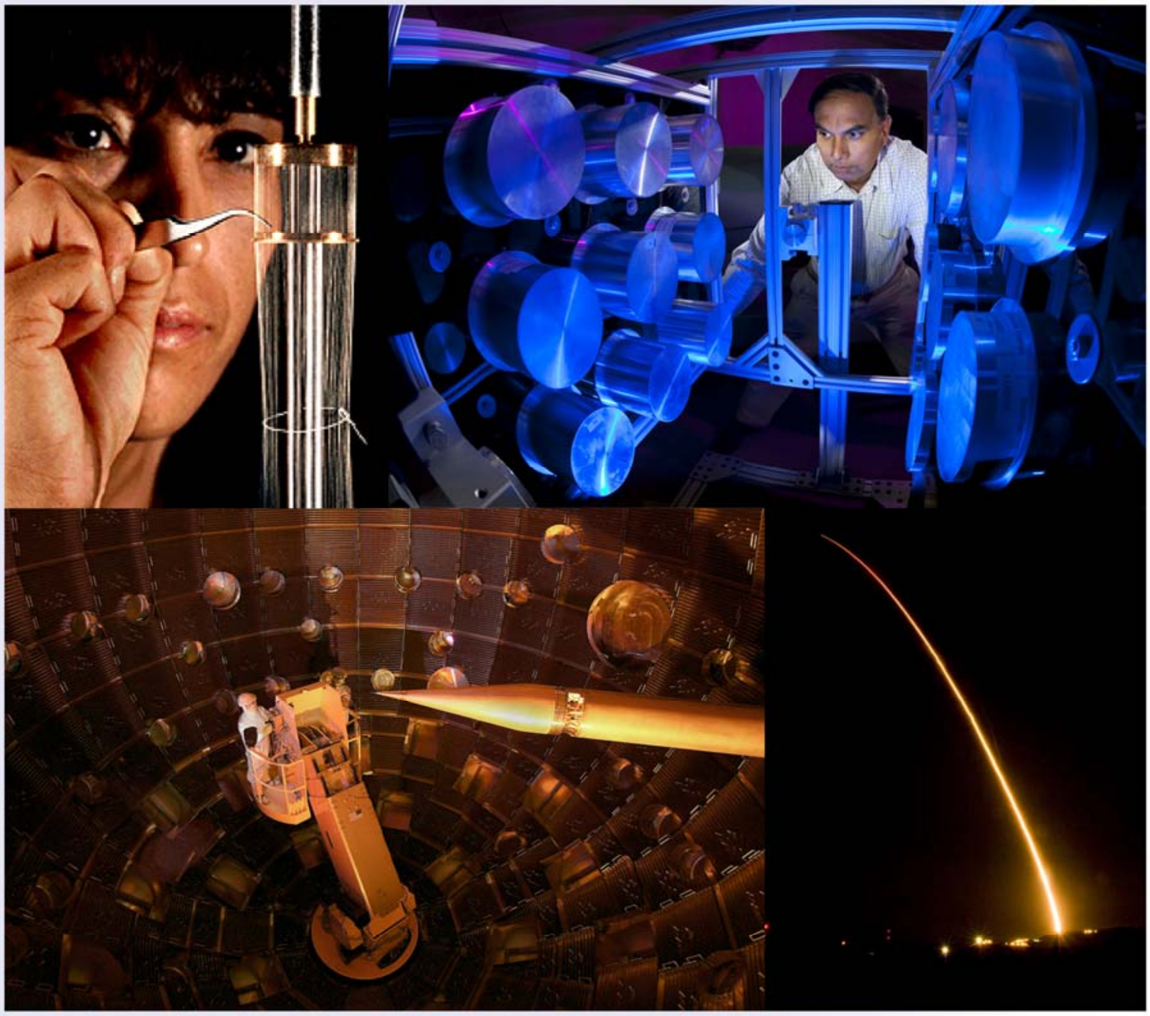
Fiscal Years 2010 - 2014

Supplement to the Stockpile Stewardship Plan



December 2009

National Nuclear Security Administration
Office of Defense Programs
1000 Independence Avenue, SW
Washington, D.C. 20585

"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 Barak Obama

April 5, 2009 – Prague, Czech Republic

"...the U.S. nuclear posture must evolve from its Cold War framework to its role as one component of a comprehensive strategy that integrates...nuclear deterrence, nonproliferation, arms control and disarmament, nuclear materials control, and nuclear counterterrorism—in seeking to reduce nuclear threats worldwide....In a sense, our job is much more than stockpile stewardship; it is the stewardship of a science & technology base that can respond to a broad array of nuclear security concerns.

...we must [continue to] *strengthen the science & technology base, restore and modernize key R&D and production capabilities and replace aging and unsupportable production facilities that do not meet modern safety standards."*

Thomas P. D'Agostino
DOE Undersecretary for Nuclear Security

June 23, 2009 – McLean, VA – "*Nuclear Arms Control – America at a Crossroads*" Conference

"Defense Programs performs a vital mission and is a true national asset. Our job cannot be done unless our core program is adequately supported through fiscal year 2014:

- *to maintain the stockpile as the President and the nation demand,*
- *to sustain our infrastructure capabilities, especially those addressing plutonium and highly enriched uranium – needed not just for the stockpile but also for a myriad of national needs, and finally*
- *to support fully our ST&E foundations upon which so much of our nuclear security rests."*

Brigadier General Garrett Harencak
NNSA Principal Assistant Deputy Administrator for Military Application

Preface

About the Stockpile Stewardship Plan: History and Purpose

The purpose of the Stockpile Stewardship Program is to preserve the nation's nuclear stockpile in a safe, secure, and effective manner without a need for underground testing. Current statute (Section 4203 of the Atomic Energy Defense Act, 50 U.S. Code Section 2523) requires that: "The Secretary of Energy shall develop and annually update a plan for maintaining the nuclear weapons stockpile. The plan shall cover stockpile stewardship, stockpile management, and program direction." This document originated in February 1996 and has been submitted to Congress every year since 1998. It has come to be known as the Stockpile Stewardship Plan (SSP) and is commonly referred to as "the Greenbook."

The National Nuclear Security Administration (NNSA — the entity responsible for authoring the plan) originally intended to publish the document in two parts. The first part would have been an unclassified publication with wide distribution. Its purpose was to describe the Stockpile Stewardship Program in detail, make available relevant information to supplement the budget request submitted by the President to the Congress in May 2009 for NNSA's Weapons Activities, and describe the overall NNSA nuclear security enterprise with particular emphasis on the portions of the enterprise that pertain to the stewardship endeavor.

The second part, referred to as the SSP-Annex, was to be a more concise companion document containing classified (Secret-Restricted Data), with a correspondingly limited distribution. The intention was to consolidate in the Annex detailed responses to the questions posed by the United States Congress regarding the status of the nuclear weapons stockpile, and the approaches used for assessing that stockpile in accordance with the elements set forth in U.S. Code Title 50, Chapter 42, Sections 2522 and 2523.

The classified FY 2010-2014 Stockpile Stewardship Plan-Annex was, indeed, completed on schedule and delivered to Congress in May 2009 fully satisfying statutory requirements. However, several factors produced significant delays for the publication of the unclassified part of the plan. Because the President's FY 2010 budget submittal to Congress did not occur until May 2009, instead of the normal February timeframe; additional transition year issues and changes had to be addressed by each of the Weapons Activities; and extensive document reformatting and reviews were necessary; the unclassified Stockpile Stewardship Plan fell considerably behind schedule. Therefore, to avoid confusion with the FY 2011 budget submittal process with a late release of the document in December 2009, NNSA decided to not publish the unclassified portion of the SSP as initially planned. Instead, the document is now being released for reference purposes only under the modified title of: "FY 2010–2014 Supplement to the Stockpile Stewardship Plan" under the auspices of NNSA Office of Military Application. The classified FY 2010–2014 SSP-Annex now stands as the sole and complete submittal to Congress by the Department of Energy for the FY 2010 budget cycle.

ORGANIZATION OF THE FY 2010–2014 SUPPLEMENT TO THE STOCKPILE STEWARDSHIP PLAN

The ***Introduction*** discusses the NNSA mission, strategies, and resulting commitments, especially as they relate to Stockpile Stewardship. ***Chapter 1, The Enterprise and the Stockpile Stewardship Endeavor***, describes the portion of the NNSA nuclear security enterprise that produces the hardware, services, and technical assessment products that constitute the output of the Stockpile Stewardship program. It explains how the stewardship endeavor is organized into Weapons Activities and how these activities implement higher level strategies in a manner that interlinks the various efforts. A summary of recent stewardship accomplishments is provided, and the current status of personnel, funds, and other enterprise metrics is covered. Upcoming challenges and approaches for confronting these challenges are also discussed.

Chapters 2 through ***14*** describe the NNSA Weapons Activities in detail. These chapters discuss the specific activity's mission; an overview of the effort; near and long term goals; strategies for meeting these goals; and issues and risks associated with the activity. Thirteen Weapons Activities (of which the first eight constitute the NNSA Defense Programs) are covered in chapters:

#2) Directed Stockpile Work,

#3) Science Campaign,

#4) Engineering Campaign,

#5) Inertial Confinement Fusion Ignition and High Yield Campaign,

#6) Advanced Simulation and Computing Campaign,

#7) Readiness Campaign,

#8) Readiness in Technical Base and Facilities,

#9) Secure Transportation Asset,

#10) Nuclear Counterterrorism Incident Response,

#11) Facilities Infrastructure and Recapitalization,

#12) Site Stewardship,

#13) Defense Nuclear Security, and

#14) Cyber Security.

Appendix A, titled ***"Funding Schedules,"*** provides financial data for the Stockpile Stewardship Weapons Activities in tabular form.

In 2005, at the direction of Congress, the NNSA reevaluated and updated the criteria that are applied by its science, technology, and engineering tools and capabilities to assure the continuing safety and reliability of the U.S. nuclear deterrent. The review was published as a companion volume to the annual update of the Stockpile Stewardship Plan for FY 2006-2010. This Volume II, "Report on Criteria for Stockpile Stewardship Tools," explained the scientific and engineering criteria applied in the weapons assessment process, explained the critical role that expert judgment plays in conclusions about weapon safety and reliability, and provided a summary of the assessment tools employed. Much of the comprehensive information in that publication remains applicable and correct, so a new update is not warranted at this time. However, some of the content has changed and this new information is provided in this year's SSP-Annex as well as in the content distributed throughout the chapters covering the appropriate FY 2010-2014 SSP elements (Chapters 2 – 14 of the supplement).

What's New

The blue background sections found throughout this document attempt to highlight major accomplishments, significant programmatic changes, and/or important issues arisen since the Stockpile Stewardship Plan was published in May 2008. It is hoped that the blue sections will allow a cursory reader of the document to rapidly obtain an overview of important recent developments in the Stockpile Stewardship Program without a need to read the document in its entirety. As far as the publication itself is concerned, notable changes in format and approach to the document's organization involve:

1) The Supplement to the Stockpile Stewardship Plan is an entirely unclassified document. On the other hand, the FY 2010–2014 Stockpile Stewardship Plan—Annex, which directly responds to specific questions posed by the U.S. Congress regarding the Stockpile Stewardship Program, is a classified (Secret-Restricted Data) document because of the details necessary to answer the queries. The consolidation of all classified details in this Annex enables a major portion of the information available in previous SSP's to now be made available in form of this unclassified supplement.

2) An overview section has been included in the supplement (Chapter 1, ***The Enterprise and the Stockpile Stewardship Endeavor*)**. It describes the portion of the NNSA nuclear security enterprise that executes the Stockpile Stewardship program and summarizes the direction, management, and operation of this endeavor. This is a new feature, not provided in earlier SSP's.

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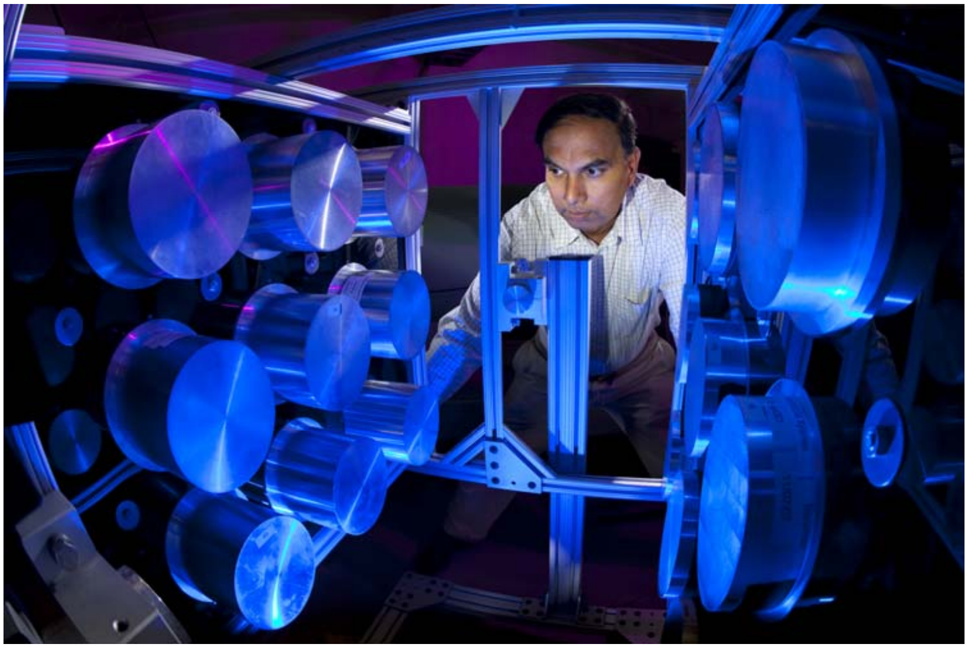
Introduction

National Nuclear Security Administration's Mission

The mission of the National Nuclear Security Administration (NNSA) is to strengthen the nation's security through the military application of nuclear energy and to reduce the global threat of terrorism and weapons of mass destruction. The NNSA is the Department of Energy (DOE) entity responsible, in collaboration with the Department of Defense (DoD), for the safety, security and reliability of the nation's nuclear weapons stockpile; for maintaining the viability of its nuclear security enterprise; and for working with other federal agencies to solve a broad spectrum of national security challenges.



Neutron scatter camera to counter smugglers of radiological threats.

NNSA's mission includes the deterrence of adversaries through the maintenance of today's U.S. strategic nuclear offensive capability. In addition, NNSA provides a strong role in defending the nation with responsibilities in propulsion systems for the U.S. Navy, nuclear nonproliferation, nuclear counter-terrorism, nuclear forensics, and an ability to respond to nuclear incidents involving improvised nuclear devices or other radiological threats. NNSA's mission impels collaboration with other federal entities to confront and resolve national challenges – for example: achieve greater reductions in the number of nuclear weapons throughout the world; conceive and emplace a secure national infrastructure; reduce American dependence on foreign supplies of energy; or assess and develop technological solutions that mitigate threats from chemical or biological attacks. The Stockpile Stewardship Program, the subject of this document, is clearly focused on the strategic deterrence aspects of the NNSA mission, but also informs and supports many other aspects of national security.

Of Highest Priority

Pursuant to this NNSA mission, in the areas pertinent to Stockpile Stewardship, the highest of present priorities are:

1) Ensure at all times a safe, secure, and effective nuclear weapons stockpile as directed by our national leadership, regardless of the size of the stockpile that might result under a follow-on Strategic Arms Reduction Treaty.
2) Energized by a vision of fewer nuclear weapons and a smaller, safer nuclear weapons endeavor, correctly size and evolve the nuclear security enterprise to effectively and efficiently meet today's and tomorrow's mission requirements.
3) Sustain the critical scientific, technological, and engineering capabilities (both human capital and technical facilities) necessary for our nation's nuclear security, no matter the size of the nation's nuclear stockpile deterrent.

Joint NNSA/DoD Minuteman-III missile flight test with denuclearized Mk21/W87 test warhead.

STOCKPILE STEWARDSHIP PROGRAM

The DOE/NNSA Stockpile Stewardship Program was established by a Presidential Decision directive and authorized[1] by Congress in October, 1993. Its purpose is to sustain the safety and reliability of the nation's nuclear arsenal without returning to the use of nuclear testing. Since its inception and to the present day, the stewardship endeavor has succeeded remarkably in accomplishing its intended purpose — but it now faces multiple challenges. Its successes, however, provide a resilient foundation from which the ongoing transition of the stockpile from its Cold War Era to a smaller, safer, and more secure stockpile of the future can be managed and impediments overcome.

[1] Presidential Decision Directive 15 (05 October 1993) and National Defense Authorization Act for Fiscal Year 1994 (P.L. 103-160, Section 3138)

The U.S. Congress funds the work of the NNSA mission through three appropriations categories:

A) Weapons Activities
B) Defense Nuclear Nonproliferation, and
C) Naval Reactors.

The Stockpile Stewardship Program work is presently organized into the first category. And it is to these thirteen Weapons Activities that the Stockpile Stewardship Plan principally addresses itself.

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

NNSA's Nuclear Security Enterprise

The NNSA nuclear security enterprise delivers the products necessary to achieve NNSA's mission. Moreover, the enterprise needs to execute its work in a manner that is safe, secure, and respectful of the environment, while effectively managing costs. As already stated, the Stockpile Stewardship Plan and this supplement focus on the portion of the enterprise that is associated with the stewardship Weapons Activities. The products resulting from the Stockpile Stewardship endeavor involve physical items—for example: nuclear weapons systems and components; specialty subsystems that involve plutonium, highly enriched uranium, tritium (a radioactive hydrogen isotope), and energetic materials (e.g. high explosives). Stockpile Stewardship products from the enterprise additionally consist of non-physical items, such as advanced technology options for enhancing the surety of the stockpile, advanced calculational or experimental tools for strengthening the stewardship of the existing stockpile, national security services, and complex technological assessments of security challenges facing the nation.

Strategies That Drive the Security Enterprise

Strategies for achieving NNSA's mission have been formulated and are being implemented:

1. At the highest level: the *"U.S. Department of Energy Strategic Plan"* [2] generated five strategic themes, a) Energy Independence, b) Nuclear Security, c) Scientific Discovery and Innovation, d) Environmental Responsibility, and e) Management Excellence.

2. In turn, *"The National Nuclear Security Administration Strategic Plan"* [3] outlined 3 long term goals for: a) nuclear weapons stewardship, b) nuclear nonproliferation, and c) naval reactors.

3. Subsequently, the *"NNSA Defense Programs Strategic Framework"*[4], to guide the portion of the enterprise that pertains to the Stockpile Stewardship, sets forth three strategies that address: a) direct stewardship of the nuclear stockpile, b) the enterprise's business practices and approaches, and c) the broader range of national security issues to be resolved.

This latter framework expands on the national and international realities that the NNSA nuclear security enterprise faces while executing its Stockpile Stewardship responsibilities. It outlines how to overcome

[2] "U.S. Department of Energy Strategic Plan"; Published in 2006; United States Department of Energy
[3] "The National Nuclear Security Administration Strategic Plan"; Document # DOE/NA-0010; November, 2004; United States Department of Energy
[4] *"Defense Programs Strategic Framework"*; Office of Defense Programs, National Nuclear Security Administration; U.S. Department of Energy; November, 2008

these challenges while continuing to sustain and modernize the enterprise to effectively deliver what the nation will demand in the future.

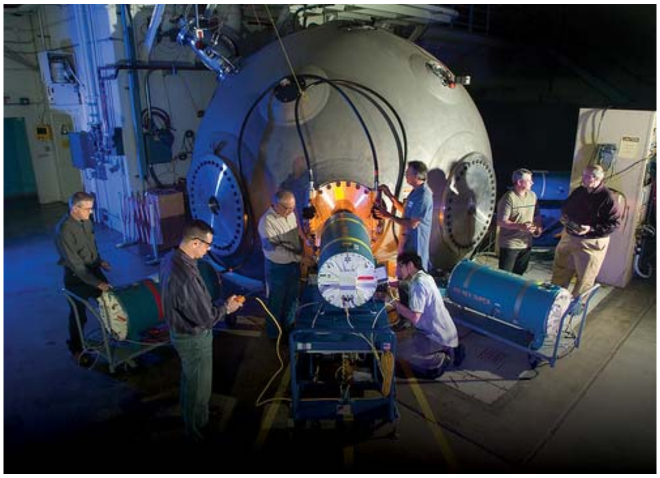
CONTEXT FOR STOCKPILE STEWARDSHIP STRATEGIES

In 2004, the United States agreed in the Treaty of Moscow, to downsize its nuclear arsenal to between 1,700 and 2,200 operationally deployed strategic warheads by 2012. Through the combined efforts of the DoD and NNSA, that reduction was achieved years ahead of schedule. Our country's national leadership will move forward from this state, and will define a future nuclear posture that provides necessary deterrence in a world that greatly differs from the global situation that existed during the Cold War era.

During his April 2009 visit to Prague (Czech Republic), President Obama outlined a vision of a world without nuclear weapons. The United States will take concrete steps toward achieving such a state by placing less emphasis on the role our nuclear stockpile plays in U.S. strategic security posture, while urging other nations to adopt similar approaches. Presidents Obama and Medvedev signed on July 6th at the Kremlin (Moscow, Russia) a framework agreement that aspires to cut the number of nuclear warheads for each nation to a maximum of 1,675 within seven years of a nuclear arms reduction treaty coming into force, and to numerically curtail each country's strategic delivery systems to between 500 and 1100.

America's deterrence policy and corresponding role of nuclear weapons in this strategy are being reviewed in the ongoing Nuclear Posture Review (NPR) — a process in which NNSA is fully engaged, providing technical and scientific advice to help inform policy decisions. Toward the end of this calendar year, NPR will help establish the size and composition of the future stockpile, and means for managing attendant geopolitical and technical risks. International negotiations over the potential follow-on Strategic Arms Reduction Treaty and the Comprehensive Test-Ban Treaty will also progress throughout the coming year. Considerable interplay will occur between all three activities and respective courses of action.

Panels of experts have recently revisited the state of our nation's strategic deterrence and provide the beginnings for a modern national dialogue on this subject. The Congressional commission on *"America's Strategic Posture"* report[5], for example, expands upon the current geopolitical security environment, the status of the U.S. nuclear stance and attendant declaratory policy, approaches to the national nuclear stockpile and nuclear enterprise, arms control and non-proliferation efforts, and many more related topics. Much of the *"NNSA Defense Programs Strategic Framework"* and the strategies and actions it engenders are in concert with the recommendations put forward by the Perry-Schlesinger panel.



High Explosives Application Facility—a national resource for explosives, pyrotechnics, and propellants research and development.

[5] *"America's Strategic Posture"*; The Final Report of the Congressional Commission on the Strategic Posture of the United States; William J. Perry, Chairman, James R. Schlesinger, Vice-Chairman; United States Institute Of Peace Press, Washington, D.C.; ISBN 978-1-60127-045-0; May, 2009

The continuing evolution of our national policy compels NNSA to contemplate and reassess many aspects of its Stockpile Stewardship Program. U.S. security demands we maintain technological superiority and be “second to none” in our nuclear capabilities. Therefore, it is essential that the NNSA nuclear security enterprise remain the preeminent scientific, engineering, and manufacturing endeavor that (a) delivers safe, secure, and effective nuclear weapons as directed by our national leadership; (b) reduces risks from external threats through a range of nuclear capabilities; (c) anticipates technical surprises that could impact the nation’s security posture; (d) provides science and engineering with a long view on national security needs; and (e) supplies knowledge, tools, and talent to collaboratively solve security challenges facing the United States and its allies. Over all, the enterprise needs to carry out this mission within a research, development, and manufacturing complex that is integrated, efficient, and cost effective.

Our national strategic deterrent and the nuclear security enterprise managed by DOE/NNSA to support that deterrent have undergone dramatic changes over the past two decades. The future now demands more change, new paths, and improved approaches — but always aligned with requirements received from the DoD and in a manner that strives to retain the intellectual excellence and key infrastructure capabilities demanded by our national interests.

Commitments to the Nation from NNSA’s Mission and Strategies

- Support the long-term goal of a world free from the threat of nuclear weapons
- Deliver and sustain a credible deterrent to our country’s potential adversaries. Allow our nation to extend this protection to our allies.
- Make available NNSA’s unique knowledge to partners in national security to collaboratively mitigate national security challenges.
- Fully engage the ongoing Nuclear Posture Review with technical and scientific inputs to inform policy decisions and enable their implementation.
- Continue to advance the knowledge of physical, chemical, and materials processes that govern nuclear weapons operations. Apply this knowledge to existing weapon systems, extending their service lifetime whenever possible, thus enabling our country’s security without the production of new fissile materials, without a need for future nuclear tests, and within the boundaries of national policy.
- Confront the long term challenges posed by the safety and reliability concerns associated with the aging of finely-tuned warheads produced in the 1970’s and 1980’s, now well past their original planned service life. Provide national solutions to this issue.
- Continue to modernize our national laboratories and production plants into a smaller more cost effective nuclear security enterprise, while enhancing the security of special nuclear materials.
- Size the enterprise based on the capability needed by the nation to meet future security needs, not on outdated manufacturing throughput capacities inherited from the Cold War era.
- Modernize the enterprise while remaining mindful of the tremendous intellectual capabilities and unique facilities that are national treasures, that support a large number of defense, security, and intelligence needs beyond the nuclear stockpile itself, and are required by the nation no matter the actual size of our country’s nuclear stockpile.

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The Enterprise and the Stockpile Stewardship Endeavor

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From Mission to Enterprise Deliverables — Now and Tomorrow

It is the intent of this section, which represents an entirely new entry in this year's Stockpile Stewardship Plan, to discuss the National Nuclear Security Administration nuclear security enterprise, especially as it pertains to the Stockpile Stewardship Program. The reader will obtain an overview background of:

- **The Enterprise.** Including ♦ its overarching mission; ♦ overall strategies for achieving this mission and facilitating integration across activities; ♦ unique technological capabilities that enable the performance of the mission and strategies; and ♦ the products supplied by these capabilities which consist of both tangible hardware and intangible security deliverables to the nation.
- **Its Current State.** Including ♦ the sites where the unique capabilities reside; ♦ the enterprise's human talent; ♦ how the endeavor is organized and integrated; ♦ recent accomplishments; ♦ funding summaries; and ♦ ongoing transformational activities.
- **Its Future State.** Including ♦ the challenges faced by the enterprise and approaches for meeting them; ♦ the strategic framework that helps address these challenges and moves the enterprise toward a desired future state; and ♦ upcoming deliverables.

Mission, Strategies, Capabilities, and Products

The National Nuclear Security Administration (NNSA) nuclear security enterprise consists of an overall mission (already discussed in the previous *Introduction* section); overarching strategies for achieving this mission; unique scientific, technological, engineering (ST&E) 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 enterprise 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 *"NNSA Defense Programs Strategic Framework,"* in concert with other high level strategic plans, is one of the venture instruments employed for illuminating the paths to be followed by the nuclear security enterprise as it thrusts forward into the 21st Century. The *Framework* was cited and summarized in the *Introduction* section of this document, and is expanded upon again below in the "Future State" portion of this overview section. By identifying strategies for the correct sustainment of the stockpile, effective enterprise-wide business practices, and approaches to address a broad scope of national security needs, the framework guides specific actions to be taken that cut across all Weapons Activities, thereby helping to integrate the overall effort.

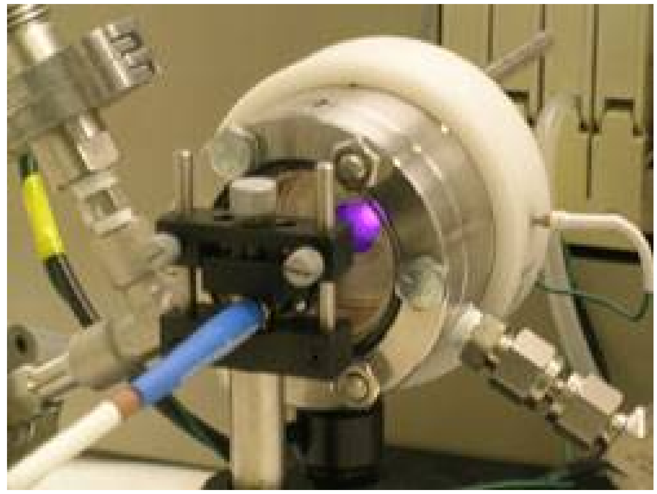

Figure 1-1. Glow discharge optical emission analysis of plutonium metal.

The research, development, and manufacturing capabilities of the enterprise create the product mix that the nation requires for its security. Entities within the enterprise refurbish the nuclear deterrent and deal with its ultimate dismantlement and consequent disposition of materials. Enterprise 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 Department of Defense (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 ST&E foundation (both human talent and physical facilities) upon which the nation's ability rests to realize and certify the existing and future nuclear deterrent. These ST&E capabilities additionally allow NNSA to engage national security issues far beyond the boundaries of the Stockpile Stewardship Program.

Stewardship challenges grow enormously when dealing with a smaller, older, and evolving stockpile. An ST&E roadmap[1] was developed and published to outline how these responsibilities are being met. It addresses three major areas:

1) Certification of Nuclear Detonation Performance and Reliability

   This includes: (a) nuclear material properties and dynamics; (b) the physics of nuclear reactions; (c) hydrodynamic flows of materials under extreme pressures and temperatures; and (d) the physics of high-energy-density plasmas.

2) Developing and Certifying 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) Deploying Technologies for the "Lifetime Warranty" 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.

[1] *"Science, Technology, and Engineering for Stockpile Stewardship (U)"*; SAND2008-7644P; NNSA Office of Defense Programs; January 2009 (Rev. 0); Originators: Drs. Gregory Simonson, Jeffrey Paisner, and James Handrock; Classified: Secret-Restricted Data

The special nuclear materials (SNM) research, manufacturing, and production elements of the enterprise 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 of the enterprise 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.

The non-nuclear component research, development, manufacturing, and assembly portions of the enterprise also are essential to the Stockpile Stewardship endeavor. A set of critical national capabilities is maintained throughout the enterprise 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 and other surety devices; and command and control systems. 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.

In areas pertinent to Stockpile Stewardship, the enterprise output routinely involves tangible items, such as nuclear weapon components, systems, and ancillary equipment. But intangible products that serve to address our nation's nuclear security in its totality are also delivered, many of which do not comprise physical hardware.

The product list is extensive— beyond the nuclear stockpile itself, its continual assessment with rigorous scientific and engineering peer reviews of its status, and investigations with attendant solutions for significant anomalies periodically uncovered in nuclear weapons—to additional deliverables. These include security processes for facilities and cyber networks; development and implementation of command & control architectures; secure transportation services; design and testing of components and systems capable of withstanding stressful environments. They involve ST&E assessments of multivariable national threats; technical advice 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; forensics associated with radiological substances; and for the sake of brevity: numerous more products not described in this section.

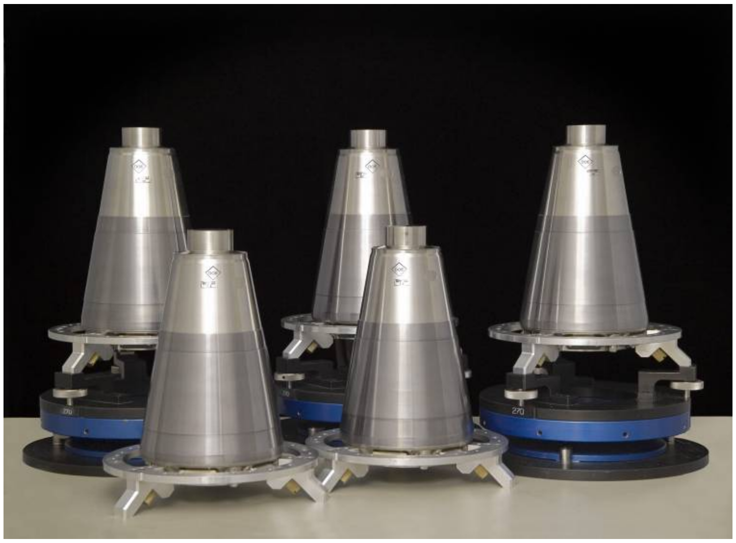

Figure 1-2. First five arming, fuzing, and firing components produced for the W76-1 Life Extension Project..

THE CURRENT STATE

Today's Sites

The unique capabilities of the Stockpile Stewardship portion of the NNSA enterprise are incorporated at three national laboratories, one national test site, and four sites dedicated to production. They are distributed throughout seven states as depicted in Figure 1-3. 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 enterprise's nuclear weapons product. These agencies also execute unique scientific and technical assessments in the interest of national security, additional significant deliverables of the enterprise. 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.

Expanded descriptions of these national assets are provided below.

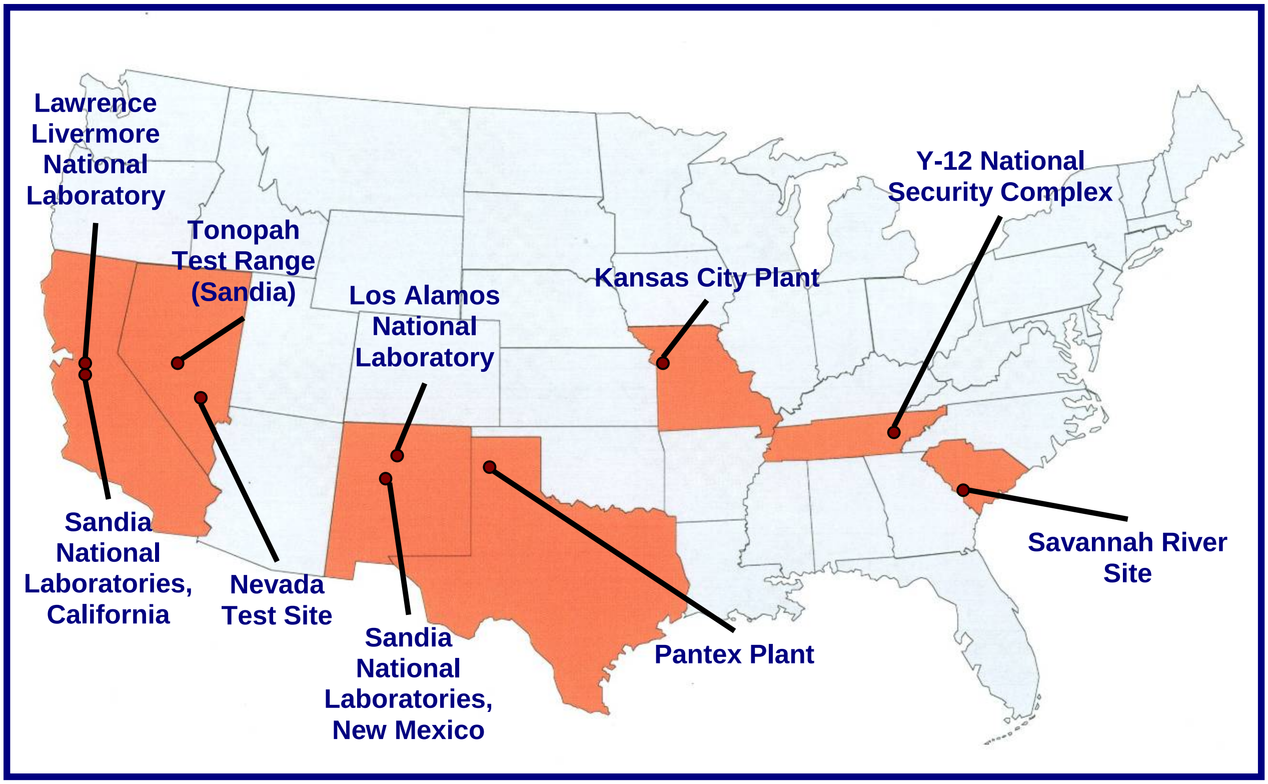

Figure 1-3. Geographic locations of NNSA Nuclear Security Enterprise major facilities.

Los Alamos National Laboratory (LANL)

Mission: Research, development, and manufacturing guidance authority for nuclear explosive packages and other nuclear weapon components (e.g. surety and gas transfer system components). Responsibilities for the performance, safety, and reliability of nuclear warheads. Support surveillance, assessments, and refurbishments of stockpile weapons. Provide unique capabilities in high performance scientific computing, neutron scattering, enhanced surveillance, radiography, plutonium science and engineering, and beryllium technology. Major participant in the annual stockpile assessment process and peer-review process.

Location: Los Alamos, New Mexico

Approximate NNSA contractor workforce: ~5,840 total employees (end of FY 2008); ~5,455 projected total (end of FY 2010); average employees on Weapons Activities throughout FY 2008: ~5,120.

Operated by: LANL is operated by the 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 research and development (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: Research, development, and manufacturing guidance authority for nuclear explosive packages and other nuclear weapon components (e.g. surety components). Responsibilities for the performance, safety, and reliability of nuclear warheads. Support surveillance, assessments, and refurbishments of stockpile weapons. Possess and employ high-energy-density physics capabilities and unique high performance scientific computing assets. Major participant in the annual stockpile assessment process and peer-review process.

Location: Livermore, California

Approximate NNSA contractor workforce: ~4,665 total employees (end of FY 2008); ~4,240 projected total (end of FY2010); average employees on Weapons Activities throughout FY 2008: ~4,350.

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, for High Explosives R&D, for High-energy-density Physics at the National Ignition Facility (NIF), and as a supercomputing platform site at the Terascale Simulation Facility.

Sandia National Laboratories (SNL)

Mission: Design authority for warhead systems engineering, integration, and quality assurance. Research, development, and production of specialized nonnuclear 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. Responsible for arming, fuzing, and firing systems; neutron generators; gas transfer systems; electronic and mechanical interfaces; safing and surety devices; power sources; aerodynamic casings and parachutes. Major participant in the annual stockpile assessment process and peer-review process.

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

Approximate NNSA contractor workforce: ~4,385 total employees (end of FY 2008); ~3,915 projected total (end of FY 2010); average employees on Weapons Activities throughout FY 2008: ~3,840.

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 (MESA) 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 enterprise manufacturer of neutron generators. The laboratories provide science-based engineering by combining fundamental science, high-performance computing, and unique experimental facilities to understand, predict, and verify warhead performance. 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, testing, 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.

Location: approximately 65 miles northwest of Las Vegas, Nevada

Approximate NNSA contractor workforce: ~2,065 total employees (end of FY 2008); ~1,540 projected total (end of FY 2010); average employees on Weapons Activities throughout FY 2008: ~1,570.

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

Additional: Capability to conduct high hazard experiments involving nuclear material and high explosives; disposition a damaged nuclear weapon or improvised nuclear device; conduct non-nuclear experiments; conduct hydrodynamic testing and high explosive testing; conduct research and training on nuclear safeguards, criticality safety, and emergency response; and maintains Category I/II quantities of SNM. NNSA envisions NTS to be the preferred site for future open air hydro testing.

Pantex Plant

B&W Pantex

Mission: Assembling high explosive, nuclear and non-nuclear components into nuclear weapons. In addition, Pantex is responsible for the fabrication of chemical high explosives 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

Approximate NNSA contractor workforce: ~3,325 total employees (end of FY 2008); ~3,295 projected total (end of FY 2010); average employees on Weapons Activities throughout FY 2008: ~3,390.

Operated by: B&W Pantex Corporation

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 (SRS) 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. Conductance of HEU R&D activities.

Location: Bear Creek Valley near Oak Ridge, Tennessee

Approximate NNSA contractor workforce: ~4,620 total employees (end of FY 2008); ~4,500 projected total (end of FY 2010); average employees on Weapons Activities throughout FY 2008: ~3,790 (this latter figure does not include ~550 security guards employed by Wackenhut Services, Inc.).

Operated by: B&W Technical Services, LLC

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

Approximate NNSA contractor workforce: ~2,190 total employees (end of FY 2008); ~1,810 projected total (end of FY 2010); average employees on Weapons Activities throughout FY 2008: ~1,960.

Operated by: Honeywell Federal Manufacturing and Technologies

Additional: KCP specializes in manufacturing and procurement processes and is responsible for the evaluation and testing of nonnuclear 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 Nuclear Nonproliferation program (not a Weapons Activities), construct and operate the Mixed Oxide (MOX) Fuel Fabrication Facility for the disposition of plutonium.

Location: Aiken, South Carolina

Approximate NNSA contractor workforce: ~1,535 total employees (end of FY 2008); ~1,570 projected total (end of FY 2010); average employees on Weapons Activities throughout FY 2008: ~1,220.

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.

The Human Talent

NNSA's nuclear security enterprise presently involves a workforce of approximately 2,700 federal employees and 30,900 contractor personnel, for an approximate total of 33,600 individuals, many of who are engaged in work other than Weapons Activities. The academic background of this workforce with heavy technical or business/program-management orientation varies greatly across the enterprise. To illustrate, one of the NNSA national laboratories having a total workforce of approximately 11,200 individuals (one-third of which work on Weapons Activities), with 8,400 categorized as regular employees, recently assessed its human resources in FY 2008. Approximately 3,844 or 46 percent of regular employees constitute this laboratory's technical staff — approximately 50 percent of which are engineers, 18 percent have a computational sciences or mathematics background, 10 percent have degrees in physics or chemistry, and the remaining 21 percent represent other sciences or related disciplines. Other national laboratories derive a larger fraction of their technical staff from physicists and chemists, and less from the engineering ranks. The technical workforce at production agencies, on the other hand, is derived primarily from engineering fields. Correspondingly, approximately 31 percent of the cited federal workforce has an engineering or science degree; 11 percent has a business, program-management, or information-technologies background; and 5 percent come from a finance or accounting discipline.

