H. Site Stewardship Milestones and Future Plans

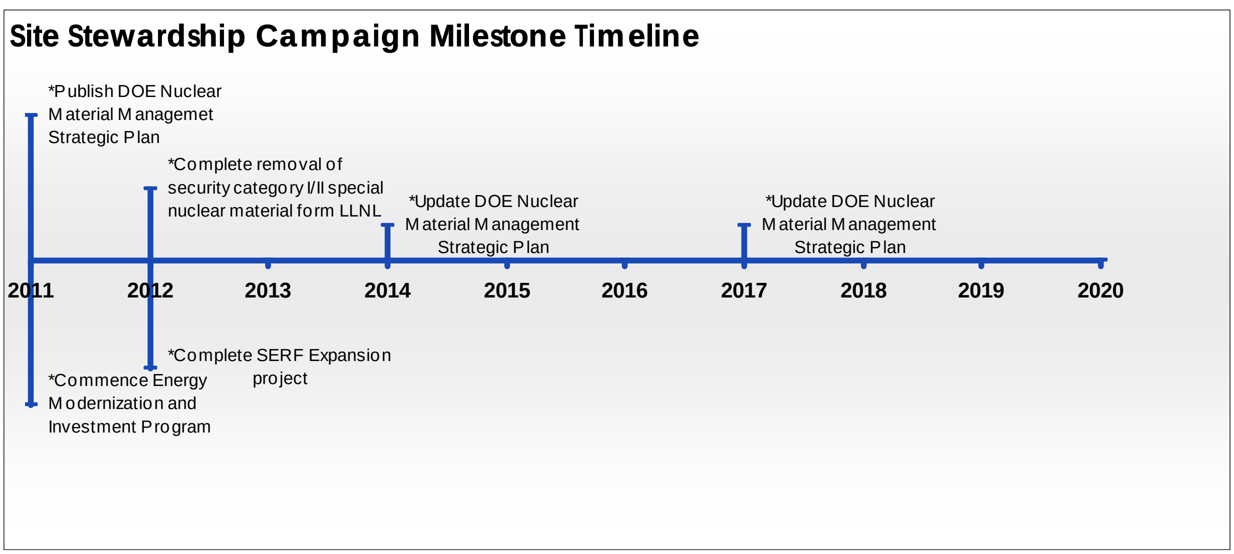

Figure A–12–2. Site Stewardship Program Milestone Timeline.

The following activities are ongoing or performed annually and do not appear on the milestone timeline above. They supplement the program goals for scheduled activities to support successful execution of the program.

- Ensure NNSA compliance with environmental policy requirements and regulations associated with federal, state, and local agencies at NNSA sites where there is legacy environmental cleanup and long term stewardship activities ongoing.

- Implement requirements for life-cycle management of accountable nuclear materials per DOE Order 410.2. Develop and implement processes for Material Forecasting and Allotment, Nuclear Material Management Plans (site and material specific), Lead Material Management Organizations, and National Asset Material designation and management.

- Implement specific energy-savings projects to reduce greenhouse gas emissions, improve energy and water efficiency of enduring assets, contribute to high performance and stainable building compliance requirements, and increase the generation and use of clean renewable energy.

12.I. Funding Schedule

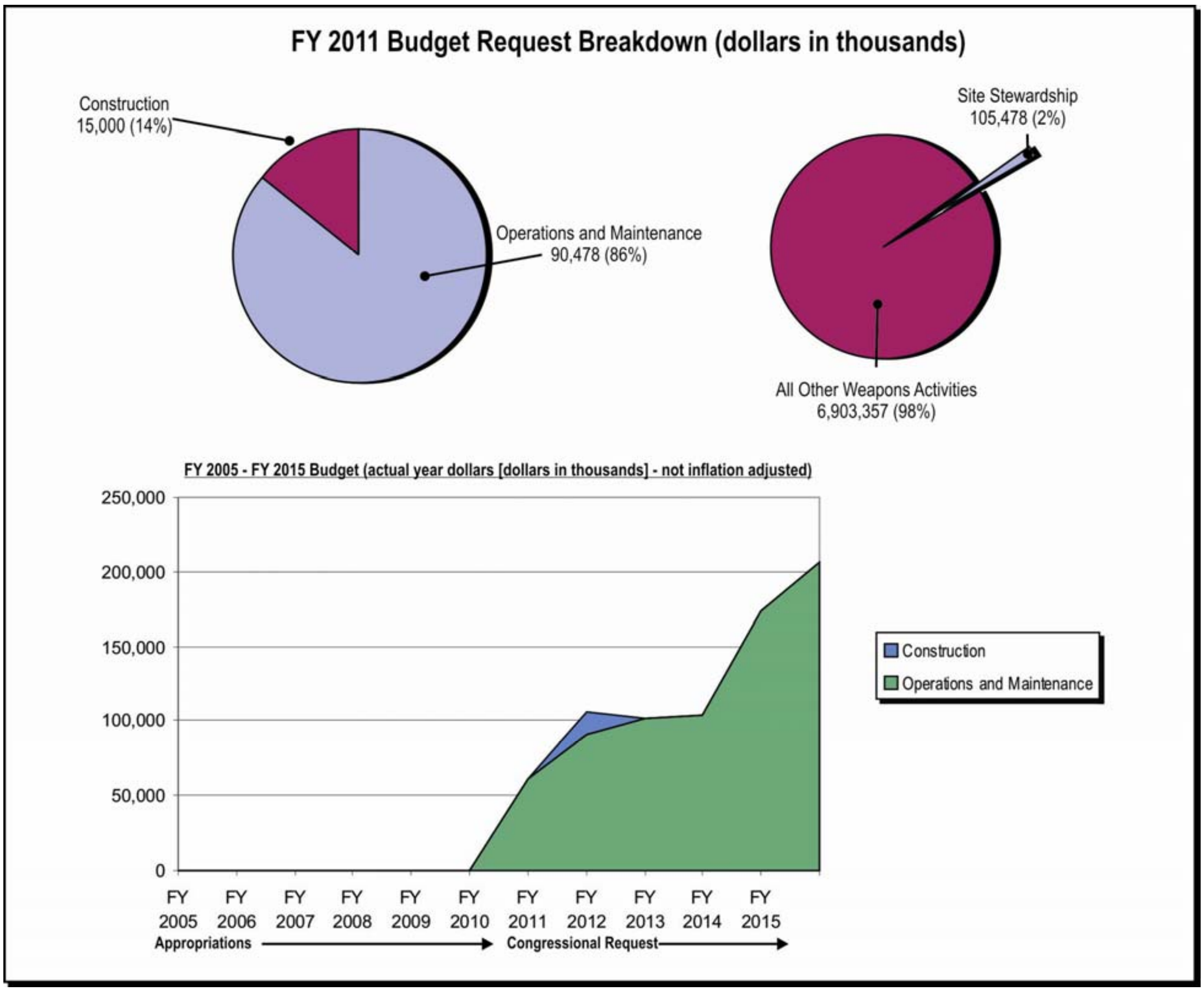

Figure A–12–3. Site Stewardship Program Funding Schedule.

Chapter 13. Defense Nuclear Security

13.A. Highlights

The Office of Defense Nuclear Security (DNS), within the National Nuclear Security Administration (NNSA), is an essential component of the U.S. nuclear security mission. DNS's core mission is to develop and implement security programs for NNSA including protection, control, and accountability of materials, and for the physical security of all facilities of the administration. The DNS Program is responsible for managing the security of the existing complex that includes the National Laboratories, production plants, processing facilities, and a remote testing site that supports NNSA missions. The complex also includes the NNSA Headquarters, site offices, the Service Center, and all employees and contractors. Beyond performing its core mission, DNS also provides unique knowledge and expertise in nuclear security for a broader set of 21st century national security needs that are synergistic with its mission, such as those in nuclear nonproliferation, homeland security, and intelligence.

NNSA is investing in improved performance assurance programs at each NNSA site, with an emphasis on Federal manager oversight, and has undertaken a new initiative (Zero-Based Security Review [ZBSR]) with the objectives of establishing clear performance expectations and issuing specific NNSA policy from a risk management perspective. The objective of the ZBSR is to identify areas where NNSA can improve the consistency and quality of Federal oversight functions, with the objective of identifying opportunities to re-align Federal oversight and assessment activities to achieve a better balance between Federal responsibilities and contractor authority to execute the site security program.

13.B. Mission

DNS is responsible for the development and implementation of security programs for the NNSA. In this capacity, DNS is the NNSA line management organization responsible for security direction and program management with respect to prioritization of resources, program evaluation, and funding allocation. Key management areas include security operations, resources, engineering, and technical support to NNSA field elements and facilities. Specific subject matter expertise also includes physical and personnel security, protective forces, nuclear materials control and accountability, classified and sensitive information protection, and technical security programs.

DNS continuously evaluates the status of protection programs at all NNSA facilities against National policy and Departmental security requirements to determine the appropriate level of resource allocation at each site and across the NNSA. Resource allocation is based on a rigorous requirements validation and evaluation process that incorporates site level vulnerability analysis and risk assessments against requirements.

13.C. Program Structure

The DNS program protects NNSA interests from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts which may cause unacceptable adverse impacts on national security, program continuity, security of employees, and the public. DNS is responsible for the NNSA development and implementation of security programs. Figure A–13–1 displays the DNS subprograms.

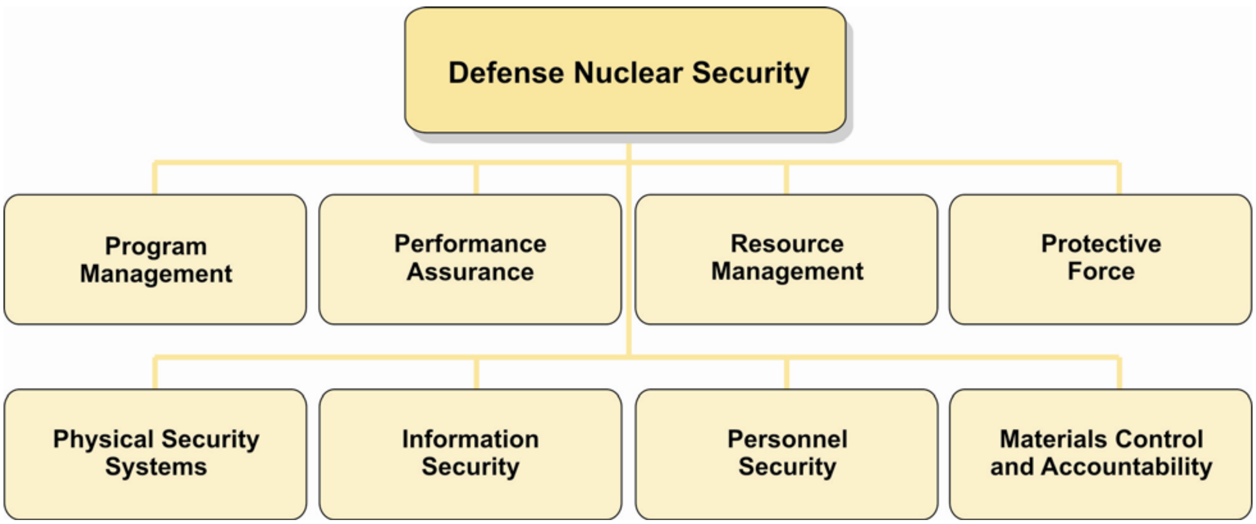

Figure A–13–1. Subprograms of Defense Nuclear Security in FY 2011.

Program Management

DNS Program Management provides direction, oversight and administration, planning, training, and development for security programs. Activities include the assurance of security implementation efforts through the review of updated security plans, performance testing, reviews of vulnerability assessments, and revised threat and vulnerability analysis.

Performance Assurance

DNS Performance Assurance Program ensures effectiveness of the site office and contractor security performance, and serves to document and communicate overall program results to NNSA Headquarters and site management. The sub-program's structure provides a multi-tiered system of self-assessments and other performance reviews, which, when aggregated, provides realistic indicators of the adequacy and effectiveness of NNSA's ability to meet its security responsibilities.

Resource Management

DNS Resource Management Program directs the Planning, Programming, Budgeting and Evaluation (PPBE) processes for DNS, to include budget formulation and execution, and conducts quarterly program and budget execution reviews to ensure program milestones and objectives are achieved within available resources. Resource Management provides guidance and assistance to field elements in the development and validation of baseline budget requests to ensure an effective and efficient security program in support of the NNSA mission.

Protective Force

Figure A-13-2. NNSA Protective Force BearCat Vehicle

The DNS Protective Force (PF) Program provides the development and implementation of policies, procedures, standards, training, and methods for protective forces and related security assets, provides professional technical advice to senior management on PF program aspects, and serves as consultants and advisors to senior NNSA Headquarters and field organization managers on all protection-related programs, policies, procedures, and issues. This group also plans, leads, and coordinates assessments, special reviews, and evaluations in the PF topical area. The NNSA PF utilizes a robust mix of offensive and defensive qualified contractor officers who are well-trained in small unit and weapons tactics. The PF is the front-line for security and an integral part of an overall security posture that protects NNSA personnel, facilities, nuclear weapons, and information from a full, dynamic spectrum of threats.

Physical Security Systems

DNS Physical Security Systems Program provides guidance on security technologies deployed throughout NNSA fixed sites. Physical Security Systems include intrusion detection and assessment capabilities, access controls, remotely operated weapons, force tracking, communications, and training simulators. Physical Security Systems focus on deployment, life-cycle replacement of equipment, and implementation of new technologies to maximize cost effectiveness. These technologies provide assistance in operational efficiencies for the NNSA security program.

Information Security

DNS Information Security Program provides direction for protection or release of classified and declassified information, critical infrastructure, Incidents of Security Concern Program, Technical Surveillance Countermeasures (TSCM), and operations security. Through periodic reviews of classified and sensitive materials information, Information Security ensures proper document marking, storage, and protection of information.

Personnel Security

DNS Personnel Security Program provides guidance and encompasses the processes for security clearance determinations to ensure that individuals are qualified for access to classified information or matter, and/or access to, or control over, SNM or nuclear weapons.

Materials Control and Accountability (MC&A)

DNS Materials Control and Accountability (MC&A) Program provides guidance for the control and accountability of special nuclear material (SNM) and other nuclear materials through measurements, quality assurance, accounting, containment, surveillance, and physical inventory. MC&A functions as a primary deterrent against unauthorized use or diversion of SNM. MC&A is also responsible for tracking movements of accountable nuclear materials between sites and reporting those movements to a national-level tracking system.

13.D. Program Goals

Program Goals	
Support the NNSA through DNS Management Excellence	DNS will provide support to the complex by establishing a life-cycle planning process to incorporate requirements and needs into the PPBE cycle, increasing communications with various stakeholders/agencies, strengthen critical partnerships through improved collaboration, establishing security focused incentives for performance, and developing feedback mechanisms to include standardized metrics.
Manage Risk to Effectively and Efficiently Address the Spectrum of Security Threats	DNS will manage risk by developing and implementing innovative safeguards and security approaches that support complex transformation and are responsive to evolving threats and requirements. DNS will ensure a complex-wide operating environment that is characterized by a responsive, modernized infrastructure, effective and informed risk management, operational efficiencies and implementation of advanced technologies.
Recruit, Sustain, and Exercise Talents of People and Critical Skills	DNS will ensure a functional and sustainable workforce, and engage in four critical activities to include identifying and addressing current skill gaps, sustaining critical skills by recruiting a motivated and innovative workforce, retaining experienced personnel, and developing succession plans.
Provide Assurance of Effective and Sustained Performance	DNS is committed to operate in a proactive manner to perform its security oversight responsibilities. DNS will emphasize continuous improvement and performance assurance by the execution of effective monitoring, tracking and analysis, sharing of best practices and lessons learned, developing standardized metrics, implementing effective line oversight contractor assurance system and improving human performance with human resource organization in the conduct of its critical security programs.

13.E. Strategy

The DNS Program will develop and implement strategies to eliminate or mitigate identified vulnerabilities across the complex and initiate activities for compliance with the Graded Security Protection (GSP) policy. These measures will include additional training of protective force, acquiring updated weapon systems and support equipment, improving physical barrier systems and standoff distances, and reducing the number of locations with "targets of interest."

13.F. Challenges

Subprogram	Challenges
Protective Forces	Develop a security force capable of employing advanced tactics, techniques, and procedures, i.e., a "Tactical Response Force." The cost of maintaining protective forces constitutes the largest part of the DNS budget. In order for the cost of security to be contained or reduced, new methods must be developed and implemented to reduce the reliance on personnel.
Physical Security Systems	Existing physical security systems require modernization and major upgrades to support Homeland Security Presidential Directive (HSPD)-12, Federal Information Processing Standards 201-1, Office of Management and Budget and the DOE Security Policies. The staffing and maintenance required to support two physical access control systems are neither efficient nor cost-effective. Security systems across the complex are aging and require repair, modernization, or replacement. DNS must ensure life-cycle maintenance and increase standardization and interoperability for effectiveness and material readiness of its security systems.
Information Security	The protection of classified information continues to pose the most significant challenge to DNS. The ease of information transfer between the cyber and physical environments, the number of areas processing classified information, and the insider threat requires DNS to identify innovative means to protect information assets.
Personnel Security	National mandates are required for fundamental changes in the management processes of the Personnel Security Program to further reduce adjudication processing times. To improve the quality, efficiency, and effectiveness of the adjudication process will require more technology, increased training, and improved quality assurance.

13.G. Recent Accomplishments

Defense Nuclear Security

- The *DNS Safeguards and Security (S&S) Evaluation and Performance Assurance Plan* was developed to provide analyses of operational awareness activities, structure for senior level communications, and the appropriate level of DNS assessment and technical assistance activities conducted in partnership with the site offices. The document reflects true cooperation with the site offices to assist in determining and improving the effectiveness of the S&S functions throughout the complex.

- DNS completed a DNS S&S self-assessment that evaluated programmatic and line management oversight processes and activities, and assessed whether requirements and management expectations are being achieved. The DNS S&S assessment process identified areas for performance improvements resulting in the implementation of a more effective DNS management program across the complex. DNS will conduct a biennial (every two years) S&S self-assessment of its line oversight and management roles and responsibilities to determine if the scope and quality of oversight activities are adequate. The DNS S&S self-assessment results will be used as a management tool for internal lessons learned to improve management systems, processes, and procedures.

- DNS conducted on-site Program Review with all site offices throughout the complex to review the past year's accomplishments and challenges. The purpose of the Program Review was to evaluate Federal oversight of field S&S programs, review S&S policy issues that affect the ability to sustain high-levels of accomplishments, and review site S&S planning and resource limitations.

- Significant strides have been made towards implementing a Common Procurement and Equipment Standardization program. DNS established a "Security Commodity Team," consisting of Federal, contractor, and union representatives from each NNSA and DOE field site, which will be the mechanism for discussion, research, evaluation, and selection of standardized security equipment across the NNSA. The DNS Office of Field Support also established a business relationship with the NNSA Supply Chain Management Center, which provides an S&S Commodity Manager to develop and manage the strategic sourcing part of this initiative. The first phase of the effort is changing and standardizing the procurement process for ammunition. A business relationship with the DoD Joint Munitions Command has been established, which offers the use of its existing ammunition contracts for future procurements. This will supply nearly 90 percent of DNS ammunition requirements at a much-reduced price and help avoid existing overhead rates required and approved by NNSA at the sites. The new process will also promote more granular reporting of the actual ammunition needs and use for each site. As a result, DNS expects to save approximately $1,000,000 in fiscal year (FY) 2010 and several million dollars in the out-years.

- A Strategic Framework was issued in June 2009, which captures the latest analysis of the challenges facing the DNS Program, identifies four strategies for achieving a more effective, efficient, and sustained nuclear security posture for the NNSA, and outlines an approach to strategy execution designed to overcome potential barriers to success. It aligns with the broader missions and strategic direction of NNSA and the DOE, and establishes a new planning "baseline" by accounting for previous strategic and programmatic plans and numerous independent analyses.

- DNS provided the DOE National Training Center's Basic Survey course, via mobile training teams, to the S&S Federal and contractor staff members at all of the NNSA field organizations. DOE personnel conducting surveys or self-assessments are responsible for planning, conducting, evaluating, and documenting performance and compliance with S&S requirements or standards. Properly training S&S staffs on the requirements, processes, and techniques of how to conduct surveys and self-assessment is essential to ensuring employees have the requisite technical competency to support the S&S operation of the complex.

- DNS led a year-long effort to improve the quality and consistency of the site-level vulnerability assessments by focusing on the improvement of the rigor and formality of the analysis process at each site, working with the sites to identify better and more cost effective security upgrades, and employing risk management in the development of the site security strategy.

- Using the lessons learned from the 2003 Design Basis Threat (DBT), a project-oriented approach has been adopted that provides for the comprehensive management of all activities covered in the site implementation plans – including detailed cost, scope, and schedule data for each site. With the replacement of the 2005 DBT policy by the Department's GSP policy in 2008, a reassessment of the site-level activities contained within the implementation plans is being conducted to determine their utility in meeting the new GSP policy. As part of the security reform initiative, DNS is piloting, in partnership with DOE's HSS, the Graded Security Protection Implementation Assistance Visit (GSP-IAV). The GSP-IAV pilots will ensure all enduring NNSA Category I sites fully utilize the flexibility of the Department's GSP and will identify low- or no-cost modifications to the site protection posture that provides high confidence that the NNSA meets or exceeds the GSP protection requirements.

- DNS established the first comprehensive NNSA Physical Security Technology Management Plan. This plan highlights the significant work that has been completed to implement physical security technologies, while working to reduce NNSA's security footprint by consolidating special nuclear material (SNM) at fewer locations.

- DNS began projects to upgrade access control and alarm systems at the Y-12 Plant and the Nevada Test Site (NTS) with the Lawrence Livermore National Laboratory-designed Argus system. Upon completion of these projects, NNSA will achieve its goal of a standard system at all NNSA Category I SNM sites.

- DNS led an effort to ensure that over 90 percent (approximately 54,000 personnel) of NNSA Federal employees, NNSA Headquarters contractors, and cleared field contractors received HSPD-12 credentials using the Federal Information Processing Standard 201-1. This huge undertaking assisted in the establishment of a standards-based authentication and authorization process for NNSA personnel.