Our nation's ability to not only sustain its nuclear deterrent today, but to respond to tomorrow's foreseeable or unforeseeable developments in areas of nuclear security is entirely dependent on this human talent and the critical skills it can bring to bear on national problems and challenges. The recruitment, hiring, retention, and the exercising-of-skills of this body of talent have been major concerns for over a decade. How to monitor the state-of-health of such critical capabilities and their intrinsic readiness or responsiveness levels will continue to test the enterprise as it confronts present and future demands. Internal assessments, as well as external reviews have been conducted on the issue of critical skills (e.g. by the *Commission on Maintaining United States Nuclear Weapons Expertise* [2]; and by the *Defense Science Board Task Force on Nuclear Deterrence Skills*[3]). Deficiencies have been articulated and catalogued, and potential remedies have been proposed. Notable concerns include the aging demographics of the workforce, loss of knowledge from the active underground testing days no longer available to today's generation of scientists, and a significantly reduced level of major design and development projects to exercise and invigorate technical skills throughout the enterprise. A sustained effort is now clearly necessary to ensure successful retention of these capabilities.

[2] *"Commission On Maintaining United States Nuclear Weapons Expertise"*; Report to the Congress and Secretary of Energy pursuant to the National Defense Authorization Acts of 1997 and 1998; March 1, 1999; Dr. Robert B. Barker, Commissioner and Admiral H.G. Chiles, Jr. USN (Retired), Chairman

[3] Report of the Defense Science Board Task Force on *Nuclear Deterrence Skills*; September, 2008; Office of the Under Secretary of Defense For Acquisition, Technology, and Logistics; Washington, D.C. 20301-3140

Organization and Integration of the Enterprise's Work

The Stockpile Stewardship endeavor has been organized into Weapons Activities involving thirteen programs or campaigns as depicted in Figure 1-4. These activities provide the products required by the Stockpile Stewardship Plan: nuclear weapons and ancillary equipment; technical assessments and reviews; necessary alterations and refurbishments; secure processes and security services; enabling facilities, transportation, and protective environmental services; plus engagement in broad national issues that go beyond the nuclear stockpile and produce solutions for the country to a myriad of challenges.

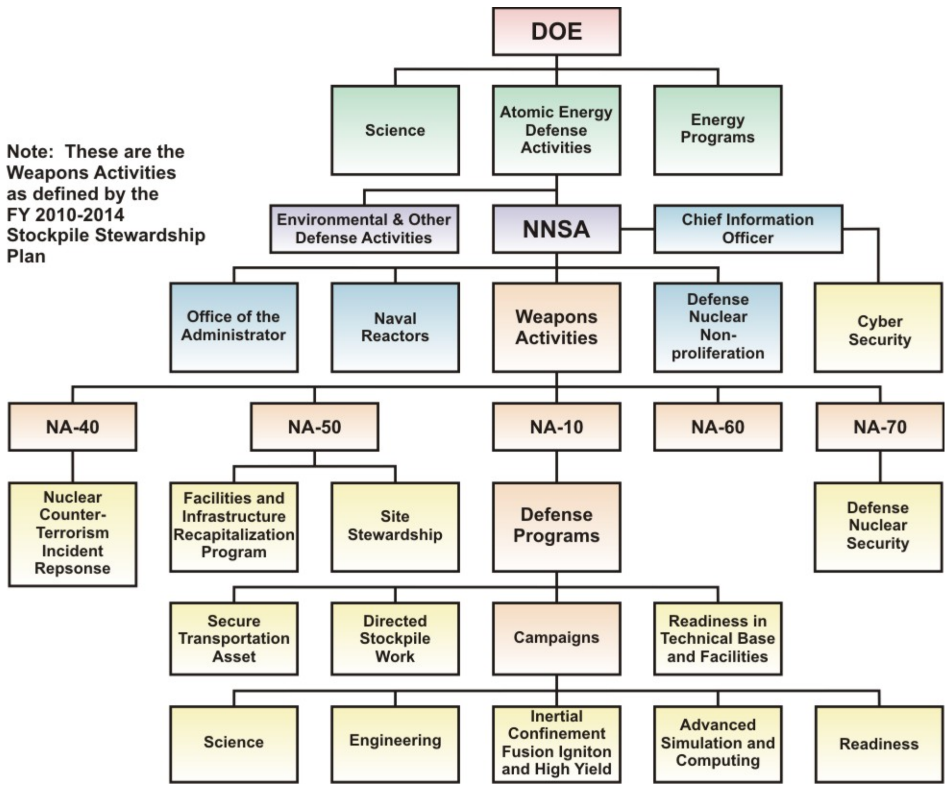

Figure 1-4. The DOE/NNSA Organization for the thirteen programs within Weapons Activities that execute the Stockpile Stewardship Program.

The thirteen separate, yet interlinked elements (of which the first eight are commonly categorized as the *"NNSA Defense Programs"*) constitute the Weapons Activities effort:

Directed Stockpile Work (DSW) **(Chapter 2)** maintains and extends the service life of the stockpile. Subprograms deal with the execution of life extension activities, the sustainment of present stockpile systems, refurbishment warhead studies, weapons dismantlement and disposition, and other necessary services to support the stockpile.

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 seven sub activities: Advanced Certification campaign, primary assessment technologies, dynamic plutonium experiments, 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 Campaign (ASC) **(Chapter 6)** provides the computational science and simulation tools to understand behaviors and effects of nuclear weapons, as well as national security scenarios.

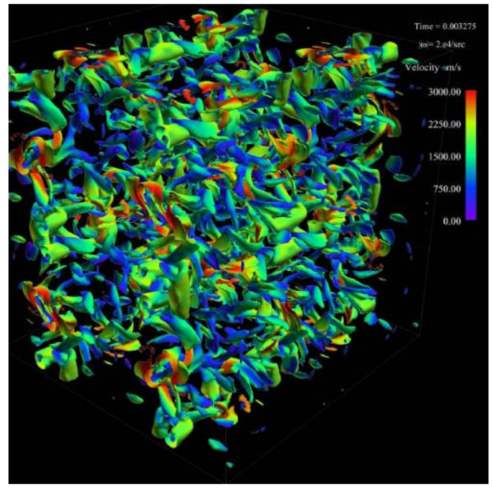

Figure 1-5. RAMSES numerical code used to simulate the penetration and production of X-rays and electrons inside weapon systems.

Readiness Campaign **(Chapter 7)** 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.

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 by NNSA's nuclear security enterprise.

Secure Transportation Asset Program **(Chapter 9)** ensures that all critical shipments for the weapons complex and military installations are completed safely, securely, and without unacceptable compromises or loss.

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

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

Facilities and Infrastructure Recapitalization Program (FIRP) **(Chapter 11)** restores, rebuilds, and revitalizes the physical infrastructure of the nuclear weapons complex.

Site Stewardship Program **(Chapter 12)** ensures that operations and activities at complex locations are properly conducted and that environmental compliance is maintained. All activities from previous years conducted under two earlier programs, the Environmental Projects and Operations and Transformation Disposition program, are now consolidated and subsumed under the Site Stewardship program.

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 enterprise.

The Defense Nuclear Security and Cyber Security programs have now become individual Weapons Activities. 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.

Integration through Strategic Plans; Specific Executable Actions; and Program Management Approaches

The strategies for achieving NNSA's mission, briefly discussed in the *Introduction* section, have led to the formulation of specific executable actions that will achieve the near-term and long-term future state of the portion of the NNSA nuclear security enterprise that provides the research, development, and manufacturing products required by Stockpile Stewardship. A process is being formulated to ensure that these specific actions will be performed and completed in a trackable manner. The thirteen Weapons Activities are consequently interlinked through these overarching, accountable actions that flow from higher level strategies.

In addition, 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 enterprise.

For example, a national work breakdown structure (NWBS) that encompasses eight of the thirteen NNSA Weapons Activities (referred to as "Defense Programs") is in the process of being deployed in stages. The subdivisions of the work that the NWBS provides, serve to organize a major portion of the Stockpile Stewardship endeavor across the breadth of the national security enterprise. By developing the NWBS 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.

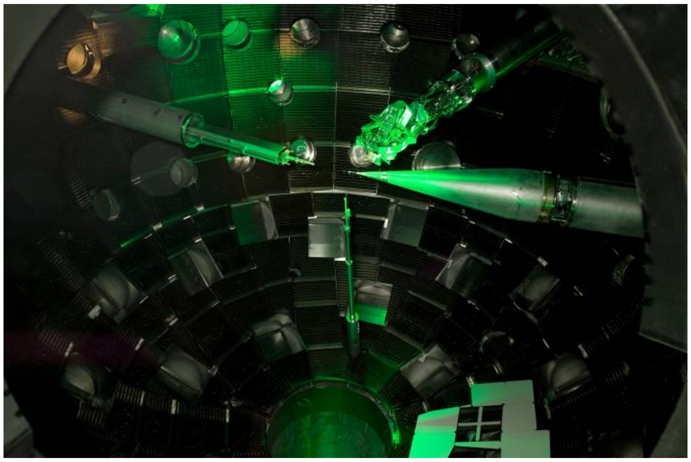

Figure 1-7. Construction of the National Ignition Facility was completed in 2009.

ADDITIONAL ORGANIZATIONAL AND INTEGRATION INSTRUMENTS: MANAGEMENT OF PERFORMANCE, COSTS, AND SCHEDULES

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

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 of the United States 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 Production and Planning Directive (P&PD). This document guides the NNSA national security enterprise 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; 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 enable the enterprise 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 refurbishment 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 Directed Stockpile Work (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 evolving national policy, NNSA will not develop future nuclear warheads to provide 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 for consideration by the President and the U.S. Congress. 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 nonstrategic 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 Stockipile Work/Stockpile Systems efforts further discussed in Chapter 2.

Specific weapon plans and directives to the enterprise flow from the P&PD in accordance with the "Master Nuclear Schedule and Limited Life Components" section of the "Development and Production (D&P) 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 PCD to translate the high-level requirements outlined in the P&PD, into the specifics of what

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

product needs to be produced, disassembled, inspected, subjected to surveillance procedures, or dismantled; where in the enterprise these activities will occur; and under what accomplishment schedules.

> **Development and Production Plans**
> **Master Integrated Schedules — Phase 2A or 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 D&P 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 2A or 6.2A – in accordance with the previously cited *D&P Manual*). A master integrated schedule, describing how the entire enterprise 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 (PMM)**
> **Individual Weapons Activities Program Plans**

The *"NA-10 Defense Programs--Program Management Manual (PMM)"*[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. Each of the thirteen Weapons Activities program elements (covered in Chapters 2 – 14) oversee individual respective plans. Specifics for each program element (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.

[5] *"NA-10 Defense Programs –Program Management Manual (PMM)"*; Document No. NA14-PMM-08-0001; Revision 0 – TBD Date

Table 1-1 Key Recent Accomplishments	Directed Stockpile Work	Science Campaign	Engineering Campaign	ICF Campaign	ASC Campaign	Readiness Campaign	RTBF	Secure Transportation Asset	Nuclear Counterterrorism Incident Response	FIRP	Site Stewardship	Defense Nuclear Security	Cyber Security
Safe, Secure, and Effective Stockpile without Nuclear Testing.													
Alteration Alt-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.	✓		✓		✓	✓	✓	✓				✓	✓
W76-1 reentry body warhead: first production unit completed on 9/26/2008. Full Scale Production/Stockpile Maintenance & Evaluation phase approved by Nuclear Weapons Council.	✓		✓		✓	✓	✓	✓				✓	✓
NIF construction project completed: March 2009.	✓	✓		✓									
The FY 2008 schedules for dismantlement of weapon assemblies at Pantex and secondaries at Y-12 were exceeded. Nation's active nuclear stockpile numbers now reduced to numbers not seen since the Eisenhower administration.	✓		✓			✓	✓	✓				✓	✓
Throughout FY 2008, limited life components and alteration kits delivered to DoD as required; all scheduled surveillance activities completed.	✓		✓			✓	✓	✓				✓	✓
More than six new W88 plutonium pits manufactured. New equipment installed as scheduled for gradual capacity increases to 80 pits per year potential by scheduled operational date for Chemistry and Metallurgy Research Replacement (CMRR) Nuclear Facility.	✓	✓	✓			✓	✓					✓	✓
ST&E endeavor began to reap benefits of 4 recently completed capabilities: Microsystems and Engineering Sciences Applications Project, the DARHT Facility, the refurbished Z pulsed power accelerator, and the Omega Extended Performance laser system		✓	✓	✓	✓		✓					✓	✓
Improved physics models, which reduce predictive uncertainties, incorporated into advanced computational simulation tools then used to reassess nuclear performance of W88 and W87 stockpile systems.	✓	✓	✓		✓							✓	✓
Joint DoD/NNSA B61-3/4/7/10 LEP Options Study initiated on 9-24-2008 (following Nuclear Weapons Council approval on 3-25-2008): determine feasibility (Phase 6.2) for refurbishing existing B61 components; and design-definition and detailed-cost-study (6.2A) of options.	✓	✓	✓		✓	✓						✓	✓

Table 1-1 Key Recent Accomplishments	Directed Stockpile Work	Science Campaign	Engineering Campaign	ICF Campaign	ASC Campaign	Readiness Campaign	RTBF	Secure Transportation Asset	Nuclear Counterterrorism Incident Response	FIRP	Site Stewardship	Defense Nuclear Security	Cyber Security
Sited Roadrunner, an advanced architecture platform and the first supercomputer capable of sustained 1-petaFLOPS performance.	✓				✓								
Continued Transformation of the NNSA Nuclear Security Enterprise.													
Final "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 & Assembly/Disassembly of Nuclear Weapons," and "Tritium R&D, Flight Test Ops & Major Environmental Test Facilities."	✓	✓	✓				✓				✓		
More than eleven metric tons of SNM removed from NNSA sites; now allocated to disposition feed stream.	✓						✓	✓				✓	✓
Highly Enriched Uranium Materials Facility (HEUMF) substantially completed August 2008.							✓					✓	✓
Achieved the long-term performance goal by eliminating over 3,000,000 gross square feet of excess facilities in FY 2008.										✓			
Continued to improve condition of facilities and infrastructure across the enterprise by reducing more than $650 million of legacy deferred maintenance from NNSA's backlog.										✓			
Roof Asset Management Program component of FIRP (innovative approach for repairing and restoring roof assets across complex) won coveted first prize for Real Property Innovation in the 2008 General Services Administration's annual federal government competition.										✓			
Solving a Broad Range of National Security Challenges.													
Complex simulations accomplished on Red Storm supercomputer system to assist U.S. Navy to shoot down errant satellite, which posed terrestrial threat if allowed to reenter Earth's atmosphere in uncontrolled manner		✓	✓		✓								✓
Continued Global Initiative to Combat Nuclear Terrorism support through outreach efforts and ongoing support to the 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.									✓				

Recent Accomplishments

Since the previous Stockpile Stewardship Plan was published, significant events have occurred which are collectively summarized in *Table 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 three strategic areas and involve the refurbishment and sustainment of stockpile warheads; dismantlement of retired warheads; manufacturing of new pits; improvements and utilization of ST&E capabilities; complex transformation plans, decisions, and ongoing results; reduction and disposition of nuclear materials; and the use of computational simulations to assist broader national security needs.

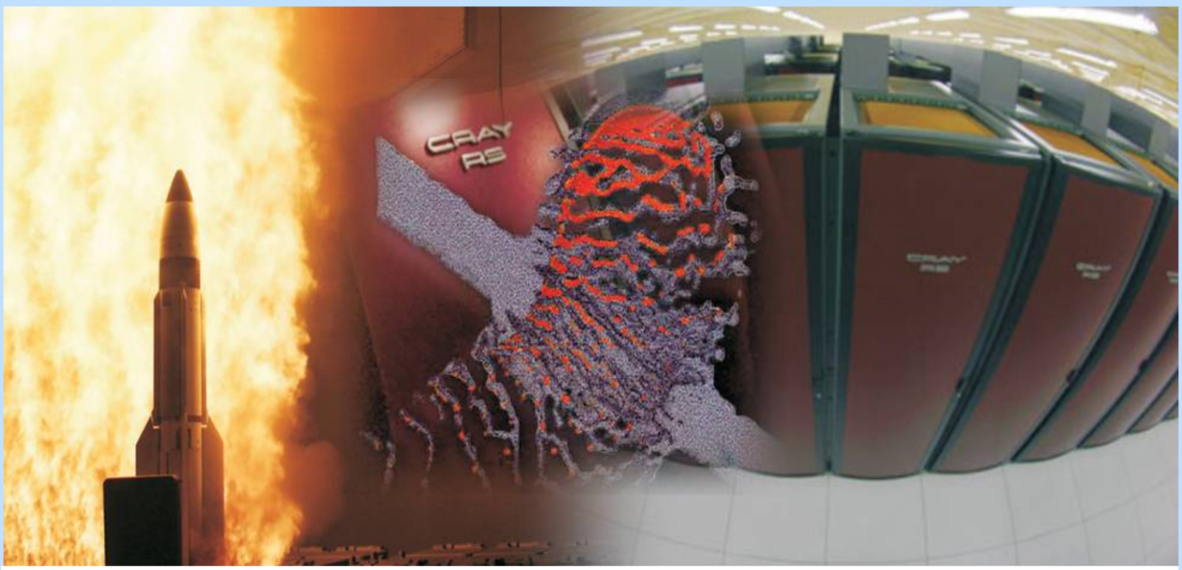

Figure 1-8. Stockpile Stewardship computational simulation capabilities assisted the U.S. Navy when the U.S.S. Lake Erie intercepted an errant satellite reentering the Earth's atmosphere.

Funding

The NNSA Weapons Activities were funded by the U.S. Congress at an appropriations level of $6,302M in the 2008 Federal fiscal year, and $6,380M in the current FY 2009. Included in these amounts were $5,124M (FY 2008) and $5,099M (FY 2009) for the subset of weapons activities that comprise the NNSA *Defense Programs* category. The President's budget request submitted to Congress for FY 2010 includes $6,384M for Weapons Activities ($5,046M in *Defense Programs*). Figure 1-9 compares the FY 2009 appropriated and FY 2010 requested amounts. Two programs constitute the largest dollar efforts: the RTBF ($1,674M-FY 2009 and $1,736M-FY 2010), and DSW ($1,590M-FY 2009 and $1,515M-FY 2010). These two are followed in size by the Defense Nuclear Security program ($735M-FY 2009 and $749M-FY 2010), the ASC campaign ($556M-FY 2009 and FY 2010), and the ICF campaign ($437M-FY 2009 and FY 2010).

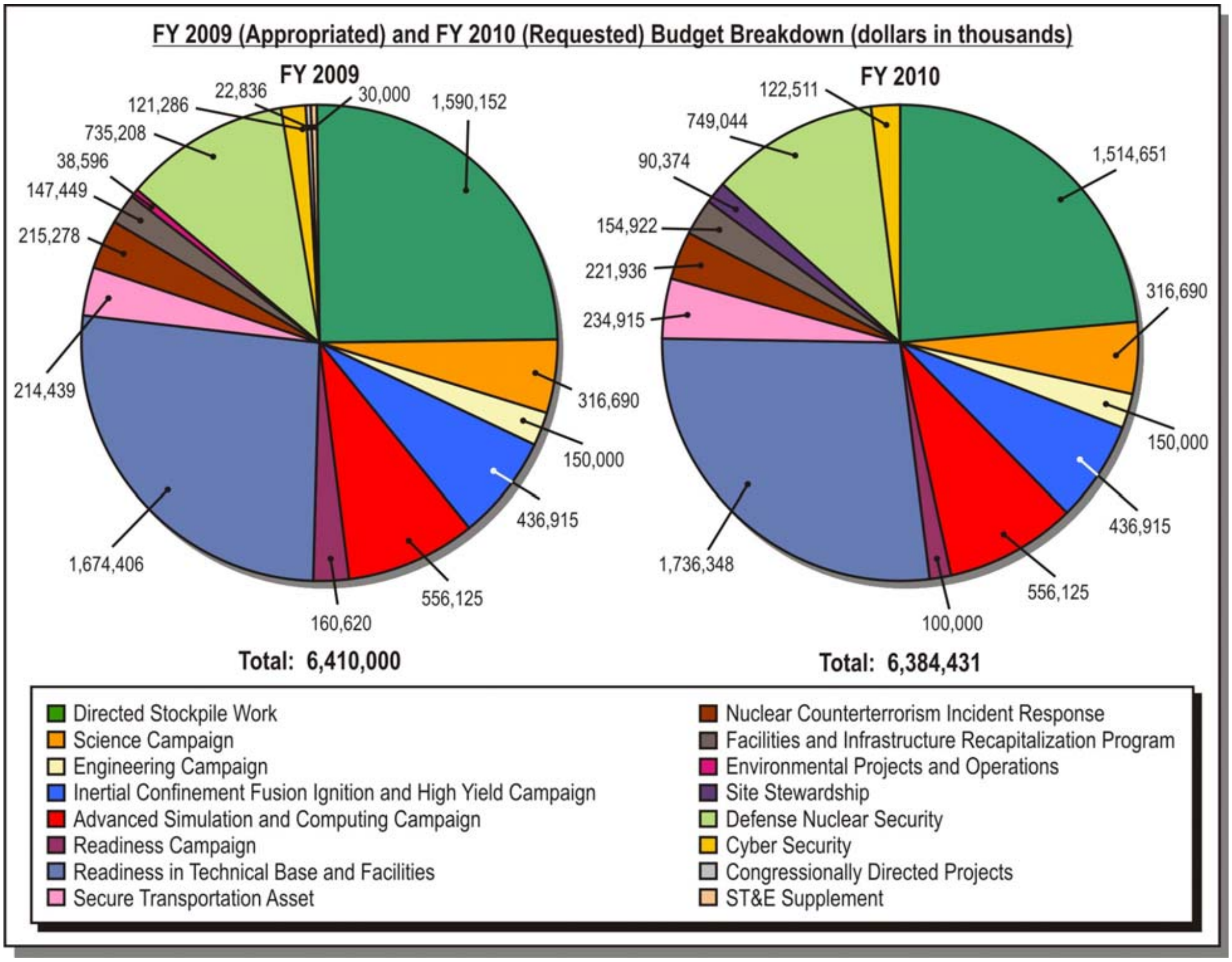

Figure 1-9. FY 2009 and FY 2010 funding levels for the thirteen weapon activities that comprise the Stockpile Stewardship Program.

The historically appropriated and Presidential requested Stockpile Stewardship expenditures, from FY 2004 through FY 2014, are shown in Figure 1-10. The dollar amounts depicted in the figure are not adjusted for inflation. Some points to be noted:

- The overall appropriated amounts for Weapons Activities, since FY 2004 to the current FY 2009 year have moderately declined by approximately 3 percent.
- In the post September 11th era, between FY 2004 and FY 2009, the amounts appropriated for the enterprise's security posture increased dramatically. Defense Nuclear Security, grew by ~42 percent, Cyber Security by ~51 percent, and Nuclear Counterterrorism Incident Response by ~124 percent (this latter number is partially affected by changes to the budget structure during the time interval).
- By contrast, during the same period, DSW and the Science campaign grew by less than 25 percent, the RTBF investments in critical facilities and other capabilities remained nearly constant, ASC became smaller by over 20 percent, and the Engineering and Readiness campaigns shrank by nearly 45 percent.
- When looking at the period from the current FY 2009 through the end of the projected Presidential request in FY 2014, the numbers indicate a small increase of approximately 1 percent in RTBF investments; continuing small declines of less than 5 percent in DSW, Science, Engineering, ICF, and ASC; and a significant, continuing decline in the Readiness campaign (of nearly 50 percent).
- During this same request period, the security posture areas (Cyber Security, Defense Nuclear Security, and Nuclear Counterterrorism Incident Response) remain nearly constant with small increases between 1 and 3 percent approximately.
- The Secure Transportation Asset activity has had its appropriations grow by more than 25 percent between FY 2004 and FY 2009, and the Presidential request indicates additional growth of approximately 20 percent between FY 2009 and FY 2014.

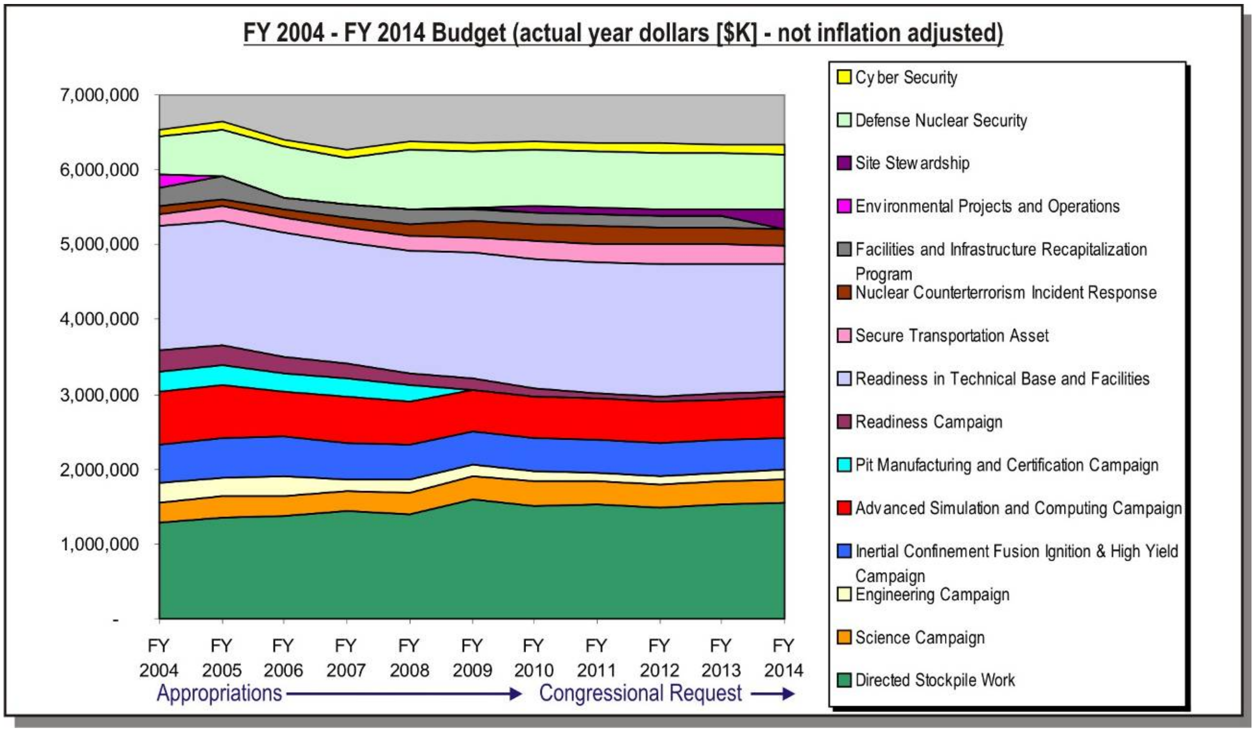

Figure 1-10. Historical and requested funding levels over a ten year span.

Ongoing Transformation of the Enterprise

The DOE, through the NNSA, and in partnership with DoD, has been transforming its nuclear security enterprise since the end of the Cold War — continuously underway from that epochal point, transformational activities will extend into the foreseeable future. Change will impact our nation's nuclear stockpile, and the full spectrum of the enterprise including its facilities infrastructure, its business practices, and its critical scientific, technological, engineering, and manufacturing capabilities. Enduring drivers for transformation include:

- Changes to the size, composition, and character of our nation's nuclear stockpile to reflect the reality that the Cold War is over;
- A mission to provide a credible deterrent to our adversaries with the lowest-possible number of U.S. nuclear warheads and without U.S. nuclear tests in a manner consistent with our national security needs, including our obligations to our allies;
- A need for a research, development, and manufacturing enterprise that is correctly sized, safer, more secure, and incorporates a responsive capability-based infrastructure;
- A pursuit of excellence in the enterprise's business practices to be cost effective; and
- A pursuit of excellence in the enterprise's scientific, technical, and engineering capabilities (both human talent and physical facilities) so that broad national security challenges can be met and overcome.

Pursuant to these imperatives, a Complex Transformation SPEIS process was completed in November 2008. This process defined a preferred alternative for what the complex should be in the future. Two records of decision were then approved on December 16, 2008 and issued to implement aspects of this Preferred Alternative.

The *"Operations Involving Plutonium, Uranium, and the Assembly and Disassembly of Nuclear Weapons"*[6] Record of Decision (ROD) decided that (1) manufacturing and R&D involving plutonium will remain at LANL; to support these activities NNSA will construct and operate the CMRR-Nuclear Facility at LANL; (2) manufacturing and R&D involving uranium will remain at the Y-12 National Security Complex in Tennessee; NNSA will construct and operate a Uranium Processing Facility at Y-12 as a replacement for existing facilities; and (3) assembly and disassembly of nuclear weapons and high explosives production and manufacturing will remain at the Pantex Plant in Texas. The second ROD, *"Tritium Research and Development, Flight Test Operations, and Major Environmental Test Facilities"*[7] decided to (1) consolidate tritium R&D activities at SRS in South Carolina; (2) conduct flight testing in a campaign mode at the Tonopah Test Range in Nevada under a reduced footprint permit; and (3) consolidate major environmental test facilities at SNL in New Mexico.

More changes, in concert with the Defense Programs Strategic Framework discussed previously, will continue to evolve the NNSA security enterprise as it marches forward, deeper into the 21st Century.

Status of Transformation

To succeed, enterprise transformation must address all four elements: the stockpile, the enterprise's infrastructure, business practices, and crucial ST&E capabilities upon which so much rests. Often, the second listed item, facilities infrastructure, receives the largest share of attention. A representative example of the interdependencies of one NNSA site with the balance of the security enterprise is depicted in Figure 1-11. Changes to the nuclear weapons mission will continue to impact enterprise facilities and their incorporated activities.

Summarized below, are recently completed and in-progress transformations, many dealing with infrastructure, but with other elements addressed as well.

[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

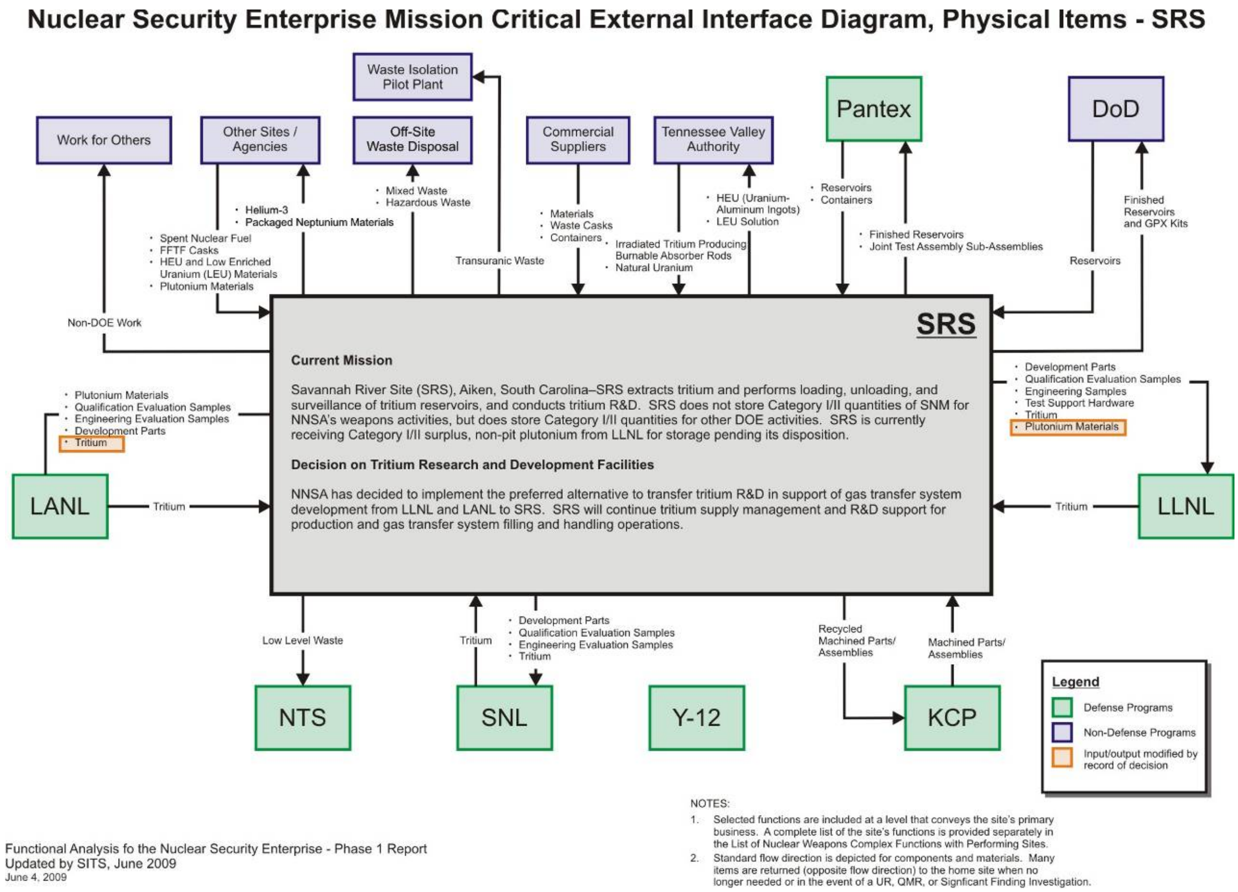

Figure 1-11. Illustrative mission-critical facility external interface diagram for SRS. Example of the process inputs, outputs, and activities that must be integrated at Nuclear Security Enterprise locations

KCP

The Kansas City Responsive Infrastructure Manufacturing and Sourcing (KCRIMS) activity will transform NNSA manufacturing operations by reducing annual operating costs and improving responsiveness to the demand for non-nuclear components. It will support the design requirements of the LEPs and other future weapons programs without the burden of maintaining excess capacity and obsolete capabilities. Commercially available capabilities will be outsourced where possible and remaining in-house capabilities will be properly sized for anticipated future weapon programs production rates. KCRIMS will

- alleviate $230M of Deferred Maintenance in 2013
- reduce the FY 2006 production mission operational footprint by approximately 1.8 million gross square feet
- potentially reduce annual operational costs by approximately $100M.

LLNL

NIF is the world's largest laser and was completed in March 2009, providing a unique capability to perform high energy material science experiments. NNSA's intends to make NIF available to the nuclear security enterprise to address key nuclear weapons stewardship issues, and to the broader scientific community to conduct groundbreaking research in areas such as astrophysics, materials science, and energy.

NNSA has begun reducing the inventory of SNM at LLNL. When the process is completed in FY 2012, Category 1 and 2 levels of material will no longer be stored at the site. This will significantly reduce the security cost at the site and the perceived risk to the public from a radioactive release. Subject to future funding availability, NNSA intends to maintain a cadre of LLNL plutonium experts, both in R&D and in technology development and demonstration, after the deinventory is complete to address a variety of plutonium research and technology issues. NNSA expects these experts to work projects collaboratively with LANL when the amount of plutonium required for development work exceeds what can be handled at LLNL.

LLNL and Sandia National Laboratories-California (SNL/CA) are examining their respective business operations for consolidation opportunities under a "one site /two labs" philosophy. The objective is to achieve more effective operations, not necessarily cost savings. Operational areas being reviewed include security and site access, combined acquisition actions and simplification of financial interactions.

NNSA is currently planning to create the Livermore Valley Open Campus capability. This will entail reconfiguring sections of the LLNL and SNL/CA campuses and combining them into a single geographically contiguous site to provide easier access to non-DOE/NNSA staff and foreign nationals to perform joint R&D activities in a number of areas that benefit NNSA nuclear security missions and other DOE Programs.

LANL

The Chemistry and Metallurgy Research Replacement (CMRR) project seeks to relocate and consolidate mission-critical analytical chemistry & material characterization and actinide R&D capabilities currently housed in the existing 1950's era CMR facility to ensure continuous national security mission support beyond 2010. These mission-critical capabilities support NNSA stockpile stewardship and management strategic objectives and are essential for supporting current and future DSW and related activities at LANL. Construction of the Radiation Laboratory/Utility/Office Building, the first facility to be constructed by the CMRR project, is currently nearing completion. This building provides the infrastructure that supports the CMRR Nuclear Facility and addresses NNSA programmatic and CMRR design/construction implementation risks by providing radiological laboratory space for transfer of limited CMR Analytical Chemistry and actinide R&D operations. Other transformational achievements include the disassembly of the Godiva IV Critical Assembly fast burst reactor and subsequent shipment to Nevada Test Site, enabling the closure of LANL's Technical Area-18 (TA-18) facility; reduction in tritium inventory, begun a decade ago through the consolidation of materials from aging facilities to the Weapons Engineering Tritium Facility (WETF) at TA-16 will now be furthered through relocation of additional inventories to the Savannah River Site; and the installation of the Roadrunner power-efficient, hybrid supercomputer — the first high performance computational platform to break the 1 petaFLOPS barrier.

Figure 1-12. The Radiological Laboratory Utility Office Building at LANL is scheduled for completion in 2009.

NTS

The Device Assembly Facility complex is being modified to perform the Criticality Experiments Facility start-up and operation, Nuclear Counter Terrorism support, and SNM storage. These modifications will be completed and fully operational in FY 2011.

Pantex Plant

Pantex is in the early stages of establishing a comprehensive data warehouse infrastructure as part of the site's Enterprise Supply Management System project. The data warehouse capability is expected to increase supply chain operational efficiencies across the Plant.

Figure 1-13. W56 nuclear warheads being dismantled at the Pantex Plant.

SNL

The December 2008 Complex Transformation SPEIS ROD—Tritium R&D, Flight Test Operations, and Major Environmental Test Facilities formalized NNSA's decision to potentially reduce the footprint of its activities at the Tonopah Test Range in Nevada, upgrade test-related equipment with mobile capability, and operate the range in campaign mode for flight testing of gravity weapons (including R&D and testing of nuclear weapons components and delivery systems). NNSA expects it will not use Category I/II SNM in future flight tests conducted at the Tonopah Test Range. SNL, NNSA and the US Air Force are analyzing strategies for implementing the SPEIS ROD. Sandia is also working with NNSA to study the potential devolution of responsibilities for the Kaui Test Facilities (located within the U.S. Navy Pacific Missile Range Facility) to other Federal agencies.

SNL/NM has completed removal of its Category I/II SNM, reducing security costs at the site and the perceived risk to the public from a radioactive release. Although SNL/NM no longer stores or uses Category I/II SNM on a permanent basis, these materials may be required for limited-duration activities in the future.

The Heating System Modernization project is replacing 22 miles of steam delivery lines and the associated centralized steam plant with smaller automated Central Utility Buildings to reduce natural gas consumption (by 50+ percent) and air emissions. The project is expected to be completed in FY 2011.

SRS

SRS currently extracts, processes, and stores tritium; loads and unloads reservoirs; performs tritium processing and tritium materials R&D; and performs surveillance of gas transfer systems. The December 2008 Complex Transformation SPEIS ROD—Tritium R&D, Flight Test Operations, and Major Environmental Test Facilities formalized NNSA's decision to transfer portions of the tritium R&D mission in support of gas transfer systems from LLNL and LANL to SRS in South Carolina—an environmentally preferable alternative that would also further the objectives of a smaller, more efficient enterprise. It would continue consolidation trends from the early 1990's when other tritium missions were moved to SRS from sites now closed. Existing facility space at SRS and SRNL could accommodate the elimination of duplicate capabilities at other sites, and benefits would accrue from more integrated operations. Recent congressional action has placed the implementation of the SPEIS ROD on hold pending an independent review of the decision and its supporting business case.

Plutonium Disposition is handled by a number of coordinated projects that will add new facilities and modify existing SRS capabilities to prepare NNSA and DOE-owned plutonium for disposition. The following projects are not Weapons Activities projects, however they are included for completeness:

- Upgrades to former K-Reactor structure to house SNM vaults and material stabilization capability
- Construction of the Mixed-oxide (MOX) Fuel Fabrication Facility (MFFF)
- Operation of H Canyon to dispose of some non-"Moxable" plutonium stocks
- Construction planning for a Pit Disassembly and Conversion (PDC) capability
- Construction of a Waste Solidification Building (WSB) supporting both MFFF and PDC.

Plutonium consolidation/processing at SRS would:

- allow NSE sites to de-inventory plutonium materials to meet regulatory commitments
- eliminate multiple (existing) storage vaults across the nuclear security enterprise
- allow existing facilities to close, reducing the DOE national nuclear footprint (and avoid a portion of its operating costs)
- avoid building new storage vaults to replace outdated facilities by retasking existing hardened structures such as the former K-Reactor
- reduce risk to the public and the environment by consolidating SNM at a single location
- leverage existing, well-developed plutonium infrastructure and workforce skills at SRS.

Y-12

NNSA completed the HEUMF project in September 2008. This single state-of-the-art storehouse replaces several aging vault-like facilities at the nuclear weapons plant, and provides storage capacity for thousands of containers of material to be held in specially designed storage racks. The HEUMF project is a modern facility for receiving, shipping and providing long-term storage of HEU and it is the largest construction project at the Oak Ridge facility in more than 40 years. In FY 2010, buildings 9206 and 9201 will be deactivated and decommissioned, as part of the overall enterprise effort to reduce infrastructure footprint. Design activities for the Uranium Processing Facility are continuing.