- DNS continued to support NNSA collaborations in support of the U.S.-Russian Federation (RF) Bratislava Agreement, including participation in the Antwerp Tri-lateral (US-UK-RF) security culture workshop.

- DNS serves as an institutional security champion for construction projects, such as the Highly Enriched Uranium Material Facility (HEUMF), Uranium Processing Facility (UPF), Chemistry and Metallurgy Research Replacement Facility, and the Nuclear Materials Safeguards and Security Upgrades Project (NMSSUP), to provide improvements in NNSA's physical security configuration, while reducing the long term cost of providing security.

- DNS is collaborating with the National Academy of Sciences to conduct a comprehensive review of the current risk-based approach for securing nuclear weapons to include materials and facilities. This effort will provide additional opportunities to improve NNSA's nuclear security program and will help to ensure that our program identifies and addresses emerging threat capabilities.

- DNS has developed and implemented a detailed Technical Qualification Program (TQP) across the complex. Additionally, DNS sponsored the rewrite of DOE Technical Standard 1171, *Safeguards and Security Functional Area Qualification Standard,* and the development of DOE Technical Standard 1123, *Safeguards and Security General Technical Base Standard,* that governs technical qualification of security professionals. The Technical Standards have been issued and are used by DOE and NNSA Federal security staff. The TQP is required to be completed within an 18 month timeframe.

Figure A-13-3. Protective Force officers prepare for a training exercise.

- DNS, in partnership with the Office of Management and Administration and NNSA site representatives, conducted baseline budget reviews at all NNSA sites to verify FY 2009 budget execution estimates, validate the supporting information for the FY 2010 – FY 2014 budget formulation process, and to develop an improved DNS budget formulation process begun with the FY 2011 – FY 2015 budget cycle.

Kansas City Plant (KCP)

- KCP achieved cost savings of five percent of the annual FY 2009 security budget. These cost savings are directly attributable to the utilization of the Site Security Standard in lieu of DOE-specific security directives. This methodology accomplishes security activities in an effective and efficient manner, and is consistent with national security standards. The cost savings continue to demonstrate success in improving the efficiency of security operations at a non-nuclear site.

- In the first five months of FY 2010, KCP destroyed over 3,500 pieces of classified matter - a four percent reduction of classified inventory at the facility. This is part of a targeted classified material inventory reduction initiative being conducted in anticipation of the move to the new KCP.

- As part of an ongoing clearance reduction initiative, KCP reduced and/or terminated 87 clearances in FY 2009 and has reduced and/or terminated an additional 78 clearances in the first five months of FY 2010.

Lawrence Livermore National Laboratory (LLNL)

- LLNL made significant progress reducing its security footprint. Approximately 8,000 hard drives (classified removable electronic media) were destroyed, which enabled LLNL to meet its stretch target in the Performance Evaluation Plan. In another major and related effort commissioned by the LLNL Director's Office, known as the Classified Document Initiative, over 60 percent of LLNL's classified documents in individual custody, in over 1,700 repositories, were relocated to central storage, queued to archives, or destroyed.

- LLNL developed and implemented a performance improvement mechanism to reduce security incidents. Cell phone enunciators have been installed at targeted security areas to verbally remind personnel that cell phones are not authorized in those areas. The enunciator can be triggered by a number of installed devices such as infrared or microwave sensors, access handles or buttons, or Argus remote access panels. The results have been positive for LLNL's Security Incidents Reporting Office, and employees and visitors have given appreciative comments for the security reminder. Additional enunciators' will be installed at the remaining targeted security areas in 2010.

- As a result of the NNSA Administrator's memorandum, *Six-Month Moratorium on NNSA Initiated Assessments*, dated December 18, 2009, the Livermore Site Office (LSO) has embarked on a refined oversight approach to allow LLNL the time to accelerate its efforts to mature its Contractor Assurance System (CAS) by the end of FY 2010. LSO has focused security program assessments regarding high consequence or risk deliverables in the areas of security planning, protective force operations, and nuclear materials control and accountability activities. During the moratorium, LLNL will continue to provide reports on implementation of all Annual Operation Plan deliverables. For deliverables with low consequence or risk, LSO will rely on the assurance provided by the LLNL CAS, and will be accepted for and used in future LLNL evaluation reports; it will be a factor in determining post moratorium assessment activities.

Los Alamos National Laboratory (LANL)

- LANL successfully implemented DOE Manual 470.4-3A, *Contractor Protective Forces*, designating the protective force responders as either Security Police Officer (SPO) Is or SPO IIIs, as a result of successfully completing two validation performance tests of the GSP Protective Force configuration on September 24, 2009.

- LANL continued to concentrate efforts on managing and mitigating security risks through a number of initiatives in 2009. The Laboratory destroyed over 1,550,000 legacy classified documents during its annual "Spring Cleaning" event in 2009 – representing a ten percent reduction in classified paper holdings. A "Security Assets Consolidation Project" was funded and is now being executed that will consolidate several vaults and vault-type rooms (VTR) into four centralized locations operated by security professionals. A similar consolidation project was started to bring all Level I/II/III security keys under security management, and is scheduled for completion in FY 2010. Efforts to reduce accountable classified removable electronic media (ACREM) also continue, with an additional 20 percent reduction achieved in 2009 (from 3,656 to 2,937).

- LANL completely eliminated its reliance on "non-standard storage" of classified interests in 2009 by destroying legacy material and consolidating remaining classified part holdings into newly constructed "Armored Magazine (ARMAG)" standard VTRs.

- In FY 2009, LANL started upgrade projects to improve the security posture and enhance the Protective Force facilities. LANL completed the Protective Force running track, the weapons and tactics simulator, and will complete installation of the Motomesh Protective Force vehicle tracking system, automation of posts, and a new training facility upgrade in FY 2010. LANL also received funding to build a Tactical Training Facility starting in FY 2010 and initiate the design of an Indoor Range Facility.

- The Nuclear Material Safeguards and Security Upgrade Project Phase II achieved Critical Design 3A and work began in September 2009 at Technical Area-55, the plutonium processing facility. This $240,000,000 capital line item will replace the outdated security infrastructure at the technical area, including the installation of a perimeter intrusion and delay system.

Nevada Test Site (NTS)

- The Nevada Site Office (NSO) served as the host site to undergo the initial DNS ZBSR Vulnerability Assessment (VA) Pilot activities during January through February 2010. Specifically, the series of tabletop exercises conducted during the ZBSR VA identified a number of potential efficiencies in protective force staffing levels through the redeployment of armed responders. This activity was supported by key representatives from the DoD, Defense Threat Reduction Agency, and other DOE organizations. NSO continues the validation process of the initial ZBSR VA results through PF performance testing.

- The upgraded NSO Protective Force Training Academy facilities support the conduct of a live fire mounted/dismounted course, live fire shoot house, and adjoining multi-story live-fire shoot tower. As a result, the NSO protective force conducts a unique Combined Arms Live Fire Exercise (CALFEX) that simultaneously integrates the live fire engagements by SPO I, II, and III personnel from these facilities against an adversary target array. The CALFEX program now features the Remote Operated Weapons Systems as part of on-going initiatives to incorporate advanced security technology applications.

- The NSO/Wackenhut Services, Inc (WSI) Technology Deployment and Integration Center (TDIC) is a recognized leader within the NNSA in conducting advanced work in testing, evaluating, and deploying commercial off-the-shelf technologies that will immediately enhance the PF detection and neutralization capabilities. The TDIC will ultimately develop a suite of integrated technologies that will help reduce the demand for PF assets in maintaining viable, cost-effective security programs. The TDIC continues to provide assistance and knowledge sharing to other DOE sites and other federal agencies by evaluating technologies that could be deployed at other sites to augment the security programs. During the last year, the TDIC hosted visits from almost every DOE site, as well as the National Security Agency (NSA), the United States Air Force, representatives of the House Appropriations committee, the UK Ministry of Defense (MOD), and the United Arab Emirates (UAE) Chairman of the Critical National Infrastructure Authority (CNIA) and his associates.

- The NTS Operations Security (OPSEC) Program has been extremely effective and garnered top honors in various National OPSEC Awards programs. NNSA has recognized the NTS

OPSEC program as a "Center of Excellence" for its "second to none" assessment program, its increase in visibility through inventive awareness techniques, and its fast and reliable response on issues within their field of expertise that directly impact the workplace. Its multi-faceted security awareness campaign blitz titled the "DOGS of OPSEC" promotes good OPSEC and Security Awareness practices.

Pantex Plant

- The Pantex S&S strategy was enhanced based on the attributes of a High Reliability Organization that includes superior leadership, teamwork, and operational management. One key organizational principle centers on ensuring formality of operations within all elements of the Program. Examples of initiatives aimed at enhancing formality included the establishment of an Issues Management Program and Board designed to address issues identified within the organization, and enhancements to the "Stand and Deliver" multi-faceted leadership development program designed to identify, assess and develop individual S&S leaders and team contributors.

- The Pantex formulation of the S&S budget is requirements-based and includes annual identification of efficiencies and strategic and tactical analysis of impacts. As a result, Babcock & Wilcox Technical Services Pantex, LLC (B&W Pantex) sustained the S&S Program within the declining funding target at the beginning of FY 2010. Continuous monitoring by the site office assures transparency and thoroughness of the budget process.

- Pantex conducted a zero-baseline risk management analysis to implement the GSP Policy. This analysis used a broad spectrum of scenarios and evaluated strategic deficiencies to better address changes in the future (less subject to changes in threat). Through risk management, site office and contractor ownership and managed conservatism, the GSP implementation required no additional funds.

- As a part of an ongoing and extensive effort to improve leadership and operational continuity within the PF, a focus was placed on improving the execution of the Security Incident Response Plans (SIRP). A team comprised of PF leadership was formed and concentrated on communications, consistency and formality of operations using GSP-like scenarios combined with revised SIRPs to improve leadership knowledge and tactics. Direct benefits of these efforts included marked improvement in tactical command-and-control and overall continuity in reaction force dynamics in the SPO ranks, improved tactical astuteness, and improved team cohesiveness.

- Pantex conducted an integrated analysis identifying and prioritizing the most critical life-cycle needs. These priorities directly supported sustainment of the current protection level by replacing aging equipment and systems critical to the effectiveness of the overall Security Program. Additionally, Pantex initiated the development of a Life-cycle Planning System (Remedy). When fully implemented, this system will provide the site with an engineered process with software controls to manage the full life-cycle management process ensuring out-year life-cycle requirements are properly planned and managed.

Sandia National Laboratories (SNL)

- The Security System Replacement Program (SSRP) is being executed to retire the Safeguards Command and Control System. The SSRP provides a modernized SNL's electronic security system infrastructure, auxiliary power system, hardware, software, and Central Alarm Station & Backup Alarm Station (CAS/BAS). SSRP is comprised of three separate efforts: Sustainment; the Security System Infrastructure Project; and the VTR and Door Conversion. Major milestones have been successfully completed in the SSRP. SNL alarm technicians have implemented the Diamond II network, and VTR conversions to the new system. At the end of February 2010, 14 percent of the VTR conversions had been completed and were fully functional on the Diamond II system, and another 24 percent were in progress.