Figure 1-14. HEUMF substantially completed at Y-12 in 2008 — specialty storage capacity for thousands of containers of HEU material.

THE FUTURE STATE

Upcoming Challenges; Approaches For Meeting These Challenges

The NNSA nuclear security enterprise responsible for the performance of the Stockpile Stewardship activities confronts major challenges today.

As discussed in the classified Stockpile Stewardship Plan—Annex, the nation's nuclear weapons arsenal continues to age. Major aspects of how this stockpile will be transformed will not be fully known until the now underway Nuclear Posture Review is completed, and our nation's leadership fully defines a future path. The nation's ability to fully implement the transformation of its nuclear deterrence is under scrutiny (e.g. previously cited Congressional commission report on *"America's Strategic Posture"*). The enterprise's research and production infrastructure is aging and often consists of remnant facilities from the legacy of the Cold War era. The composition and functional alignment of the workforce is problematical, as is the enterprise's ability to not only attract and retain, but also exercise and invigorate the critical technical skills necessary to ensure that NNSA can respond with needed agility to future national or international events. With steady or decreasing budgets in several key Weapons Activities, the realization of a research, development, and manufacturing enterprise that is integrated, efficient, and cost effective is of paramount importance. Finally, NNSA is not only tasked with addressing national security issues associated with nuclear weapons stockpile, but also with the application of its unique resources to attack and solve other problems of national importance. Institutional impediments sometimes prevent the dedication of enterprise resources to this important mission.

This section expands upon these challenges. The approaches to confront them are also addressed. The previously discussed *Defense Programs Strategic Framework* and the plans that flow from that strategy, play a major role in identifying today's challenges, and tomorrow's solutions to these challenges. The framework and plan are discussed again later in this section.

Challenge: Define the Future Configuration of the Stockpile and Address Stockpile Aging Concerns

It is widely recognized that the present configuration of the stockpile and its continual aging places at risk an effective future strategic deterrent. Our national leaders are in the process of reviewing our country's present nuclear posture, and decisions will be made in the coming months as to how the country will proceed. It is anticipated that fewer nuclear weapons and a correspondingly smaller, safer nuclear weapons enterprise, sized on the basis of necessary capabilities rather than being defined by manufacturing throughput capacities, will result from national guidance.

NNSA is committed to work in collaboration with the DoD, and in concert with the requirements received from the DoD, to assist our national leaders in reviewing the U.S. nuclear posture, defining the future state of the deterrent, and continuing to implement and maintain a transformed stockpile, which is as safe, secure, and effective as possible, without a need for underground nuclear testing. As the national laboratory directors recently expressed during the most recent annual stockpile assessment cycle, the difficulties of continuing to ascertain the reliability and safety of the stockpile will continue to increase with age and reduced numbers. Recognition of this challenge places even more importance on the ST&E stewardship capabilities and processes (discussed in the classified Stockpile Stewardship Plan—Annex) which are the core guardians of the integrity of the nuclear stockpile in today's world.

The path to transform the nation's nuclear warhead stockpile will likely involve the continued implementation of refurbishments to extend the life of existing warheads. NNSA plans also include a vigorous pursuit of the dismantlement of unneeded warheads, the maintenance of the non-refurbished stockpile, and a sustainment of the future viability of the national deterrent by protecting multiple options that our country's leadership may potentially consider and choose to pursue.

Challenge: Achieve a Correctly-Sized, Capabilities-Based Infrastructure

NNSA's national security enterprise may not be able to respond to future world events if it encompasses research, development, and fabrication facilities that are old, unnecessarily large for present demands, outmoded, and inefficient. Yet, this is exactly the present situation that the enterprise confronts.

In concert with the *Strategic Framework* NNSA has defined specific actions to be taken, and has moved forward to further transform its security enterprise in a pursuit of modern facilities and operational configurations that are responsive to national needs while becoming less costly to operate and secure. No matter the size of the stockpile, essential national security capabilities will be retained — moving the enterprise away from sizing facilities based on production output rates like was done during the Cold War to basing the size of the enterprise instead on the minimum capability required by future national security considerations. Cessation of research into new nuclear weapon designs, or cessation of any production of new nuclear warhead systems, does not eliminate a national need for baseline functional capabilities whether we retain a few warheads, or a few thousand warheads.

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. All of the actions regarding physical infrastructure will be based on the previously discussed 2008 records of decision that resulted from the *Complex Transformation SPEIS* process.

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

Escalating costs throughout the enterprise have, and will continue to have, major impacts on the price of doing business—most notably: 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 fiscal crisis, pressures on funding profiles will be unremitting.

Such budgetary challenges, once the Nuclear Posture Review process matures to further reveal its future requirements, will lead to a reconsideration of the out-year funding profile included in the transitional FY 2010 budget request. But the budgetary challenges will also make companion demands for the enterprise to improve its operational effectiveness. The *Strategic Framework* provides a roadmap for achieving such results — 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 in the process of evaluation. Initiatives are looking to change how risk is managed at enterprise 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.

Challenge: People — Sustain an Effective Workforce; Retain and Exercise the Critical Competencies of the Enterprise's Human Talent

If the infrastructure is transformed, but the configuration and deployment patterns of the workforce remain static, the enterprise will ultimately fail in its mission to deliver national security solutions in a manner that the nation can afford. While the workforce is transformed, the enterprise must find ways for hiring, retaining, and effectively exercising a talent pool of science, engineering, technologist, business/project-management professionals, and corresponding enablers who will deliver successful responses to future national needs.

NNSA has specific actions in progress to identify the present and future technical and supportive critical skills required by the enterprise. This activity will also wrestle 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 retained, properly exercised and invigorated through application to national challenges. The enterprise will need to monitor and maintain a level of future responsiveness so that the NNSA mission can be fully executed when asked to respond by the country. And the enterprise can not 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.

The NNSA enterprise has transitioned its emphasis to a broader national security outlook. Through development of new scientific tools such as NIF—poised on the threshold of producing stellar fusion conditions inside a laboratory, confronting new challenges to detect smuggled uranium and plutonium threats, or modernizing capabilities like the CMRR facility, the enterprise 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 nation more secure, but also provide a key ingredient to motivate young scientists and engineers to join its Stockpile Stewardship mission.

Challenge: 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 issues. The motivation, retention, and meaningful employment of the human talent critical for the success of the enterprise, as previously discussed, 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; enhancing the ability of other federal agencies to establish strategic partnerships with NNSA to attack national problems in common; simplification of business rules that cover work with other agencies; and using the ST&E roadmap previously cited to guide effective national security partnerships.

Strategic Framework: Confront Challenges and Achieve Future State

The evolution of deterrence in national policy has led NNSA to continually reassess its core mission and formulate plans for the future. The previously cited *Defense Programs Strategic Framework* was recently developed to help confront the very challenges discussed above, and to direct future actions at a desired future state. Figure 1-15 depicts the framework's three interrelated strategies and specific actions required to secure its future vision. The framework and resulting plans and actions guide the future pursuits of a large portion of the Stockpile Stewardship endeavor, help to integrate efforts across the

Weapons Activities as discussed previously in this chapter, and attempts to impact the research, development, and manufacturing products required for the security of the nation.

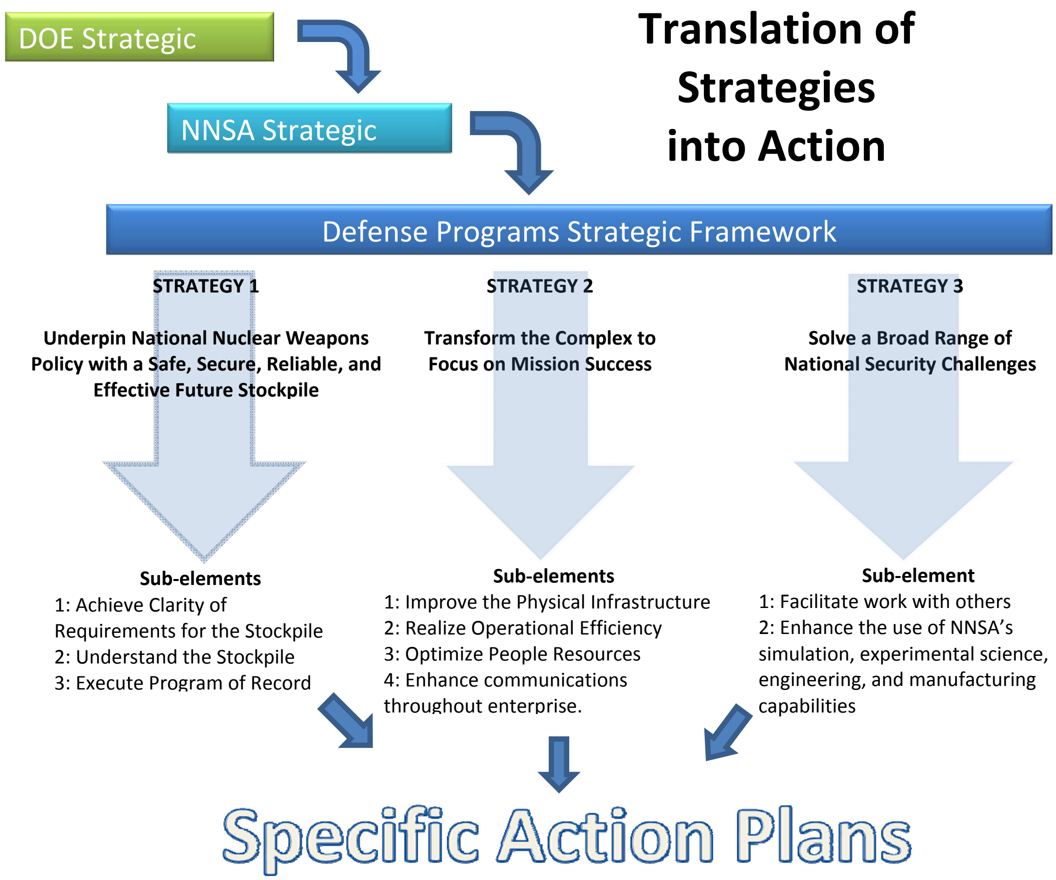

Figure 1-15. A Strategic Framework Process for confronting challenges and achieving a future state.

The *Defense Programs Strategic Framework* directly impacts portions of the NNSA national security enterprise that execute the Stockpile Stewardship activities. Additional strategic plans exist that drive other portions of the endeavor and are of great importance to Stockpile Stewardship as well. Two such examples:

a) *NNSA Office of the Chief Information Officer (OCIO) Strategic Plan*[8]: This plan deals with information technology (IT) systems that span the entire NNSA security enterprise. It not only impacts the weapons activities that comprise the Stockpile Stewardship endeavor, but also extends beyond these boundaries to the entire NNSA mission. The plan lays out three goals:

   (1) Institutionalize effective program/project management and lifecycle governance of the NNSA IT resources;

   (2) Ensure all IT projects and services are performed effectively and efficiently; and

   (3) Improve NNSA security posture to adequately protect NNSA information assets.

[8] *"NNSA Office of the Chief Information Officer (OCIO) Strategic Plan,"* Document # DOE/NA-0015; Department of Energy; NNSA-OCIO; June, 2008

Objectives have been developed for how these goals are to be achieved and are being implemented.

b) *Defense Nuclear Security Strategic Framework* [9]: deals with the essential security of the NNSA enterprise and Defense Nuclear Security's core responsibilities for protecting its capabilities, facilities, materials, information, and employees. The framework captures the latest analysis of the challenges facing the Defense Nuclear Security program, and proposes four strategies (with execution approaches) to achieve a more effective, efficient, and sustained security posture throughout NNSA's venture:

1) Support the nuclear security enterprise through management excellence

2) Manage risk to effectively and efficiently address the spectrum of security threats

3) Recruit, sustain, and exercise talents of people and critical skills, and

4) Provide assurance of effective and sustained performance.

The *Defense Programs Strategic Framework* acts in concert with these other high level strategies to drive the stockpile stewardship endeavor forward. Together they provide an overarching structure that provides cohesion and integration across all of the Weapons Activities that the NNSA nuclear security enterprise performs.

Near Future Actions and Deliverables

The strategies for achieving NNSA's mission provide coherence to the Stockpile Stewardship effort and impact the enterprise's approach to its future. Execution of the strategies with deliberate plans of action will reduce the pitfalls that are easy to encounter when undertaking meaningful change.

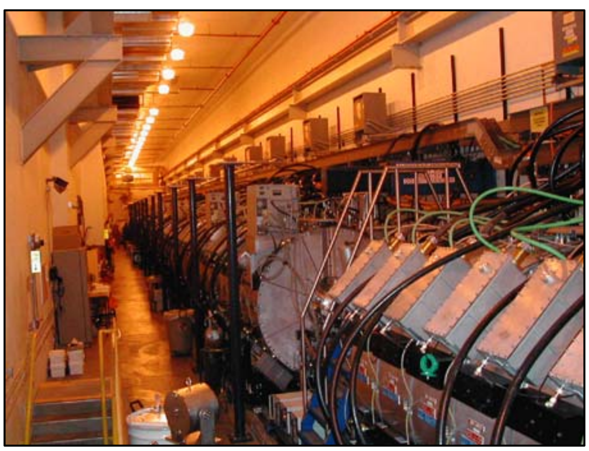

Figure 1-16. Example of key ST&E capabilities — the electron accelerator hall at the Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility.

In subsequent chapters of this document, each of the Weapons Activities is described, including its mission, an overview of the efforts, goals, strategies, and resulting accomplishments to date. The reader will witness examples throughout on how programs or campaigns responded to the overarching strategic framework and provided results and accomplishments that depend on contributions that cut across the entire, integrated Stockpile Stewardship endeavor.

The multitude of near-future Stockpile Stewardship deliverable 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 enterprise, and it is these highlights that are provided in Table 1-2. The list also demonstrates how the thirteen Weapons Activities are interlinked through collaborative actions encompassed under the strategic framework umbrella.

[9] "*Defense Nuclear Security Strategic Framework,*" Office of Defense Nuclear Security; Department of Energy/National Nuclear Security Administration; June 2009

Table 1-2 Key Near-Future Deliverables (FY 2009-FY 2012)	Directed Stockpile Work	Science Campaign	Engineering Campaign	ICF Campaign	ASC Campaign	Readiness Campaign	RTBF	Secure Transportation Asset	Nuclear Counterterrorism Incident Response	FIRP	Site Stewardship	Defense Nuclear Security	Cyber Security
Safe, Secure, and Effective Stockpile without Nuclear Testing.													
Deliver technical and scientific input to Nuclear Posture Review processes to inform and enable policy decisions	✓	✓	✓		✓		✓	✓					
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.	✓		✓					✓			✓	✓	✓
Deliver W76-1/Mk4A Reentry Body Assemblies for Initial Operational Capability.	✓		✓		✓	✓	✓	✓				✓	✓
Formalize design requirements with DoD by July 2009 for B61-3/4/7/10 LEP options study, to meet mission effectiveness, treaty obligations, and enhanced safety & security goals.	✓	✓	✓		✓	✓							
Complete the first programmatic NIF experiment.		✓	✓	✓	✓								
Complete first experiment to radiograph an imploding primary along two axes at DARHT facility.	✓	✓	✓		✓		✓					✓	✓
Respond to recommendations of the Independent Review Team on Control and Accountability of Weapons and Weapons Related Material.	✓	✓	✓						✓			✓	✓
Deliver solutions to the energy balance issue.		✓			✓								
Demonstrate uncertainty quantification aggregation methodology for full-system weapon predictions.		✓	✓		✓								
Continued Sustainment & Modernization of the NNSA Nuclear Security Enterprise.													
Continue design activities of the Uranium Processing Facility at Y-12, the Pit Disassembly and Conversion Facility at SRS, and the CMRR Facility at LANL. Continue process for orderly migration of missions to a smaller/flexible KCP.	✓	✓	✓				✓			✓	✓		
Achieve Critical Decision-2 to provide Plutonium Disposition & Conversion capability; complete LANL's Radiological Laboratory construction.							✓						
Develop management and operating contract acquisition strategy by May 2009 for enterprise sites to enhance efficiency & collaboration; implement strategy prior to expiration of plant contracts in late 2010.	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Achieve significant efficiencies through multi-site agreement to accomplish Accelerated Complex Transformation activities.	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓

Table 1-2 Key Near-Future Deliverables (FY 2009-FY 2012)	Directed Stockpile Work	Science Campaign	Engineering Campaign	ICF Campaign	ASC Campaign	Readiness Campaign	RTBF	Secure Transportation Asset	Nuclear Counterterrorism Incident Response	FIRP	Site Stewardship	Defense Nuclear Security	Cyber Security
Reduce number of locations with security Category I/II SNM, including all removal from LLNL by the end of 2012. Complete shipments for the Hanford de-inventory campaign and move eight metric tons of SNM from NNSA Sites.							✓	✓			✓	✓	✓
Initiate program to ensure increased use of renewable and efficient energy											✓		
Solving 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.	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
Deliver a new forensics capability in our ASC weapons simulation codes to interpret radioactive debris from a potential nuclear event.		✓			✓				✓				✓

CONCLUSION

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 nuclear security enterprise is delivering a future propelled by strategies that include the correct sizing of its complex based on the sustainment of critical capabilities that do not depend on the exact size and configuration of the stockpile. Major challenges remain, and are being confronted — preeminent amongst them: preserving and energizing the critical skills workforce upon whose intellect and talents our nation's nuclear deterrent rests. Additionally, the enterprise 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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Directed Stockpile Work

2

Program Highlights

In FY 2008, the Directed Stockpile Work (DSW) program delivered the B61-7/11 Alt 357 [refurbished canned sub-assemblies (CSAs)] units to the U.S. Air Force. Additionally, DSW achieved W76-1 Phase 6.5 authorization and the First Production Unit. Within the Stockpile Systems subprogram, DSW delivered all limited-life components as scheduled; and the Weapons Dismantlement and Disposition subprogram well-exceeded scheduled dismantlement quantities of warheads at Pantex and canned sub-assemblies at Y-12. The Stockpile Services subprogram completed Product Realization Integrated Digital Enterprise planned deliverables; executed the Y-12 Throughput Improvement Plan for CSAs; and established the Requirements Modernization Integration project web-based portal for accessing DSW business requirements and processes.

In FY 2009, portions of the Pit Manufacturing and Certification Campaign were incorporated into DSW. Beginning in FY 2010, this effort will be renamed as Plutonium Sustainment and will endeavor to sustain the U.S. capability and current knowledge base for plutonium manufacturing.

Mission

The mission of the Directed Stockpile Work (DSW) program is to provide nuclear warheads and bombs to the Department of Defense (DoD) in accordance with the Nuclear Weapons Stockpile Plan (NWSP) memorandum. To fulfill this mission, DSW ensures that the Nation's nuclear weapons continue to serve their essential deterrence role by maintaining and enhancing their safety, security, and reliability. DSW provides evidence of success in meeting its mission through bi-annual weapons reliability reports to the DoD and the Annual Assessment process where the Department of Energy/National Nuclear Security Administration (NNSA) and DoD jointly provide an in-depth and up-to-date assessment of weapons in the stockpile and state to the President whether resumption of underground nuclear testing is necessary to assure the safety and reliability of the stockpile. In addition, DSW is responsible for the dismantlement and disposition of retired weapons and weapon components and the sustainment of the plutonium enterprise.

Program Structure

The following four subprograms comprise DSW: (1) Life Extension Programs (LEPs); (2) Stockpile Systems; (3) Weapons Dismantlement and Disposition (WDD); and (4) Stockpile Services. The Stockpile Services subprogram is further broken down into sub-elements which include Production Support; Research and Development (R&D) Support; R&D Certification and Safety; Management, Technology, and Production (MTP); and Plutonium Sustainment. Obligations and costs are reported at lower levels, e.g., R&D and Stockpile Management for LEPs and stockpile systems, and discrete categories under Stockpile Services.

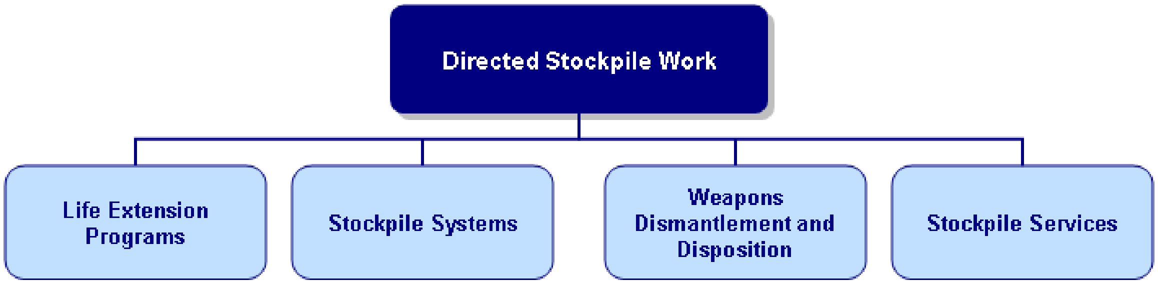

Figure 2-1. Subprograms of Directed Stockpile Work in FY 2010.

Life Extension Programs (LEPs)

LEPs enable the nation's nuclear weapons stockpile and the supporting nuclear security enterprise to respond to 21st century threats. As the U.S. nuclear weapons stockpile continues to age, LEPs will be required for multiple warhead systems to ensure their continued safety, security, and reliability.

The W76 LEP contributes significantly to the long-term viability of the United States national security by extending the life of the W76 nuclear warhead for another 30 years and exists as a path finder in energizing the revitalization and restructuring of the NNSA nuclear security enterprise. Production of the W76 LEP enables NNSA and the DoD to refurbish the W76 warhead without reliance on underground testing.

Stockpile Systems

Stockpile Systems directly supports the needs of the enduring stockpile and includes weapon-specific R&D, assessment and certification activities, limited life component exchange activities, surveillance activities, maintenance, feasibility and safety studies, and military liaison work for the B61, W76, W78, W80, B83, W87, and W88 weapon systems. Enduring stockpile maintenance and evaluation provide the basic foundation for the NNSA assessment that stockpile stewardship is working and that there is no need to resume nuclear testing. Efforts that affect multiple systems are currently reported under Stockpile Services. In addition, Stockpile Systems includes limited weapon refurbishments approved by the Nuclear Weapons Council, but below the threshold for separate reporting as an LEP and feasibility studies prior to approval of full-scale engineering development. The Phase 6.2/6.2A study of options for extending the service lifetime of the existing B61-7 and -3/4/10 family of weapons marks the start of an evaluation of options for the future refurbishment of the strategic and non-strategic deterrence provided by nuclear bombs. This LEP study will generate options for decision makers to address aging, reliability, surety improvements, and the consolidation of numerous existing designs.

Weapons Dismantlement and Disposition (WDD)

WDD activities enable the elimination of retired weapons, thus reducing the security and maintenance burden of legacy warheads. WDD includes the dismantlement and disposition of retired weapons, weapon components, and supporting functions. Success of the WDD program relies heavily on the Office of Secure Transportation, Production Support, and Readiness in Technical Base and Facilities to provide the base capability for all WDD activities.

Stockpile Services

Stockpile Services provides the foundation for all DSW operations. Specifically, Stockpile Services provides research, development, and production support base capabilities for multiple warheads and bombs; certification and safety efforts; quality engineering and plant management, technology, and production services; support for stockpile evaluation and surveillance; and investigating options for meeting DoD requirements. Stockpile Services also invests in sustaining the plutonium enterprise to achieve a cost-effective, modern plutonium capability that can respond with agility to evolving or emerging threats to U.S. national security. Stockpile Services includes the following sub-elements which are discussed in more detail below: Production Support; R&D Support; R&D Certification and Safety; MTP; and Plutonium Sustainment Infrastructure.

- Production Support includes activities that directly support site-specific production mission. In this context, the term “support” refers to site-specific personnel and routine functional activities associated with keeping the basic site capability and capacity at a sufficient level to meet current production requirements while modernizing the production capabilities at each site to meet established future requirements. The production mission is defined as weapon assembly, weapon disassembly, component production, and weapon safety testing.

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

- R&D Certification and Safety activities provide the core competencies and capabilities for R&D efforts not directly attributable to a single specific warhead system and take place at design laboratories and the Nevada Test Site. These activities include the basic research required for developing neutron generators and gas transfer systems and other critical non-nuclear components, surveillance activities, and the base capability for conducting hydrodynamic experiments. The non-nuclear component research is typically beyond the basic research of a Campaign and is critical in sustaining design capabilities and maturing advanced technology options for future LEP and other stockpile refurbishment action.

Figure 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.

- MTP includes activities that 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. Additionally, MTP includes activities that benefit the nuclear security enterprise mission as a whole, as opposed to Production Support activities that only support internal site-specific production missions.

- 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. Some funding will be used to support disassembly and removal of outdated equipment and glove-boxes to free-up limited space within the plutonium facility to provide greater flexibility in supporting a variety of plutonium programs and responsiveness to any future emerging requirements involving the use and handling of plutonium.

PROGRAM GOALS

Subprogram	Program Goals
Life Extension Programs	Achieve full scale production for the W76-1 LEP in FY 2011.
	Contingent on national leadership authorization, initiate Phase 3 for the B61-3/4/7/10 Life Extension Program.
	If authorized, achieve First Production Unit (FPU) in 2017 and complete production of B61-3/4/7/10 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 the yearly new 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.
	Conduct optimum sampling strategy, selection methodology, and surveillance testing by weapon according to the Surveillance Transformation Plan.
	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 canned sub-assemblies (CSAs) to select weapons for annual destructive evaluation.
	Provide field-engineering support to ensure safe maintenance operations with nuclear weapons.
	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 exceed CSA scheduled dismantlement quantities at Y-12.
	Continue to 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.

Subprogram	Program Goals
	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, reliable, and secure 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.
	Implement greater production and test-readiness responsiveness through a more integrated and fully collaborative enterprise.
	Improve design, engineering, and computer-aided manufacturing processes across the Enterprise.
	Work toward integration and optimization of a design-to-delivery "enterprise model."
	Preserve the scientific-base and R&D capabilities to support a safe, secure, and reliable nuclear weapons stockpile.
	Implement efficient business practices in support of an integrated and interdependent enterprise.
	Establish long-term manufacturing support for producing 50-80 pit capacity per year.

STRATEGY

As stated earlier, the DSW mission is to maintain and enhance the safety, security, and reliability of U.S. nuclear weapons and provide those weapons to the DoD per the NWSP. The NWSP contains, by year, the numbers for each warhead and delivery system required by DoD and NNSA. From the NWSP, DSW ultimately derives its nuclear weapons stockpile requirements. The NWSP drives ongoing maintenance activities, warhead life extension needs, stockpile surveillance and assessment, and R&D of new technologies needed to support the 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 evaluations to assess weapons reliability and to detect/anticipate potential weapon issues, from manufacturing defects and aging; (5) quantify margins and uncertainties in order to better assess and certify the nuclear stockpile; (6) develop concepts and programs which provide enhanced safety, security, and reliability for insertion into LEPs/Mods/Alts; (7) efficiently refurbish weapons by installing the life extension solutions and other authorized modifications to

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

correct technical issues and enhance safety, security, and reliability; (8) sustain the plutonium infrastructure to meet enduring national requirements unique to this special nuclear material; and, (9) dismantle and dispose of weapons and components for systems retired from the stockpile.

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

DSW has developed interrelationships within the Office of Defense Programs to provide the necessary tools and capabilities to assess the reliability and performance of an aging stockpile. These include the Science, Engineering, Inertial Confinement Fusion Ignition and High Yield, Readiness, and Advanced Simulation and Computing Campaigns. The Readiness in Technical Base and Facilities program supports DSW infrastructure sustainment and facility modifications and the Secure Transportation Asset program supports DSW through the movement of weapons and components. DSW also works with Defense Nuclear Security to ensure that personnel, facilities, nuclear weapons, and information are protected from a full spectrum of threats, and works with the Cyber Security program to implement a flexible, comprehensive, and risk-based cyber security program that adequately protects NNSA information and information assets.

Part of the interrelationship between DSW and other programs is the sustainment of a plutonium "enterprise" that provides the integrated planning of programs, campaigns, facilities, and the technical base (personnel and skills) associated with the use of plutonium while providing a means to maintain the necessary stability between all elements required for mission success. DSW sustains and retains the technical skills and infrastructure critical to the nation's ability to work with plutonium material across a spectrum of applications. These applications 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; nuclear forensics support; weapon 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.

CHALLENGES

Subprogram	Challenges
Life Extension Programs	If authorized, initiate Phase 6.3 Engineering Development Activities for the new B61-3/4/7/10 Life Extension Program upon completion of the feasibility/cost-analysis study listed below.
	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 6.2/6.2A 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.

Subprogram	Challenges
Weapons Dismantlement and Disposition	Prioritize future dismantlement activities for retired weapons.
	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 dismantlements.
Stockpile Services	Achieve cost recovery funding critical to supporting plutonium sustaintment infrastructure investments.
	Loss of R&D and production personnel (critical skills).
	The capability and capacity within the nuclear security enterprise to produce critical components or refurbish components for the stockpile (new neutron generators, multiple Acorn designs, and CSA materials).
	Disposition of pits and resulting plutonium material reliance on sustained plutonium infrastructure and the technical capabilities being retained under the Plutonium Sustainment program.

RECENT ACCOMPLISHMENTS

Life Extension Programs

- Delivered B61-7/11 Alt-357 units with refurbished canned sub-assemblies to the Air Force on time, having completed 100 percent of planned retrofits for FY 2008 at Pantex and 100 percent of production activity at Y-12 for the program.
- Completed W76-1 SS-21 Authorization for disassembly and inspection.
- Completed down-selection of W76-1 CSA, with decision to proceed with original design.
- Completed W76-1 Draft Final Weapons Development Report for delivery to the DoD Design Review and Acceptance Group.
- Completed W76-1 CSA FPU.
- Completed W76-1 Major Assembly Release.
- Completed W76-1 Los Alamos National Laboratory (LANL) Certification Letter.
- Received W76-1 unconditional Phase 6.5 Authorization.
- Achieved W76-1/Mark 4A Reentry Body Assembly FPU.

Reliable Replacement Warhead

- Completed close-out activities as directed by the FY 2008 Consolidated Appropriations Act (P.L. 110-161).

Figure 2-5. W87 warheads.

Stockpile Systems

- Within all Systems (B61, W62, W76, W78, W80, B83, W87, W88):
  - Delivered all scheduled Limited Life Components (Program Control Document requirements and quantities) and alteration kits to the DoD.
  - Produced 933 reservoirs at Kansas City Plant (KCP).
  - Filled 825 reservoirs at Savannah River Site (SRS).
  - Produced 356 neutron generators at Sandia National Laboratories (SNL).
  - Shipped 1,524 Group Ten kits to DoD used in field maintenance.
  - Shipped 793 Alt 900 kits for reservoir removal.
  - Completed all Annual Assessment Reports.
  - Completed all requirements for certification of the stockpile without nuclear testing.
- 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 W76-0 1E33 Detonator Cable Assembly (DCA) life of program production and shipments.
- Completed W78 MC4381 Neutron Generator FPU.
- Completed W87 JTA4 FPU and delivered to the Air Force.
- Completed Nuclear Explosive Safety Study and Reauthorization of W88 SS-21 Bay operations.
- Completed rebuilds of W88 Cell Operations Restart Project units.
- Completed W88 JTA2 telemetry refresh FPU.
- Achieved approval of W88 SS-21 Cell Hazard Analysis Report.

Weapons Dismantlement and Disposition

- Exceeded scheduled weapon dismantlement quantities at Pantex by over 10 percent, a 20 percent increase over FY 2007.
- Exceeded scheduled CSA dismantlement quantities at Y-12 by 41 percent.

Stockpile Services

- Met scheduled Surveillance requirements:
  - Completed 98 percent of surveillance plan (50 assembly/disassembly, 28 test-bed builds at Pantex).
  - Completed 100 percent (20) of scheduled flight tests.

  - Completed 97 percent of scheduled Test-bed Evaluations at Weapon Evaluation Testing Lab (SNL/Pantex).
  - Completed 100 percent of CSA destructive and non-destructive planned tests at Y-12.
  - Completed 103 percent of planned gas transfer system evaluations at SRS.
  - Completed 100 percent of planned DCA evaluations at LANL and Lawrence Livermore National Laboratory.
- Completed Product Realization Integrated Digital Enterprise key deliverables per the FY 2008 Program Plan:
  - Delivered an enterprise-wide production infrastructure, establishing a common Product Data Management System that enables sites to manage and share Computer Aided Design Definition and reduce design cycle times and product definition release rates.
  - Delivered Master Nuclear Schedule two-site (SNL and KCP) upgraded system development, leveraging integrated data exchange within the Weapon Information System and Program Control Document System.
  - Completed migration of legacy weapons information/data to new database thus reducing data loss risk from antiquated equipment.
- Developed FY 2008 Joint Hydrodynamic Test Plan.
- Executed Y-12 Throughput Improvement Plan thereby increasing CSA deliverables.
- Launched RMI Explorer Portal as the single site for accessing DSW business requirements and processes in August 2008.
- Released Integrated Phase Gate, Technology Readiness Level and Manufacturing Readiness Level assessment checklists on RMI Portal for B61 Phase 2A Study and Complex-wide stockpile support.
- Manufactured 6 pits and qualified 7 pits for acceptance.
- Completed the installation and initiated operation of an interim high energy radiography capability at LANL.
- Completed installation of 5 pieces of equipment for support of the sustainment of the plutonium technical base at LANL.
- Demonstrated new casting technology for better efficiency and reduced wastes.
- Completed studies for a modern training center that can perform multiple operations in support of several programs.

FUNDING SCHEDULES

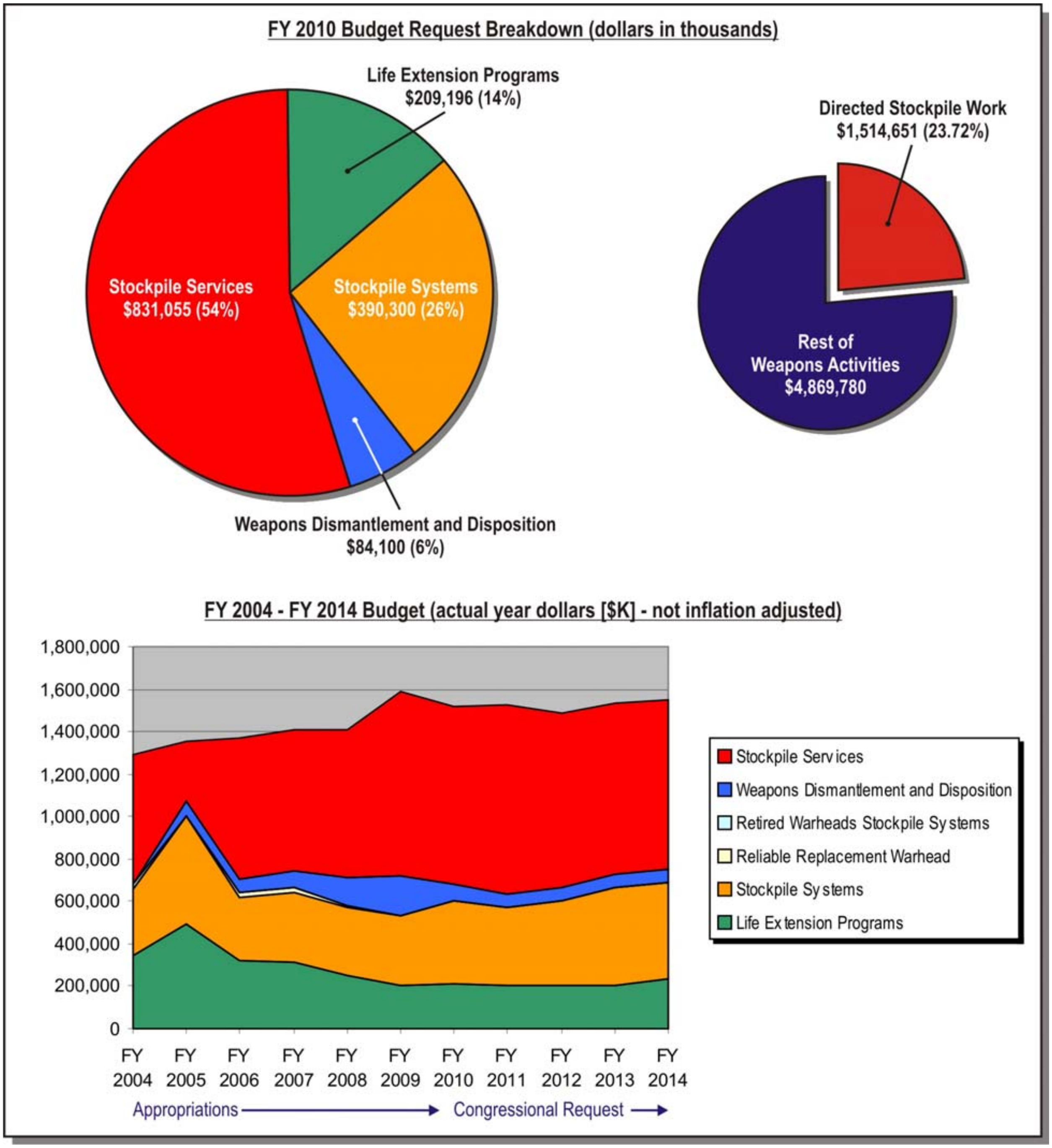

Figure 2-6. Funding Schedule for the DSW program.

Science Campaign

3

Program Highlights

In 2008, the Science Campaign conducted the first Stockpile Stewardship Program experiment on the refurbished Z Facility at Sandia National Laboratories; completed the Dual-Axis Radiographic Hydrodynamic Test Facility 2nd Axis Project with all requirements met or exceeded; implemented the National Boost Initiative; started the Advanced Certification subprogram; and delivered a *Getting the Job Done* goal to improve physics applied to weapon baselines. The Science Campaign also re-established the capability to conduct isentropic compression experiments on the refurbished Z; completed a major experimental series with plutonium and surrogates on the Joint Actinide Shock Physics Experimental Research Facility; developed a test bed for the Barolo dynamic plutonium experiment at the Nevada Test Site U1a Facility; and developed a systematic prioritization of plutonium data requirements for the initial conditions for boost.

The long-term goal of the Science Campaign is to improve predictive capability sufficient for nuclear explosive packages in the current stockpile by 2020. Major steps on this path include: fundamental multi-phase plutonium equations-of-state and constitutive properties models for primary implosions by 2014; models for full primary operation by 2018; and models for full secondary performance by 2020.

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 (SFIs) 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 Directed Stockpile Work (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 maintain the intellectual vitality of the National Nuclear Security Administration's (NNSA) 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 by the President.

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 on-going 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 six subprograms: Primary Assessment Technologies, Dynamic Materials Properties, Advanced Radiography and Transformational Technologies, Secondary Assessment Technologies, Advanced Certification, and Academic Alliances. The Predictive Capability Framework (PCF) provides a roadmap that identifies long-term stockpile goals requiring tight integration between the Science, Advanced Simulation and Computing (ASC), Inertial Confinement Fusion Ignition and High Yield, and Engineering Campaigns.

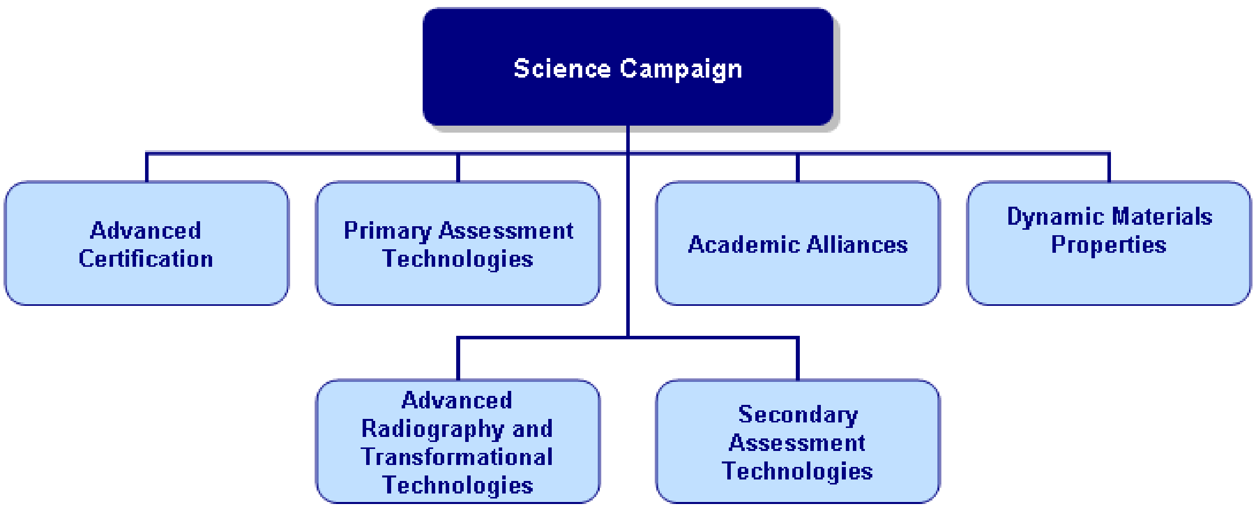

Figure 3-1. Subprograms of the Science Campaign in FY 2010.