- S&S effectively managed the impacts of a change in mission and protection requirements, i.e., designation as a Security Protection Level (SPL)-4 facility. Efforts included developing budget and programmatic planning for FY 2010 and out years, assuming the SPL-4 designation; and completing an analysis defining required PF configuration based on order compliance for New Mexico and California sites. In addition, the S&S organization was realigned in two phases to accommodate the reduction in Physical Security, Performance Assurance and PF management activities due to the resulting change in requirements. Specifically, of the 110 originally impacted positions from the initial FY 2010 budget request, all but five were resolved without layoff.

Savannah River Tritium Site

- The Savannah River Tritium Site completed the realignment of the security posture to ensure the security of the facilities complies with the DOE Orders and the GSP. This realignment has allowed the Tritium Facilities to reduce costs by approximately $4,000,000 per year.

NNSA Service Center

- NNSA possesses approximately half of DOE's active clearances. In FY 2009, the NNSA Service Center reduced the backlog of clearance adjudications by 99 percent, and the NNSA Service Center realigned resources to streamline the adjudication process. By the end of the calendar year 2009, the NNSA Service Center met the 2004 Intelligence Reform and Terrorism Prevention Act (IRTPA) requirement to finalize 90 percent of the applicant cases within 20 calendar days of receiving the completed Office of Personnel Management (OPM) background investigation. Streamlining processes and attention to operational metrics have enabled the NNSA Service Center to achieve a 33 percent reduction in days to adjudicate applicant clearances. IRTPA also requires Federal agencies to submit investigation requests to OPM in 14 days or less. The Personnel Security Department (PSD) is also meeting this requirement and has been for over a year. Additionally, a new case management system (CMS) is scheduled for deployment in FY 2010. The System will track the clearance application or reinvestigation throughout its life-cycle, providing working information about given workloads and processes or aggregates thereof at any level of PSD management.

- The Service Center worked with DNS for elimination of annual Foreign Ownership, Control, or Influence (FOCI) certificate for contractors not under FOCI mitigation. This action aligns the NNSA with reporting requirements contained within the National Industrial Security Program Operating Manual. Additionally, the Service Center agreed to accept the contractor's electronic submission of the Certificate Pertaining to Foreign Interest (SF 328), thus eliminating the need for the original signed hard copy. This will promote effective and efficient processing of information for Facility Clearances and FOCI determinations, and supports the Government-wide initiative of electronic records and electronic records management.

- The Service Center upgraded the electronic access controls from the magnetic swipe readers to contactless readers. The installation of the new readers will improve access controls to security areas, and save on wear and tear of the new HSPD-12 credential – a cost saving of $49.00 per credential. The use of the HSPD-12 credential and contactless reader is an extremely secure method of access control. The new credential has an encrypted card number that cannot be reproduced. When used with the new contactless readers, users can be assured that their information is protected.

Y-12 National Security Complex

- The Security Improvement Project (SIP) will provide the Y-12 plant with the Argus security control system and raise the existing alarm control equipment up to modern standards. The SIP Project Team finalized design, obtained the Critical Decision-2 package approval, and began construction activities. Completion is expected in FY 2014. SIP supports implementation of a comprehensive framework for managing and integrating personnel security and access control systems across DOE, and will address long-standing problems with duplicative and redundant development and maintenance of site-level security information systems.

- The HEUMF began loading material two months ahead of schedule. The denial facility design provides significantly increased security with less reliance upon protective forces, ultimately facilitates a dramatic reduction in the 150-acre Protected Area, and allows for the decertification of an old and difficult to protect Material Access Area.

- The designing phase for the Uranium Processing Facility (UPF) is underway, and the

Figure A-13-4. Physical Security Systems provide security technologies deployed throughout NNSA sites.

UPF will take advantage of opportunities identified during construction and testing of the HEUMF. The UPF will also be a designed denial facility and contain all highly enriched uranium operations at Y-12 Plant. Completion of this project is essential to accomplish the modernization effort and reduce the Protected Area by 90 percent. This accomplishment will greatly reduce security and infrastructure costs at Y-12.

- Y-12 has initiated planning and design for an interim Protected Area reduction effort. This will allow the site to reduce the Protected Area by approximately 70 acres in approximately two years and facilitate more efficient demolition of facilities, potentially reduce the need for "Q" clearances, reduce security maintenance costs, and provide space for much needed parking when the UPF begins construction. This will also reduce costs for all operations conducted in the new Property Protection Area.

13.H. DNS Milestones and Future Plans

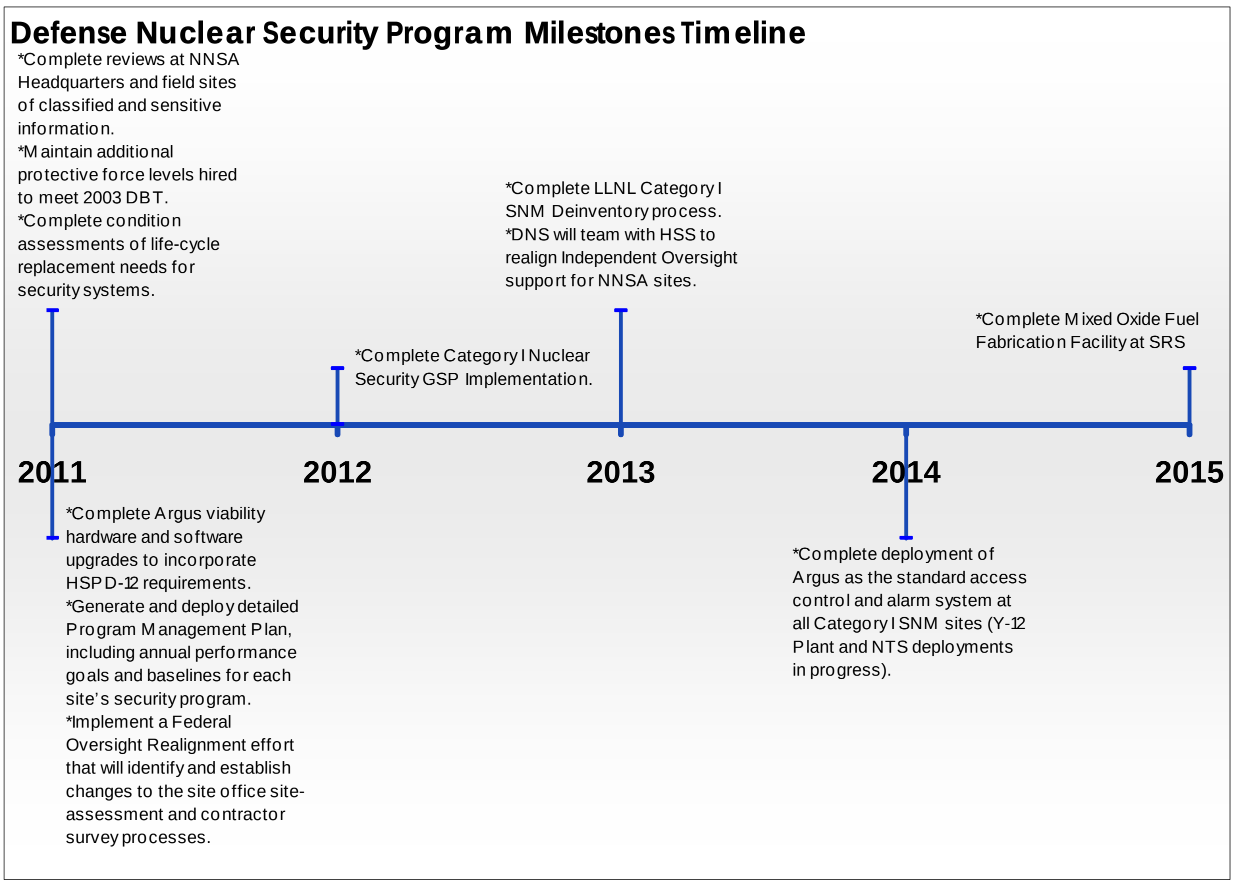

Figure A–13–5. DNS Milestones Timeline.

DNS Ongoing Activities and Projects

- Conducting a Protective Force Comparability Study that will assist in improving consistency and standardization throughout the complex.

- Implementing Protective Force consolidation of SNL and LLNL.
- Implementing new technologies to maximize cost-effectiveness while fully integrating security assets requirements into NNSA ten-year site plans.
- Completing reviews at NNSA Headquarters and field sites of classified and sensitive information.
- Supporting the Access Authorization, Human Reliability Program, Control of Classified Visits, Security Awareness, and Unclassified Visits and Assignments by Foreign Nationals Programs.
- Assessing security implementation efforts through the review of updated security plans and performance testing, reviewing of vulnerability assessments, and revising threat and vulnerability analysis.
- Identifying and facilitating deployment of security technology to address both short- and long-term solutions to specific physical security and MC&A needs at NNSA sites. Focusing on promising, emerging technologies that will provide operational efficiencies for the NNSA security program.
- Supporting construction phase of the Nuclear Materials Safeguards and Security Upgrades project, 08-D-701, at LANL.
- Completing Project 10-D-708, Security Improvements, at Y-12.
- Assessing, testing, transferring, verifying and measuring, reconciling and performing statistical analyses related to MC& A requirements.

13.I. Funding Schedule

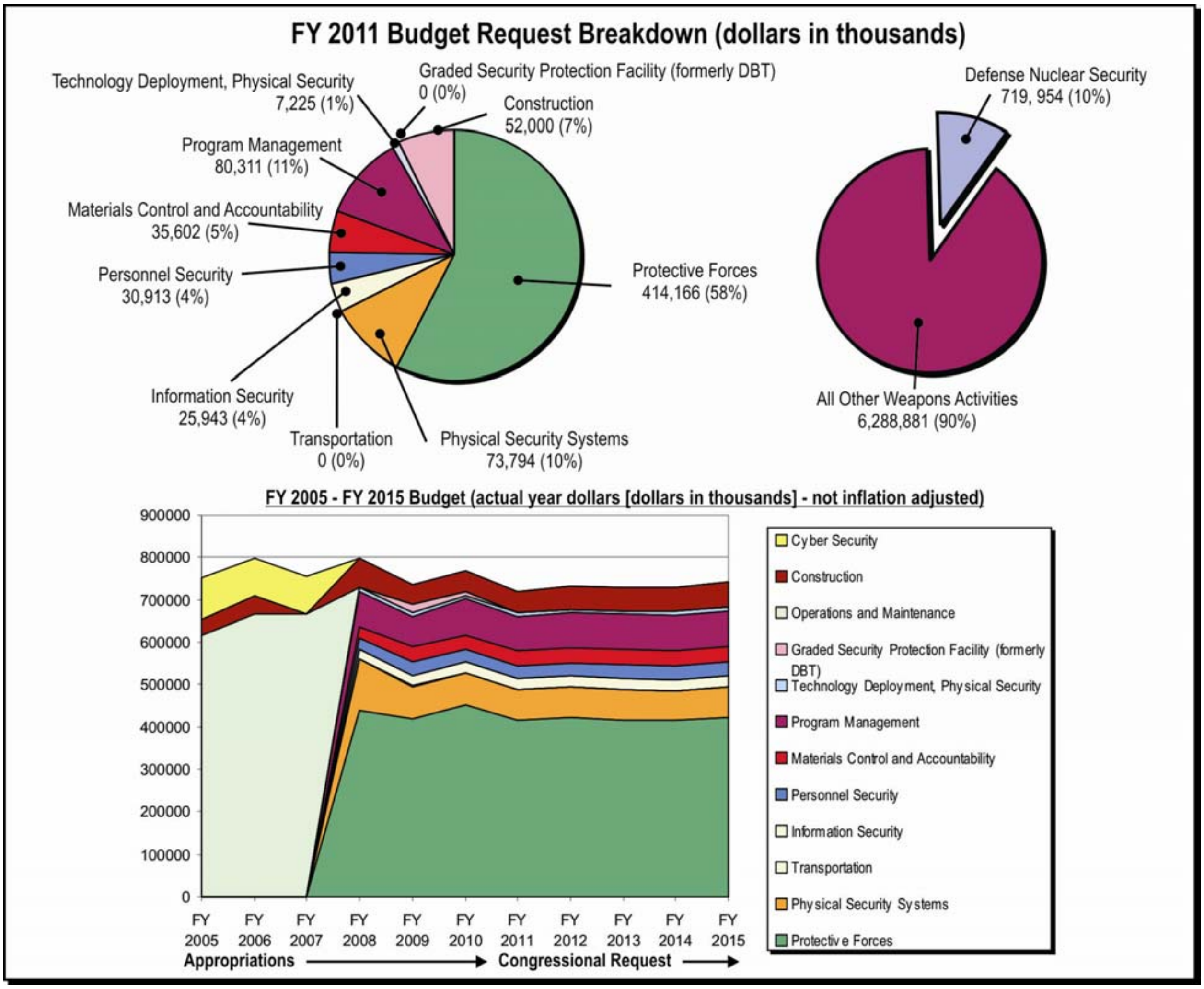

Figure A–13–6. DNS Funding Schedule.