Primary Assessment Technologies

The Primary Assessment Technologies subprogram is responsible for the development and implementation of QMU methodology for primaries. QMU 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. Key milestones include the completion of validated models to support a FY 2010 ASC code release for future certification, and subsequent assessment of the ability of that code release to predict the integrated behavior of nuclear primaries. Improved materials and high explosives burn models were integrated into the codes in FY 2007. The National Boost Initiative is coordinated with 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. Finally, the plutonium aging experiments and pit lifetime assessments were moved to Primary Assessment starting in FY 2009.

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 in FY 2010 and beyond for improved materials models that need to be incorporated into ASC codes, and for achieving an understanding of the contributions of material conditions to boost physics. Knowledge of the initial conditions of plutonium, energetic materials, and other materials required for understanding boost physics are assessed through these activities. Finally, beginning in FY 2010, the Dynamic Plutonium Experiments subprogram has been integrated into the Dynamic Materials Properties subprogram.

Advanced Radiography and Transformational Technologies

The Advanced Radiography and Transformational Technologies subprogram develops improved hydrotest and radiographic capabilities 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 imagery 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 work plays a key role in analyzing system modifications planned in the context of safety and surety upgrades to weapons systems, and in ensuring the nuclear performance of aged, altered, or modified, systems.

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 certify the nuclear performance of secondaries without nuclear testing.

Advanced Certification

The Advanced Certification subprogram leverages the results of stockpile stewardship activities within Science, ASC, Inertial Confinement Fusion, and DSW Campaigns to eliminate systemic gaps in the NNSA certification process. It integrates the scientific and technological advances from stockpile stewardship to improve the weapons certification

Figure 3-2. Typical tower and rack for an underground nuclear test.

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 the modeling and experiments addressing failure modes, developing quantified understanding of the significance of changes in margin, and peer review and evaluation of the performance of proposed surety technologies.

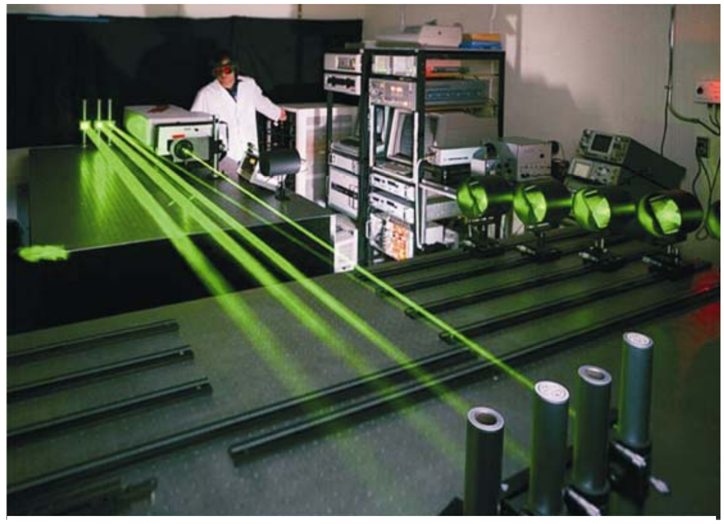

Figure 3-3. A subcritical experiment being performed at the Nevada Test Site.

Academic Alliances

The FY 2010 budget request proposes a new structure to consolidate academic programs previously funded under the Primary Assessment Technologies, Dynamic Material Properties and Advanced Radiography subprograms into one new subprogram. The funding is transferring along with the scope. Academic Alliances will support the Stewardship Science Academic Alliances Program and contributes to the High Energy Density Laboratory Plasmas Program and the Stewardship Science Graduate Fellowship Program.

PROGRAM GOALS

Subprogram	Program Goals
Primary Assessment Technologies	Continue to develop the QMU methodology.
	Implement QMU, with a principal focus on boost physics, near term certification programs, and simulation uncertainties.
	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 SFIs and stockpile options.
	Supply material property and performance data as set forth in the future requirements and priorities of DSW, assessment campaigns, and ASC.
Advanced Radiography and Transformational Technologies	Improve compact radiography capabilities.
	Develop containment technologies.
	Develop and verify computational models supporting the Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility experiments.

Subprogram	Program Goals
	Identify and evaluate potential future needs for compact 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 catalog of failure modes, thresholds and metrics.
Academic Alliances	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.

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 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 Inertial Confinement Fusion, DSW, Engineering, Readiness, and ASC Campaigns. Key predictive capability activities and their timelines are captured in the PCF, 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 SFIs, to perform annual assessments and certifications, and to analyze stockpile options, as required. In FY 2010, the pace of work under the Science Campaign is timed, through the PCF, to support an ASC Campaign milestone to complete substantially improved simulation codes for primaries and secondaries. This milestone will require the incorporation of improved physics models 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 Department of Energy Office of Science's Basic Energy Sciences for the application of the Advanced Photon Source, and the LINAC 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.

CHALLENGES

Subprogram	Challenges
Primary Assessment Technologies	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.)
	Developing predictive models for boost physics.
	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. (Generally applicable over all subprograms).
	Meeting needs of facility operations for experimental platforms—budget, safety and maintenance issues (Z, Los Alamos Neutron Science Center, DARHT, other). (Generally applicable over all subprograms.)
Dynamic Materials Properties	Availability of plutonium samples for materials experiments.
	Facility costs to provide high pressure plutonium data.
	Ensuring the availability of our platforms to generate plutonium data in support of our data generation needs (JASPER, U1a, etc).
Advanced Radiography and Transformational Technologies	Minimize equipment downtime at DARHT facility
	Developing quantitative methodologies for radiographic analysis.
	Lack of clear future requirements.
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.
Academic Alliances	Growing the program to a size sufficient to provide future scientific leadership in Stockpile Stewardship.

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 will be inconceivable otherwise.

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 points in the program is an effective means of assessing progress.

From its inception, the ultimate fall-back of stockpile stewardship has been to maintain readiness to resume a limited number of underground tests if questions 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.

RECENT ACCOMPLISHMENTS

Primary Assessment Technology

- Implemented the National Boost Initiative.
- National Hydrotest Plan updated to include the DARHT 2nd Axis.
- First Stockpile Stewardship Program experiment on refurbished Z.

Dynamic Materials Properties

- Reinstated isentropic compression capability for refurbished Z.
- Completed major JASPER experimental series with plutonium and surrogates.
- Completed experiments at Big Explosive Experiment Facility in developing high pressure explosive pulsed power plutonium experiment capabilities.
- Completed first Stockpile Stewardship experiment on the Z pulsed power accelerator, obtaining pressure-density data for metal (tantalum) at pressures up to 4 megabars.
- Completed development of test bed for the Large Bore Powder Gun (LBPG) site at the U1a Facility.
- Prepared for the Barolo experiments at U1a.
- Instituted redesign of the LBPG explosively driven valve and containment system following failures during the integrated testing program.
- Continued operation of all smaller scale plutonium experiment facilities.

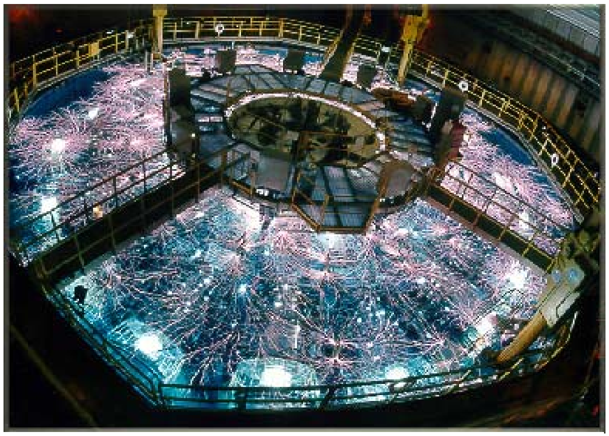

Figure 3-5. In FY 2008, the Science Campaign conducted the first Stockpile Stewardship Program experiment on the refurbished Z Facility.

- Developed a systematic prioritization of plutonium data requirements for the initial conditions for boost and started development of a resource loaded Dynamic Plutonium Experiment plan.

Figure 3-6. Large Bore Powder Gun tests in Ancho canyon.

Advanced Radiography

- DARHT 2nd Axis Project completed with all requirements met or exceeded. Significantly different in design than the 1st axis, the 2nd Axis involves special technical challenges and encountered important problems during its start-up commissioning phase. Equipment failures occurred which required diagnosis and damage repairs, and the downtime of other equipment adversely impacted schedules. These problems were addressed, and the facility recently achieved a milestone on November 10, 2009 with the successful execution of a materials equation-of-state experiment during which both axes were successfully fired for the first time. The desired radiographic images were captured, and other diagnostics produced good data.

Secondary Assessment Technologies

- Completed FY 2008 *Getting the Job Done* milestone by including physics-based models in two baselines.

- Established accuracy and reproducibility criteria for initial and high precision Secondary Assessment Technologies experiments on refurbished Z.

Test Readiness

- Down selected to a single legacy emplacement vehicle that could be used in a test by either laboratory.

Advanced Certification

- Developed an Advanced Certification implementation plan.

- Developed an evaluation of QMU addressing the question of how much margin is "enough."

- Identified future certification activities related to historic and existing stockpile systems which are opportunities to deploy advanced certification techniques.

FUNDING SCHEDULES

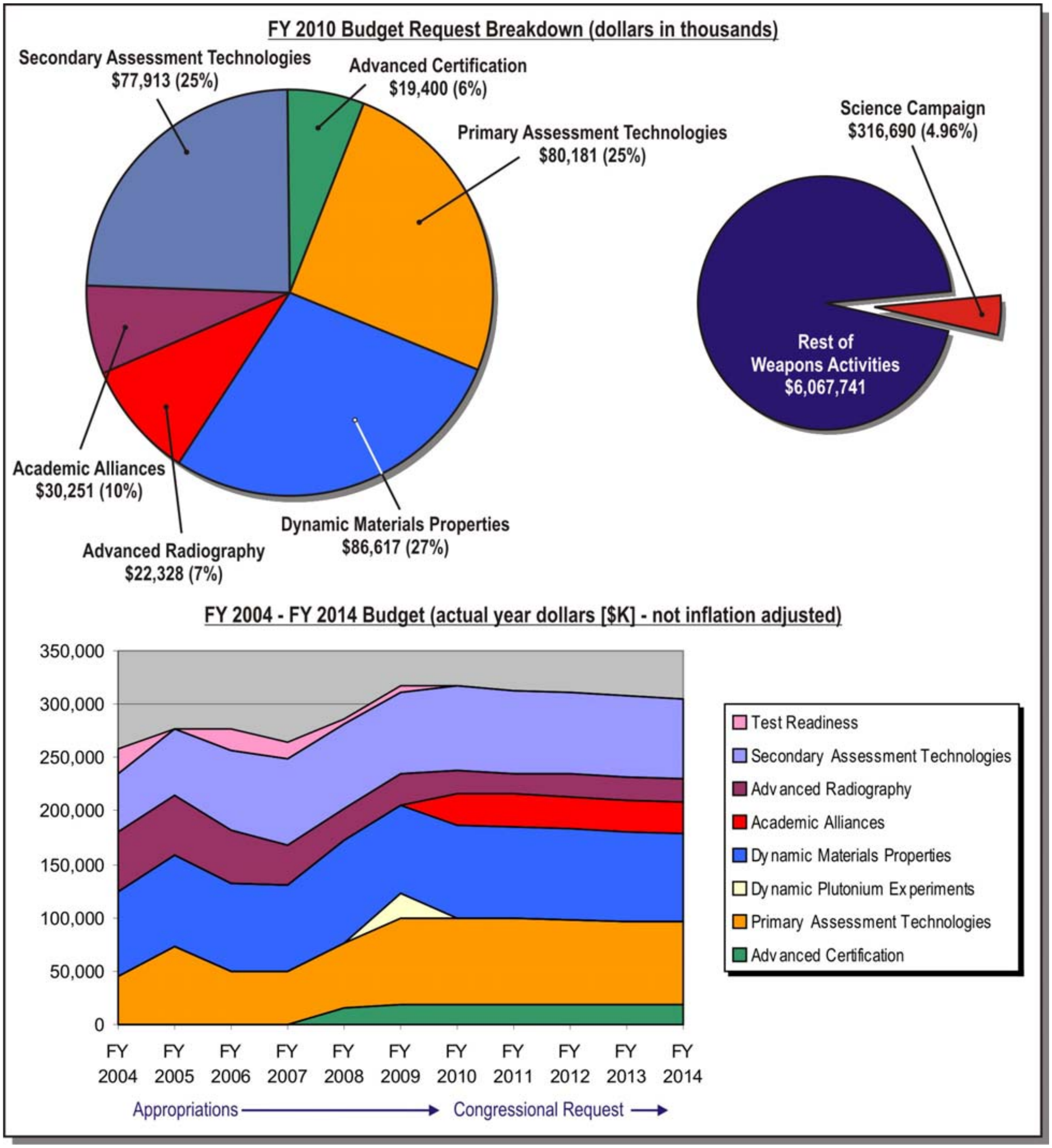

Figure 3-7. Funding Schedule for the Science Campaign.

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Engineering Campaign

4

Program Highlights

The Engineering Campaign has produced a number of significant FY 2008 accomplishments in support of the Stockpile Stewardship Program. Within the Enhanced Surety subprogram, the Engineering Campaign has completed the Built-In-Test/State-of-Health work for the Optical Initiation Firing Set and has delivered and demonstrated a fully assembled Direct Optical Initiation Firing Set prototype unit. The Weapons Systems Engineering Assessment Technology subprogram has established a technique for ground-based testing of flight and re-entry environments combining acceleration, vibration, and spin. In FY 2008, this new technique was successfully scaled up to full system scale, supporting Surveillance Transformation by providing performance and margin assessment. The Nuclear Survivability subprogram has successfully completed and documented the Qualification Alternatives to the Sandia Pulse Reactor (QASPR) simple prototype exercise to compare QASPR predictive tool capabilities to data sets derived from the Sandia Pulse Reactor III prior to its closure. In this initial step, agreement between predictions developed by the QASPR tool and experimental data sets was excellent. The Enhanced Surveillance subprogram has provided the initial framework for integrating component aging model information into an analytical toolset for predicting system reliability and has demonstrated a specific application of this framework. The Ion Beam Laboratory is now being funded by the Readiness in Technical Base and Facilities program and will not be covered in this chapter.

Mission

The goal of the Engineering Campaign is to develop capabilities to assess and improve the safety, reliability, and performance of the engineering components within the nuclear and nonnuclear explosive package of a nuclear weapon without further underground testing. Additionally, the Engineering Campaign strives to increase the ability to predict the response of all components and subsystems to external stimuli (such as large thermal, mechanical, and combined forces and extremely high radiation fields) and predict the effects of aging. The Engineering Campaign provides information, data, tools, predictive capability, and expertise to designers, analysts, surveillance, and system managers and helps develop technology options and essential capabilities for the stockpile.

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 4-1 shows the organizational structure of the Engineering Campaign.

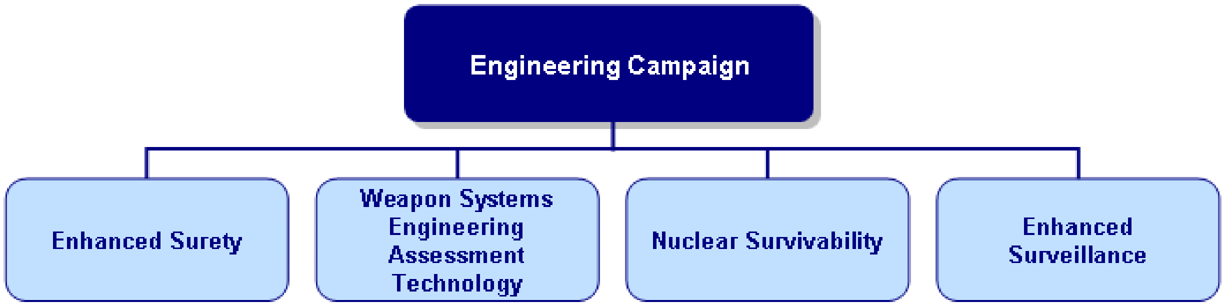

Figure 4-1. Subprograms of the Engineering Campaign in FY 2010.

Enhanced Surety

The Enhanced Surety subprogram is designed to provide advanced technology options for all weapons systems in the enduring and future stockpile to ensure modern nuclear safety standards are fully met and a new level of unauthorized use denial performance is achieved. This mission need is reflected in the current stockpile life extension program (LEP) where surety improvements are being pursued under clear guidance.

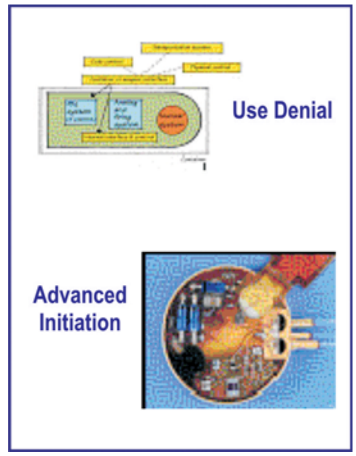

Figure 4-2. Enhanced Surety develops, validates and demonstrates advanced initiation and use-denial options for insertion into the stockpile.

The advanced technology pursued in the Enhanced Surety subprogram will reduce the dependence on the integrity of the weapons' nuclear safety exclusion region barriers by the implementation of initiation systems that are incompatible with the direct application of electrical energy. This Subprogram is also pursuing new engineering approaches for implementing in all weapon systems, new or refurbished, advanced use control technology that provides requisite delay and/or denial capability.

Weapon Systems Engineering Assessment Technology (WSEAT)

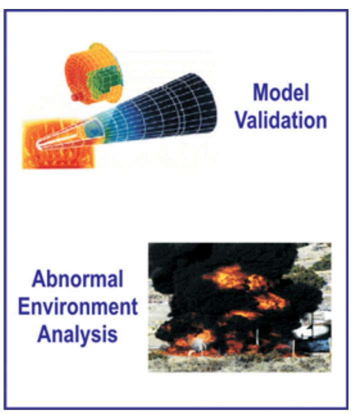

Figure 4-3. WSEAT provides experimental data to develop and validate advanced engineering computational models and simulation tools.

The WSEAT subprogram develops the experimental capability diagnostics and data needed to enable responsive engineering assessments and agile infrastructure in support of National Nuclear Security Administration (NNSA) stockpile management and transformation. The development cycle for future weapons will necessarily be compressed, and full scale testing will be reduced. In the context of the WSEATS subprogram, utilization of predictive simulations with applicable experimental validation becomes an increasingly important concept in response to this vision.

The WSEAT subprogram works closely with Directed Stockpile Work (DSW) and the Advanced Simulation and Computing (ASC) Campaign 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. Nuclear Survivability enables the continuing certification of nuclear survivability and effectiveness of the enduring and evolving stockpile through an engineering research and development (R&D) program in radiation sciences that integrates computational capabilities, experimental capabilities, new assessment methodologies, and further development of radiation-hardened technologies.

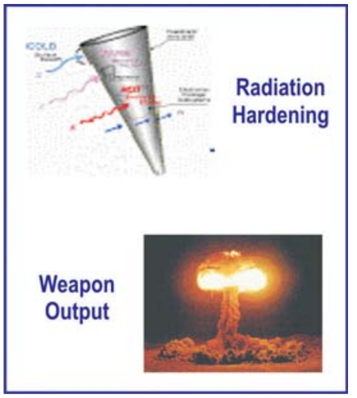

Figure 4-4. Nuclear Survivability provides tools to design and certify components and assemblies for meeting survivability requirements and for predicting weapon effectiveness.

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.

Enhanced Surveillance (ESV)

The 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.

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

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, for example, the Weapons Surveillance Facility. The subprogram contributes current weapon aging information for completing the Annual Assessment Reports to certify to the President that the stockpile is safe and reliable. 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 that replaces the Life Extension Options document for scheduling and planning future refurbishments of the stockpile.

PROGRAM GOALS

Subprogram	Goals
Enhanced Surety	Demonstrate advanced initiation technologies including new concepts in stronglinks, optical firing sets, and detonator safing for weapon refurbishments beginning in FY 2009 or later.
	Demonstrate advanced use-denial technologies, internal or external to the weapon, for use in future weapons or weapon refurbishments.
	Pursue concept feasibility studies and demonstration of selected smart weapon technologies including integrated surety solutions.
	Support incorporation of long-range, high payoff technologies such as Multi-Point safety for future insertion opportunities.
	Identify and demonstrate use control options for alts or mods of existing weapon systems that are effective and affordable and can counter the threats of the 21st century.
	Develop and mature promising surety technologies that can significantly enhance safety and reliability of the nuclear weapon stockpile, and can render the unauthorized use of U.S. nuclear weapons impossible without remanufacturing them.
Weapon Systems Engineering Assessment Technology	Support the W76-1 refurbishment qualification strategy by investing in experimental data to develop and validate models.
	Develop a validated capability to predict the transmission of mechanical energy through a broad class of joints found in reentry vehicles.
	Develop a validated capability to predict 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 W76 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 first application to W76 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.

Subprogram	Goals
	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.

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 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.

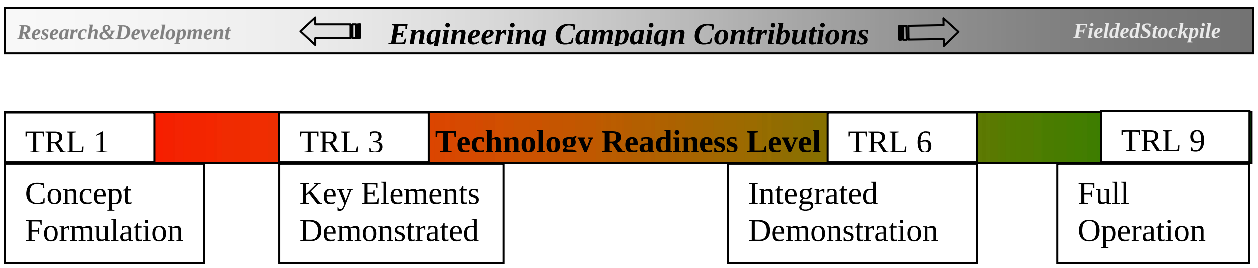

Figure 4-6. The Engineering Campaign connects the fundamental science and engineering base to stockpile applications.

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 within the Nuclear Security Enterprise.

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 Campaign, the Science Campaign, the Inertial Confinement Fusion Ignition and High Yield Campaign, and Readiness in Technical Base and Facilities (RTBF). 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 DSW interface, many of the scientific models that are to be developed or improved as input to the ASC Campaign come from the engineering research within the Engineering Campaign. The ASC Campaign also provides the validation and verification requirements for the advanced codes so that the Engineering Campaign can properly design and conduct the required experiment to validate the code for use in the complex. The engineering science basis for enhanced surveillance and nuclear survivability assessments depends on data on aging and relevant changes in material properties 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.

CHALLENGES

Subprogram	Issues
Enhanced Surety	One major challenge in implementing new surety technology in any refurbished warhead system is maintenance of certification. Designers must be confident that nuclear performance measures are sufficiently close to that of systems tested in underground nuclear tests for them to be able to assess that a system can maintain its original contribution with the advanced technologies. Closely related is the timely availability of the necessary, validated assessment tools required to measure the effect of changes to the nuclear performance of a warhead introduced by advanced surety technologies.
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 W76, and other Stockpile Stewardship activities.
Nuclear Survivability	The Dual-Axis Radiographic Hydrodynamic Test Facility, the Contained Firing Facility, the Z pulsed power accelerator, and the NIF are essential to verify that weapon modifications do not decrease margins or increase uncertainties in nuclear performance.

Subprogram	Issues
	The Annular Core Research Reactor is 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.
Enhanced Surveillance	Risk that unknown aging problems will not be identified with sufficient lead-time to respond prior to significant impacts to stockpile reliability, safety, or performance.
	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 reliable 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 reliable warheads.
	The time that existing components will endure in the stockpile goes beyond our experience for aged warhead materials.

Recent Accomplishments

Enhanced Surety

- An Optical Initiation Firing Set prototype was designed, developed, and delivered.
- Two thermoelectric transducer prototypes, fabricated last fiscal year, for use in future weapons systems were performance tested.
- A third prototype for the highest priority surety sensor technology was developed based on a new technology.
- Designed, fabricated, assembled, bench-top and environmentally tested Dual Stronglink Mechanism prototype hardware.
- Parametric material studies on Multi-Point Safety options were conducted at Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL).
- Under the Enhanced Collaboration effort with the United Kingdom, the Subprogram shares the load and cost of experimental activities through facility leveraging and exhibits complementary development of certification tool calculation capability, internationally expanding stockpile safety applications.

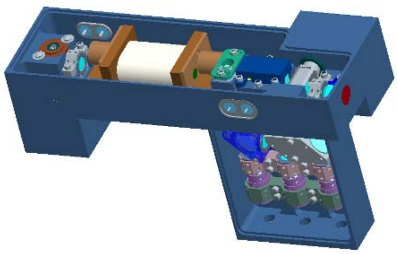

Figure 4-7. Several surety system components were advanced to TRL 4.

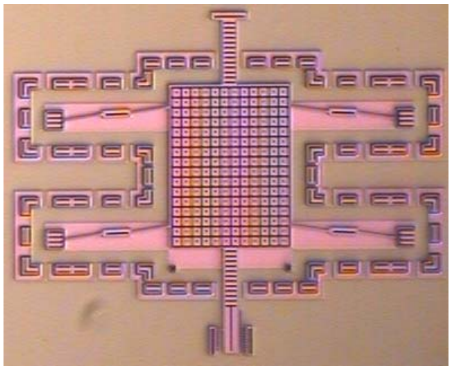

Figure 4-8. The WSEAT subprogram demonstrated simulation of reentry mechanical environments.

Weapons Systems Engineering Assessment Technology

- Delivered four datasets to reduce simulation uncertainty, including Beryllium creep properties at elevated temperatures; creep of plastic bonded explosive (PBX) 9501–a joint effort between test labs at LANL and LLNL examining material and test facilities' impact on observed creep behaviors; three-dimensional Digital Image Correlation data analysis; and coefficient of Thermal Expansion tests of PBX 9501.

- Developed an effective thermal conductivity characterization test that measures the conductivity of a material stack-up and its sensitivity to repeatability of the assembly, in support of the material testing effort.

- Identified the transferability of embrittlement properties from coupon tests to geometries of interest and identified the critical stainless steel material inputs for the fracture code under development by the University of Illinois.

- Successfully scaled up the new technique for ground-based testing of flight and re-entry environments combining acceleration, vibration, and spin, supporting Surveillance Transformation by providing performance and margin assessment.

- Provided performance assessment validation data on the highest priority surety component, characterizing the mechanical and thermal response of material over a range of environments, serving as input to ASC simulations.

- Published the 1st edition of a Joints Handbook consolidating the results of computational, theoretical, and experimental programs in support of the W76-1 LEP to foster the transition from R&D to Stockpile Applications.

- Complete assessment of impact initiation thresholds for stockpile high explosives. This effort supports our ability to make reliable, quantified predictions of weapon response in accident environments.

Nuclear Survivability

- Developed and demonstrated protocol specifying methods to establish margins impacting design and qualification of most electronic circuits for reentry systems.

- Developed methodology for studies of age-related changes in device hardness, enabling dose-rate sensitivity changes to be observed.

- Focused System Generated Electromagnetic Pulse (SGEMP) research on radiation induced conductivity in gases, with an emphasis on time-dependent effects, collecting data at SPHINX and the ISIS facility at Idaho State University, to ascertain existence of short time scale phenomena that could significantly alter SGEMP response models.

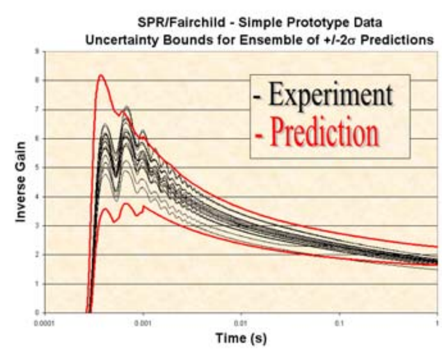

Figure 4-9. The Nuclear Survivability Subprogram successfully completed QASPR simple prototype exercise.

- Developed methods to significantly reduce the uncertainty set to a limited number of critical leverage parameters under radiation effects science.
- Develop SGEMP test capability for laser facilities. Data collected from a variety of closed cavities laser sources, with code-validation data collected fro a number of test objects with gas fill pressure for 0 to 10 Torr.
- Began analysis of effect of the new NWM21 Redbook threat models on the NEP of a weapon system. Completed initial analysis for one threat model with significant effect changes noted.

Enhanced Surveillance

- Completed an Enhanced Surveillance stockpile aging assessment report to support the annual assessment process.
- Completed selected aging and lifetime assessments for canned sub-assemblies, metals, polymers and ceramic materials in non-nuclear components, neutron tube, mechanical safe and arming devices, getters, silicone elastomers and polyurethane for NEP, and B61 non-nuclear parts.
- Completed initial characterization of representative samples to assess longevity of newly manufactured pits.
- Developed improved component aging models for canned sub-assemblies, polymers, high explosives, and initiation systems which support lifetime assessments and developed initial framework for inputting aging signatures into quantitative predictive models for assessing uncertainties.

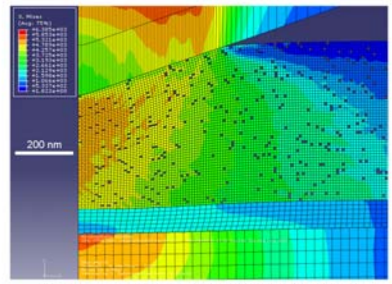

Figure 4-10. The Enhanced Surveillance subprogram developed improved aging models.

- Provided initial framework for integrating component aging model information into an analytical toolset for predicting system reliability and demonstrated its application on neutron generators.
- Established initial component and material evaluation capabilities to respond to the new challenges associated with reduced reliance on system-level testing.
- Down selected most promising embedded sensor technologies that could be applied to NEPs for future stockpile applications. Developed and deployed an embedded stockpile integrated evaluation prototype for field testing. Performed functional demonstration of test bed prototype and documented the results.
- Provided updated aging and lifetime assessments to support future weapon alteration or modification options for sufficient longevity of materials and components.

FUNDING SCHEDULES

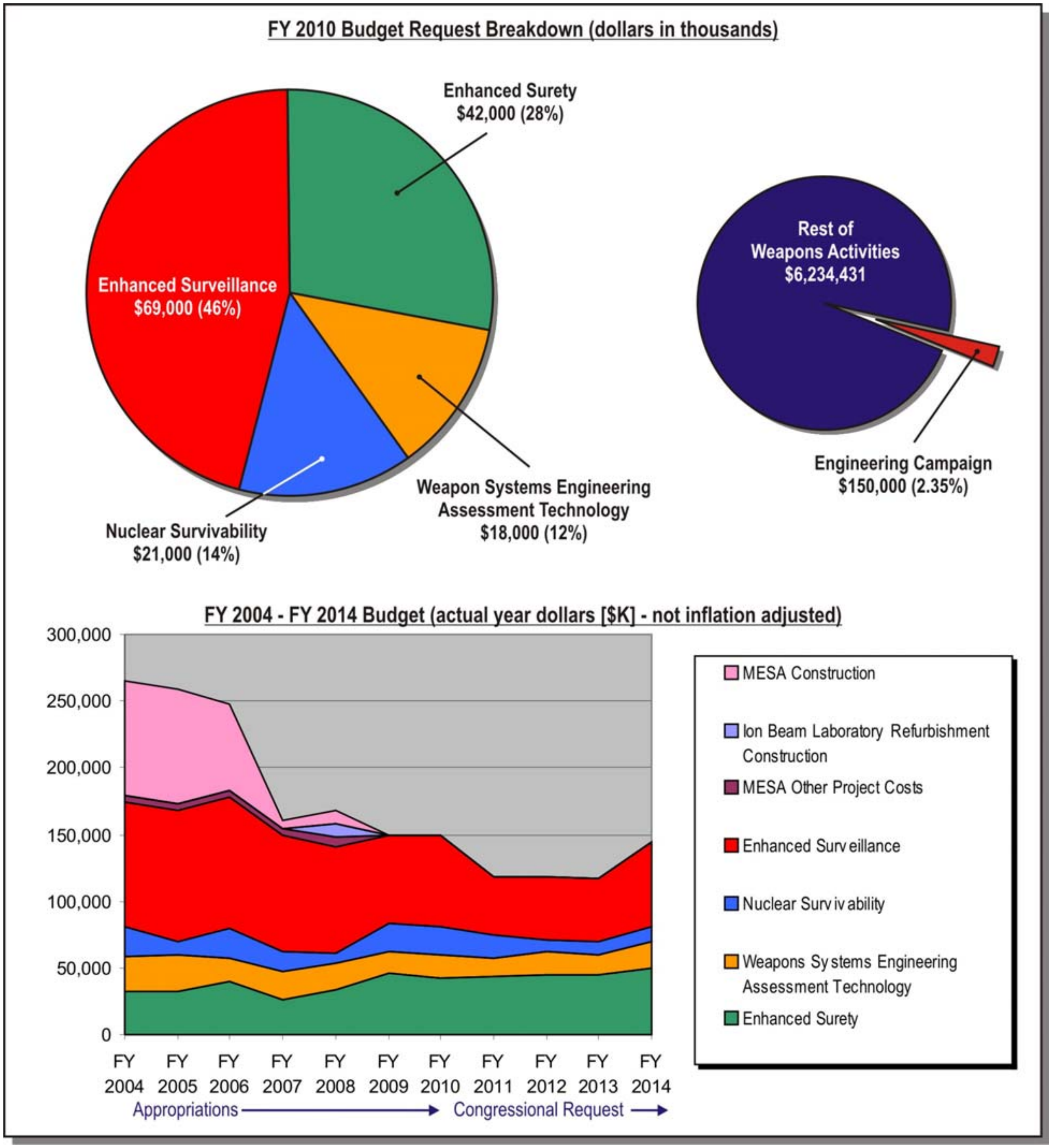

Figure 4-11. Funding Schedule for the Engineering Campaign.

Inertial Confinement Fusion Ignition and High Yield Campaign

5

Program Highlights

In FY 2008, the National Ignition Campaign continued to make significant progress towards meeting the program objectives of conducting the first integrated ignition experiments on the National Ignition Facility (NIF) in FY 2010 and preparing to transition the NIF to routine facility operations by the end of FY 2012. The physics requirements for the initial ignition target design were refined and validated and a detailed experimental plan for fielding the FY 2010 ignition campaign was developed. In addition, prototype ignition target components were successfully fabricated, assembled, and tested. Cryogenic fuel ice layers were formed and characterized and the Campaign made excellent progress in developing and deploying required diagnostics. The OMEGA Extended Performance addition to the OMEGA laser facility at the University of Rochester was completed on schedule and budget. Sandia National Laboratories, in collaboration with Los Alamos National Laboratory, completed the first Stockpile Stewardship experiment on the Z pulsed power accelerator obtaining pressure-density data for a metal (tantalum) at pressures up to 4 megabars. The experiment was completed jointly by the Inertial Confinement Fusion Ignition and High Yield Campaign and the Science Campaign. The NIF Project was completed at Lawrence Livermore National Laboratory in the second quarter of FY 2009 and was approved to start operations. The NIF achieved a world record for highest laser energy: 4.2 megajoule infrared (1.053 µm laser light) and 1.1 megajoule ultraviolet (0.351 µm laser light).

In FY 2010, emphasis will continue on critical path activities required to support the first ignition campaign that will attempt to compress, implode, and ignite a layered deuterium-tritium capsule with a ~1.3 megajoule energy pulse from the NIF.

Mission

The mission of the Inertial Confinement Fusion (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 can access the high energy density (HED) regimes of extreme temperature, pressure, and density required to assess the nuclear stockpile; and (3) maintain the U.S. preeminence in HED science and support broader national science goals.

Greater than 99.9 percent of the energy from a nuclear weapon is generated in the HED state. HEDP experiments on ICF facilities are required to validate the advanced theoretical models that are used to assess and certify the stockpile without nuclear testing. The National Ignition Facility (NIF) will extend HEDP experiments to include access to thermonuclear burn conditions in the laboratory—a unique and unprecedented scientific achievement. Once thermonuclear ignition is achieved on the NIF, a reproducible ignition platform will be developed that can be exploited to address the remaining important weapons physics questions. The OMEGA/OMEGA Extended Performance (OMEGA EP) and Z facilities support that National Nuclear Security Administration's (NNSA) HED missions and enhance the cost effective use of the NIF.

PROGRAM STRUCTURE

The ICF Campaign has seven major components: (1) NIF Construction Project; (2) the National Ignition Campaign (NIC); (3) support of stockpile stewardship through HED weapons physics experiments; (4) development of pulsed power ICF; (5) development of high energy petawatt lasers; (6) inertial fusion technology; and (7) the Joint Program in High Energy Density Laboratory Plasmas. These major components are funded under ten subprograms. Eight of the subprograms are in the technical program: (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. Two of the subprograms are part of the NIF Construction Project and were completed in FY 2009: (1) NIF Assembly and Installation Program; and (2) 96-D-111, NIF.

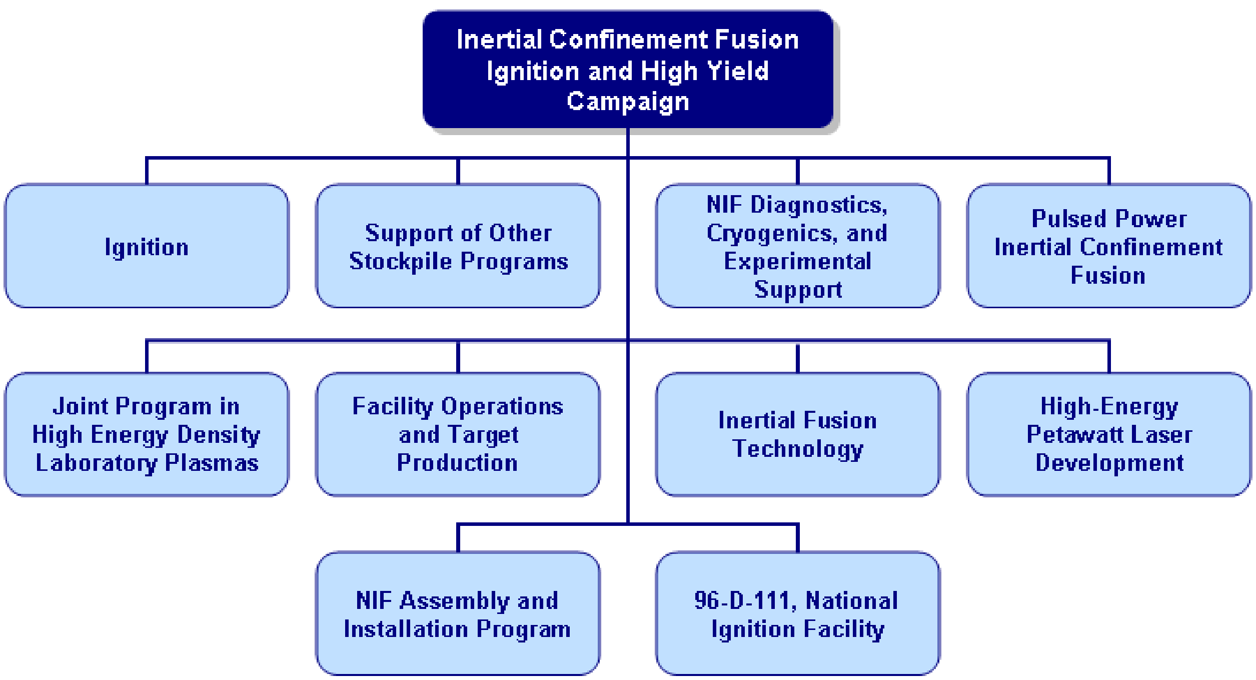

Figure 5-1. Subprograms of the ICF Campaign in FY 2010.

It should be noted that 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. Unlike other programs described in this FY 2010-2014 Stockpile Stewardship Plan, the ICF program does not have "subprograms." The ICF program is organized, funded, and managed around "major technical efforts" or MTEs. Changes to these MTEs require Congressional concurrence. In this chapter the ICF Campaign has used the word "subprogram" in order to maintain consistency with the other chapters in the Plan. However, the "subprograms" displayed and discussed are actually ICF Program MTEs. All the MTEs are fully integrated within the ICF Program. The completion of all the MTEs is necessary for meeting the three ICF strategic objectives. Additional details about the MTEs will be found in the next section on Program Goals.

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, validation 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 will continue to be on the most significant activities required to achieve indirect-drive ignition on the NIF. In anticipation of the achievement of ignition, the ICF program will also initiate specific and focused planning towards application of ignition conditions.

Figure 5-2. The National Ignition Facility was completed in the second quarter of FY 2009.

Support of Other Stockpile Programs

The Support of Other Stockpile Programs subprogram develops experimental capabilities, performs experiments, and uses analytic and computational tools to resolve important stockpile questions.

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, and systems to field cryogenic targets and 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 Z-pinches 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 and 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 Department of Energy. 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. These activities were previously funded under the University Grants/Other ICF Support subprogram. This activity is at pilot level at this time. 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 in 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. For FY 2010, the NIF will provide 300 shot-per-year capability. This subprogram supports the target fabrication subcontractor(s) activities including ICF target production and delivery, data collection and archiving, routine facility maintenance, engineering support for facility-supplied diagnostics, and office and laboratory space at the Lawrence Livermore National Laboratory (LLNL). This subprogram supports outside reviews and direct technical support for the Campaign. As a reaffirmation that NIF was intended to be both a national facility as well as a users' facility, the ICF Program will take the appropriate steps to implement this vision. The experience acquired in this first step will help prepare NIF for expanded use by a broader scientific community.