Chapter 14. Cyber Security

14.A. Highlights

In FY 2009, the National Nuclear Security Administration (NNSA) underwent a major revitalization of its Cyber Security Program implementing a strong risk management framework for cyber security and reducing the need for compliance-based assessments. NNSA has also published the Cyber Security Risk Assessment Methodology and the NNSA Cyber Security Threat Statement to facilitate a consistent approach to quantifying threats and residual risks.

The highly complex and global nature of the NNSA mission environment makes it critically important that information and information assets are managed and protected using a risk management approach. Leaders must recognize that well-informed management decisions require a systematic understanding of the risks inherent in the use of information systems. All information collected, created, processed, transmitted, stored, or disseminated by, or on behalf of, the NNSA on automated information systems requires a level of protection commensurate with the risk to the information and the associated information processing systems. The information systems facilitating these activities must also be protected.

The NNSA mission is further complicated by the geographically diverse nature of the NNSA. A flexible, comprehensive Risk Management Program promoting risk-informed decision making, and providing approaches and methodologies to conduct risk management activities, will greatly benefit the complex, ensuring that information security considerations are integrated into the NNSA enterprise architecture and business processes of the organization. The full integration of management processes organization-wide will reduce risk – providing greater degrees of security, privacy, reliability, and cost effectiveness for core missions and business functions.

The Office of the Chief Information Officer is responsible for fostering a culture of information sharing to ensure that investments in information technology systems and projects across the NNSA are coordinated, have the necessary cyber security protection, and are in alignment with the NNSA Strategic Plan, and Department of Energy (DOE) requirements and objectives. A holistic and common approach to identifying, analyzing, and mitigating risks to the sites and will improve the security posture and assist decision makers throughout the NNSA. The risk management approach defined in this policy document provides for the implementation of a comprehensive, sustainable risk management program to assist in the protection of NNSA assets and information.

14.B. Mission

The mission of the NNSA Cyber Security Program is to ensure that sufficient information technology and information management security safeguards are implemented throughout the NNSA complex to adequately protect the NNSA information assets.

The overarching goal is to implement a flexible, comprehensive, full life-cycle, risk-based Cyber Security Program that:

- adequately protects the NNSA information and information assets;
- is predicated on Executive Orders; national standards, laws and regulations, and, where appropriate, Departmental and NNSA orders, manuals, directives, and guidance; and
- results in:
  - a cyber security architecture, aligned with the NNSA enterprise architecture;
  - an appropriate policies and procedures framework and methodology; and
  - a management approach that integrates all of the components of a comprehensive Cyber Security Campaign; ensures alignment of the program with the NNSA and Departmental strategic plans and relevant plans of the Offices of the Chief Information Officer; and supports the NNSA mission.
- ensures that the NNSA complies with the DOE Defense in-Depth Cyber Security strategy and the NNSA Information Management Strategic Plan and that all NNSA elements maintain current certification and accreditation packages resulting in an official Authority to Operate, signed by the Designated Approval Authority.

Executing the carefully developed strategies and meeting the milestones to accomplish the objectives and goals outlined in this plan will result in an integrated Cyber Security Program that considers and balances operations, technologies, and people and will result in realizing the transformational vision for defense in depth. For an overview of the components of their Cyber Security Program established to execute this strategic plan, please reference the Office of the Chief Information Officer Cyber Security Program Overview.

Successful execution of this technology plan can be gauged by evaluating general success indicators for each of the key pillars in defense-in-depth. The underlying premise of risk management is that every organization exists to achieve its mission in support of its stakeholders, and faces uncertainty as it attempts to do so. The challenge for management is to determine how to respond to uncertainty as the organization strives to meet its goals and objectives. Uncertainty presents risk, with the potential to adversely affect the organization. Risk management enables management to intelligently and proactively deal with risk and enhance performance and mission success.

Risk management encompasses:

- ❍ Aligning risk tolerance and strategy – Management considers the risk tolerance level in evaluating strategic alternatives, setting related objectives, and developing mechanisms to manage related risks.
- ❍ Enhancing risk response decisions – Risk management provides the rigor to identify and select among alternative risk responses: mitigation, risk avoidance, acceptance, and transference.
- ❍ Reducing operational surprises and losses – Organizations gain enhanced capability to identify potential risks and respond quickly to avoid problems and losses.
- ❍ Identifying and managing multiple risks – Risk management facilitates effective response to the interrelated impacts, and integrated responses to multiple risks.

The capabilities inherent in risk management help management achieve targets and improve resource deployment. Risk management helps ensure effective reporting and compliance with laws and regulations, and helps avoid damage to the mission, performance, reputation, and associated consequences.

14.C. Program Structure

In order to achieve its mission, the Cyber Security Program is structured into three subprograms. These subprograms are: (1) Infrastructure Program; (2) Enterprise Secure Computing; and (3) Technology Application Development.

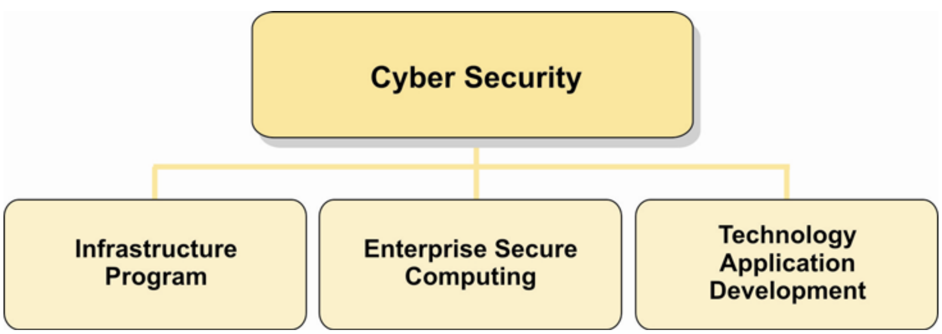

Figure A–14–1. Subprograms of the Cyber Security Program in FY 2011.

Infrastructure Program

The Infrastructure Program supports the cyber security operations and activities at all NNSA sites. This subprogram is built around a defense-in-depth approach for achieving cyber security in a highly networked environment. The cyber security defense-in-depth approach is a combination of known best practices and cost strategy that relies on the intelligent application of techniques and technologies which exist today. The defense-in-depth approach consists of three major components: personnel; technology; and operations. This approach recommends a balance between the protection capability and cost, performance, and operational considerations. The implementation of this approach provides the necessary personnel and technology to maintain a cyber security posture that complies with all Federal, DOE and NNSA policies and processes while addressing the increasing number and complexity of cyber security threats, vulnerabilities, and risks.

Enterprise Secure Computing

Enterprise Secure Computing provides state-of-the-art level classified computing infrastructure that enables effective collaboration and information sharing necessary for the NNSA. This subprogram focuses on daily operations, infrastructure enhancements, and application deployment.

Technology Application Development

Technology Application Development is responsible for developing and advancing policies and initiatives that will support short and long-term solutions to specific cyber security needs at NNSA sites and headquarters locations. Technological innovation, research, and development are critical components for NNSA to protect its assets in national and global technology-driven environment. The research and technology development efforts will focus on emerging technologies and leverage existing technology resources to create a more secure environment. In addition, new strategies can be developed to support cyber security activity across NNSA and foster collaboration between organizations.

14.D. Program Goals

Subprogram	Goals
Infrastructure Program	Protect and defend NNSA information and information assets within the sites, from the perimeter to the end user, by ensuring data availability, integrity, and confidentiality.
	Manage Objectives for Information and Related Technology – provides a broad and deep framework for cyber security controls.
	Initiate site assessment visit process to assure support for the current cyber security mission and future requirements. Develop and deploy a centralized assets management system to track cyber security assets.
	Develop a career development and tracking program providing enhanced technical and management training opportunities and implement enhancement to the training program.
Enterprise Secure Computing	Significantly mitigate the risk of security events on classified information by an appropriate technology design that provides for effective network-level monitoring, limits an intruder's ability to traverse the network, offers the minimum level of services required for business needs, and is updated in a timely manner to mitigate newly discovered vulnerabilities.
	Develop enhanced information security protections and transparencies for NNSA's information systems, applications and networks, and improved information security protection/accountability tools and practices within the classified and unclassified environments.
Technology Application Development	Improve Federal oversight and compliance assessment. Improve insight into the cyber security posture.
	Continue to prepare NNSA policy that implements current and emerging national and DOE cyber security policy and best practices. Implement the updated the certification and accreditation processes.
	Develop consolidated cyber security policy guidance, balanced risk management and performance, and use of modern document distribution methods.

14.E. Strategy

NNSA continues to maintain its cyber security defenses against cyber threats that are increasing in number, complexity, and sophistication while supporting the application of advanced information technologies to the NNSA national security and other missions. NNSA sites continue to improve the scope and quality of Cyber Security Campaigns through implementation of NNSA cyber security guidance and by addressing an increasing number of requirements. The NNSA strategy for a long-term Cyber Security Program is composed of several components, including planning, policy, management and technology, services, and performance management. These components are described in detail below.

Planning

Planning is supported by a collaborative effort with the site offices to understand the threat landscape and identify weaknesses through compliance reviews and performance measurement. This information is fed back into the planning activities to generate both a long-term strategic plan and an annual tactical plan. Processes and documentation produced include a cyber security working group, strategic and tactical plans, and both a Departmental threat statement and risk assessment.

Cyber security policy and guidance

The policy component is very closely aligned with both the governance program and the planning component. Cyber security policies establish the high-level goals and outcomes for the overall DOE Cyber Security Campaign. Enhanced through guidance, and performance metrics, the policy is in place to drive the program's implementation. The focus is on top level "thin-policy" supported by guidance at the Departmental level for a less risk averse program.

Architecture and Technology

Installing well-defined, high-level department structure, processes, and principles puts the Department in position to successfully manage the technology it employs. To achieve the best possible results from this structure and to ensure that a standard approach across the Department is achieved, the set of sub-processes, which fall within the leadership decision process, address the management and technology component. Products stemming from this component include architectural guidance, licensing of security tools and products, and a technology review and development process.

Services

As field sites adapt to the new processes and policies, it is the role of the Office of the Chief Information Officer to facilitate that adjustment through various services and through the performance of several key initiatives that protect the entire department. The aim of these services is to develop an intelligent, proactive approach to mitigate the security threat to the department. Processes stemming from this component include cyber security communications, education and awareness, asset management, advice and assistance, and awards and recognition.

Performance Measurement

Performance measurement provides a clear and consistent way to measure success and demonstrate results to senior management. Process and documents stemming from this component include compliance review, monitoring, and cyber security metrics.

14.F. Challenges

Subprogram	Issues
Infrastructure Program	Unfunded new requirements from the Office of Management and Budget and DOE for unclassified cyber security activities.
	Complex-wide cyber security risk management approach – defining requirements and developing implementation plan.
	Lack of consistent incident management and handling processes (interpretation, coordination, implementation) across NNSA and with DOE.
	Expanded use of advanced Information Technology solutions to improve the overall computing environment and enhance user interactions.
	Cyber Security infrastructure replacement and modernization.
Enterprise Secure Operations	Implementation of new federal requirements for classified environments complex-wide, such as Comprehensive National Cyber Security Initiative Item #7, network and system enhancements.
	Proliferation of classified computing activities across the NNSA, in such areas as Special Access Programs, infrastructure enhancement and new program requirements for classified computing.
	Investment planning for cyber security technologies in NNSA networks.
Technology Application	Resources to research cyber security development and deployment issues resulting from expanded use of advanced IT.
	Investment planning for cyber security technology development.

14.G. Recent Accomplishments

- The Cyber Security Program has sustained the NNSA infrastructure elements to counter cyber threats from external and internal attacks using the latest available technologies.

- The Cyber Security Program developed and implemented a critical cyber asset recovery plan. The plan consisted of the following elements:

  - Exercises – The recovery plans were exercised at least annually. An exercise of a recovery plan ranged from a paper drill, to a full operational exercise, to recovery from an actual incident.
  - Change Control – Recovery plans were updated to reflect any changes or lessons learned as a result of an exercise or the recovery from an actual incident. Updates were communicated to personnel responsible for the activation and implementation of the recovery plan(s) within 90 calendar days of the change.
  - Backup and Restore – The plans included processes and procedures for the backup and storage of information required to successfully restore Critical Cyber Assets.

- Testing – Information essential to recovery that is stored on backup media was tested at least annually to ensure that the information is available.

❍ The Office of the Chief Information Officer, Cyber Security Program Manager has strengthened the Cyber Security Program by implementing the following:

- Policy development and implementation
- Site Assessments
- Enhanced Enterprise Secure Network (ESN) activities

❍ Completed all engineering projects on schedule and budget:

- Ensured technology insertion was managed properly.
- Ensured logistics actions supported engineering projects.
- Ensured the Enterprise Data Resource Management project was coordinated with the engineering projects.
- Ensured the Enterprise Architecture project supported the future growth of ESN.
- Ensured cyber security best practices were integrated into the development of all engineering projects.

❍ Ensured standardized network and site operations were followed:

- Developed and executed the Operator Readiness Review initiative.
- Executed the Transition Plan which increased network cyber security.
- Developed and integrated the Operator Tool Set.
- Enhanced and customized the overall Training initiatives.
- Integrated the Configuration Management project into ESN operations.
- Ensured cyber security best practices were integrated into all network and site operations.
- Implemented Required Committee on National Security Systems Activities.

❍ Audit Management

- Developed a comprehensive governance, performance, and assessment plan to focus efforts on continuous improvement and sustainability of the Cyber Security Campaign.

❍ Configuration Management

- Established a rigorous configuration management plan with regards to the Cyber Security Infrastructure to ensure appropriate visibility and communication of security significant changes to the complex.

❍ The Cyber Security program maintained a flexible, comprehensive, and risk-based Cyber Security Program that protects the NNSA information and information assets.

❍ Completed the DOE Office of Health, Safety and Security independent oversight inspection at NNSA sites with 100 percent effective ratings.

- All Site Assessment Visits conducted by the Cyber Security Program Manager at NNSA sites resulted in an effective rating.
- Maintained and improved the NNSA cyber security architecture for NNSA Headquarters and sites.
- Designed and built an enterprise secure network gateway. Testing of the gateway and the integration into enterprise secure will began in FY 2010.

14.H. Cyber Security Milestones and Future Plans

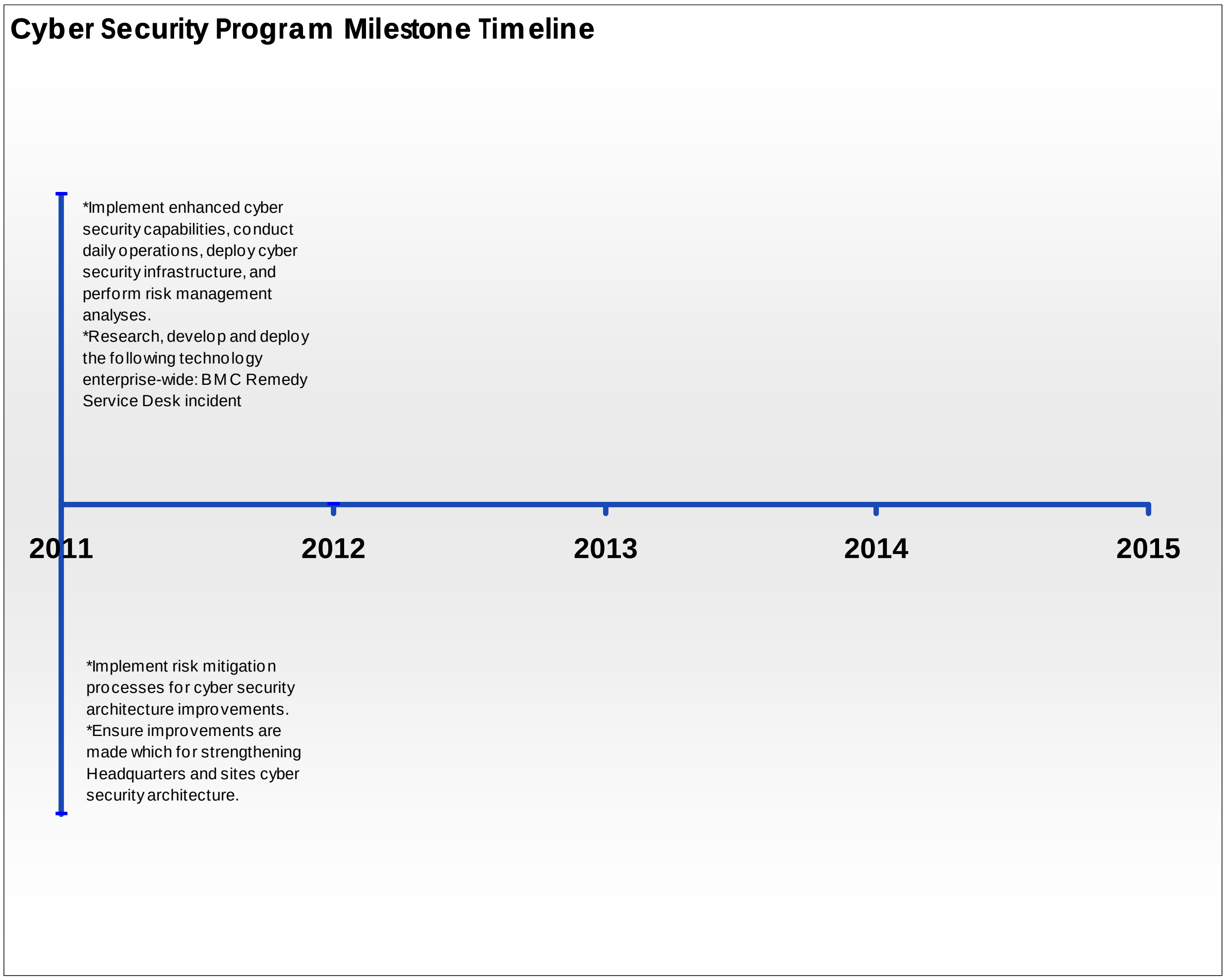

Figure A–14–2. Cyber Security Program Milestone Timeline.

With the increased prioritization of cyber security within NNSA, the program is working to develop a more robust set of performance metrics to better align the budget requirements to anticipated and demonstrated NNSA Cyber Security Program performance outcomes.

The following activities are ongoing or performed annually and do not appear on the milestone timeline above. They supplement the program goals for scheduled activities to support successful execution of the program.

- Provide leadership in the development and deployment of cyber security technologies for enhanced incident management and the reduction of insider threat capabilities.
- Support research, development, and deployment of the following technologies complex-wide: Cyber Tracer, Raytheon Oakley Systems' InnerView, Fidelis XPS, and Symantec/Vontu's Data Loss Prevention Product.
- Baseline the cyber security controls for confidentiality, integrity, and availability, and incorporate the certification and accreditation process into the cyber security architecture life-cycle model.