Inertial Fusion Technology

The Inertial Fusion Technology subprogram supports development of high repetition rate laser and pulsed power devices and associated technologies required to conduct experiments with these drivers to advance inertial fusion energy. This includes development of High Average Power Lasers related technologies and developing strategies beyond ignition leading to energy applications that include high yield with z pinches.

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 program.

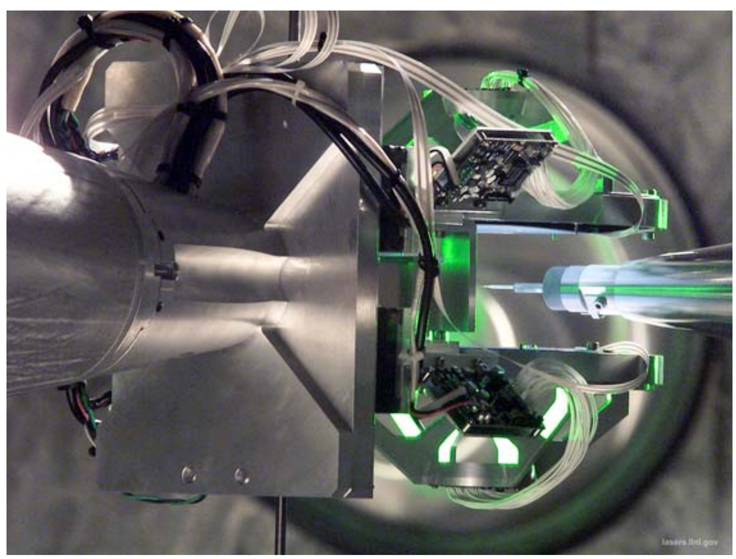

Figure 5-3. The target positioner and target alignment system precisely locate a target in the NIF target chamber.

NIF Assembly and Installation Program

The NIF Assembly and Installation Program subprogram supported assembly, installation, and commissioning of line replaceable units for all beams as part of the NIF construction project, plus other facility commissioning and related management activities required to demonstrate NIF laser performance.

96-D-111, NIF

The 96-D-111, NIF subprogram supported construction of the NIF, including the laser building, laser system, target area, integrated computer control system, and optical components.

PROGRAM GOALS

As mentioned in the previously, the subprograms discussed in the table below are actually the elements of the ICF Program structure, the Major Technical Efforts, or MTEs. Due to this programmatic structural change many of the goals identified in the table below are goals that pertain to the entire ICF program, rather than only to the subprogram. Other goals, more focused towards the subprogram, are actually specific milestones.

The ICF program uses a prescribed set of milestones to manage and track the progress of the ICF Program. The milestone content, the completion date and the criteria for completion are negotiated with the proposing laboratory (or laboratories) to ensure both an acceptable level of accomplishment as well as a realistic time frame for completion. A milestone-based quarterly program review is held and chaired by the NNSA Deputy Administrator for Defense Programs.

In addition, NNSA uses milestones to implement its Performance Evaluation Process System (PEPS), a process used to evaluate the performance of its management and operating contractors (Los Alamos National Laboratory [LANL], LLNL and Sandia National Laboratories [SNL]). A significant part of this process includes a set of milestones, some of them involving multi-site participation. These multi-site milestones have enhanced objectives, beyond the level of accomplishment originally agreed upon for the "regular" 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 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 ignition platform to enable Science-based Stockpile Stewardship experiments jointly with the Science Campaign.
	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 Stockpile Stewardship Program 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 and qualify cryogenic ignition target production capability for the NIF.
	Complete operational qualification of cryogenic system on the NIF.

	Subprogram Goals
	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 (PEPS) commissioning for routine yield operations on the NIF.
	Define requirements for diagnostics and plan for support of HED weapons physics experiments in support of the PCF.
Pulsed Power Inertial Confinement Fusion	Determine the physics requirements and feasibility of high yield fusion using z-pinch technology.
	Demonstrate a 100 kilojoule 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.
	Perform the first Z experiments using high-resolution neutron imaging to measure the fusion fuel parameters.
Joint Program in High Energy Density Laboratory Plasmas	Conduct solicitations with the Office of Science to support basic HEDP research.
	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.
	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.
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.
	Provide 300 shot-per-year capability.
	Complete transition of the NIF to routine operations in support of Stockpile Stewardship Program, including classified operations in FY 2012.
Inertial Fusion Technology	No funds were provided for this subprogram in FY 2009 and no funds are requested for FY 2010.*
NIF Assembly and Installation Program	The NIF was completed in March 2009. No activity under this subprogram is currently planned.*
High-Energy Petawatt Laser Development	This subprogram supported construction of the OMEGA EP facility that was completed in FY 2008. No activity under this subprogram is currently planned.*
96-D-111, National Ignition Facility	The NIF was completed in March 2009. No activity under this subprogram is currently planned.

* 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 approved funding.

STRATEGY

The ICF Program will accomplish its mission (described above), through 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. These experiments 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

Figure 5-4. A view of the OMEGA EP laser at the University of Rochester.

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 will provide 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.

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, 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 the ultraviolet. Two of these beamlines can be operated a high-energy, short-pulse lasers producing up to 2.6 kilojoules of infrared energy in a 10 picosecond pulse. OMEGA EP can produce the high energy x-rays required for the advanced radiography capability needed in 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 ignition experimental campaign 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.

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. ICF subprogram activities in both ignition and HEDP rely on the advanced simulation and computing expertise of the ASC Campaign. ICF experimental results, in turn, are used to validate and support ASC computational capabilities and simulations for subsequent application to warhead analysis. The PCF is a vital tool in linking ICF Program activities to weapons program requirements in a number of areas: (1) advanced theoretical model development; (2) measurement of physical properties of matter in extreme conditions; and (3) testing of specific weapons phenomena. The ICF Program is actively engaged in the development and use of the PCF.

The ICF Campaign, 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 Stockpile Stewardship Program 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.

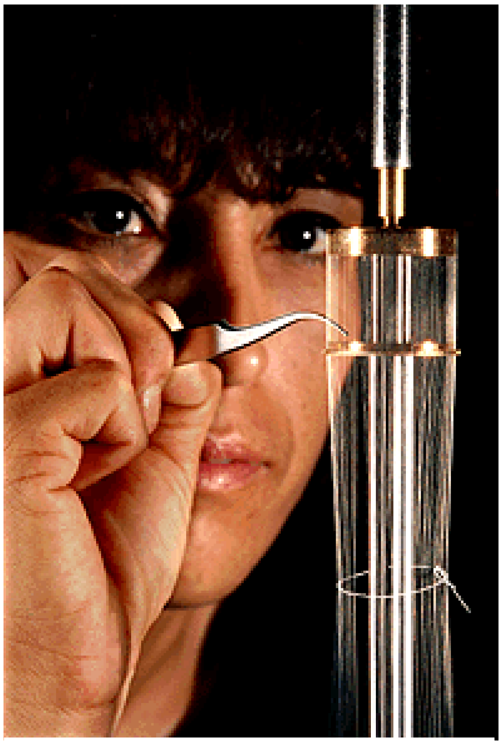

Figure 5-5. A Sandia technician builds an array of wires, each 1/10th the width of a human hair, that form a target for the Z accelerator.

The data, methodologies, models and simulation codes developed by the Defense Programs' science effort lend confidence to and support the calculations performed to meet Directed Stockpile Work's 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 will effectively steward high energy density laboratory plasmas within DOE while maintaining the interdisciplinary nature of this science and engage members of the broader scientific community in these efforts. 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).

CHALLENGES

Subprogram	Challenges
Ignition	Examine options for reducing risk to the ignition program including alternatives to the current indirect drive target design and for providing higher gains, if required. Approaches include innovative target designs, direct drive illumination using indirect drive beam geometry, continued experimentation on existing facilities, mitigating stimulated scattering of incident laser energy, the use of second harmonic (green) laser light.
	Closely coordinate NNSA Stockpile Stewardship Program campaign activities (using PCF and other tools) to ensure cross-campaign support efforts remain well integrated. In particular, assure that the ignition platform satisfies the requirements of the weapons program as a whole.
Support of Other Stockpile Programs	Develop advanced capabilities including modifications to current ICF facilities or the addition of new facilities that would expand the parameter space for HEDP stockpile support experiments, consistent with and in support of the Complex Transformation vision.

Subprogram	Challenges
	Identify HEDP science technology and resource requirements to meet future Stockpile Stewardship Program needs, including a robust research environment for training the next-generation of weapons scientists, engineers, and program managers.
	Work with other campaigns to define and develop experimental platforms on NIF, OMEGA, and Z for HEDP experiments relevant to Stockpile Stewardship.
NIF Diagnostics, Cryogenics, and Experimental Support	Complete the diagnostics required for the understanding of ignition and near-ignition conditions on the NIF.
	Work with other campaigns to define and develop new diagnostics for HEDP experiments on NIF, OMEGA, and Z, including diagnostics that function during the ignition process.
Pulsed Power Inertial Confinement Fusion	Understand the science and develop the pulsed power technology that could be used to achieve thermonuclear fusion in a Z pinch device.
Joint Program in High Energy Density Laboratory Plasmas	Steward and grow the field of HED physics to maintain the U.S. preeminence in HED science and support broader national science goals with the Office of Science.
	Establish all ICF facilities as user facilities and develop strategy to ensure adequate university and outside user participation.
	Ensure that critical skills needs are met for the Stockpile Stewardship Program.
Facility Operations and Target Production	Balance capability, capacity, and program needs among the ICF HED facilities. Ensure that critical resources and skills needs are met for Stockpile Stewardship Program. Reduce operating costs at HED facilities through efficiency gains.
	Establish a national policy for operation of NNSA facilities as national user resources.
Inertial Fusion Technology	Partner with the Office of Science to use NNSA's HED facilities in support of the development of inertial fusion energy.
NIF Assembly and Installation Program	The NIF was formally completed in March 2009.
High-Energy Petawatt Laser Development	Define need and demonstrate proof of concept for next generation of high-energy petawatt lasers to support the Stockpile Stewardship Program.
96-D-111, National Ignition Facility	The NIF was formally completed in March 2009.

Recent Accomplishments

NIF Project

- The NIF project was completed in FY 2009 within its approved baselines. The Project successfully maintained cost and schedule performance since the major re-baseline in 2000, and demonstrated an excellent overall project safety record. The NNSA Administrator approved the Critical Decision 4 (Project Complete) on March 27, 2009.

- NIF has demonstrated the capability of producing 4.2 megajoules of infrared laser light at a wavelength of 1.053 μm (micrometers), over thirty-five times more energy than any previous laser system.

- NIF has demonstrated the capability of delivering 1.1 megajoules of ultraviolet (0.351 μm) laser light to target chamber center.

NIC

- The NIC continues to make significant and sustained progress towards meeting its program objectives of conducting the first integrated ignition experiments in FY 2010 and preparing to transition the NIF to routine facility operations by the end of FY 2012. During FY 2008, the physics requirements were refined for the initial ignition target design and validated through extensive reviews of recent experimental data obtained on OMEGA and Z and high-performance computer simulations. Target design considerations focused primarily on scattering phenomena that prevent the laser energy from coupling with and heating the target to drive the implosion (hohlraum laser-plasma instabilities), capsule perturbations resulting from defects in the capsule material microstructure, and the radiation-hydrodynamic responses of the two candidate target ablator materials, beryllium with a graded copper dopant, and plastic with a graded germanium dopant. The beryllium and plastic ignition target designs were re-optimized and both have a reasonable probability to ignite and burn the thermonuclear fuel (deuterium-tritium [DT]) using a nominal ~ 1.3 megajoule laser pulse from the NIF.

- A detailed experimental plan was developed that defines the system shot requirements, both primary and contingency, for fielding the FY 2010 credible ignition campaign on the NIF. This plan identifies the early experiments that will be conducted and the decision tree that will be used to 'fine tune' the ignition target design for the FY 2010 ignition campaign. As a prelude to the FY 2010 ignition experiments, simulated shot campaigns are being executed to exercise and test all aspects of the NIC experimental program. Follow-on simulation campaigns will include additional complications such as the introduction of further imperfections in two dimensions (i.e. laser pointing and power balance, capsule and ice surface roughness) and will address the diagnostic strategy for implosions of both DT and tritium-hydrogen-deuterium capsules.

- In the third quarter of FY 2009, the first major ignition target physics campaign began. The hohlraum energetics campaign is intended to set the radiation drive temperature for the full scale ignition campaigns planned for FY 2010.

- Prototype ignition target components were successfully fabricated, assembled, and tested at General Atomics and LLNL and cryogenic DT fuel ice layers of the required thickness and roughness were formed and characterized using x-ray imaging techniques. Target production capabilities were established and shown to be able to consistently assemble, leak-tight cryogenic ignition layering targets. Considerable progress was made to increase the throughput of the target production capabilities to deliver quality, high precision ignition targets meeting the ignition point design specifications in the quantity consistent with the NIC experimental schedule.

- Excellent progress in the development and deployment of diagnostics needed for the FY 2010 ignition campaign was made. Diagnostics that measure x-ray emission from an irradiated target (a static x-ray imager and a streaked x-ray detector) were activated and used for commissioning the first

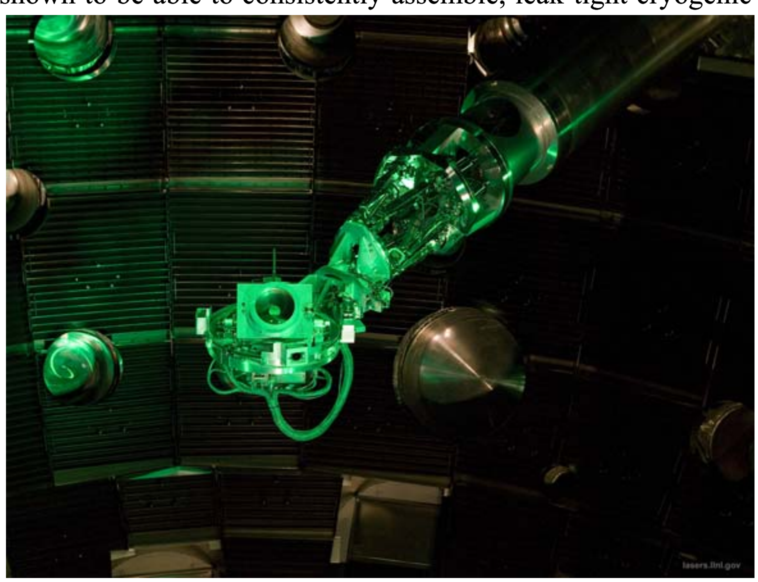

Figure 5-6. NIF's final optics inspection system, when extended into the target chamber from a diagnostic instrument manipulator, can produce images of all 192 beamline final optics assemblies.

NIF bundle (eight beams) to target chamber center. An ignition diagnostic developed by the University of Rochester to measure the time-of-flight of neutrons was successfully calibrated on the OMEGA facility. The first ignition target inserter and cryostat was assembled and shown to provide the required cryogenic temperature control. A final optics inspection system was developed and commissioned on the NIF.

- 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.

OMEGA Laser Facility

- The OMEGA EP Laser Project was completed in FY 2008. It significantly extends the research capabilities and adds significant flexibility to the existing 60-beam line OMEGA laser at LLE. The OMEGA EP Project added four high energy laser beam lines. Each of the four beam lines can operate in the ultraviolet (0.35 µm wavelength) in long-pulse mode (1-10 nanoseconds) and two of the beam lines can be operated in short-pulse, high-energy petawatt mode (~10 picoseconds) in the infrared (1.053 µm wavelength). In May 2008, an Energy Systems Acquisition Advisory Board reviewed and approved Critical Decision 4, Project Completion and Start of Operations. The OMEGA EP Project was completed on time and on budget, with a Total Project Cost of $98.5 million. Since completion, a short-pulse beam has been delivered orthogonally to the existing backlighter path into the OMEGA EP target chamber, enhancing even more the experimental flexibility. An OMEGA EP beam line has provided greater than 1.3 kilojoules of infrared light to target in a 10 picosecond laser pulse and this energy is more than a factor of two higher than has ever been achieved with a high energy short pulse laser system. The first user experiments on OMEGA EP were carried out in July 2008 by an LLE/LLNL team. A significant number of energetic protons were observed, consistent with the expectations of high-energy, short-pulse, laser-target interactions.

- In FY 2009, the first short pulse x-ray radiograph of an imploding cryogenic DT target was produced using ~1.6 kiloelectronvolt radiation generated by a ~1 kilojoule, 10 picosecond 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. In another experiment, a multi-institutional team captured a radiograph of a shock wave propagating in a solid Aluminum target. The shock wave was generated by one of OMEGA EP's long pulse ultraviolet beams and the x-ray source was generate by a high energy short pulse delivered by a second OMEGA EP beamline interacting with a Samarium target.

- In FY 2008, the 60-beam, 30 kilojoule ultraviolet OMEGA laser system performed 1,169 target shots with high availability and effectiveness. Users included scientists from LANL, LLE, LLNL, SNL and various universities.

Z Refurbishment

- SNL completed and commissioned the refurbished Z pulsed power facility at a Total Project Cost of $91.4 million in FY 2007. As a result of the refurbishment, the maximum current was increased from 18 to 26 mega-amperes. The refurbished Z has improved shot-to-shot reproducibility (within +/- 1.5 percent for the current pulse shape), more precise current shaping, and a longer, variable pulse length. Upgrades to the Z-machine include more lines of sight for diagnostics and more diagnostics including the ability to measure neutron time of flight and radiograph an imploding target yielding 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.

Other ICF Accomplishments

- SNL, in collaboration with LANL, completed the first Stockpile Stewardship experiment on the refurbished Z-machine obtaining pressure-density data for a metal (tantalum) at pressures up to 4 megabars. This was a Level-1 milestone that represented a joint effort between the ICF and the Science Campaigns. Design simulations provided by several advanced computer codes, were used to achieved the required very precise shaping of Z's current pulse. The refurbished Z also provided data on the strength of beryllium, an important material used in both ICF capsules and other defense applications.

- In pulsed power ICF, SNL made progress on two different approaches to achieve ignition and high yield. One approach used z-pinch x-rays to implode a fusion capsule and the other used magnetic pressure to compress the fuel directly. As part of this effort, SNL conducted the first neutron-producing fusion experiments on the refurbished Z. SNL used complex, multi-dimensional computer codes to provide insight in to how to scale z-pinches to high current as a potential path to fusion ignition and high yield.

- The Naval Research Laboratory and its collaborators in industry built a repetitively pulsed, all-solid-state 250,000 volt Marx generator that creates the type of short, high-power electrical pulses needed to efficiently pump a Krypton Fluoride (KrF) gas laser. The Electra system has run continuously for over one million shots. The essential components are based on elements that have demonstrated lifetimes of several hundred million shots.

- NRL has carried out extensive one-dimensional and two-dimensional computer simulations of directly-driven, shock-ignited targets employing the beneficial effects of shorter wavelength and focal zooming available with KrF lasers. Energy gains have been observed in the simulations near one hundred at 300 kilojoules and greater than two hundred at 1 megajoule. These simulations further indicate that the shock-ignited designs are resistant to hydrodynamic instabilities. If such performance could be realized, it would make laser fusion more attractive for energy applications.

- The LLNL High-Average Power Laser group activated an advanced front end injection and pulse shaping system on their diode-pumped, solid-state Mercury laser system. Mercury has now demonstrated sustained operations for 70 minutes at an energy level of 55 joules and a repetition rate of 10 hertz. The resulting shot total was 300,000.

FUNDING SCHEDULES

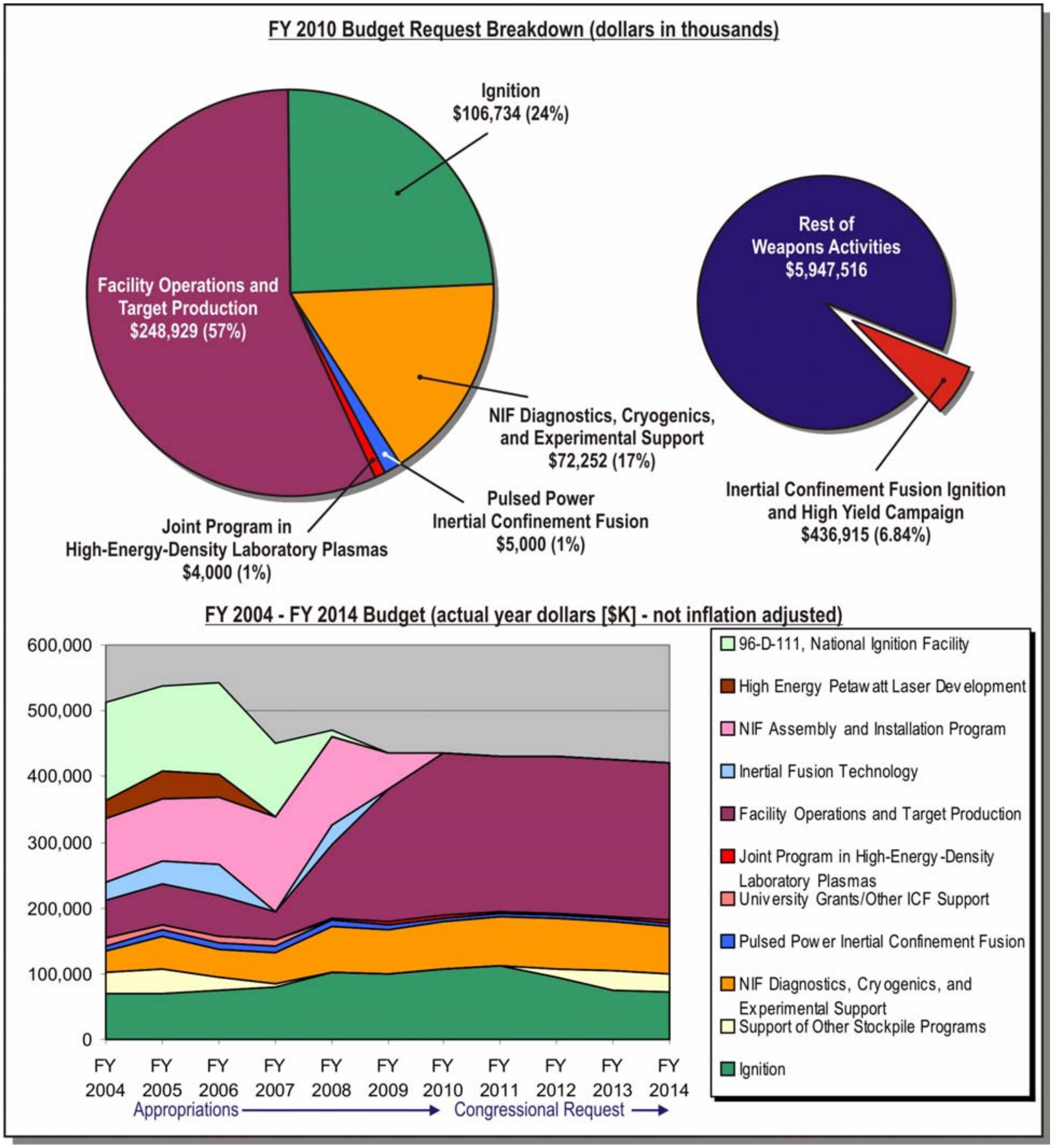

Figure 5-7. Funding Schedule for the ICF Campaign.

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Advanced Simulation and Computing Campaign

6

Program 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 technology investments allow an unprecedented level of computing capability and advanced weapons codes in support of the mission of the Nuclear Security Enterprise.

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 implementing into our modeling and simulation tools. ASC's collaboration with the other Campaigns, Directed Stockpile Work, and the Department of Energy's Office of Science is a major strength of the Stockpile Stewardship Program and instrumental to providing increased predictive capability for the Complex.

Considerable progress has been made by establishing two user facilities for production capability computing for the Complex. One of these facilities is located at Lawrence Livermore National Laboratory and the other is established through the Alliance for Computing at Extreme Scales (ACES) partnership between Sandia National Laboratories and Los Alamos National Laboratory. The establishment of these two centers facilitates a synergistic approach to servicing the high-performance computing needs of the Nuclear Security Enterprise.

The ASC Campaign's simulation tools for the nuclear stockpile have inherent applications for a broader national security mission. In conjunction with developing science-based, predictive simulations capabilities for nuclear weapons assessment, ASC has supported the research, development, and application of tools for nuclear forensics and the science of post-detonation analysis. ASC is committed to further exploring areas of national security where the simulation toolset may enable faster turnaround of operations, higher-fidelity simulations, and improved scientific understanding of the underlying physical phenomena. These mission areas include nonproliferation applications and nuclear counterterrorism applications.

Mission

The Advanced Simulation and Computing (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.

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).

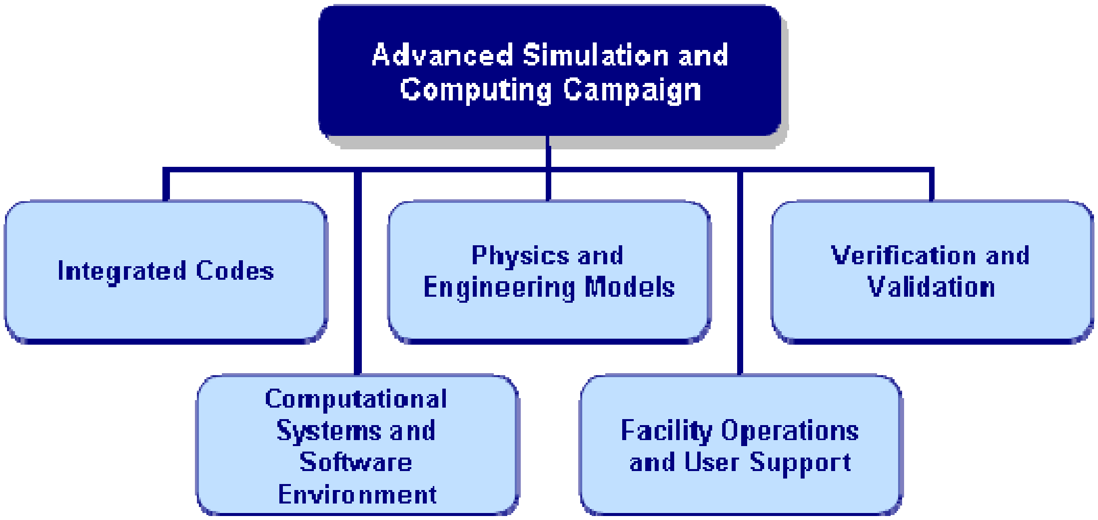


Figure 6-1. Subprograms of the ASC Campaign in FY 2010.

Integrated Codes (IC)

The IC subprogram produces large-scale integrated simulation codes that are needed for stockpile maintenance, Life Extension Programs, Significant Finding Investigations (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.

The Directed Stockpile Work (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 National Ignition Campaign also uses the codes to meet its mission goals, including the National Ignition Facility. 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.

Figure 6-2. IC produces the weapons simulation codes used by the Stockpile Stewardship Program.

Physics and Engineering Models (PEM)

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 Stockpile Stewardship Program experimental programs executed by the Science Campaign, the Inertial Confinement Fusion Campaign, and the Engineering Campaign.

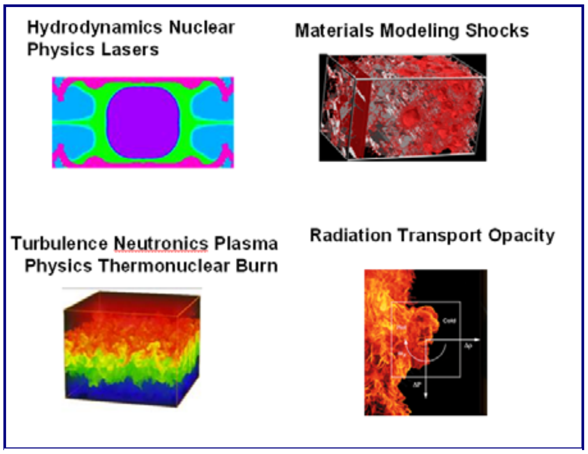


Figure 6-3. PEM develops microscopic and macroscopic models of physics and material properties.

Verification and Validation (V&V)

Verification activities demonstrate that the weapons codes are solving equations related to physics and engineering models correctly. 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 part of the foundation to the Quantification of Margins and Uncertainties (QMU) process of weapons assessment and certification.

Computational Systems and Software Environment (CSSE)

This subprogram builds integrated, balanced, and scalable computational capabilities to meet predictive simulation requirements. The complexity and scale of nuclear weapons performance and analysis 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 National Nuclear Security Administration (NNSA) investment in secure simulation codes.

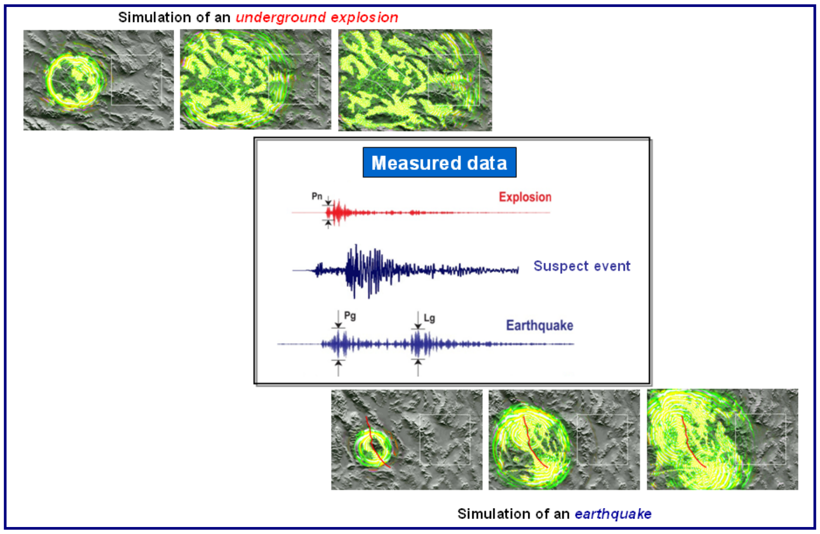


Figure 6-4. V&V demonstrates that weapons codes are correctly solving physics and engineering models.

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 a million billion floating point mathematical operations per second, levels of performance by 2018. Significant technology shifts in high-performance computing are anticipated, and have already begun, in order to meet this goal 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 Purple, Red Storm, Blue Gene/L, Roadrunner, Zia, Sequoia, and beyond.

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 6-5. CSSE builds integrated, balanced, and scalable computational capabilities to meet simulation requirements.

Facility Operations and User Support (FOUS)

This subprogram provides physical facility and operational support for production computing and storage, as well as providing users with a suite of services enabling effective use of ASC Tri-Laboratory computing resources. The designers, analysts, and code and model developers of the National Security Enterprise provide functional and operational requirements for FOUS.

FOUS provides the necessary physical facility and operational support for reliable production computing and storage environments as well as user services. 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.

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 (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).

Subprogram	Goals
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 distant computing infrastructure that enables remote users to access petascale systems.
	Continue to provide user services and helpdesks for ASC users.

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, Inertial Confinement Fusion Campaigns, and DSW through the Predictive Capability Framework, an integration tool used by the Campaigns to plan scientific work for tackling difficult problems in select weapons physics and engineering areas.

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;
- 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 National Security Enterprise, 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 show in the 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.

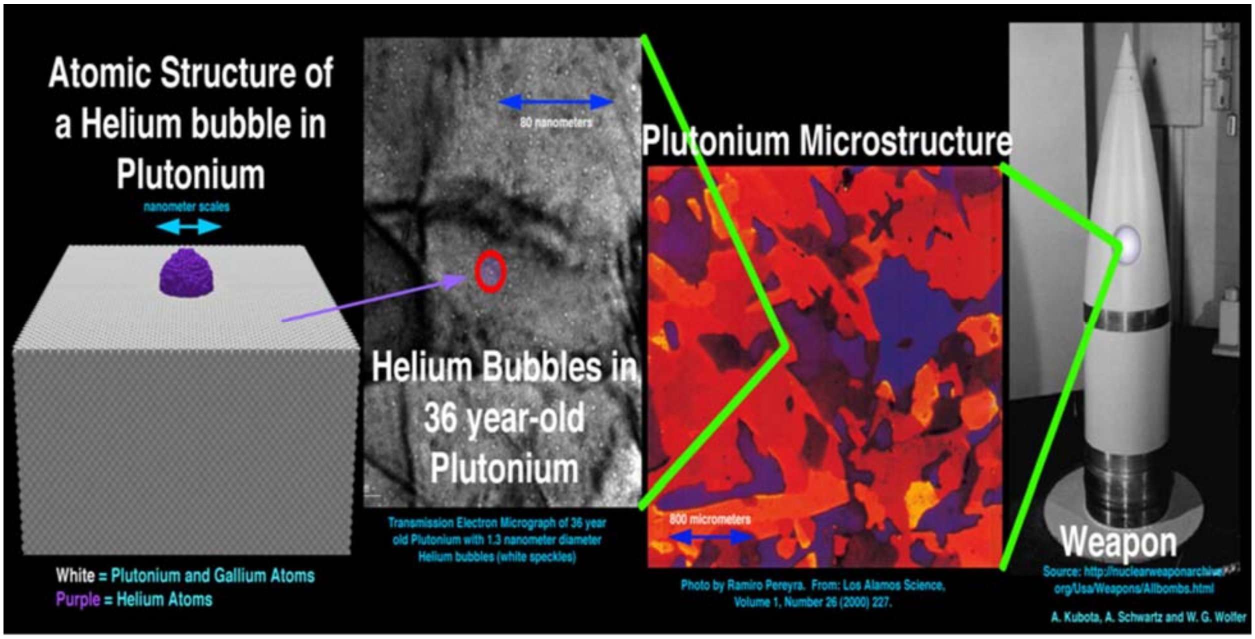


Figure 6-6. Understanding Science from the Microscale to Macroscale through Simulation.

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 will increase as High Performance Computing systems grow, requiring innovative solutions.

RECENT ACCOMPLISHMENTS

Integrated Codes

- The SIERRA engineering simulation framework has been instrumental in Kansas City Plant's W76 applications as part of their production build schedule. Kansas City Plant 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.
- A three-dimensional modeling capability was developed in FY 2008 for the plasma physics phenomena that underlie operation of the neutron tube in neutron generator subsystems. This

- ASC delivered the codes for experiment and diagnostic design to support the Critical Decision-4 approval on the National Ignition Facility.
- Geologic material properties in engineering code have been implemented to support non-traditional/national security applications.
- ASC forensics team successfully identified a device in recent blind exercise organized by NA-42 and the Defense Threat Reduction Agency. This success was enabled by use of validated ASC codes, together with cross section advances that enabled usage of new metrics to guide identification of the device technology. A valuable list of lessons-learned was obtained that is helping direct future research efforts needed.
- New numerical tools developed for Sandia National Laboratories' (SNL) XYCE code, a massively-parallel, electrical circuit modeling code, produced speedups of 2000X for circuit calculations and enabled many circuit design analyses to be performed in a matter of seconds.
- Several code efficiency improvements were identified and implemented into one of the ASC performance codes. For a full system test problem, time-to-solution was reduced 7 percent with the new code version relative to the FY 2007 code version.
- A model was developed and implemented for LLNL's modern full-system capability to support energy balance resolution.
- Completed the first-generation Modern ASC baseline models for stockpile systems and their application to Annual Assessment, SFI closures, and other DSW activities.
- Released new versions of weapons physics performance codes including new capabilities to support analysis of the W88 as well as analysis of the hypotheses surrounding major areas of uncertainty in weapon performance across a variety of weapon systems.

Physics and Engineering Models

- A particular thermo-mechanical model in use at Lawrence Livermore National Laboratory (LLNL) was calibrated for use in support of a specific SFI.
- Delivered a materials model to a modern code, in order to support a physical model for initial conditions for boost.
- The molecular dynamics code SPaSM (Scalable Parallel Short-range Molecular dynamics) was a finalist for the 2008 Gordon Bell Prize. SPaSM simulations are being used in collaboration with experimental and theoretical efforts in the Science Campaign at LANL to develop fundamental science-based models of shock ejecta production and transport that are valid over atomistic (sub-nm) to macroscopic (mm) scales.
- Implemented relevant physics and engineering models needed in support of safety calculations of a weapon in a fire.

- In conjunction with DSW, completed initial assessment of an Alternate Material Option for a critical component in the stockpile Life Extension Program.
- The 6Li(n,t) cross section, which is of crucial importance for tritium breeding, has been determined accurately above 1 MeV for the first time using the Los Alamos Neutron Science Center measurements and R-matrix theory calculations. Uncertainties have been reduced from 20 percent to < 5 percent. The impact of the improved data is now being assessed.
- Developed, implemented, and validated two next-generation models describing a major physical phenomenon that is critical to predicting weapons physics performance including yield.
- Assessed the predictive capability of advance material damage models by comparison with small-scale data from subcritical plutonium experiments.

Verification and Validation

- Computational study for the Qualification Alternatives to the Sandia Pulsed Reactor, employing a series of UQ calculations performed on the ASC Red Storm and Purple platforms, has successfully made "blind" predictions of device response data.
- Developed a strategy for large-scale debugging to ensure LLNL applications can run correctly on petascale platforms.
- Model set-ups using Modern ASC codes were undertaken for a large set of nuclear tests that will populate the LANL: (1) primary validation suite; (2) boost validation suite; and (3) secondary validation suite.
- Assessed the ability of weapons physics performance codes to predict late-tine implosion behavior via comparison to relevant non-nuclear and underground test experimental data.
- Received the Department of Energy Award of Excellence for work on the tri-lab verification suite.
- Reanalyzed underground test data for five test shots to assess the ability of weapons physics codes to accurately simulate certain aspects of secondary behavior.

Computational Systems and Software Environment

- A significant fraction of the Red Storm compute time in FY 2008 being was dedicated to an urgent classified National Security project requested by NNSA. While details are classified, one of the special request projects provided critical information that enabled an accelerated conceptual design process for weapon security technology.
- 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.
- As part of the system and code stabilization effort for the ASC Roadrunner petascale installation at LANL, ten Open Science projects were chosen from a field of 29 proposals in a selective process and are running on Roadrunner in FY 2009. 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.

- 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.

- Created the NNSA Alliance for Computing at the Extreme Scales (ACES) between LANL and SNL whose goal is to provide high performance capability computing assets required by NNSA's stockpile stewardship mission. An ACES Architecture Office was set up which developed a request for proposal to be released in FY 2009 for the next ASC production capability system, Zia, as well as making preliminary specifications for a 2014 platform in support of continued improvement in predictive simulation capabilities for stockpile stewardship.

FUNDING SCHEDULES

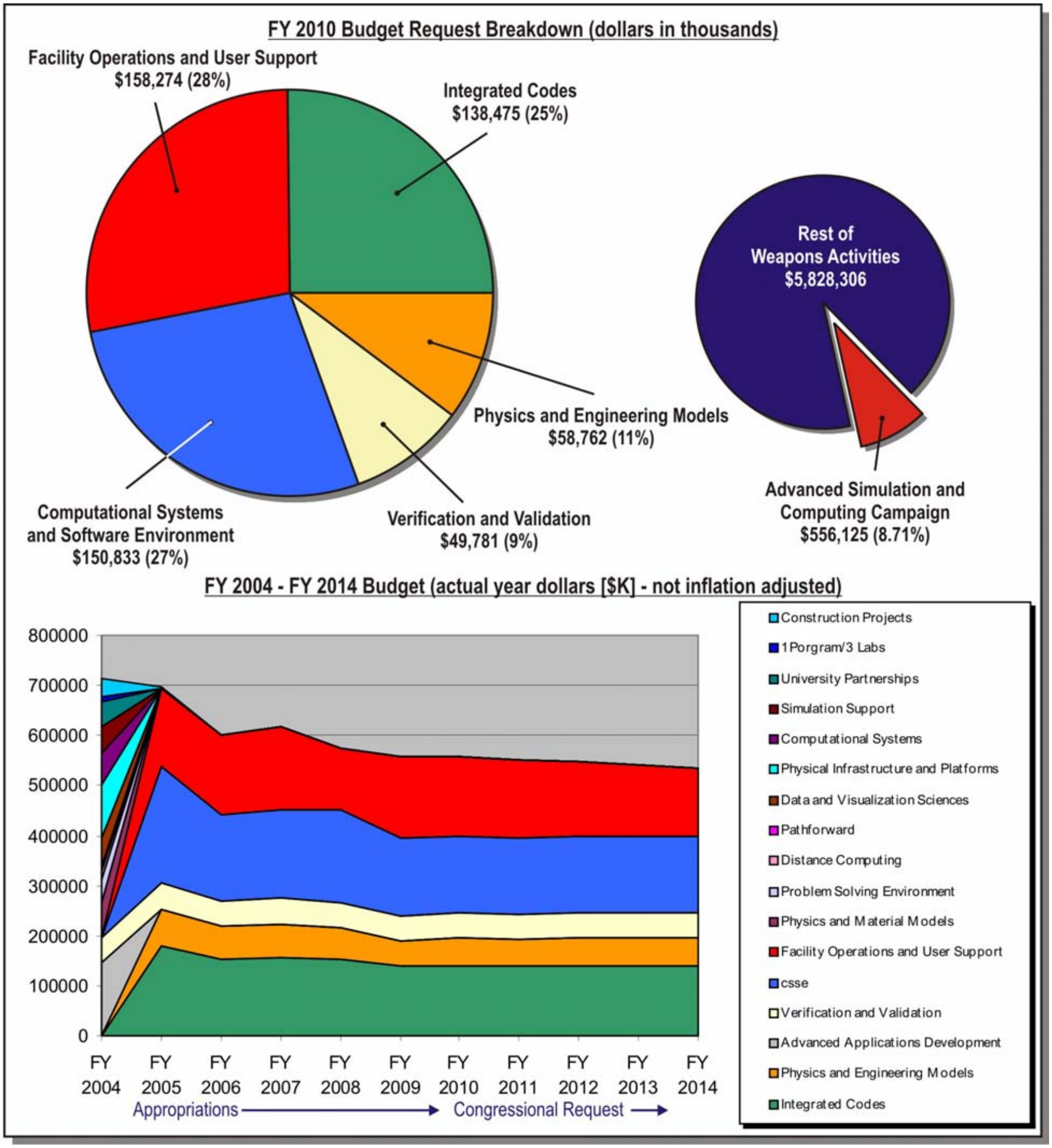


Figure 6-7. Funding Schedule for the ASC Campaign.