14.I. Funding Schedule

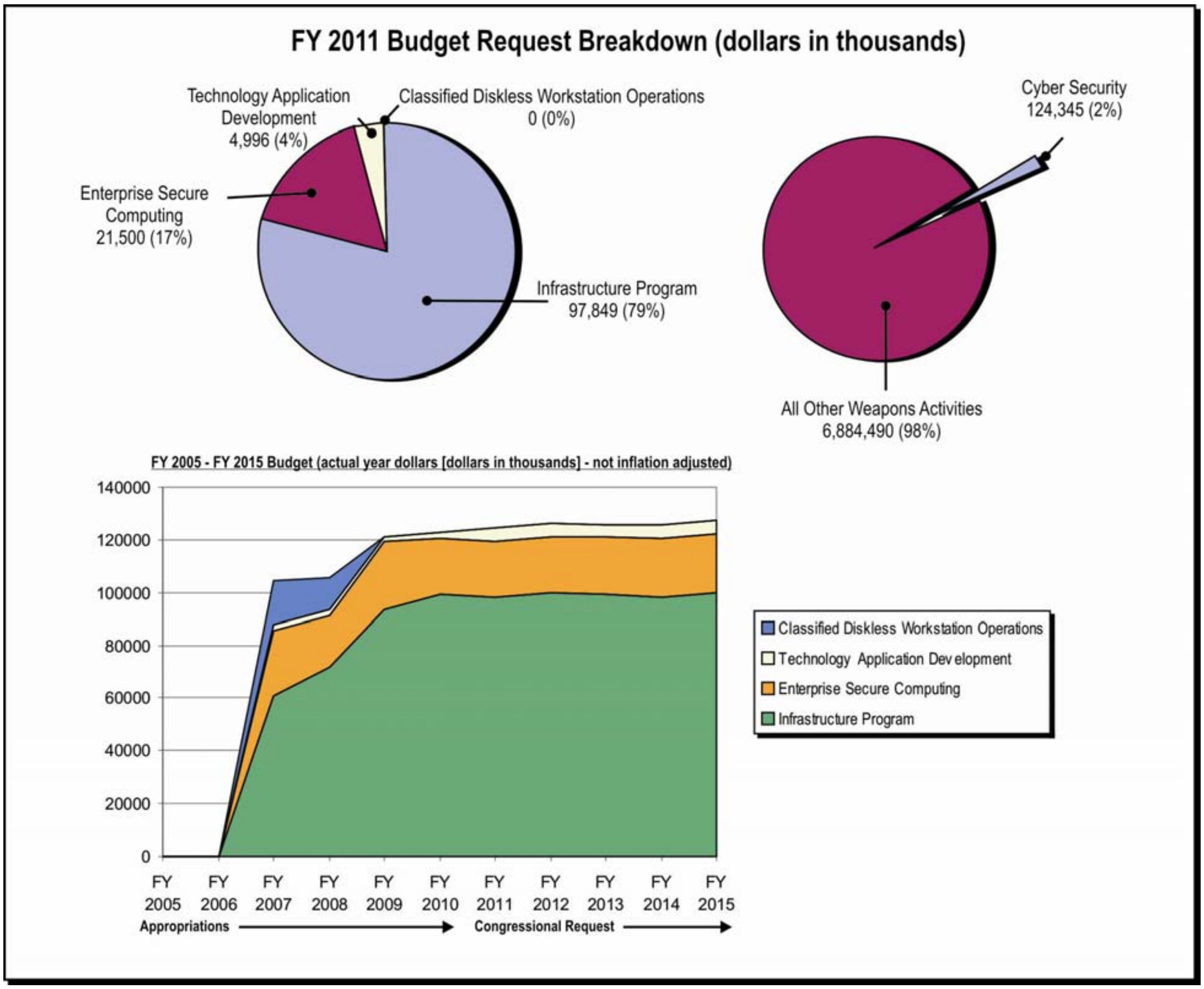

Figure A–14–3. Cyber Security Program Funding Schedule.

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Appendix A. Tabular Financial Data

Weapons Activities

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Directed Stockpile Work	1,590,152	1,505,859	1,898,379	1,900,736	1,999,470	2,240,139	2,346,254
Science Campaign	316,690	295,646	365,222	397,460	418,823	416,199	394,766
Engineering Campaign	150,000	150,000	141,920	149,737	134,996	144,920	145,739
Inertial Confinement Fusion and High Yield Campaign	436,915	457,915	481,548	480,451	457,597	470,994	484,812
Advanced Simulation and Computing Campaign	556,125	567,625	615,748	622,940	616,257	615,420	633,134
Readiness Campaign	160,620	100,000	112,092	81,697	70,747	69,854	72,584
Readiness in Technical Base and Facilities	1,674,406	1,842,870	1,848,970	1,872,546	1,841,325	1,926,568	1,997,764
Secure Transportation Asset	214,439	234,915	248,045	251,272	249,456	252,869	261,521
Nuclear Counterterrorism Incident Response	215,278	221,936	233,134	222,914	222,508	235,300	237,986
Facilities and Infrastructure Recapitalization Program	147,449	93,922	94,000	94,000	94,000	0	0
Site Stewardship	0	61,288	105,478	101,929	103,536	174,071	205,802
Environmental Projects and Operations	38,596	0	0	0	0	0	0
Defense Nuclear Security	735,208	769,044	719,954	730,944	729,609	728,925	740,649
Cyber Security	121,286	122,511	124,345	126,046	125,822	125,707	127,189
Strategic Capability Support for Broader Security Mission	30,000	0	20,000	0	0	0	0
Congressionally Directed Projects	22,836	3,000	0	0	0	0	0
Use of Prior Year Balances	0	-42,100	0	0	0	0	0
Total	6,410,000	6,384,431	7,008,835	7,032,672	7,082,146	7,400,966	7,648,200

Directed Stockpile Work

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Life Extension Programs							
B61 Life Extension Program	1,854	0	0	0	0	0	0
W76 Life Extension Program	203,189	223,196	249,463	255,000	255,000	255,000	255.000
Subtotal, Life Extension Programs	205,043	223,196	249,463	255,000	255,000	255,000	255.000
Stockpile Systems							
B61 Stockpile Systems	90,204	91,956	317,136	337,8651	394,027	437,518	512,296
W62 Stockpile Systems	1,500	0	0	0	0	0	0
W76 Stockpile Systems	63,219	56,554	64,521	56,418	58,312	55,396	54,038
W78 Stockpile Systems	40,347	48,311	85,898	104,964	156,340	346,923	345,359
W80 Stockpile Systems	30,712	27,398	34,193	31,627	34,566	35,974	36,621
B83 Stockpile Systems	26,938	33,502	39,349	37,160	38,294	42,621	42,059
W87 Stockpile Systems	40,949	48,139	62,603	67,754	64,924	51,898	50,433
W88 Stockpile Systems	43,928	51,940	45,666	61,229	65,094	69,777	68,648
Subtotal, Stockpile Systems	337,797	357,800	649,366	697,003	811,557	1,040,107	1,109,454
Weapons Dismantlement and Disposition	186,929	96,100	58,025	53,327	48,446	58,102	60,089
Stockpile Services							
Production Support	308,806	300,037	309,761	288,227	271,067	265429	274,509
Research and Development Support	35,049	37,071	38,582	35,044	34,667	35,497	36,711
Research and Development Certification and Safety	169,403	166,523	209,053	207,133	213,923	214,632	222,777
Management, Technology, and Production	192,072	183,223	193,811	202,020	196,676	198,660	205,454
Plutonium Capability	155,053	0	0	0	0	0	0
Plutonium Sustainment	0	141,909	190,318	162,982	168,134	172,712	182,260
Subtotal, Stockpile Services	860,383	828,763	941,525	895,467	884,467	886,930	921,711
Total, Directed Stockpile Work	1,590,152	1,505,859	1,898,379	1,900,736	1,999,470	2,240,139	2,346,254

Science Campaign

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Advanced Certification	19,400	19,400	76,972	104,704	129,481	129,978	98,908
Primary Assessment Technologies	80,181	80,181	85,723	86,253	85,248	84,327	87,165
Dynamic Plutonium Experiments	23,022	0	0	0	0	0	0
Dynamic Materials Properties	83,231	86,617	96,984	97,114	95,980	94,945	98,144
Advanced Radiography	28,535	28,535	23,594	27,132	26,816	26,528	27,421
Secondary Assessment Technologies	76,913	77,913	81,949	82,257	81,298	80,421	83,128
Test Readiness	5,408	0	0	0	0	0	0
Total, Science Campaign	316,690	295,646	365,222	397,460	418,823	416,199	394,766

Engineering Campaign

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Enhanced Surety	46,111	42,000	42,429	44,019	43,699	48,851	50,523
Weapons Systems Engineering Assessment Technology	16,593	18,000	13,530	16,533	15,199	19,730	20,404
Nuclear Survivability	21,100	21,000	19,786	20,627	18,550	10,334	10,687
Enhanced Surveillance	66,196	69,000	66,175	68,558	57,548	66,006	64,125
Total, Engineering Campaign	150,000	150,000	141,920	149,737	134,996	144,921	145,739

Inertial Confinement Fusion Ignition and High Yield Campaign

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Ignition	100,535	106,734	109,506	110,222	74,410	71,479	73,886
Support of Other Stockpile Programs	0	0	0	17,240	39,637	35,522	49,154
NIF Diagnostics, Cryogenics, and Experimental Support	66,201	72,252	102,649	74,104	83,878	82,921	76,117
Pulsed Power Inertial Confinement Fusion	8,652	5,000	5,000	5,000	5,000	5,000	5,000
Joint Program in High-Energy-Density Laboratory Plasmas	3,053	4,000	4,000	4,000	4,000	4,000	4,000
Facility Operations and Target Production	203,282	269,929	260,393	269,885	268,672	272,072	276,655
NIF Assembly and Installation Program	55,192	0	0	0	0	0	
Total, Inertial Confinement Fusion Ignition and High Yield Campaign	436,915	457,915	481,548	480,451	475,597	470,994	484,812

Advanced Simulation and Computing Campaign

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Integrated Codes	138,917	140,882	165,947	167,327	163,752	163,887	168,143
Physics and Engineering Models	49,284	61,189	62,798	66,541	65,019	64,626	66,438
Verification and Validation	50,184	50,882	54,781	54,168	52,879	52,300	53,835
Computational Systems and Software Environment	156,733	159,022	175,833	175,833	175,833	175,833	180,912
Facility Operations and User Support	161,007	155,650	156,389	159,071	158,774	158,774	163,806
Total, Advanced Simulation and Computing Campaign	556,125	567,625	615,748	622,940	616,257	615,420	633,134

Readiness Campaign

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Stockpile Readiness	27,869	5,746	18,941	0	0	0	0
High Explosives and Weapon Operations	8,581	4,608	3,000	0	0	0	0
Nonnuclear Readiness	32,545	12,701	21,864	0	0	0	0
Tritium Readiness	70,409	68,246	50,187	81,697	70,747	69,854	72,584
Advanced Design and Production Technologies	21,216	8,699	18,100	0	0	0	0
Total, Readiness Campaign	160,620	100,000	112,092	81,697	70,747	69,854	72,584

Readiness in Technical Base and Facilities

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Operations of Facilities	1,163,331	1,348,303	1,257,991	1,178,512	1,129,208	1,061,276	1,097,791
Program Readiness	71,626	73,021	69,309	48,492	47,998	63,541	65,713
Material Recycle and Recovery	70,334	69,542	70,429	61,678	63,973	63,386	65,554
Containers	22,696	23,392	27,992	22,043	23,100	22,971	23,757
Storage	31,951	24,708	24,333	19,535	21,425	21,942	22,693
Construction	314,468	303,904	399,016	542,286	555,921	693,452	722,256
Total, Readiness in Technical Base and Facilities	1,674,406	1,842,870	1,849,070	1,872,546	1,841,625	1,926,568	1,997,764

Secure Transportation Asset

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Operations and Equipment	127,701	138,772	149,018	149,274	144,398	144,660	150,066
Program Direction	86,738	96,143	99,027	101,998	105,058	108,209	111,455
Total, Secure Transportation Asset	214,439	234,915	248,045	251,272	249,456	252,869	261,521

Nuclear Counterterrorism Incident Response

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Emergency Response	132,918	139,048	134,092	137,715	138,359	139,504	141,107
National Technical Nuclear Forensics	12,557	10,217	11,698	11,589	11,694	11,577	11,828
Emergency Management	7,428	7,726	7,494	7,129	6,629	6,505	6,694
Operations Support	8,207	8,536	8,675	8,691	8,799	8,749	9,000
International Emergency Management and Cooperation	4,515	7,181	7,139	7,129	7,139	7,032	7,275
Nuclear Counterterrorism	49,653	49,228	64,036	50,661	49,888	61,933	62,082
Total, Nuclear Counterterrorism Incident Response	215,278	221,936	233,134	222,914	222,508	235,300	237,986

Facilities and Infrastructure Recapitalization Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Recapitalization	69,226	69,377	79,600	79,600	86,600	0	0
Facility Disposition	0	5,600	5,000	5,000	5,000	0	0
Infrastructure Planning	10,324	8,982	9,400	9,400	2,400	0	0
Construction	67,899	9,963	0	0	0	0	0
Total, Facilities and Infrastructure Recapitalization Program	147,449	93,922	94,000	94,000	94,000	0	0