Readiness Campaign

7

Program Highlights

Since last year, investments in the Readiness Campaign have developed and deployed innovative new enabling technologies including process improvements that reduced recycling and waste processing costs for high explosives; advanced testers that support several nuclear weapons systems; nuclear magnetic resonance spectrometers and other nondestructive evaluation technologies that benefit Directed Stockpile Work across the board and new machining centers to replace aging equipment. The campaign also continues to implement improved business practices that reduce costs, optimize resources and ensure on-time deliveries.

NNSA's direction to the Readiness Campaign is to eliminate the four production readiness subprograms by FY2012 and concentrate exclusively on tritium readiness. The Readiness Campaign is working to transition ongoing and planned vital projects to other Defense Programs accounts so that critical capabilities, technical maturation priorities and Complex Transformation strategies continue to be supported.

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 provide quick response to national security requirements. The Nuclear Security Enterprise 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 include 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 Enterprise in response to Department of Defense requirements and Stockpile Stewardship Program criteria for sustaining a safe, secure, and reliable stockpile.

Figure 7-1. Multi-Axis Orbital Machining Center increases safety and versatility.

Program Structure

The Readiness Campaign includes five subprograms: Advanced Design and Production Technologies (ADAPT), High Explosives and Weapon Operations (HEWO), Nonnuclear Readiness (NNR), Stockpile Readiness (SR) and Tritium Readiness (TR). 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 7-2 shows the work breakdown structure for the Readiness Campaign.

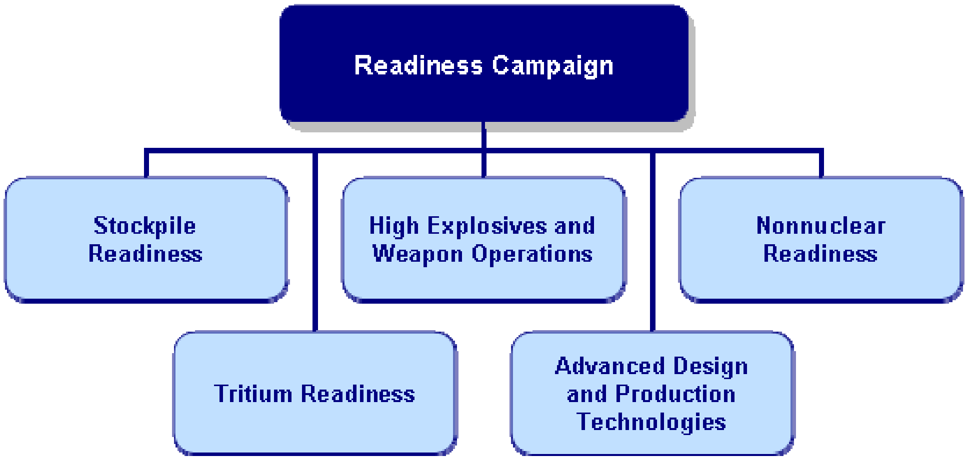


Figure 7-2. Subprograms of the Readiness Campaign in FY 2010.

Advanced Design and Production Technologies (ADAPT)

ADAPT funds development of cross-Enterprise capabilities that rely on fundamental principles of science-based manufacturing, models-based manufacturing, and alternatives evaluation to select and develop robust, technology-based solutions that underpin a responsive and agile production enterprise.

High Explosives and Weapons Operations (HEWO)

HEWO develops, enhances, and deploys capabilities for the production of high explosive and other energetic components, the requalification of weapons components for reuse, and the assembly and disassembly of war reserve nuclear weapons.

Nonnuclear Readiness (NNR)

NNR develops and deploys new capabilities to manufacture electrical, electronic, electro-mechanical and other nonnuclear components that synchronize and initiate weapon detonation when required while preventing unauthorized and inadvertent activation for the safe, secure, and reliable stockpile.

Stockpile Readiness (SR)

SR develops and deploys manufacturing capabilities and special processes for production of components containing special materials and advanced component qualification and acceptance.

Tritium Readiness (TR)

TR has reestablished an assured tritium supply to sustain the nuclear weapons stockpile for its lifetime and continues to improve design increase production capacity.

PROGRAM GOALS

Subprogram	Program Goals
ADAPT	Lawrence Livermore National Laboratory (LLNL) will complete the Advanced Initiation Systems Detonator Design and Prototype.
	Sandia National Laboratories (SNL), Kansas City Plant (KCP) and Pantex Plant will complete the Multi-Site Test Equipment Design Guide.
	Los Alamos National Laboratory (LANL) and Y-12 National Security Complex will complete the Accelerated Cast Technology Insertion Testworks.
	LLNL will complete the CASTLE Electronic Facilitation of Safety Basis for Seamless Safety in the 21st Century (SS-21).
	SNL will complete the Micro-Modular Telemetry.
	LLNL will establish production capability for advanced micro technology based detonators for future Life Extension Programs.
HEWO	Pantex Plant will complete the Non Destructive Density Evaluation of High Explosives.
	Pantex Plant will complete the Advanced Inventory and Material Tracking.
	Pantex Plant will complete the High Explosives Booster and Detonator Materials.
	Pantex will establish the capability to become primary supplier for TATB and TATB-based explosives to support stockpile management activities by 2011.
	Pantex Plant will establish process capability for models-based design/fabrication of high explosives main charges.
	Pantex Plant will establish an enterprise approach to safe, efficient, high-quality weapon operations related to SS-21 process start-ups for assembly, disassembly and surveillance.
	Pantex Plant will establish advanced inventory and materials management systems for storing, tracking and controlling material and hardware assets used in/on the nuclear weapons stockpile.
	Pantex will complete advanced high explosive gauging techniques and the predictive optimized control of high explosives.
NNR	KCP will complete Material Refurbishment Capability Readiness for Directed Stockpile Work.
	SNL will complete the Neutron Generator Testers – Capability Readiness.
	KCP will complete the Production tester readiness for the B61 Trajectory Sensing Signal Generator.
	LANL will complete Detonator Manufacturing Readiness.
	SNL will complete readiness of product testers as required to support production of electronic Neutron Generators.
	SNL will complete demonstration of Electronic Neutron Generator Related Technology.
SR	Y-12 will complete the Microwave Casting Technology for Uranium.
	Y-12 will deploy the Infrared Debonding process which will allow Y-12 to create a process that will disassemble components with a high-energy source.
	Y-12 will complete the Qualification of Lithium Material Parts and Manufacturing.
	Savannah River Site (SRS) will deliver the Automated Reservoir Management System to manage the tritium reservoir processing activities and all Stockpile Life Extension Programs.
TR	Deliver 368 irradiated Tritium Producing Burnable Absorber Rods (TPBARs) from the Cycle 9 run to the Tritium Extraction Facility.
	SRS will continue Responsive Operations mode, and will extract tritium from the first of two batches of Cycle 9 TPBARs.
	Fabricate 240 TPBARs and deliver them to Watts Bar nuclear plant for Cycle 10.
	Load 240 TPBARS into TVA Watts Barr nuclear plant to commence irradiation of the Cycle 10 production run and then deliver the irradiated rods to the Tritium Extraction Facility.

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 Nuclear Security Enterprise into an agile and more responsive enterprise with 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 for FY 2008 – FY 2012*.
- 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 (RTBF) operations.
- Increase integration and coordination among Enterprise facilities, operations, processes, and management.
- Reduce waste streams, energy consumption, and maintenance costs, when possible.
- Provide technical solutions that will lead to reduced manpower and facility footprint requirements.
- Assure 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 nuclear security enterprise infrastructure with integrated lifecycle capabilities as directed in the *Defense Programs FY 2009 – FY 2013 Program and Resource Guidance*.
- Support NNSA goals directed at improved program and project management.

Figure 7-3. Coordinate Measuring Machine in glove box is used for machining and inspecting parts.

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

Figure 7-4. 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.

CHALLENGES

Subprogram	Challenges
ADAPT, HEWO, NNR and SR	Capability to define Readiness Campaign interfaces with major Directed Stockpile Work, RTBF, 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 a proactive enterprise.
	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.
TR	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.

RECENT ACCOMPLISHMENTS

ADAPT

- Completed a cross-enterprise plan to propagate the W88 Joint Test Assembly 2 Refresh (W88 JTA2 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 SS-21 processes at Pantex, including data management and the development of safety-basis documentation. CASTLE supported the B53 and W84 SS-21 processes.

HEWO

- Completed three nondestructive evaluation projects to reduce or recycle the waste from high explosive processing materials operations.

- Established compatibility for a substitute solvent for W88 program materials to replace a solvent no longer available.

NNR

- Deployed advanced mechanical and electrical acceptance testers used to diamond stamp accepted stronglinks, cushions, and electrical components for the W76-1, B61, and other Directed Stockpile Work systems in active production; full production for the W76-1 system was realized as a result. The deployment removed hazardous hydraulic driven pressure systems, added safety shut off features, and reduced footprint of the systems by approximately 2000 square feet with an immediate cost savings. Over 50,000 components have been tested, yielding $1.8M in documented cost savings.

SR

- Deployed the Computer Numerically Controlled Machining Center and a new Coordinate Measuring Machine system used for machining and inspecting special materials parts respectively. These established new capabilities to support programmatic requirements for Directed Stockpile Work Life Extension Programs.

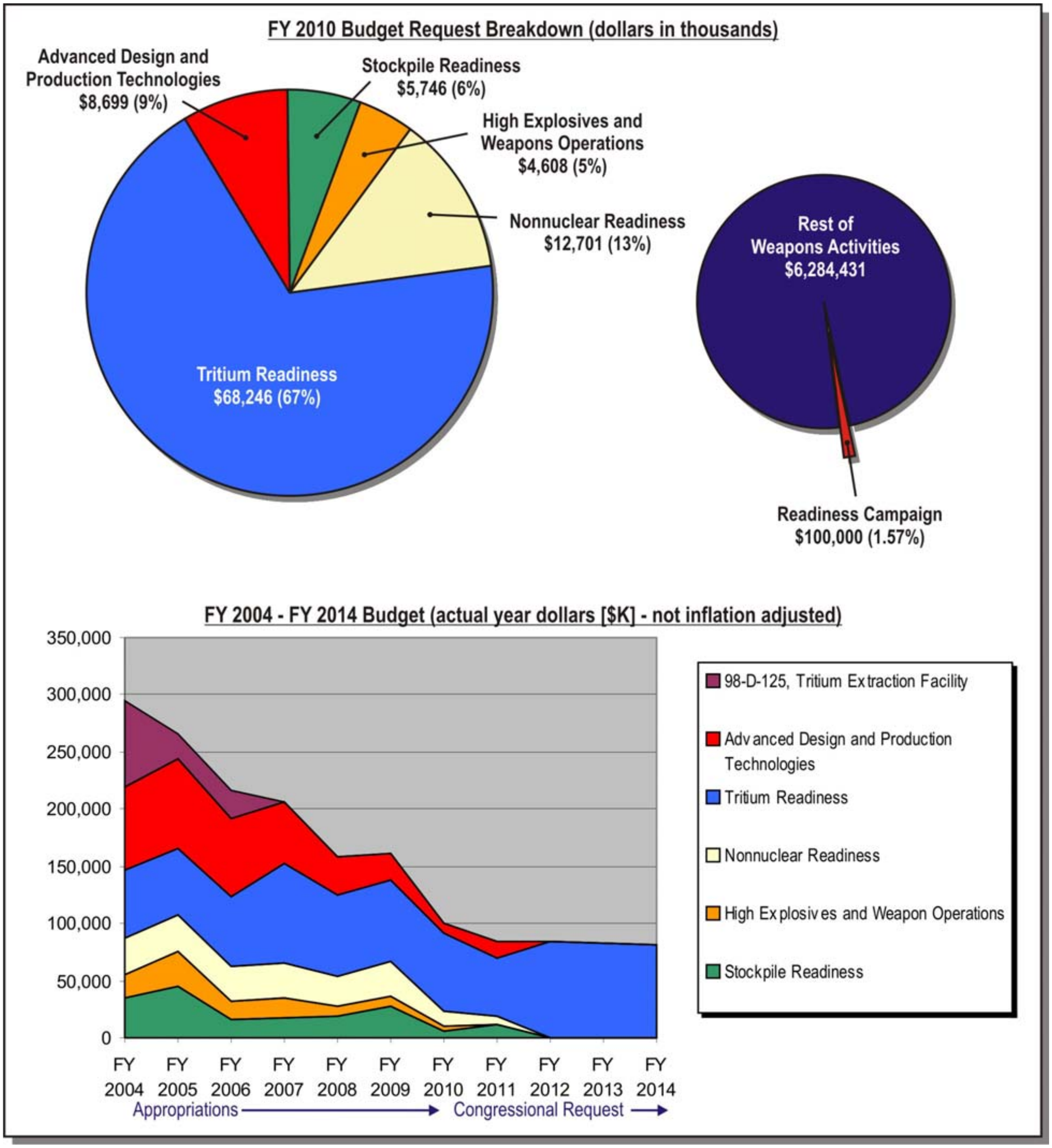
- Deployed a nuclear magnetic resonance spectrometer, one of the few nondestructive methods for analyzing structure and molecular dynamics. This helps to sustain manufacturing and stockpile evaluation for Directed Stockpile Work Life Extension Programs.

- Deployed the Multi-Axis Orbital Machining Center to replace aging equipment. The system demonstrates increased safety and versatility using drilling, milling, turning with the ability to map the surface of the object being machined. Efficiencies also include increased accuracy and reduced machine time.

TR

- Delivered the ninth production run of TPBARs to the Tennessee Valley Authority's Watts Bar nuclear plant to replace the rods irradiated during FY 2008.

FUNDING SCHEDULES



NOTE: The Readiness Campaign no longer funds production technology maturation and is exclusively funding Tritium Readiness after FY 2011.

Figure 7–5. Funding Schedule for the Readiness Campaign.

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Readiness in Technical Base and Facilities

8

Program Highlights

In FY 2008, the Nuclear Criticality Safety Program helped establish an experiment and training partnership with France. In addition, the Building B-3 Remediation, Restoration, and Upgrade Project was completed at the North Las Vegas Site and the construction of the Highly Enriched Uranium Materials Facility at Y-12 was also completed. In FY 2010, Test Readiness will be moved from the Science Campaign into Readiness in Technical Base and Facilities, Operations of Facilities, under the Program Readiness subprogram.

Mission

The goal of the Readiness in Technical Base and Facilities (RTBF) Program is to operate and maintain National Nuclear Security Administration (NNSA) program facilities in a safe, secure, efficient, reliable, and compliant condition, including facility operating costs (e.g., utilities, equipment, facility personnel, training, and salaries); facility and equipment maintenance costs (e.g., staff, tools, and replacement parts); environmental, safety, and health costs; and to plan, prioritize, and construct state-of-the-art facilities, infrastructure, and scientific tools that are not directly funded by Directed Stockpile Work (DSW) or a Campaign within approved baseline costs and schedule.

Program Structure

To accomplish its overall mission, the RTBF program provides the physical and operational infrastructure at the eight NNSA sites: the Nevada Test Site, the three NNSA national security laboratories, and the four production sites. RTBF funds the specific facilities that are required to conduct the scientific, research, development, and testing activities of the Stockpile Stewardship Program. 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 8-1. The Highly Enriched Uranium Materials Facility at the Y-12 National Security Complex.

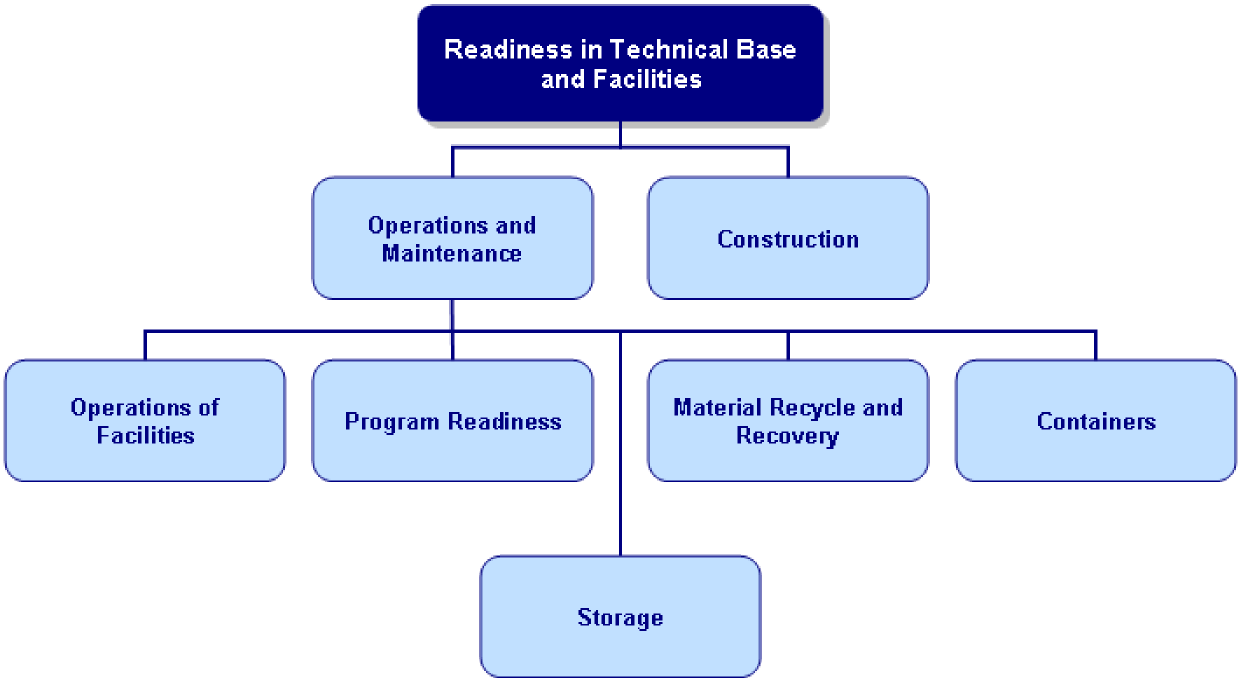

Figure 8-2. Subprograms of Readiness in Technical Base and Facilities for FY 2010.

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, and supports integrated maintenance programs for routine maintenance activities.

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 Stockpile Stewardship Program. 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 Department of Energy.

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.

Figure 8-3. Material Recycle and Recovery is responsible for the recycling and recovery of: plutonium, enriched uranium, heavy water, and tritium from fabrication and assembly operations.

Storage

The Storage subprogram provides effective storage and management of strategic reserve and surplus pits, Highly Enriched Uranium (HEU), and other weapons and nuclear materials in compliance with NNSA requirements. This includes the cost of receipt, storage, and inventory of nuclear materials, non-nuclear 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 National Security Enterprise, 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.

PROGRAM GOALS

Subprogram	Program Goals
Operations of Facilities	Maintain the aggregate complex-wide facility condition index (FCI) for mission-critical facilities.
	Maintain the complex-wide mission-critical and facilities infrastructure at an FCI level of 5 percent or less.
	Improve the complex-wide mission-dependant, not critical facilities and infrastructure to an FCI level of 8 percent or less.
	Ensure mission-critical facilities are available to support program work at least 95 percent of schedule days.

Subprogram	Program Goals
	Annually, prepare and execute an integrated, comprehensive RTBF/FIRP plan consistent with the Nuclear Weapons Complex Enterprise Strategy to ensure a flexible, responsive, and robust infrastructure.
Program Readiness	Leverage validation activities to sustain the capability to conduct an Underground Test within 36 months.
	Ensure that testing capabilities are current rather than tied to early 1990's technologies.
Material Recycle and Recovery	Continue Uranium stabilization, decontamination, and repackaging, and tritium recycling in support of Life Extension Programs and the limited life program.
Containers	Support nuclear material consolidation, and deinventory activities to ensure needed transportation containers are certified and available to accommodate proposed material movements.
	Support deinventory of Lawrence Livermore National Laboratory (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	Establish a capability for pit disassembly and conversion at the Savannah River Site to provide feed material to the Mixed Oxide Facility currently under construction. If construction of a new Pit Disassembly and Conversion Facility is selected to accomplish this goal, take steps as needed to have it in operation by about FY 2018.
	Continue efforts to revitalize and consolidate the Uranium Enterprise at the Y-12 National Security Complex by bringing the Highly Enriched Uranium Facility into operation in FY 2010; by completing the design, construction, and startup of the Uranium Processing Facility by a date to be determined; 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 extend the life of Buildings 9212 and 9204-2E until consolidation can be accomplished.
	At the Los Alamos National Laboratory (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. - 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 Project 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 Nevada Test Site 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.

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 8-4. Containers support RTBF nuclear material consolidation, and deinventory 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 partner with the Site Stewardship Program and will prepare excess square footage for disposition.

CHALLENGES

Subprogram	Challenges
Operations of Facilities	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, Complex transformation. 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.

Subprogram	Challenges
	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 dependant – 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.

Recent Accomplishments

Operations of Facilities

- Exceeded corporate facility availability goals to support DSW and Campaign activities as RTBF facilities were available 97.6 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.
- Funded seven transformation projects through Institutional Site Support, facilitating square foot reduction and modernization activities across the complex. These include consolidating Depleted Uranium/Binary processes at the Y-12 Security Complex, which will remove the last of the mission work from the Alpha 5 facility and preparing Chemistry and Metallurgy wing 4 at LANL for closure.
- Restarted Oxide Conversion Facility to produce 'Green Salt' at Y-12.
- Exceeded the 11 metric ton deinventory goal and removed 15 metric ton of special nuclear material from NNSA sites.
- Supported the successful completion of Sandia Phase I deinventory effort.

Program Readiness

- The Nuclear Criticality Safety Program established experiment and training partnership with France.

Containers

- Approximately 42 percent of LLNL's nuclear material was processed to meet shipment and receiver site requirements with 35 percent shipped off-site in support of nuclear material de-inventory goals.

- Provided transportation container support for DSW and NNSA missions to support Life Extension Programs and Stockpiles Stewardship programs.
- Received the Certificate of Compliance for the 9977 package (RTG content) and shipped RTGs for the first time in many years and supported these containers for Nevada's efforts with the Department of Homeland Security test and evaluation facility.

Construction

- Completed the Building B-3 Remediation, Restoration, and upgrade Project at the North Las Vegas Site.
- Completed physical construction of the Highly Enriched Uranium Manufacturing Facility at Y-12.
- Approved Critical Decision-1 for the Y-12 Complex Command Center.
- TA-55 Re-investment Phase II CD-1 was approved at LANL.
- Approved CD-4 for the Phase II NSSB-Los Alamos Site Building.

FUNDING SCHEDULES

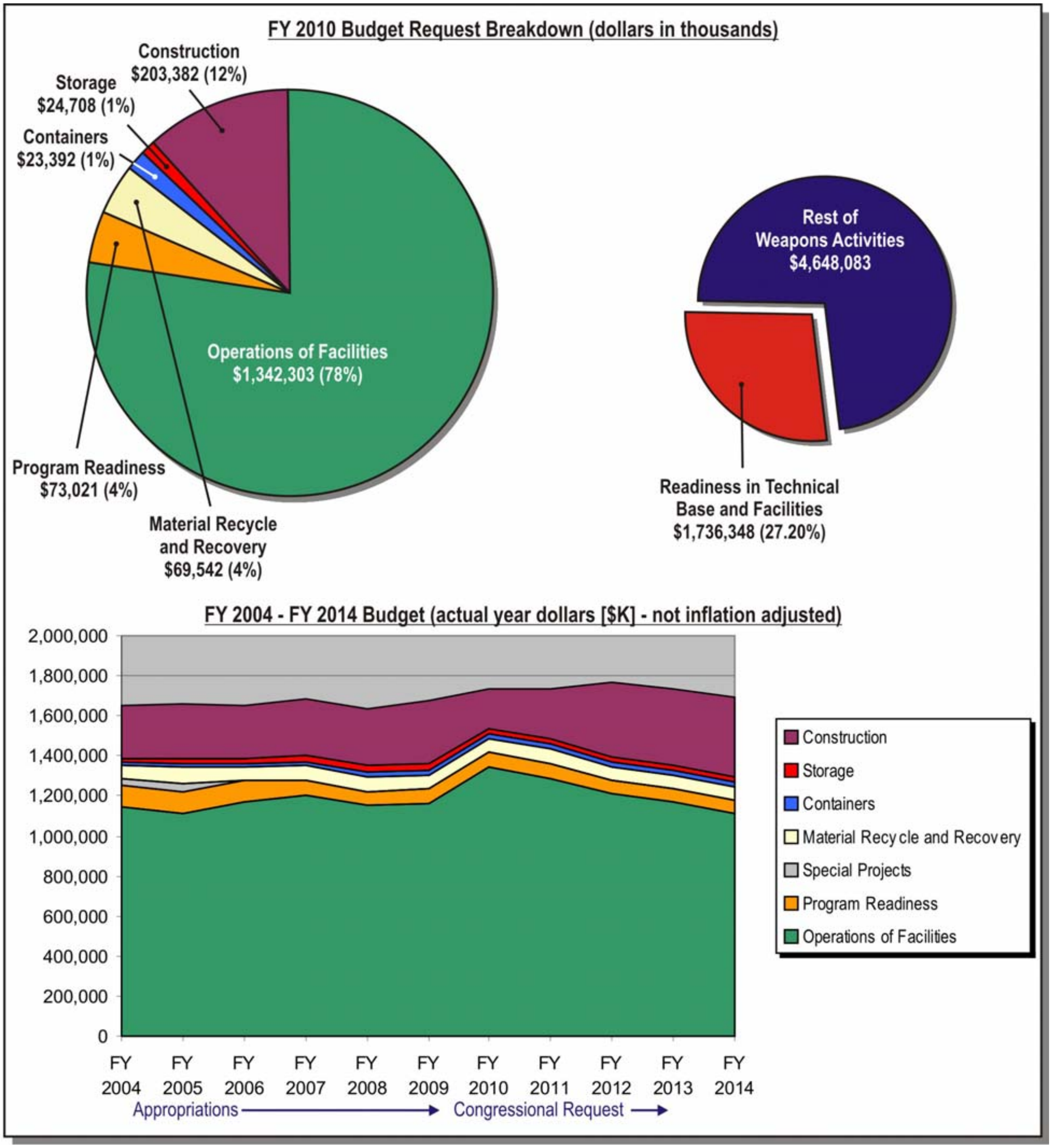

Figure 8-5. Funding Schedule for Readiness in Technical Base and Facilities.

Secure Transportation Asset

9

Program Highlights

FY 2010 marks the purchase of the first of three replacement aircraft. These aircraft will replace the three DC-9's which are at the end of their planned life cycle. Also this year, escort vehicle replacements will increase to stabilize the life cycle and maintenance of the fleet.

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, and other customer requirements. STA provides this critical support by ensuring 100 percent of shipments for the weapons complex and military installations are completed safely and securely, without a compromise/loss of nuclear weapons/components or a release of radioactive materials.

Figure 9-1. STA provides the capability for the safe and secure transport of nuclear warheads, components, and materials.

PROGRAM STRUCTURE

STA is a Direct Federal Program (government-owned, government-operated) and consists of two funding sub-programs: Operations and Equipment and Program Direction (See Figure 9-2). The program direction funding is separate from the National Nuclear Security Administration (NNSA) and provides for the federal staff to manage, support, and execute the transportation mission. The operations and equipment funding is structured along four strategic objectives and supporting strategies that were established in 2001: These strategic objectives are: (1) Mission Capacity; (2) Security and Safety Capability; (3) Infrastructure and C5 Systems; and (4) Program Management.

Although there are two funding subprograms, they are managed as one cohesive effort. While Program Direction Funds are accounted for separately, they are also linked to the four major mission efforts described below.

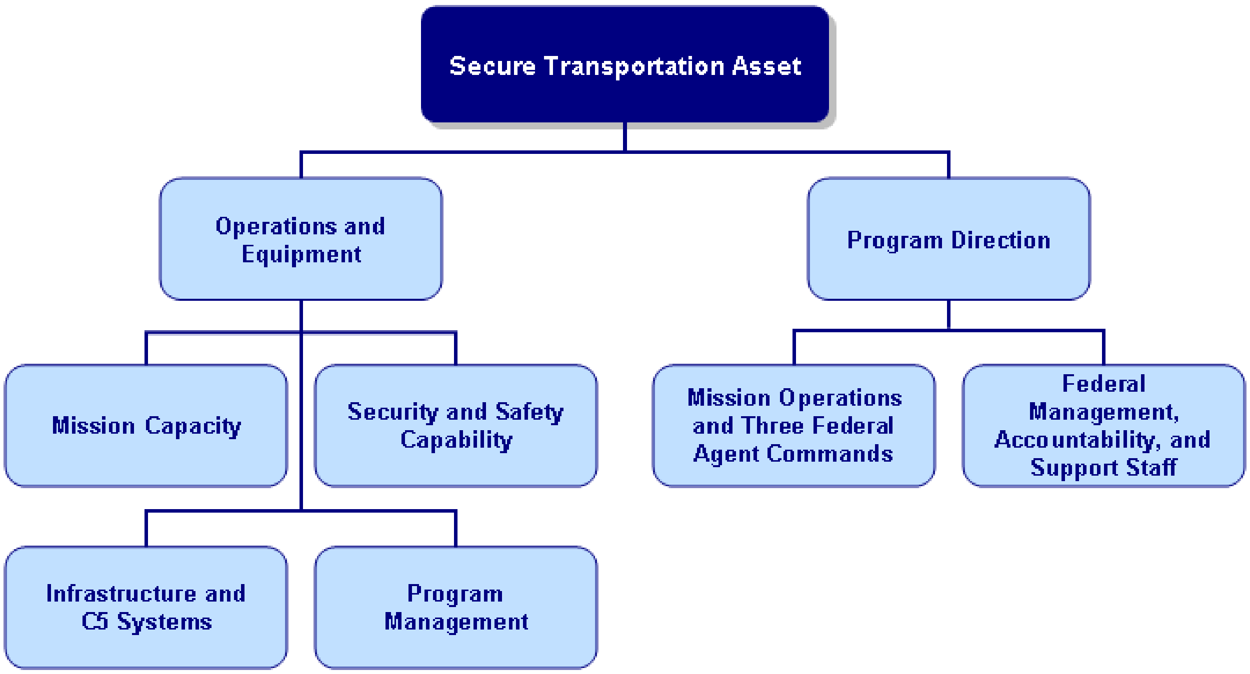

Figure 9-2. Subprograms of the Secure Transportation Asset in FY 2010.

Mission Capacity

Mission Capacity is focused on meeting the predicted workload by maintaining and equipping the Federal Agent Force; replacing, upgrading, and maintaining the vehicle, trailer, and aviation fleet; and employing contract drivers to move unloaded convoys and optimize agent mission time.

Security and Safety Capability

Security and Safety Capability is focused on identifying, designing, and testing new fleet protection/safety technologies; intensifying Federal Agent training to support a wide spectrum of tactical and emergency capabilities; and maintaining security licenses and the safety basis for operations.

Figure 9-3. Mission Capacity funding maintains and equips the Federal Agent Force.

Infrastructure and C5 Systems

Infrastructure and C5 Systems is focused on modernizing, upgrading, and integrating command and control communications, computers, cyber, intelligence, surveillance, and reconnaissance (C5ISR) systems; maintaining and upgrading mission facilities and equipment; and establishing a comprehensive intelligence cycle within the organization.

Program Management

Program Management is focused on organizational accountability, evaluation, integration, oversight; and unification; providing support staff and human resource functions for a large Federal Agent Force; and quality management/cost effectiveness studies.

PROGRAM GOALS

Subprogram	Program Goals
Mission Capacity	Recruit, hire, train, and equip enough agent candidates each year to maintain an Agent end-strength of 390.
	Maintain the readiness of the transportation fleet (escort vehicles and armored tractors) to support 107 convoy mission-weeks.
	Maintain and refurbish an operational fleet of 46 Safeguard Transporters (SGT).
	Develop and field a replacement for the armored tractor that will support future initiatives throughout the Nuclear Security Enterprise.
	Design, test, build, and field replacement vehicles and tractors for the operational and training fleet.
	Increase the presence of heavy-chassis vehicle models to the escort fleet.
	In FY 2010, FY 2011, and FY 2012, replace the three DC-9 aircraft with 737s.
	Maintain an aircraft on continuous alert to support NNSA's Nuclear/Radiological Incident Response mission.
	Utilize air assets to move nuclear components and to rotate driving teams on long duration shipments.
	Optimize Agent mission time by employing contract drivers to move and stage unloaded convoys.
	Continue to improve workload planning models and systems to enhance convoy efficiencies.
	By FY 2014, balance all of the elements of mission capacity (Agents, fleet, air, technology, and optimization) to ensure sustained, consistent, and efficient transport operations.
Security and Safety Capability	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.
	Continue the development of Project OPUS to mitigate known safety and security risks.
	Maintain an emergency management control center for NNSA and DOE.
	Maintain a validated Site Safeguards and Security Plan to meet the requirements of the Design Basis Threat and the Graded Security Protection Policy.
	Conduct Agent Candidate, Operational Readiness, Special Response Force, and Unit Training for Federal Agents to ensure operational proficiency.
Infrastructure and C5 Systems	Develop and implement the next generation of operational command and control systems.
	With the NNSA Service Center, identify and develop plans for the establishment of a new STA headquarters facility to consolidate STA functions.
	Implement a steady-state, life-cycle for all C5ISR systems.
	Enhance the domain awareness along transportation corridors through intelligence and reconnaissance.
	Continue to develop training facilities that support collective and realistic training venues.
	Continue to improve ground-truth feedback technology for tactical response operations.
Program Management	Conduct one Joint Testing Exercise each year with state and/or federal participation.
	Support nuclear non-proliferation and nuclear security efforts by providing training and expertise to foreign nations.
	Schedule and conduct independent audits that evaluate compliance and systemic effectiveness.

STRATEGY

The primary objective of the transportation program is to serve its customers through the provision of safe and secure shipments. Defense Programs remains the highest priority customer for STA, as these shipments are required to support and maintain the nuclear weapons in the national stockpile. The

Stockpile Refurbishments, Life Extensions, various test programs, and nuclear weapon disassemblies, for example, depend on the movement of material on schedule. In addition to this responsibility, the STA must also provide secure transport to support other NNSA, DOE, and government programs (Naval Reactors, Nuclear Non-Proliferation, Nuclear Incident Response, Nuclear Energy, Environmental Management, and the National Aeronautic and Space Administration). STA is also involved with the international shipments to and from Canada, United Kingdom, and France.

To accomplish it missions, STA maintains over 80 distinct facilities across the United States (see Figure 9-4 below). With its primary headquarters and vehicle production 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 Oakridge, Tennessee. The principle training facility is at Fort Chaffee, Arkansas, with a satellite training facility located at the Nevada Test Site. Since the transportation routes are across diverse environments, STA conducts unit-level exercises at a variety of Department of Defense installations across the United States.

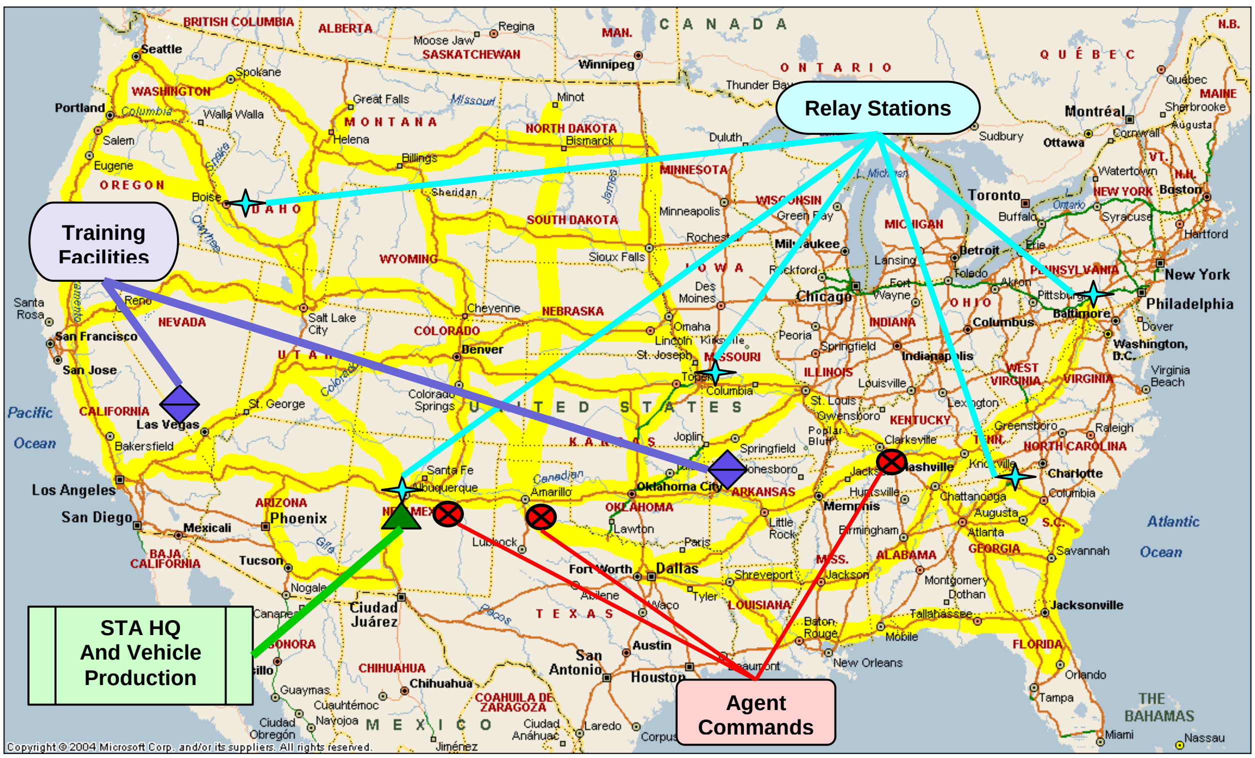

Figure 9-4. STA transport corridors and facilities.

CHALLENGES

Subprogram	Challenges
Mission Capacity	The high quality of training that 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.
	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.

Subprogram	Challenges
	The challenge to increase mission capacity is coupled by the impacts associated with increasingly complex national security and enhancing our situational awareness through an active security implementation, which requires additional Agents and vehicle assets be deployed during the execution of convoys. If new and innovative force-multiplier technologies can be acquired and implemented, some of the need for these additional assets may be alleviated.
Security and Safety Capability	The increasingly complex collective training needs is placing additional demands on funding resources.
	Full implementation of Project OPUS will require extensive coordination with the Department of Defense and all NNSA sites.
Infrastructure and C5 Systems	With the closing of the SGT production facility at Kansas City Plant, a new facility at Albuquerque will have to be established to continue the SGT refurbishments.
	Post 911 security requirements established the need for real-time operational intelligence and the technology to enhance situational awareness.
	The focus to meet mission security and delivery requirements has diverted funding from facility maintenance. These neglected facilities will require increased funding in the out-years.
Program Management	"Work for others" programs enable STA to provide unique instruction to transporters of nuclear material, but these programs require a dedicated staff so that mission operations are not disrupted.
	As a government operated program, STA has had to increase its management, oversight, and support staff to address the needs of a larger workforce.
	A career development program is being established to retain agent expertise and allow for a long term career progression.

Recent Accomplishments

- Safely and securely completed 100 percent of shipments without compromise/loss of nuclear weapons/components or a release of radioactive material.
- Reduced the cost per convoy from $2.65M in FY 2002 to $1.73M.
- Manufactured three SGTs for a total fleet of 42.
- Achieved Federal Agent end-strength of 373, meeting a multi-year milestone.
- Participated in the Department of Homeland Security national Emergency Response Exercise (Diablo Bravo) as the major role player.
- Established an Injury Review Council for Federal Employee Compensation Act compliance.
- Completed the Agent Central Command Facility at Pantex. This is the culmination of a 5 year path to enhance all of the Agent Operation Facilities to support the increase of Agents.
- Completed Integrated Safety Management System description.
- Completed all requests for shipping (109 convoy equivalents), accomplishing the following:
  - Met Lawrence Livermore National Laboratory accelerated de-inventory shipping schedules.
  - Completed 55 percent of the Hanford surplus nuclear material de-inventories, staging material for final processing and disposition.

  - Transported a large inventory of excess material, packaged in Department of Transportation (DOT) "6M Type-B" transportation containers, prior to the DOT container de-certification, eliminating a departmental requirement to repackage.
  - Completed the B61, W76, and W80 refurbishment transportation schedules.
  - Met the Pit production and delivery schedules.
  - Optimized shipping schedules to reduce mileage and offset the high fuel costs of the summer.
  - Supported a Category IV Plutonium-238 source recovery from a decommissioned facility in Italy (maritime shipment).
  - Delivered Category I highly enriched uranium feed material to Canada supporting the Medical Isotope Program (airlift).
  - Delivered highly enriched uranium from a Kodak decommissioned reactor in New York to the Savannah River Site for final disposition.
- Completed a Joint Testing Exercise at the Nevada Test Site, where a ground-truth-feedback system was successfully tested.

FUNDING SCHEDULES

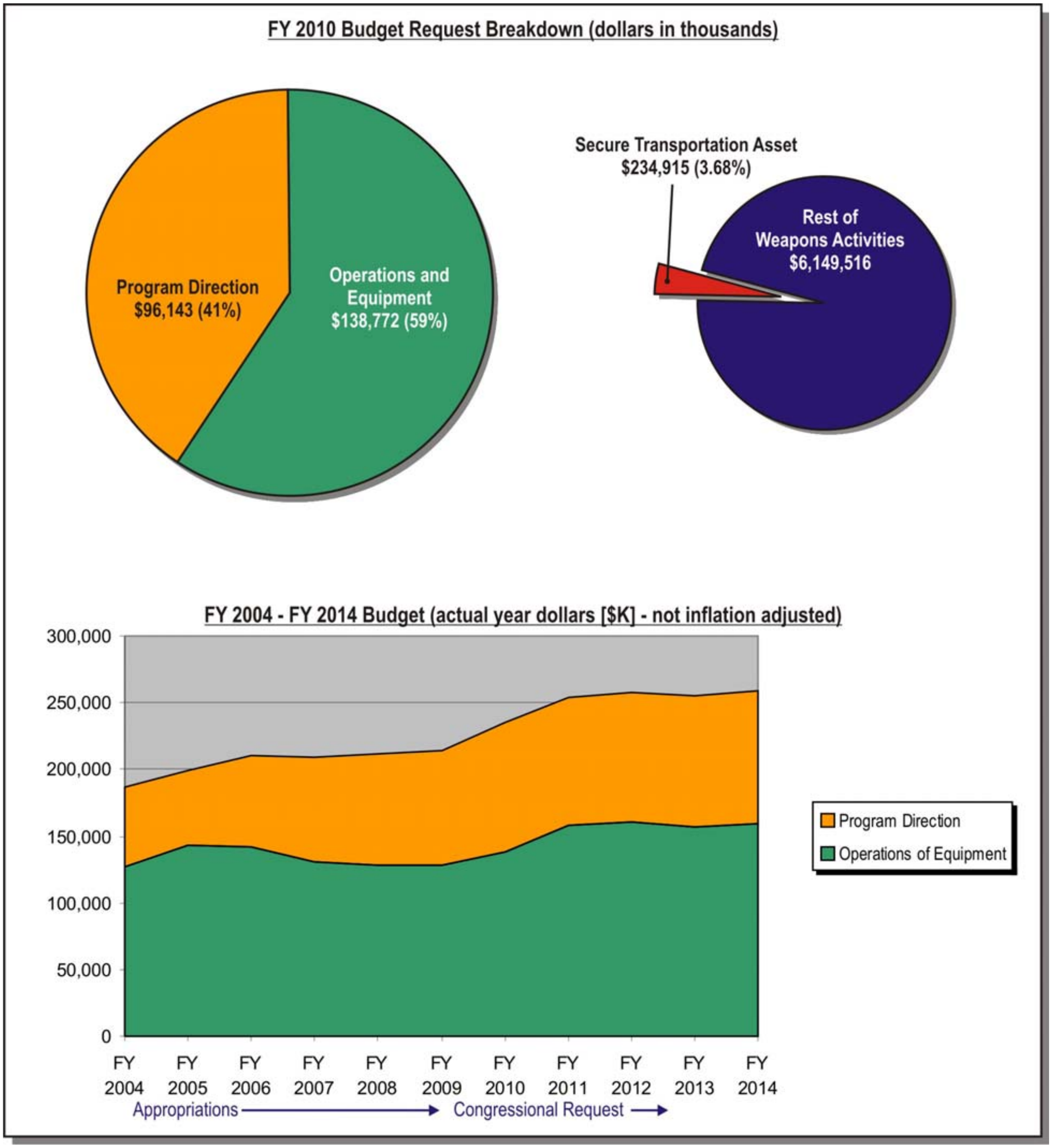

Figure 9–5. Funding Schedule for Secure Transportation Asset.

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Nuclear Counterterrorism Incident Response 10

Program Highlights

In FY 2008, 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.

The Office of International Emergency Management and Cooperation was transferred out of the Office of Defense Nuclear Nonproliferation and into the NCTIR program (formerly Nuclear Weapons Incident Response). This was done to consolidate international emergency missions, functions, authorities, and activities within the National Nuclear Security Administration. The Office of Nuclear Counterterrorism Design Support was also functionally transferred from the Office of Defense Programs to NCTIR to consolidate activities within NNSA aimed at countering nuclear terrorism. The transition of these Offices to NCTIR has helped to further the goals and mission of NCTIR and provides a unified, single center of excellence to counter nuclear terrorism on many fronts. FY 2009 was the first full year of executing these combined activities in NCTIR, along with Emergency Response functions already comprising the core program.

Mission

The mission of the Nuclear Counterterrorism Incident Response (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.

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. The program 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).

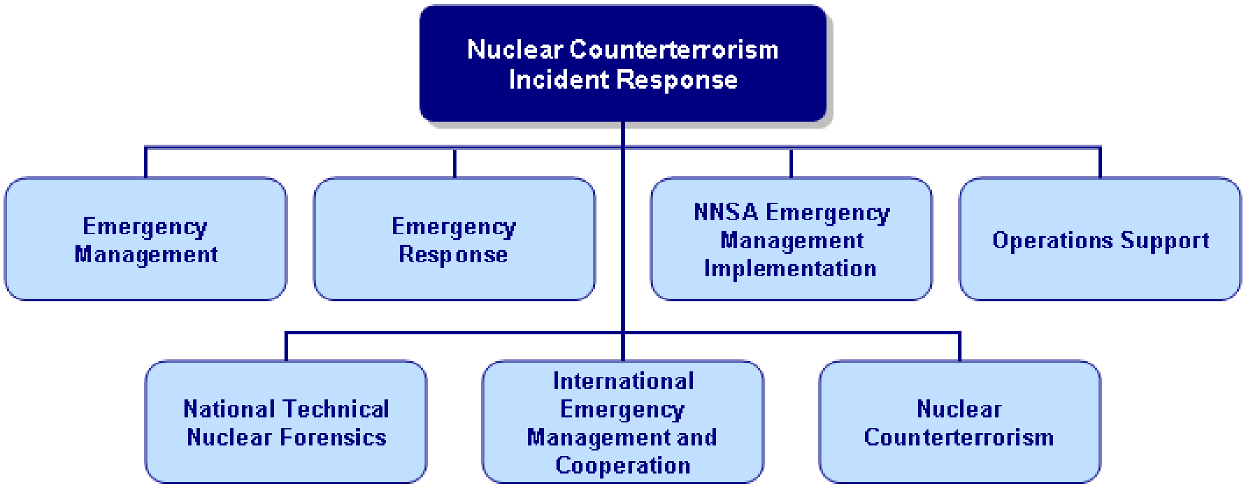

Figure 10-1. Subprograms of the Nuclear Counterterrorism Incident Response program in FY 2010.

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.

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.

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

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 program 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, 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 (NCT)

The NCT program serves as the single point of contact for nuclear counterterrorism in the U.S. Government, directly supporting other agencies needs relative to Improvised Nuclear Device (IND) 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.

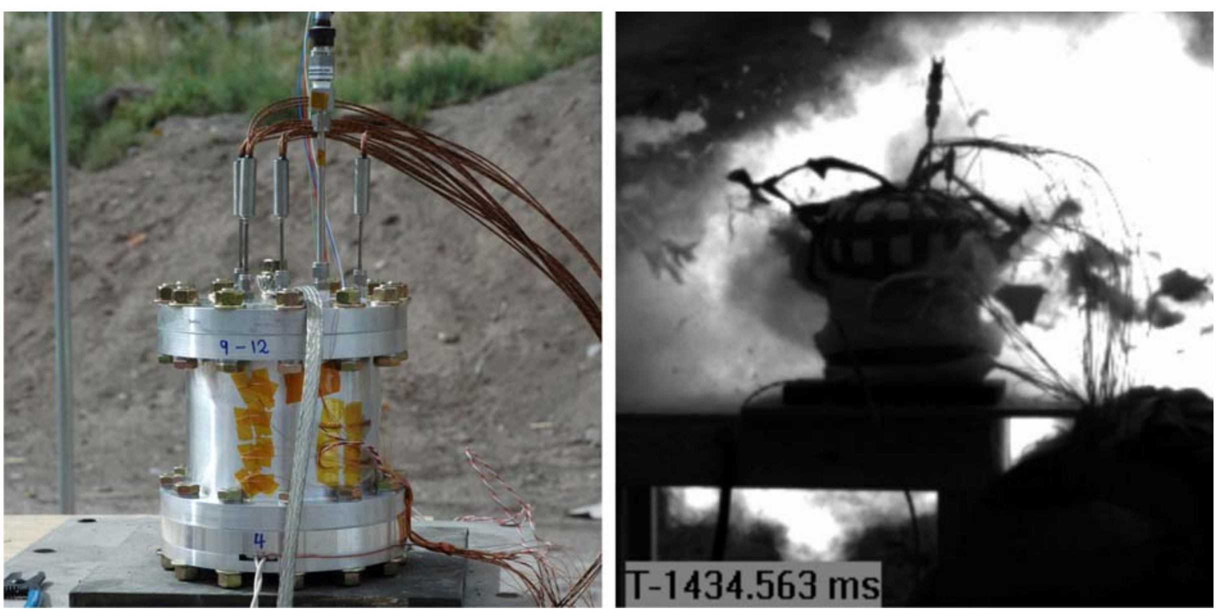

Figure 10-3. The NCT program works with other agencies to prevent the threat of INDs.

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, 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.
	Execute a formalized test and evaluation program to support Technical Integration product development and delivery.
	Demonstrate to other organizations the First Responder expertise and build a positive rapport with the personnel of those organizations to: (1) expand outreach to better understand state and local needs and response infrastructure; (2) contact each state Radiation Health Office, Urban Area Security Initiative city management, and major law enforcement agencies annually.; and (3) assist all state and local radiological response assets in their professional development and response efforts because of their close proximity to likely incident scenes.
	Complete development of Stabilization technology and concept of operations for the deployment of equipment to prevent operation of an IND until national assets can arrive to conduct traditional render safe procedures.
	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, e.g. POST-NUDET, NUWAIX, SEARCH/FIND to focus on gaps that occur when deploying and tracking multiple assets in response to a single event.
	Independent technical review of all Technology Integration projects.
	Establish consortium of genetic evaluators for the cytogenetic biodosimetry laboratory.
	Enhance and maintain a rapid nuclear/radiological first-responder counter-terrorism capability designed to improve readiness and response capabilities and coordination with national, state, and local assets.
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 IND and radiological dispersal device (RDD) program for technical nuclear forensics support to the Federal Bureau of Investigation (FBI).

Subprogram	Program Goals
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 a 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 IND or RDD 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 IND or RDD event.

STRATEGY

The NNSA Emergency Operations program remains the United States 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 U.S. and its allies—a readiness level that provides the U.S. Government with quickly 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 the 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 FBI, and defining relationships with other 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.

CHALLENGES

Subprogram	Challenges
Emergency Management	Updating DOE emergency management directives for consistency with evolving Departmental and homeland security documents and programs.
Emergency Response	Maintaining adequate equipment recapitalization pace for new technology with increasing numbers of drills and exercises.
NNSA Emergency Management Implementation	Continue to provide technical support and assistance to NNSA sites for implementation of successful Emergency Management Programs.
Emergency Operations Support	Ensure that the Emergency Communications Network can continue to meet DOE/NNSA operational requirements.

Subprogram	Challenges
National Technical Nuclear Forensics	Continue 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.

RECENT ACCOMPLISHMENTS

- Deployed multiple field teams to conduct 34 high profile special events and 47 emergency responses around the world in support of Homeland Security, FBI and Department of State including National Special Security Events, National Security Events, and elevated threats. These included: State of the Union; Super Bowl; several NASCAR events; Papal visits to DC and New York; Annapolis Conference; Marine Corps Marathon; Republican and Democratic National Conventions, MLB and NBA All-Star Games; Rolling Thunder; UN General Assembly; and Radiological Assistance Program support to Chicago police department and aerial monitoring.

- Participated in 137 interagency national and international counter terrorism exercises, including: Marble Challenge(2), TOPOFF 4, Ardent Sentry 2008, and led the Diablo Bravo nuclear weapon accident-incident exercise, which was a Tier 2 National Level Exercise, supported by the Department of Defense and the FBI.

- Continued support to the FBI of its render safe capability and completed the first-ever Stabilization tool kit, which will be field tested and training conducted in FY 2009.

Figure 10-4. Interagency field teams conduct counterterrorism exercises.

- Prepared for the first-ever nuclear forensics exercise, Oak Phoenix, an end-to-end technical nuclear forensics exercise incorporating notification/deployment, sample collection, lab analysis, and data evaluation phases.

- Continued Global Initiative to Combat Nuclear Terrorism support through outreach efforts and ongoing support to the 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 conferences included China workshop, the 2008 Beijing Olympics, Spain, Morocco, International Atomic Energy Agency, and the Baltic States.

- 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.

FUNDING SCHEDULES

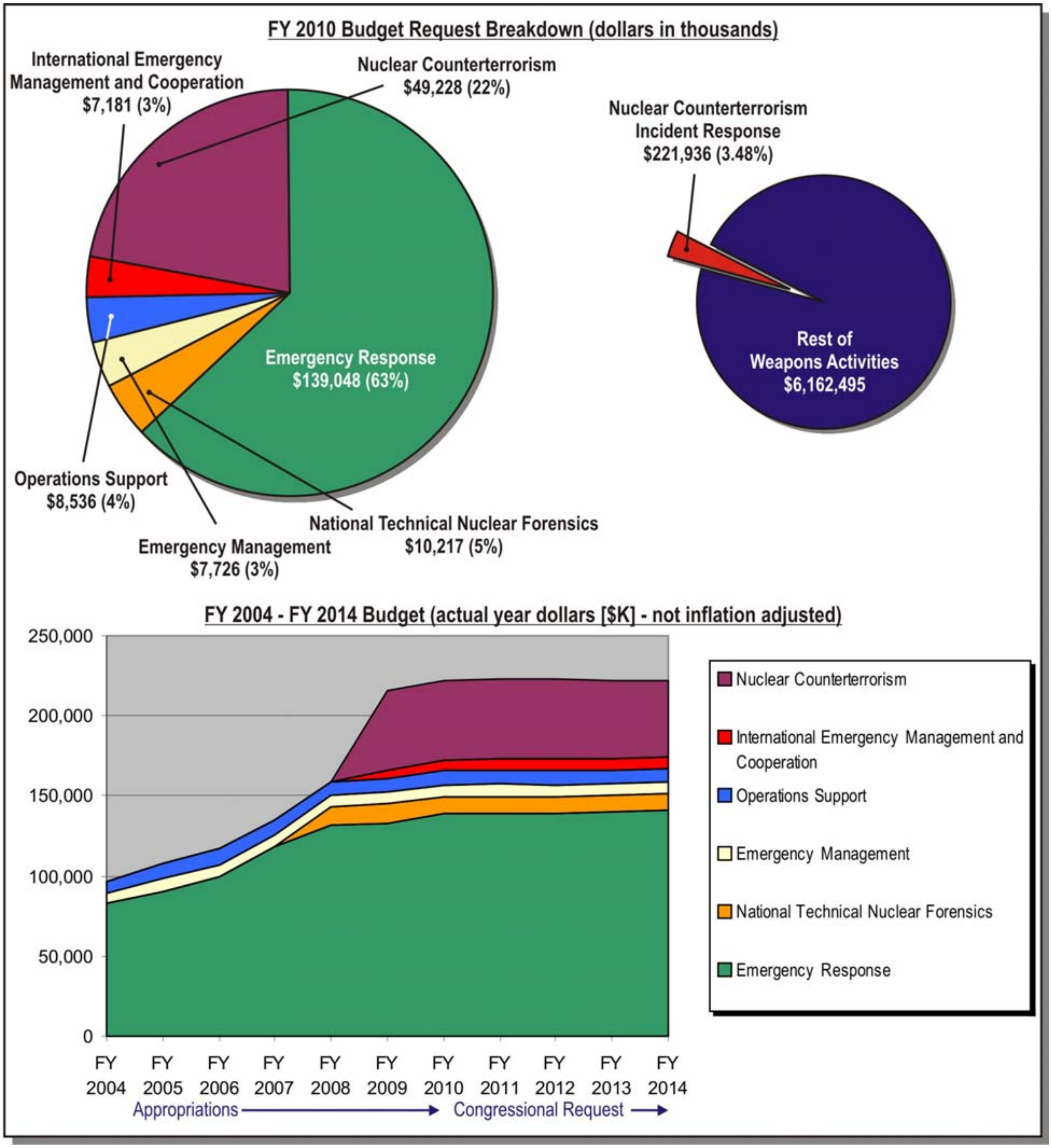

Figure 10-5. Funding Schedule for Nuclear Counterterrorism Incident Response.

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Facilities and Infrastructure Recapitalization Program

11

Program Highlights

The Facilities and Infrastructure Recapitalization Program (FIRP) Facility Disposition program 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, completing in FY 2008. In addition, FIRP funded $93 million of the FY 2003 Baseline Deferred Maintenance Reduction.

The Roof Asset Management Program (RAMP) component of the Facilities and Infrastructure Recapitalization Program won the coveted first prize for Real Property Innovation, in the 2008 General Services Administration's annual federal government competition. Competing against 40 other federal candidates, the National Nuclear Security Administration's five-year old innovative approach to repairing and restoring roof assets across the complex is both unique and remarkable. Chosen the best in class across government, RAMP garnered the award for partnering with federal and management and operating facility management professionals in ways that provided economic, speedy, life extension to the vast roof sets across the enterprise. Among its key features is the use of a world class construction management contractor, Building Technology Associates, Inc. (BTA). Together, federal managers, management and operating contractors, and the BTA staff added $19.5 million in value to the National Nuclear Security Administration roofing portfolio through life extending repairs, saved $7 million in construction costs, increased average remaining life of roof inventory by 25 percent, replaced two million square feet of roof with energy efficient sustainable materials, and eliminated over $46 million in deferred maintenance. The foregoing achievements, though impressive, were capped by an exceptional safety record. Best of all—the roofs don't leak.

Mission

The Facilities and Infrastructure Recapitalization Program (FIRP) mission is to restore, rebuild, and revitalize the physical infrastructure of the nuclear security enterprise. 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 National Nuclear Security Administration (NNSA) at enterprise sites.

Program Structure

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

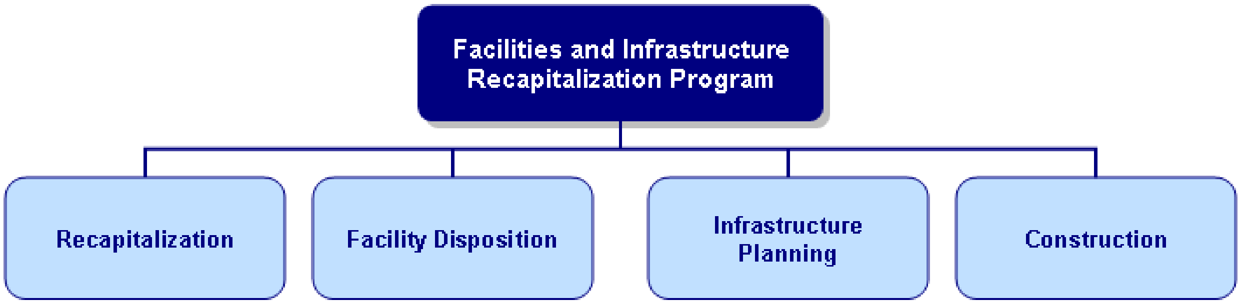

Figure 11–1. Subprograms of FIRP in FY 2010.

Recapitalization

Recapitalization funds capital renewal and sustainability projects, focusing on deferred maintenance reduction, required to restore the facilities and infrastructure comprising the Nuclear Security Enterprise 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, as discussed under "Issues," 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 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 Roof Asset Management Program (RAMP). RAMP attacked a complex wide problem—leaky roofs. RAMP's achievement, though understated, has significantly improved the enterprise. The focus of the Recapitalization subprogram in FY 2010 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 2009 FIRP annual performance target is to fund projects to achieve a

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

reduction to the NNSA deferred maintenance of $62 million, increasing the total deferred maintenance reduction to approximately 80 percent of the estimated $900 million FIRP deferred maintenance reduction goal.

Figure 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 funded projects to achieve a reduction to the NNSA footprint of 292,000 gross square feet (gsf). Added to the program totals eliminated in prior years, FIRP achieves 100 percent of the target goal of 3,000,000 gsf, one-year ahead of schedule. With the advent of the transformation of the nuclear security enterprise, the total footprint of the Complex will be reduced from greater than 35 million square feet to less than 26 million square feet. The newly formulated Site Stewardship program, identified in Chapter 12, will undertake and support the elimination of roughly 5,000,000 gsf of that NNSA Complex Transformation target.

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; Army Corps of Engineer activities to support the procurement of small business contracts; and planning for the repair and renewal of cross-complex roofing projects.

FIRP Construction

FIRP Construction funds selected utility line-item construction projects across the enterprise 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 typically 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 construction in FY 2009 for selected utility line-item projects, consistent with submitted Congressional Project Data Sheets. These projects will enhance program execution, satisfy a critical need for improvement to NNSA site utilities infrastructure, and make a significant contribution to the overall reduction of deferred maintenance. Initial planning and conceptual design activities for proposed FIRP utility line-item construction projects (i.e., other project costs) are funded from the Infrastructure Planning subprogram. 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."*

PROGRAM GOALS

Subprogram	Program Goals
Recapitalization	To execute reduction of legacy deferred maintenance of $52M for FY 2010; $40M for FY 2011; $39M for FY 2012; and $38M for FY 2013, which will exceed overall program goal of $900M 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.
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 beyond FY 2010.

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.

CHALLENGES

Subprogram	Challenges
All Subprograms	FIRP faces no major challenges on the glide path to program completion now scheduled for FY 2013

RECENT ACCOMPLISHMENTS

Recapitalization

- Funded $93M of FY 2003 Baseline 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. Competing against 40 other federal candidates, NNSA's five-year old innovative approach to repairing and restoring roof assets across the complex is both unique and remarkable. Chosen the best in class across government, RAMP garnered the award for partnering with federal and management and operating facility management professionals in ways that provided economic, speedy, life extension to the vast roof sets across the enterprise. Among its key features is the use of a world class construction management contractor, Building Technology Associates, Inc. (BTA). Together, federal managers, management and operating contractors, and the BTA staff added $19.5 million in value to the NNSA roofing portfolio through life extending repairs, saved $7 million in construction costs, increased average remaining life of roof inventory by 25 percent, replaced 2 million square feet of roof with energy efficient sustainable materials, and eliminated over $46 million in deferred maintenance. The foregoing achievements, though impressive, were capped by an exceptional safety record.

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 the FY 2009 goal one year early, completing in FY 2008.

Infrastructure Planning

- All construction projects scheduled for FY 2009 were successfully planned and designed.

Construction

- Completed the Gas Main and Distribution System Upgrades at the Pantex Plant.

FUNDING SCHEDULES

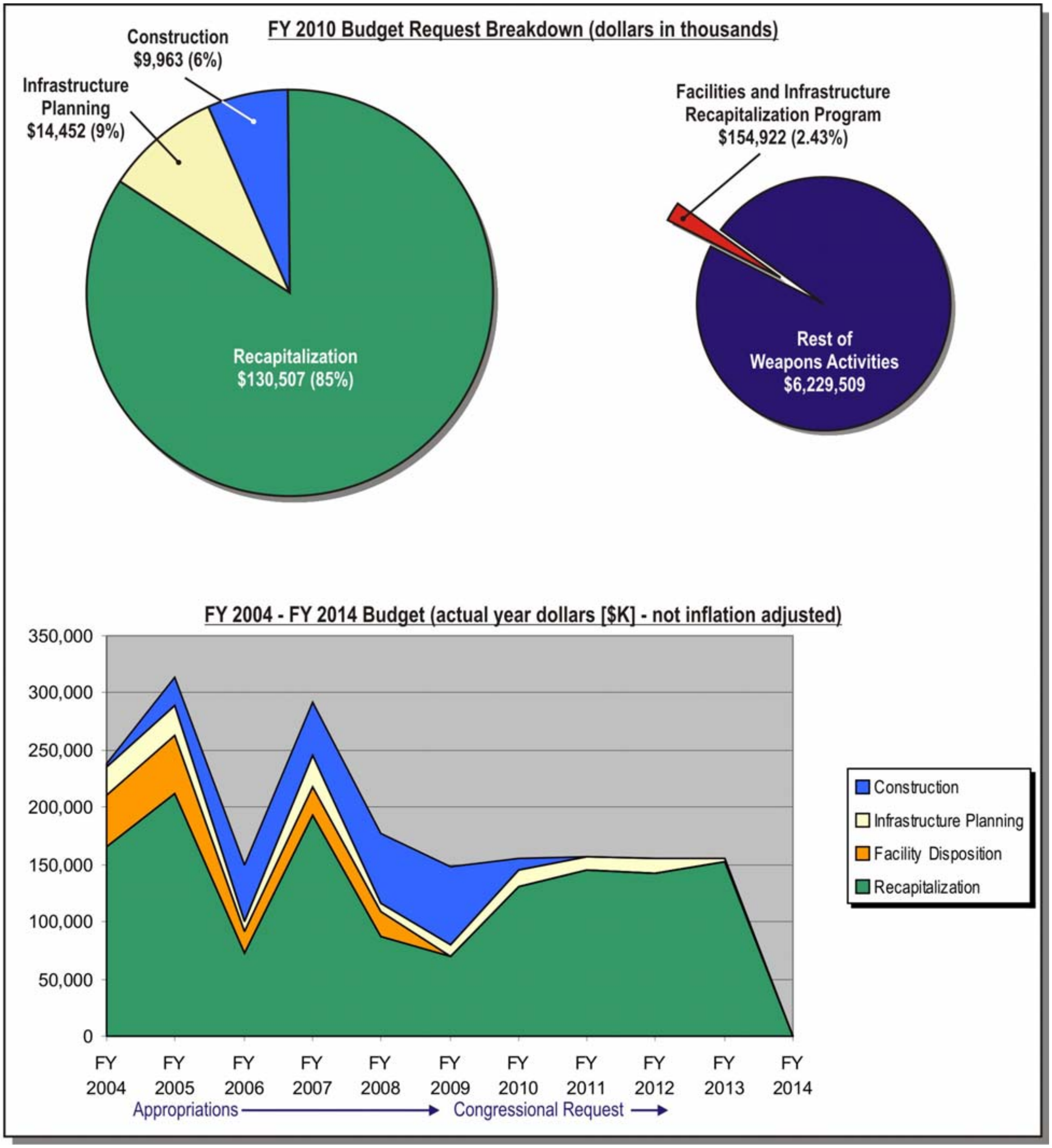

Figure 10-2. Funding Schedule for FIRP.

Site Stewardship

12

Program Highlights

Site Stewardship is a new Government Performance and Results Act (GPRA) unit that begins in FY 2010 and consolidates activities managed by the Office of Infrastructure and Environment. This new GPRA unit includes activities currently conducted under the Environmental Projects and Operations program as well as new program elements for Nuclear Materials Integration, Stewardship Planning, and Construction. Integration of these program responsibilities, functions, and funding into a single GPRA unit will allow the Associate Administrator for Infrastructure and Environment (AAIE) to focus on meeting environmental compliance and energy and operational efficiency requirements throughout the nuclear security enterprise, while modernizing, streamlining, consolidating, and sustaining the stewardship and vitality of the sites within the National Nuclear Security Administration's plans for transformation. Integration of these program responsibilities, functions, and funding into a single Site Stewardship GPRA unit allows the AAIE needed flexibility in program management, priority-setting, and funding capability throughout the Planning, Programming, Budgeting, and Evaluation process to ensure a balance among subprograms that provide common stewardship contributions to the GPRA Unit Program Goal 2.1.60.00.

MISSION

The mission of the Site Stewardship Program is to is to maintain facility and overall site capabilities and efficacies by ensuring that regulatory and energy efficiency requirements are being met, that Special Nuclear Material (SNM) is being appropriately and cost effectively managed, and that the National Nuclear Security Administration (NNSA) excess facilities are appropriately disposed of (sold, transferred, or demolished) in order to better focus resources in support of the overall NNSA mission.

Figure 12-1. Site Stewardship responsibilities will include the disposal of excess NNSA facilities.

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) Stewardship Planning; and (4) Construction.

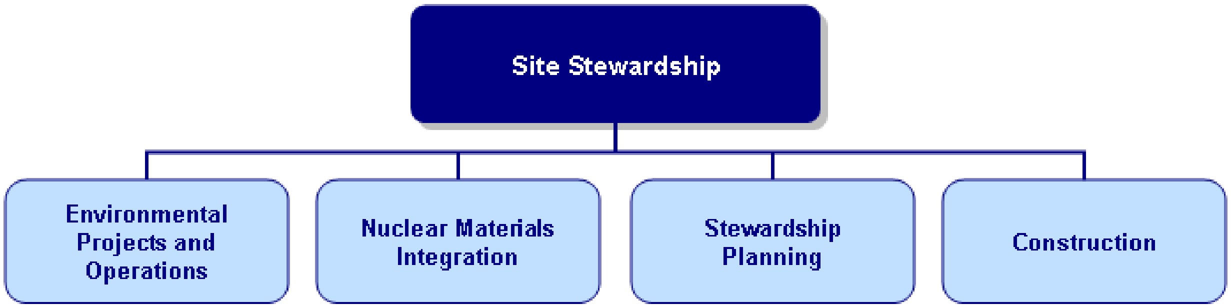

Figure 12-2. Subprograms of Site Stewardship in FY 2010.

Environmental Projects and Operations (EPO)

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 requirements 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 performs long-term environmental monitoring activities and analyses. In addition, EPO subprogram managers and staff provide effective oversight of these activities and ensure integration of a responsible environmental stewardship program.

Nuclear Materials Integration

The Nuclear Materials Integration subprogram provides focused attention on the consolidation and disposition of NNSA SNM. This effort was previously conducted under the auspices of the Readiness in Technical Base and Facilities (RTBF) Weapons Activities. Current activities include de-inventory of security category I and II SNM from Lawrence Livermore National Laboratory and the disposition of inactive actinides.

Stewardship Planning

The Stewardship Planning subprogram is responsible for planning activities needed to provide efficient design and execution of site infrastructure construction projects. Its primary objective is to ensure that stewardship projects are adequately planned in advance of project start to permit the timely obligation of construction funds and effective project execution. The Stewardship Planning subprogram supports: the establishment of all Site Stewardship project baselines; planning and design for prioritized general stewardship projects and for stewardship utility line items; and contract preparation and other activities necessary to ensure the readiness to obligate and execute funds. Stewardship Planning also funds Other Project Costs in anticipation of Project Engineering and Design and construction for Site Stewardship line items. In addition, this subprogram provides planning and funding for excess facility deactivation and demolition and the elimination of NNSA excess property through demolition, sale, or transfer and the preparation of process-contaminated facilities for transfer to the Department of Energy (DOE) Office of Environmental Management (EM) for final disposition. Current FY 2010 activities also include the Pantex Renewable Energy Project at the Pantex Plant. NA-50 anticipates refinements to the Site Stewardship Program Structure to address NNSA priorities for excess facility deactivation and demolition and energy efficiency and renewable energy.

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 across the enterprise and will address environmental compliance; energy efficiency; consolidating and improving the efficiency of operations; and modernization projects. Two Stockpile Stewardship Line Item construction projects were identified during the FY 2010 NNSA internal Planning, Programming, Budgeting, and Evaluation process for inclusion in the Site Stewardship Program in FY 2011.

PROGRAM GOALS

Subprogram	Program Goals
Environmental Projects and Operations	Effectively manage the cost, scope, and schedule of LTS activities at NNSA sites and continue risk reduction through operation of installed remedies at five NNSA sites.
	Continue to work corporately with all involved parties to meet the requirements of the Los Alamos National Laboratory (LANL) Consent Order and other agreements between DOE, NNSA, and the site regulators.
	Oversee efforts at NNSA sites for continued packaging, shipping, and disposal of transuranic waste shipments to the Waste Isolation Pilot Plant.
	Establish planning and management systems to provide oversight and direction to management of newly generated wastes at the NNSA sites.
	Ensure that radioactive, hazardous, and sanitary wastes generated and/or accepted by NNSA sites are treated, stored, and disposed of in compliance with all internal and external regulatory requirements; and within those requirements wastes are addressed in a timely and cost effective manner that controls risks to worker and public health and the environment to acceptable levels.
Nuclear Materials Integration	Complete the de-inventory of category I and II SNM from Lawrence Livermore National Laboratory.
	Complete disposition of all CMR Wing 3 Uranium Items.
	Disposition 486 kg of Nuclear Material from CMR Wing 4 locked rooms.
	Size reduce and consolidate approximately 120 legacy highly enriched uranium metal components at Y-12.
	Complete estimated 23 shipments of depleted uranium/NU material from Y-12 to the Nevada Test Site for disposal.
Stewardship Planning	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 enterprise-wide and to address NNSA near-term facility deactivation and demolition needs and energy requirements.
Construction	The Stockpile Stewardship Line Item construction projects have financial controls and apply direct appropriations to an integrated, prioritized series of projects and activities resulting in increased operational efficiency for the nuclear security enterprise. All projects will be managed in accordance with project management principles embodied in DOE Order 413.3.

STRATEGY

Beginning in FY 2010, the new Site Stewardship program will integrate program elements managed under the Associate Administrator for Infrastructure and Environment into one program that will operate under a consistent policy. The subprogram elements within Site Stewardship are either previously identified or new program responsibilities that have resource requirements (Environmental Projects and Operations, Nuclear Materials Integration, Stewardship Planning and Construction Projects) that are being combined. Integration of these responsibilities, functions and funding into a single Site Stewardship Program provides both focus and flexibility in program management, priority-setting and funding capability. The Site Stewardship mission will ensure environmentally compliant and energy efficient operations throughout the Nuclear Security Enterprise, and modernize, streamline, and sustain the vitality of the utilities and physical infrastructure. The current outyear projections for Site Stewardship are $518,541,000 for FY 2011 through FY 2014. In the first three years of this four-year trend, funds are relatively level with a slight increase for Stewardship Line Item Construction projects starting in FY 2011 and an increase in the outyears to fund the critical and persistent needs of a stewardship program that supports and is aligned with the NNSA mission and proposed transformation. NNSA is evaluating options for Site Stewardship in the outyears, including FY 2014, to ensure that attention continues to be directed toward maintaining the infrastructure enterprise-wide and to address NNSA near term facility deactivation and demolition needs and energy requirements. Specific use of these funds is part of the ongoing decisions that are related to transforming the nuclear security enterprise.

CHALLENGES

Subprogram	Challenges
Environmental Projects and Operations	LTS activities began at several NNSA sites beginning in FY 2007 (Kansas City Plant, Sandia National Laboratories, and Lawrence Livermore National Laboratory ([LLNL)) and was initiated at Pantex and at LLNL Site 300 in FY 2009. The EPO LTS Program scope and budget authority addresses the ongoing support for environmental cleanup activities initiated originally under the current EM activity baselines. 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. Organizational management authority and funding responsibilities for these LTS future liabilities have yet to be assigned within DOE.
	The New Mexico Environmental Department Consent Order covering Resource Conservation and Recovery Act related cleanup of sites associated with LANL activities and programs represents a major driver for changes in the scope, schedule, and costs of LANL environmental programs. EM and NNSA must continue to work in concert to fully assess and address the impacts of the LANL Consent Order and realign LANL environmental program activities in a timely manner, as needed, to assure compliance with the Consent Order's requirements.
	The mission need for regulatory compliance and LTS activities at a number of NNSA enterprise 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 can be expected 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 initiative for transformation of our nation's nuclear weapons complex infrastructure can be expected to drive some significant changes to environmental program activities at some NNSA Sites.
Nuclear Materials Integration	To be determined.
Stewardship Planning	NNSA sites are identifying significant amounts of additional required decontamination and decommissioning , demolition, and infrastructure improvements beyond the Future-Years Nuclear Security Program funds currently requested. There are potential Environmental Management System/Integrated Safety Management Systems impacts associated with some of these requirements. NNSA sites have also identified a performance and "funding" gap to achieving the energy goals provided in Executive Order 13423/DOE O 430.2B.
Construction	To be determined.

RECENT ACCOMPLISHMENTS

Environmental Projects and Operations

- Signed the Chemical Commodities Superfund Consent Decree at the Kansas City Plant.
- Submitted all regulatory documents on time for the Kansas City Plant, Lawrence Livermore National Laboratory, and Sandia National Laboratories.

Nuclear Materials Integration; Stewardship Planning; and Construction

- These Site Stewardship subprograms will begin in FY 2010 (Nuclear Materials Integration efforts were previously conducted under RTBF Weapons Activities).

FUNDING SCHEDULES

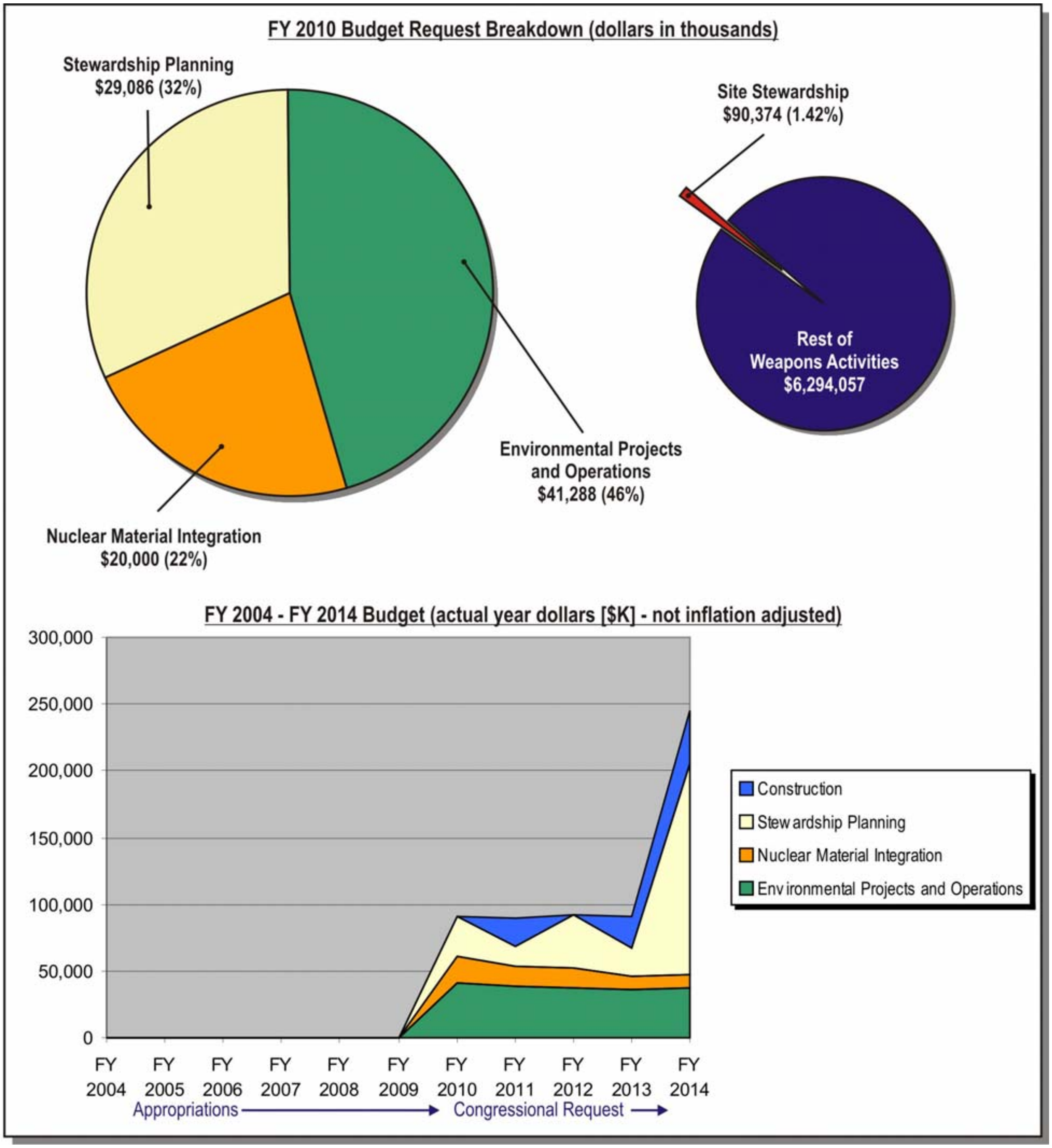

Figure 12-3. Funding Schedule for Site Stewardship.