Site Stewardship

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Operations and Maintenance	0	61,288	90,478	101,929	103,536	174,071	205,802
Construction	0	0	15,000	0	0	0	0
Total, Site Stewardship	0	61,288	105,478	101,929	103,536	174,071	205,802

Environmental Projects and Operations

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Long-Term Stewardship	38,596	0	0	0	0	0	0
Total, Site Stewardship	38596	0	0	0	0	0	0

Defense Nuclear Security

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Protective Forces	418,694	453,000	414,166	422,221	414,432	414,617	421,346
Physical Security Systems	77,245	74,000	73,794	71,405	73,987	71,165	72,297
Transportation	420	0	0	0	0	0	
Information Security	25,880	25,300	25,943	26,202	26,464	26,729	26,996
Personnel Security	31,263	30,600	30,913	31,222	31,534	31,849	32,167
Materials Control and Accountability	35,929	35,200	35,602	35,958	36,318	36,681	37,048
Program Management	71,364	83,944	80,311	80,924	82,239	83,186	83,887
Technology Deployment, Physical Security	9,431	8,000	7,225	7,297	7,370	7,444	7,518
Graded Security Protection Policy (formerly DBT)	19,284	10,000	0	0	0	0	0
Construction	45,698	49,000	52,000	55,715	57,265	57,254	59,390
Total, Defense Nuclear Security	735,208	769,044	719,954	730,944	729,609	728,925	740,649

Cyber Security

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Infrastructure Program	93,776	99,011	97,849	99,550	99,326	98,211	99,693
Enterprise Secure Computing	25,500	21,500	21,500	21,500	21,500	22,500	22,500
Technology Application Development	2,010	2,000	4,996	4,996	4,996	4,996	4,996
Total, Cyber Security	121,286	122,511	124,345	126,046	125,822	125,707	127,189

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Appendix B. List of Acronyms

A

AAIE	Associate Administrator for Infrastructure and Environment
ABLE	Argonne, Berkeley, and Livermore Exascale
ACES	Alliance for Computing at the Extreme Scale
ACREM	Accountable Classified Removable Electronic Media
ADAPT	Advanced Design and Production Technologies
ALCM	Air Launched Cruise Missile
Alt	Alteration
ARMAG	Armored Magazine
ARS	Acoustic Resonance Spectroscopy
ASCR	Advanced Simulation and Computing Research

B

BTA	Building Technology Associates, Inc.
B&W	Babcock and Wilcox

C

CALFEX	Combined Arms Live Fire Exercise
CAS	Contractor Assurance System
CASTLE	Collaborative Authorization for Safety-basis Total Lifecycle Environment
CDI	Classified Document Initiative
CMR	Chemistry and Metallurgy Research Facility
CMRR	Chemistry and Metallurgy Research Replacement Facility
CMS	Case Management System
CNIA	Critical National Infrastructure Authority
CSA	Canned Subassembly
CSSE	Computational Systems and Software Environment

D

DARHT	Dual-Axis Radiographic Hydrodynamic Test Facility
DBT	Design Basis Threat
DNS	Defense Nuclear Security
DoD	Department of Defense
DOE	Department of Energy
DOF	Degrees of Freedom
D&P	Development and Production
DSW	Directed Stockpile Work
DT	Deuterium-tritium
DTRA	Defense Threat Reduction Agency
DU	Depleted Uranium

E

EM	Office of Environment Management
EMIP	Energy Modernization and Investment Program
EO	Executive Order
EPA	Environmental Protection Agency
EPO	Environmental Projects and Operations
EU	Enriched Uranium
ESD	Environmental Sensing Device
ES&H	Environmental Safety and Health
ESN	Enhanced Secure Network
ESS	Enhanced Surety Subprogram
ESV	Enhanced Surveillance

F

FBI	Federal Bureau of Investigations
FCI	Facility Condition Index
FEMA	Federal Emergency Management Agency
FIRP	Facilities and Infrastructure Recapitalization Program
FMP	Functional Management Plan
FOCI	Foreign Ownership, Control or Influence
FOUS	Facility Operations and User Support
FPU	First Production Unit
FY	Fiscal Year
FYNSP	Future Years Nuclear Security Program

G

gsf	Gross Square Feet
GSP-IAV	Graded Security Protection Implementation Assistance Visit

H

HED	High Energy Density
HEDP	High Energy Density Physics
HEU	Highly Enriched Uranium
HEUMF	Highly Enriched Uranium Materials Facility
HEWO	High Explosives and Weapon Operations
HPC	High Performance Computing
HRO	High Reliability Organization
HSPD	Homeland Security Presidential Directive
HSS	Office of Health, Safety, and Security

I

IAA	International Architectures and Algorithms
IBM	International Business Machines
IC	Integrated Codes
ICBM	Intercontinental Ballistic Missile
ICF	Inertial Confinement Fusion
IRTPA	Intelligence Reform and Terrorism Prevention Act

J

JASPER	Joint Actinide Shock Physics Experimental Research Facility

K

KCP	Kansas City Plant
KCRIMS	Kansas City Responsive Infrastructure Manufacturing and Sourcing
KrF	Krypton Fluoride

L

LAC	Lightning Arrestor Components
LANL	Los Alamos National Laboratory
LEP	Life Extension Program
LEU	Low Enriched Uranium
LLC	Limited Liability Component
LLE	Laboratory for Laser Energetics

LLNL	Lawrence Livermore National Laboratory
LTS	Long-Term Stewardship
LSO	Livermore Site Office

M

M	Million
MagLIF	Magnetized Liner Inertial Fusion
MC&A	Materials Control and Accountability
Mod	Modification
MOU	Memorandum of Understanding
MPS	Multi-Point Safety
MTE	Major Technical Effort
MTP	Management, Technology, and Production

N

NATO	North Atlantic Treaty Organization
NCT	Nuclear Counterterrorism
NCTIR	Nuclear Counterterrorism Incident Response
NEP	Nuclear Explosive Package
NIC	National Ignition Campaign
NIF	National Ignition Facility
NMR	Nuclear Magnetic Resonance
NMSSUP	Nuclear Materials Safeguards & Security Upgrades Project
NNC	Nonnuclear Component
NNR	Nonnuclear Readiness
NNSA	National Nuclear Security Administration
NPR	Nuclear Posture Review
NSE	Nuclear Security Enterprise
NRC	Nuclear Regulatory Commission
NSO	Nevada Site Office
NSPD	National Security Presidential Directive
NTS	Nevada Test Site
NWBS	National Work Breakdown Structure
NWE	Nuclear Weapon Effects
NWSP	Nuclear Weapons Stockpile Plan

O

OCEM	Office of Engineering and Construction Management
OMEGA EP	OMEGA Extended Performance
OPM	Office of Personnel Management
OPSEC	Operations Security
ORNL	Oak Ridge National Laboratory

P

P&PD	Production and Planning Directive
PBX	Plastic Bonded Explosive
PCD	Program Control Document
PCF	Predictive Capability Framework
PEM	Physics and Engineering Models
PEPS	Performance Evaluation Process System
PF	Protective Force
PMM	Program Management Manual
PSD	Personnel Security Department

Q

QASPR	Qualification Alternatives to the Sandia Pulse Reactor
QER	Qualified Engineering Release
QMU	Quantification of Margins and Uncertainties

R

R&D	Research and Development
RAMP	Roof Asset Management Program
RDD	Radiological Dispersal Device
REV	Revision
RF	Russian Federation
RLUOB	Radiological Utility/Office Building
RMI	Requirements Modernization Integration
ROD	Record of Decision
RTBF	Readiness in Technical Base and Facilities
RV/RB	Re-entry Vehicles/Re-entry Bodies

S

SARP	Safety Analysis Report for Packages
SERF	Sanitary Effluent Reclamation Facility

SCIDAC	Science Discovery Through Advanced Computing
SDRT	Scenario Development Review Team
SFI	Significant Finding Investigation
SGT	Safeguards Transporter
SIP	Security Improvement Project
SIRP	Security Incident Response Plan
SLBM	Submarine Launched Ballistic Missile
SLC	Security Leadership Coalition
SNL	Sandia National Laboratories
SNM	Special nuclear material
SPO	Security Police Officer
SR	Stockpile Readiness
SRD	Secret Restricted Data
SRNL	Savannah River National Laboratory
S&S	Safeguards and Security
SSIMS	Safeguards and Security Information Management System
SRS	Savannah River Site
SSP	Stockpile Stewardship Plan
ST&E	Scientific, Technological, and Engineering
STA	Secure Transportation Asset

T

TDIC	Technology Development and Integration
TLAM-N	Tomahawk Land Attack Missile - Nuclear
TLCC	Tri-lab Linux Capacity Clusters
TPBAR	Tritium Producing Burnable Absorber Rod
TQP	Technical Qualification Program
TRL	Technology Readiness Level
TSCM	Technical Surveillance Countermeasures

U

UAE	United Arab Emirates
U.K.	United Kingdom
UPF	Uranium Processing Facility
U.S.	United States
UQ	Uncertainty Quantification

V

VA	Vulnerability Assessment
V&V	Verification and Validation
VTR	Vault-Type Room

W

WDD	Weapons Dismantlement and Disposition
WIPP	Waste Isolation Pilot Plant
WSEAT	Weapons Systems Engineering Assessment Technology
WSI	Wackenhut Services, Inc.

Z

ZBSR	Zero-Based Security Review

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United States Active Nuclear Weapons Stockpile

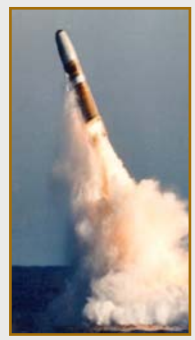
Bomb	Weapon System	Laboratories	Mission	Military Service
B61-3/4	F-15, F-16, and certified NATO aircraft	Los Alamos/ Sandia	Air to Surface	Air Force
B61-7	B-52H and B-2A	Los Alamos/ Sandia	Air to Surface	Air Force
B61-11	B-2A	Los Alamos/ Sandia	Air to Surface	Air Force


B61


W62/W78/W87

Warhead	Weapon System	Laboratories	Mission	Military Service
W62-0	Minuteman III ICBM	Livermore/ Sandia	Surface to Surface	Air Force
W78-0	Minuteman III ICBM	Los Alamos/ Sandia	Surface to Surface	Air Force
W87-0	Minuteman III ICBM	Livermore/ Sandia	Surface to Surface	Air Force

Warhead	Weapon System	Laboratories	Mission	Military Service
W76-0/1	D5 Missile, Trident Submarine	Los Alamos/ Sandia	Underwater to Surface	Navy
W88-0	D5 Missile, Trident Submarine	Los Alamos/ Sandia	Underwater to Surface	Navy


W76/W88


B83

Bomb	Weapon System	Laboratories	Mission	Military Service
B83-1	B-52H and B-2A	Livermore/ Sandia	Air to Surface	Air Force

Warhead	Weapon System	Laboratories	Mission	Military Service
W80-0	TLAM-N, Attack Submarine	Livermore/ Sandia	Underwater to Surface	Navy
W80-1	ALCM/B-52	Livermore/ Sandia	Air to Surface	Air Force