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Defense Nuclear Security

13

Major Changes

In August 2008, the Acting Deputy Secretary of Energy approved Department of Energy (DOE) Order 470.3B, *Graded Security Protection (GSP) Policy*, to replace the Design Basis Threat. The National Nuclear Security Administration (NNSA) and DOE are transitioning to a new security posture to meet the requirements of the GSP. This new policy establishes a graded set of security requirements for the numerous assets entrusted to DOE and NNSA. The graded security philosophy is based on the premise that the highest investment of security resources should be made to protect those assets whose "loss, theft, compromise, and/or unauthorized use" would most seriously affect national security. Allocation of resources for the protection of other interests and activities must be graded accordingly. The GSP defines security requirements in terms of adversary characteristics, capabilities, and numbers. These security requirements allow each site to analyze and design a security posture that can be tailored to address its unique assets and operational considerations.

Mission

Defense Nuclear Security (DNS) is responsible for the development and implementation of security programs for the National Nuclear Security Administration (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.

Figure 13-1. DNS officers protect NNSA interests.

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 Enterprise. Resource allocation is based on a rigorous requirements validation and evaluation process that incorporates site level vulnerability analysis and risk assessments against requirements.

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 13-2 displays the DNS subprograms.

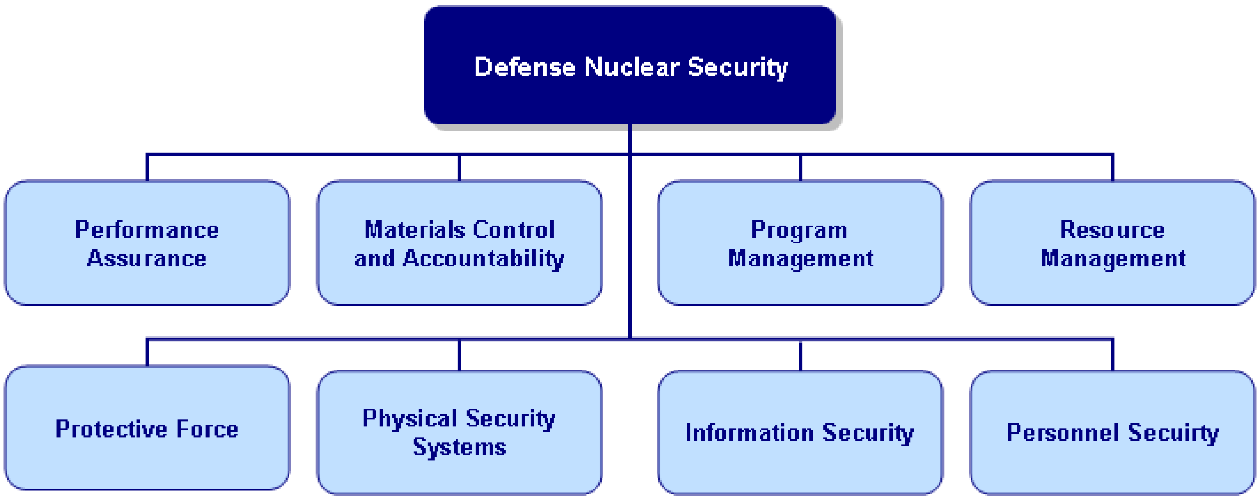

Figure 13-2. Subprograms of Defense Nuclear Security in FY 2010.

Resource Management

Resource Management directs the Planning, Programming, Budgeting and Evaluation 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.

Performance Assurance

Performance Assurance provides direction of the effectiveness of the site office and contractor security performance, and serves to document and communicate overall program results to 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 the NNSA's ability to meet its security responsibilities.

Materials Control and Accountability (MC&A)

Materials Control and Accountability (MC&A) 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.

Program Management

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.

Protective Force

Protective Force provides guidance to the "tactical response force." The force utilizes a robust mix of offensive and defensive qualified contractor officers who are well-trained in small unit and weapons tactics. Protective Force 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 spectrum of threats regarding terrorism.

Figure 13-3. Protective Force provides guidance to the "tactical response force."

Physical Security Systems

Physical Security Systems provide guidance on security technologies deployed throughout NNSA fixed sites. Physical Security Systems includes: 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

Information Security 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

Personnel Security 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.

PROGRAM GOALS

Subprogram	Program Goals
All Subprograms	A Security Program that is integrated, efficient, and cost-effective. The goal is to eliminate practices that do not add value to the security program, align business practices with the Planning, Programming, Budgeting, and Evaluation process, and maintain our ability to respond to changes in the threat environment.
	Risk management principles are implemented in a transparent manner. Develop a framework to accurately articulate risk management principles to facilitate program decision-making. Federal and contractor governance processes will manage risk so that the demands of security and business practices are balanced against considerations of cost-effectiveness and operating efficiency.

Subprogram	Program Goals
	Communicate on the DNS security program state of health with Department of Energy (DOE), NNSA, and stakeholders' concerning the NNSA Enterprise is coordinated and integrated. Maintain and cultivate enduring partnerships with the Department of Defense (DoD) and Nuclear Regulatory Commission (NRC) on nuclear security policy and implementation.
	Technology deployment that improves the efficiency and effectiveness of security approaches. Support research and development efforts for Delay/Denial technologies that are resistant to changing threats. Work in concert with DOE's Office of Health, Safety and Security (HSS) and the DoD to obtain technologies to improve the lethality and survivability of NNSA Protective Force.
	Reduction of the security footprint. Develop a long-range security program plan that fully supports the NNSA's Enterprise Transformation vision. The future weapons enterprise must be secure, with security built in to the projects undertaken to implement the Enterprise Transformation vision. Enterprise Transformation initiatives will reduce the facility footprint by nine million square feet, consolidate SNM storage to reduce security costs at multiple sites, modernize plutonium and uranium manufacturing capabilities, and reduce by 20–30 percent that portion of the workforce supported by weapons activities funding.

STRATEGY

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

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 constitute 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 that reduce the reliance on manpower.
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 manpower and maintenance required to support two physical access control systems are neither efficient nor cost-effective. Security systems across the enterprise are aging and require repair, modernization, or replacement. DNS must reduce the maintenance and increase standardization and interoperability for effectiveness and material readiness of its security systems. The implementation of HSPD-12 funding is not fully allocated to ensure NNSA-wide compliance.
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 require DNS to identify innovative means to protect information assets.
Personnel Security	National mandates to further reduce adjudication processing times require fundamental changes in the management processes of the Personnel Security Program. To improve the efficiency and effectiveness of the adjudication process, while maintaining or improving the quality, requires increased training, and improved quality assurance. Clearance backlogs continue to delay effective application of personnel resources.

RECENT ACCOMPLISHMENTS

Defense Nuclear Security

- In September 2007, DNS was tasked to prepare a comparative analysis of contractor and Federalized protective forces at NNSA fixed sites to help determine whether a more effective and efficient model for providing security in the current threat environment is possible. The analysis compared the potential costs and benefits of using contract employees (the current model), Federal employees, or a combination of the two for providing protective forces at NNSA sites. The *NNSA Comparative Analysis of Contractor and Federalized Protective Forces at Fixed Sites Study Report* was issued in March of 2008. While DNS concluded that neither partial nor complete Federalization of the Protective Forces would be viable at this time, the study also indicated that increased standardization could address some of the goals of Federalization, such as improving the effectiveness of protective forces, increasing efficiencies, and facilitating responses to potential work stoppages. As a result, the NNSA Chief, Defense Nuclear Security, was directed to pursue a standardization initiative regarding NNSA fixed site protective forces.

- The *Safeguards and Security Functional Management Plan* (FMP) establishes the specific requirements and guidance for the DNS security oversight program. The DNS oversight program consists of evaluating site office performance, operational awareness of security programs, and DNS self-assessment process. The FMP, when utilized in conjunction with line oversight and contractor assurance systems, NNSA Site Office oversight programs, and independent oversight inspections, provides a comprehensive approach to ensuring an effective, responsive, enterprise-wide focus on security requirements, and performance in accomplishing our mission.

Figure 13-4. DNS is responsible for the protection of NNSA SNM.

- NNSA security professionals need to be trained and qualified to perform their duties. A concerted effort is underway to ensure this is accomplished through the re-invigorated Technical Qualification Program (TQP). DNS has developed a detailed TQP implementation plan to ensure staff obtains certification under the program. NNSA Site Offices have also committed to having their security professionals participate in the TQP program. DNS sponsored the rewrite of DOE Standard 1171, DOE Standard Safeguards and Security Functional Area Qualification Standard, and the development of a Security General Technical Base Standard that governs technical qualification of security professionals. The Standards are currently in draft form and are being coordinated with the DOE Security Leadership Coalition and Federal Technical Capabilities Panel for final approval. Once this process is complete, all NNSA security professionals will complete their TQP certifications, as appropriate.

- DNS, in partnership with the Office of Management and Administration (NA-60) 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 beginning with the FY 2011 – FY 2015 budget cycle.

- DNS established a Field Assistance Cadre comprised of Federal and independent contractor personnel that can be made available to Site Offices to address skill mix gaps, understaffing issues, and temporary technical voids. The cadre provides assistance in all facets of the security program for achieving compliance and in strengthening the Site Office capabilities.

- The DOE Security Leadership Coalition (SLC) was established to support the enhancement and continuity of security throughout DOE and NNSA by providing innovative, practical advice and recommendations that strengthen the overall safeguards and security program; foster a security leadership forum for all security related functions; and ensure a stabilized safeguards and security community by facilitating clear communication, providing objective analysis, and effecting solutions with both short and long-term implications. The SLC is a field-led entity that is composed of representatives from field security organizations, Headquarters Program Offices, and HSS. While the SLC includes all DOE organizations, there is a subgroup focused solely on NNSA security issues. The SLC NNSA subgroup provides significant benefit to DNS that helps identify systemic security issues facing NNSA sites.

- DNS began a pilot project to review the effectiveness of security at each NNSA site. To date, several sites have been evaluated. The effort involves the use of the General Campaign Analysis Model (GCAM) to conduct detailed operational tactical level modeling analyses to evaluate the effectiveness of protection measures at the sites, and to determine whether additional resources might be necessary to improve them. Postulated threat scenarios, either developed by the sites or by DNS and its team of independent experts, are also being imported into the GCAM. The model is run using multiple threat scenarios (Red and Blue) and the results reported to DNS and the site during a validation review. The model helps determine whether there are better options to provide protection that could potentially result in cost saving while affording a level of protection commensurate with the associated risks.

- DNS was a key participant in a December 2008 United States, Russian, and United Kingdom (U.K.) nuclear security best practices workshop to exchange expertise and reduce possibilities of weapons or materials falling into terrorist hands. The workshop was part of a series held between the United States and Russia pursuant to the Bratislava Nuclear Security Initiative, and was the first multilateral exchange. Representatives from the NNSA, U.K. Ministry of Defence, Russian Ministry of Defense, and Russian State Atomic Energy Corporation (Rosatom) exchanged their best practices in material control programs, vulnerability analysis tools, new technologies for nuclear security, and personnel reliability programs.

- In September 2008, DNS successfully hosted the Nuclear Security Summit at the Y-12 National Security Enterprise for approximately 250 attendees, including participants from DOE, DoD, NNSA, and NRC. The meeting allowed different Federal agencies to share security solutions, technical research, lessons learned, and best practices. This enhanced collaboration that will ensure greater nuclear security across the country.

Kansas City Plant (KCP)

- KCP achieved cost savings of 2.8 percent of the annual 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 demonstrate success in improving the efficiency of security operations at a non-nuclear site.

- KCP completed an upgrade to the security and access control system. The upgrade included replacement of aging system hardware and an upgrade of the system software, incorporating a more user friendly "Windows" type interface and using detailed three dimensional facility alarm graphics.

- All KCP personnel were fully enrolled in the HSPD-12 credential system by October 29, 2008.

Figure 13-5. DNS officers prepare for a training exercise.

Lawrence Livermore National Laboratory (LLNL)

- Upon completion of the Office of Independent Oversight inspection in April 2008, LLNL initiated an aggressive "Recovery Plan" to improve the effectiveness of its protection strategy. LLNL implemented several security upgrades in physical, communications, and system security. Upgraded weapons systems were deployed and a multitude of force-on-force exercises were conducted that demonstrated significant improvements in the protective forces' response. LLNL also implemented corrective action plans for all of the findings resulting from the Independent Oversight inspection.

- LLNL enhanced its protection of sensitive unclassified information by removing foreign national users from its sensitive network ("Yellow Network") and placing them on a new, separate network ("Blue Network").

- LLNL continues to upgrade Vault-Type Rooms (VTRs) and improve the protection of classified matter.

Los Alamos National Laboratory (LANL)

- LANL successfully deployed the Dillon M-134D Minigun within Technical Area-55 during FY 2008. The effectiveness of the Dillon Minigun now employed was successfully demonstrated during the recent Force-on-Force exercise held during the Headquarters Independent Oversight inspection.

- LANL continued to concentrate efforts on managing and mitigating security risks through a number of initiatives in 2008. The Laboratory destroyed over 1,500,000 legacy classified documents during its annual "Spring Cleaning" event in 2008. Vault and Vault-Type Room (V/VTR) consolidation efforts continue, and the number of facilities was reduced from 142 to 107. A "Security Assets Consolidation Project" was funded and is now being executed that will consolidate the contents of 30 V/VTRs into four centralized locations operated by security professionals. Efforts to reduce accountable classified removable electronic media also continue, with an additional 20 percent reduction achieved in 2008. Finally, more than 30,000 classified parts have been destroyed, representing a 40 percent reduction in the inventory.

- LANL continued to reduce its reliance on "non-standard storage" of classified interests in 2008 by destroying legacy material and consolidating holdings. This resulted in a 25 percent reduction in non-standard storage facilities. Two 2008-funded projects are currently underway that will eliminate the need for non-standard facilities in FY 2009.

- The LANL Security and Safeguards Directorate implemented an annual V/VTR certification process that combines comprehensive reviews of configuration management, physical security compliance, and sensor system performance test requirements into an annual accreditation. This process led to an "Effective Performance Rating" and "Best in Complex" designation by the DOE Office of Independent Oversight.

- LANL implemented a risk-based process for determining the annual TSCM facility surveys schedule. This process assures the limited TSCM resources are efficiently applied in a manner to most effectively manage the technical surveillance risks at the site. The process is a collaborative effort among LANL's TSCM, Operations Security (OPSEC), Counterintelligence, TEMPEST, and Physical Security programs. Collectively, this group evaluates a number of factors from each discipline taking into account the date of each facility's last survey. Based on the results of this analysis, a final list is provided to the site risk official for acceptance and authorization of the schedule.

- LANL implemented an enhanced issues management process consisting of a Management Review Board concept and an Integrated Security Issues Tracking System (ISITS) which captures classified and unclassified internal and external security deficiencies (both cyber and physical). In addition, the issues management process tracks causal analyses and corrective actions, improves trending capabilities, identifies performance indicators and effectively improves the timely resolution of physical and cyber security deficiencies. Reports are presented to and used by LANL managers and organizational security professionals to more effectively understand and act to improve security operations, and to reduce security incidents in their organizations. The ISITS project was completed ahead of schedule and under budget.

Nevada Test Site (NTS)

- The NTS Nuclear MC&A Program has emerged as a "Best in Complex" program. This is a remarkable achievement considering the program was rebuilt only two years ago as a result of new missions at the site. NTS MC&A was a pilot program for the Safeguards First Principles Initiative (SFPI) in FY 2007 and operated under this risk-based approach in FY 2008, validating the success of the program. The SFPI effectiveness modeling tools were characterized and improved and have become the standard benchmark upon which the other sites will implement SFPI.

- The NTS OPSEC Program is highly acclaimed. The NTS OPSEC Program has and continues to garner top honors in various National OPSEC Awards programs.

- Based on awareness, innovations, and its comprehensive OPSEC vulnerability assessments for DOE, DoD customers, and the OPSEC community, the NTS OPSEC program recently received an unprecedented third National OPSEC Organizational Achievement Award. Other awards garnered by the NTS OPSEC Program include three Individual Awards, seven Multimedia-Print and Video, one Literary award, twelve Defense Program Awards of Excellence, two American Society for Industrial Security International Awards, and the DOE Secretary's Appreciation Award for Individual Achievement.

- 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 innovative OPSEC awareness campaign titled the "DOGS of OPSEC" promotes good OPSEC and Security Awareness practices through the use of "Way to Go" cards and "DOGS of OPSEC" certificates handed to those that are seen following OPSEC guidelines and security policies. In addition, the original NTS OPSEC awareness program, "Canine Idol II," received more than 14,000 viewings of OPSEC messages read by an increasingly OPSEC aware employee population.

- The Nevada Site Office (NSO) completed a major Protective Force Training Academy facilities upgrade resulting in the establishment 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 that simultaneously integrates the live fire engagements by Security Police Officer I, II, and III personnel from these facilities against an adversary target array.

- Although the NSO protective force conducts an aggressive "train as you fight" program to enhance individual and collective tactical skill proficiency, the site security contractor, Wackenhut Services, Inc. (WSI), was unanimously recommended by the Voluntary Protection Program (VPP) assessment team from the HSS Office of Worker Safety and Health in retaining its "Star" status for a remarkable tenth consecutive year. This is an unprecedented level of VPP achievement for a protective force contractor that resulted in DOE Secretarial individual recognition awards.

- The NSO/WSI Technology Deployment and Integration Center is a recognized leader within the DOE/NNSA in conducting advanced work in testing, evaluating, and deploying commercial off-the-shelf technologies that will immediately enhance the protective force detection and neutralization capabilities and, ultimately, develop a suite of integrated technologies that will help reduce the demand for protective force assets in maintaining viable, cost-effective security programs.

Pantex Plant

- The following initiatives were completed during FY 2008: development of a tracking and trending process that provides a mechanism for monitoring the health of the Safeguards and Security program; creation of Systems Effectiveness & Performance Testing working groups focused on integration among all Safeguards and Security functional areas; and the development of an enterprise-wide Impact Management Index reportable metric. Additionally, the Pantex Plant developed the protective force refresher training that allows for more realistic evaluation of the tactical abilities of both individuals and teams; installed and activated a HSPD-12 Enrollment Center; created the enterprise-wide NNSA Policy Letter 14.2c Security Plan format; and exceeded the DOE standard for nuclear material accountability reporting requirements with a data error rate of less than one percent.

- As part of addressing infrastructure needs, two security-related construction projects were completed the Security Operations and Security Locker Facilities during FY 2008.

Sandia National Laboratories (SNL)

- In support of the 2005 Design Basis Threat (DBT) Implementation Plan, SNL developed an innovative methodology for analyzing facilities designated by the Deputy Administrator for Defense Programs (NA-10) as "Mission Critical," in accordance with the 2005 DBT. This methodology has been approved by NA-10 and has allowed SNL to avoid significant costs by applying a risk-based approach for protection of designated facilities. The methodology developed by SNL will be utilized by other NNSA sites in determining protection requirements to meet the newly published GSP.

- SNL met the NNSA goal to remove and de-inventory all Category I and II SNM from SNL in New Mexico and ceased all Category I SNM testing activities at the Tonopah Test Range in

FY 2008. In preparation for this inevitable end state, SNL made strategic business, staffing, and financial decisions beginning in FY 2005 which would minimize potential layoffs and allow for re-deployment of equipment and materials to other NNSA sites. This was achieved through the use of extended overtime for the protective forces and implementation of non-permanent upgrades to meet 2003 DBT protection requirements. As a result, SNL achieved a total cost savings to the Security Program of $20M over a period of five years and was able to avoid significant costs associated with implementation of the 2005 DBT and DOE Manual 470.4-3, Change 1, *Protective Force*.

Savannah River Tritium Site

- The Savannah River Tritium Site installed a Cell Phone Detector System. The system is an adhesive Radio Frequency Identification Device that initiates an alarm prior to an individual entering a security area. The site also integrated security videos into the security awareness program using the Dynamic Learning Objective concept.

Service Center

- NNSA possesses approximately half of the DOE's active clearances, including 65 percent of the "Q" clearance population. In FY 2008, the NNSA Service Center realigned resources to streamline the adjudication process. As a result, the backlog of applicant cases was reduced by over 50 percent during the Fiscal Year. Additionally, by the end of the fiscal year, the NNSA Service Center met the 2004 Intelligence Reform and Terrorism Prevention Act requirement to finalize 80 percent of the applicant cases within 30 calendar days of receiving the completed Office of Personnel Management background investigation.

Y-12 Plant

- The Security Improvement Project (SIP) will provide the Y-12 Plant with the Argus security control system and raise the existing alarm system backbone control equipment up to modern standards. The SIP Project Team finalized design and is developing the Critical Decision-2 package. Construction is scheduled to start in FY 2010, with completion 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 longstanding problems with duplicative and redundant development and maintenance of site-level security information systems.

- The Oak Ridge Central Training Facility opened a new "Live Fire Shoot House" and a "one-of-a-kind" tactical training facility. The tactical training facility allows simulation of multiple facilities, and provides realistic training outside hazardous areas. The new facilities broaden indoor weapons training capabilities, permitting security police officers to train under a

Figure 13-6. Physical Security Systems provide security technologies deployed throughout NNSA sites.

variety of scenarios. The new facilities enable training to be conducted 24 hours per day, and night qualifications to be completed during daylight hours, thereby reducing training downtime and overtime costs.

- The Highly Enriched Uranium Materials Facility (HEUMF) completed construction on schedule. The denial facility design will provide significantly increased security with less reliance upon protective forces. Loading of HEUMF is schedule to begin by the end of calendar year 2009 and will allow for the consolidation of nuclear material and the closure of a difficult to maintain Material Access Area.

- Design of the Uranium Processing Facility is underway and will take advantage of opportunities identified during construction and testing of the HEUMF. The Uranium Processing Facility 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 Plant successfully completed 13 projects related to DBT implementation during FY 2008. Projects included physical security upgrades (hardened fighting positions, access delay projects, vehicle arresting system); portal automation to reduce lifecycle costs (Post 5); construction of a new Protected Area Vehicle Portal (Portal 24); and a state of the art wireless mesh system that will allow for installation of situational awareness systems and sensor networks. Upgrades provide enhanced security protection at substantial cost avoidance by alleviating the need to hire additional protective force personnel.

FUNDING SCHEDULES

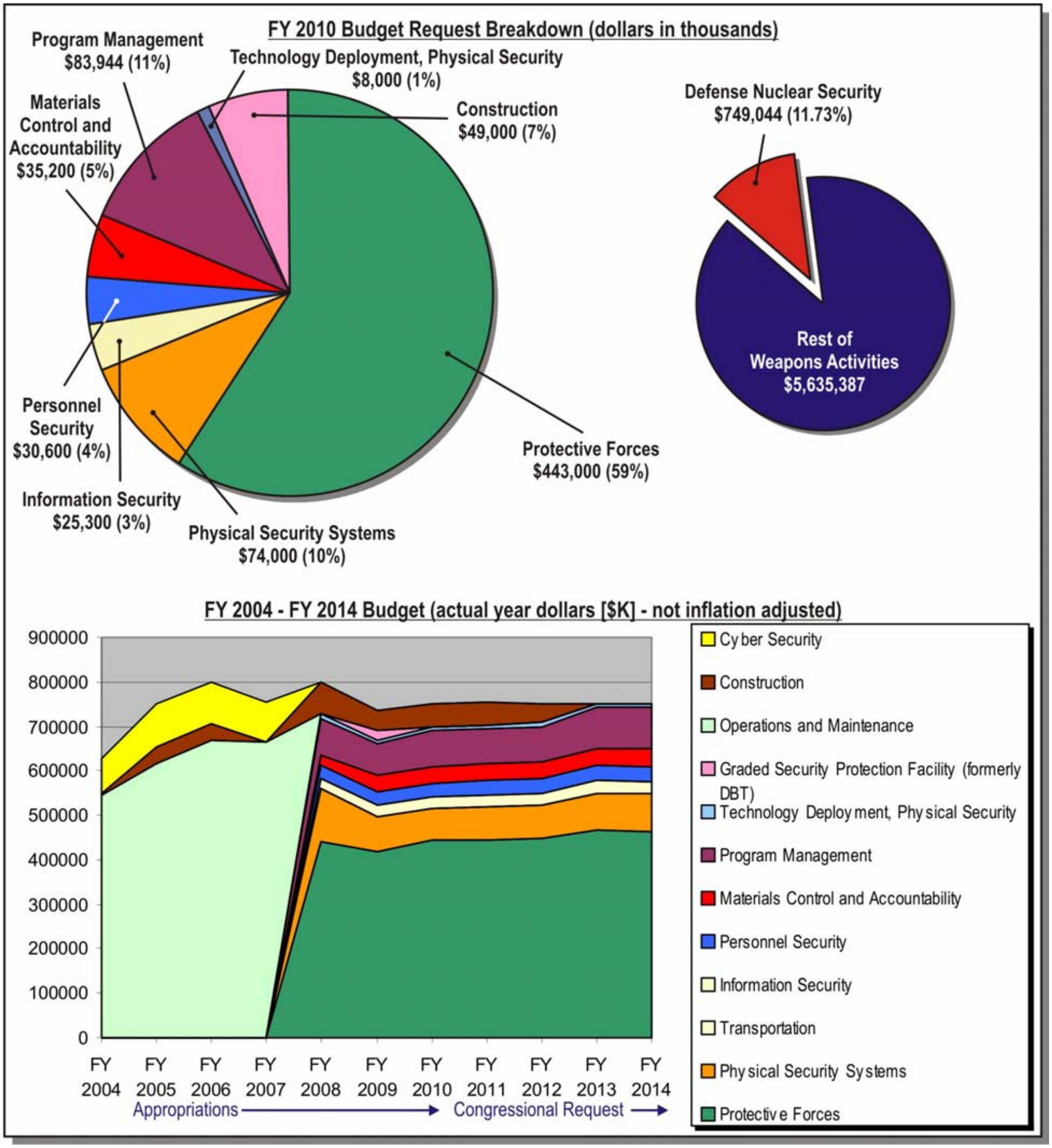

Figure 13-5. Funding Schedule for Defense Nuclear Security.

Cyber Security

14

Major Changes

In FY 2008, the National Nuclear Security Administration (NNSA) underwent a major revitalization of its cyber security program via the Program Cyber Security Plan; the NNSA Certification and Accreditation Process; and the Transmission of Secret Restricted Data on SIPRNET documents. 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 throughout the nuclear security enterprise. The Classified Diskless Workstation Operations subprogram was successfully completed in FY 2008.

MISSION

The National Nuclear Security Administration (NNSA) Cyber Security Program provides the requisite guidance needed to ensure that sufficient information technology and information management security safeguards are implemented throughout the NNSA enterprise. This program implements a flexible, comprehensive, and risk-based cyber security program that: (a) adequately protects the NNSA information and information assets; (b) is predicated on Executive Orders, national standards, laws and regulations, and Departmental and NNSA orders, manuals, directives, and guidance; and (c) results in a policy-driven cyber security architecture; a programmatic framework and methodology that is based on current policies and procedures; and a management approach that integrates all of the components of a comprehensive cyber security program.

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. The Classified Diskless Workstation Operations subprogram reported in past budgets was successfully completed in FY 2008 within budget and schedule.

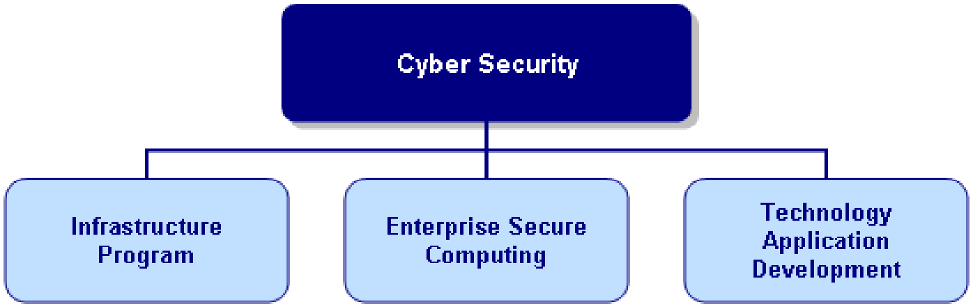

Figure 14–1. Subprograms of the Cyber Security Program in FY 2010.

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, Department of Energy (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 enterprise level classified computing infrastructure that enables effective collaboration and information sharing necessary for the NNSA complex. 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.

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 centralize 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.

Subprogram	Goals
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 compliance and performance, and use of modern document distribution methods.

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 programs 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 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 Program. 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, enterprise 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 and monitoring and cyber security metrics.

CHALLENGES

Subprogram	Issues
Infrastructure Program	Unfunded new requirements from the Office of Management and Budget and DOE for unclassified cyber security activities.
	Costs (funding, resources, schedule) to implement new federal policies and DOE guidance.
	Lack of consistency incident management and handling processes (interpretation, coordination, implementation) across NNSA enterprise and with DOE.
	Expanded use of advanced IT solution to improve the overall computing environment and enhance user interactions.
	Investment planning for cyber security technologies.
Enterprise Secure Operations	New unfunded federal requirements for unclassified cyber security activities.
	Improve the proliferation of classified computing activities across the NNSA enterprise.
	Investment planning for cyber security technologies in NNSA enterprise 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.

RECENT ACCOMPLISHMENTS

- The Cyber Security Program will sustain the NNSA infrastructure elements to counter cyber threats from external and internal attacks using the latest available technologies.
- The Cyber Security Program will develop and implement critical cyber asset recovery plan. The plan must consist of the following elements:
  - Exercises – The recovery plan(s) shall be exercised at least annually. An exercise of the recovery plan(s) can range from a paper drill, to a full operational exercise, to recovery from an actual incident.
  - Change Control – Recovery plan(s) shall be updated to reflect any changes or lessons learned as a result of an exercise or the recovery from an actual incident. Updates shall be communicated to personnel responsible for the activation and implementation of the recovery plan(s) within ninety calendar days of the change.
  - Backup and Restore – The plan(s) shall include 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 shall be tested at least annually to ensure that the information is available.

- The Office of the Chief Information Officer, Cyber Security Program Manager will strengthen the Cyber Security Program by implementing the following:
    - Policy Development and Implementation
    - Site Assessment
    - Enhance ESN Activities
        - Complete all engineering projects on schedule and budget:
            - Ensure technology insertion is managed properly.
            - Ensure logistics actions support engineering projects.
            - Ensure the Enterprise Data Resource Management (EDRM) project is coordinated with the engineering projects.
            - Ensure the Enterprise Architecture (EA) project supports the future growth of ESN.
            - Ensure cyber security best practices are integrated into the development of all engineering projects.
        - Ensure standardized network and site operations are followed:
            - Develop and execute the Operator Readiness Review (ORR) initiative.
            - Execute the Transition Plan which will increase network cyber security.
            - Develop and integrate the Operator Tool Set.
            - Enhance and customize the overall Training initiatives.
            - Integrate the Configuration Management (CM) project into ESN operations.
            - Ensure cyber security best practices are integrated into all network and site operations.
    - Implement Required Committee on National Security Systems (CNSS) Activities
        - Audit Management
        - Configuration Management

FUNDING SCHEDULES

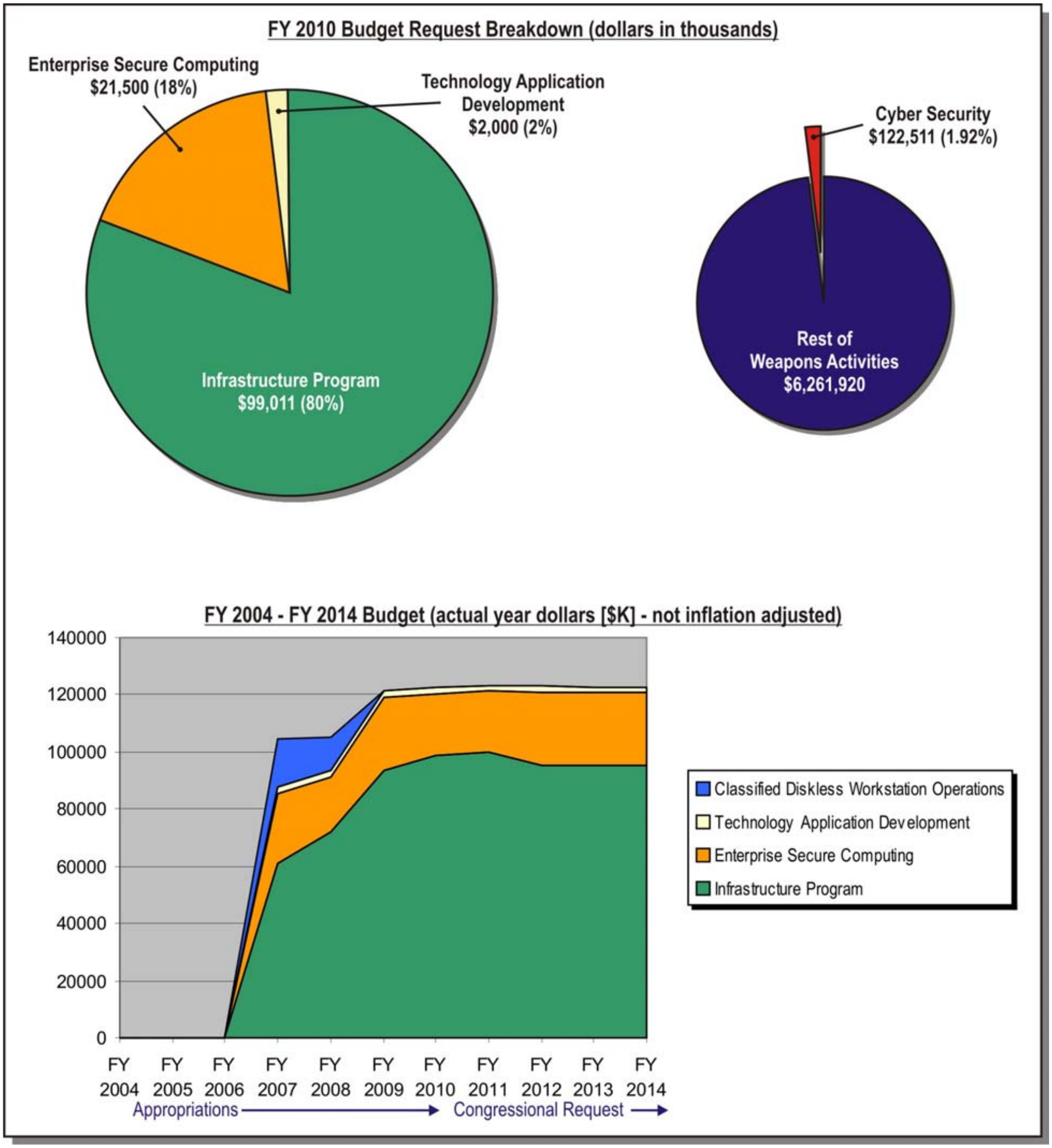

Figure 14–2. Funding Schedule for the Cyber Security Program.

Funding Schedules

A

Weapons Activities

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Directed Stockpile Work	1,405,602	1,590,152	1,514,651	1,522,230	1,485,842	1,531,408	1,553,468
Science Campaign	286,274	316,690	316,690	313,075	311,860	308,223	304,899
Engineering Campaign	168,548	150,000	150,000	118,630	118,170	116,792	144,415
Inertial Confinement Fusion Ignition and High Yield Campaign	470,206	436,915	436,915	431,927	430,251	425,234	420,648
Advanced Simulation and Computing Campaign	574,537	556,125	556,125	549,776	547,643	541,257	535,420
Pit Manufacturing and Certification Campaign	213,831	0	0	0	0	0	0
Readiness Campaign	158,088	160,620	100,000	84,029	83,704	82,728	81,835
Readiness in Technical Base and Facilities	1,635,381	1,674,406	1,736,348	1,736,779	1,770,867	1,736,475	1,694,224
Secure Transportation Asset	211,523	214,439	234,915	253,902	257,444	255,575	259,146
Nuclear Counterterrorism Incident Response	158,655	215,278	221,936	223,178	222,914	222,508	222,300
Facilities and Infrastructure Recapitalization Program	177,861	147,449	154,922	156,764	154,750	154,687	0
Site Stewardship	0	0	90,374	89,915	91,636	91,261	245,729
Environmental Projects and Operations	17,272	38,596	0	0	0	0	0
Defense Nuclear Security	799,133	735,208	749,044	753,233	752,341	750,972	750,271
Cyber Security	105,287	121,286	122,511	123,197	123,050	122,826	122,711
Congressionally Directed Projects	47,232	22,836	0	0	0	0	0
Subtotal, Weapons Activities	6,429,430	6,380,000	6,384,431	6,356,635	6,350,472	6,339,946	6,335,066
Security Charge for Reimbursable Work	-34,000	0	0	0	0	0	0
Use of Prior Year Balances	-93,064	0	0	0	0	0	0
Total, Weapons Activities	6,302,366	6,380,000	6,384,431	6,356,635	6,350,472	6,339,946	6,335,066

Directed Stockpile Work

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Life Extension Programs							
B61 Life Extension Program	57,013	2,123	0	0	0	0	0
W76 Life Extension Program	189,822	202,920	209,196	206,808	206,005	203,603	236,403
Subtotal, Life Extension Programs	246,835	205,043	209,196	206,808	206,005	203,603	236,403
Stockpile Systems							
B61 Stockpile Systems	64,125	78,021	124,456	110,689	138,084	195,768	198,355
W62 Stockpile Systems	2,122	1,596	0	0	0	0	0
W76 Stockpile Systems	65,212	66,365	65,497	56,884	51,348	52,883	49,177
W78 Stockpile Systems	36,880	42,049	50,741	47,596	39,077	38,158	41,518
W80 Stockpile Systems	27,342	31,073	19,064	17,599	15,909	18,482	19,444
B83 Stockpile Systems	23,959	24,986	35,682	34,649	34,616	35,447	38,596
W87 Stockpile Systems	53,199	36,073	51,817	55,196	61,555	59,247	46,002
W88 Stockpile Systems	54,250	48,358	43,043	40,120	56,354	60,137	62,069
Subtotal, Stockpile Systems	327,089	328,521	390,300	362,733	396,943	460,122	455,161
Reliable Replacement Warhead	1,527	0	0	0	0	0	0
Weapons Dismantlement and Disposition	138,832	190,205	84,100	62,464	60,783	61,928	59,544
Stockpile Services							
Production Support	283,529	293,062	301,484	317,074	295,307	277,715	272,016
Research and Development Support	31,386	35,144	37,071	39,494	35,904	35,517	36,378
Research and Development Certification and Safety	173,609	187,574	143,076	193,516	176,360	183,311	184,090
Management, Technology, and Production	202,795	195,334	200,223	198,387	206,980	201,499	203,590
Plutonium Capability	0	155,269	0	0	0	0	0
Plutonium Sustainment	0	0	149,201	141,754	107,560	107,713	106,286
Subtotal, Stockpile Services	691,319	866,383	831,055	890,225	822,111	805,755	802,360
Total, Directed Stockpile Work	1,405,602	1,590,152	1,514,651	1,522,230	1,485,842	1,531,408	1,553,468

Science Campaign

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Advanced Certification	14,866	19,400	19,400	19,316	19,104	18,881	18,678
Primary Assessment Technologies	61,844	80,181	80,181	79,835	78,958	78,038	77,195
Dynamic Plutonium Experiments	0	23,022	0	0	0	0	0
Dynamic Materials Properties	95,978	83,231	86,617	86,243	85,296	84,301	83,392
Academic Alliances	0	0	30,251	30,120	29,790	29,442	29,125
Advanced Radiography	30,282	28,535	22,328	19,984	21,987	21,731	21,497
Secondary Assessment Technologies	78,399	76,913	77,913	77,577	76,725	75,830	75,012
Test Readiness	4,905	5,408	0	0	0	0	0
Total, Science Campaign	286,274	316,690	316,690	313,075	311,860	308,223	304,899

Engineering Campaign

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Enhanced Surety	34,137	46,112	42,000	43,431	45,101	44,770	50,064
Weapons Systems Engineering Assessment Technology	18,814	16,592	18,000	13,850	16,938	15,572	20,218
Nuclear Survivability	8,644	21,100	21,000	17,922	9,454	8,760	10,590
Enhanced Surveillance	78,573	66,196	69,000	43,427	46,677	47,690	63,543
MESA Other Project Costs	7,485	0	0	0	0	0	0
Ion Beam Laboratory Refurbishment Construction	9,911	0	0	0	0	0	0
MESA Construction	10,984	0	0	0	0	0	0
Total, Engineering Campaign	168,548	150,000	150,000	118,630	118,170	116,792	144,415

Inertial Confinement Fusion Ignition and High Yield Campaign

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Ignition	103,029	100,535	106,734	111,173	94,773	74,410	71,479
Support of Other Stockpile Programs	0	0	0	0	13,102	29,495	29,177
NIF Diagnostics, Cryogenics, and Experimental Support	68,107	66,201	72,252	74,370	75,395	74,921	71,348
Pulsed Power Inertial Confinement Fusion	10,241	8,652	5,000	4,978	4,924	4,866	4,814
Joint Program in High-Energy-Density Laboratory Plasmas	3,152	3,053	4,000	3,983	3,939	3,893	3,851
Facility Operations and Target Production	112,012	203,282	248,929	237,423	238,118	237,649	239,979
Inertial Fusion Technology	29,426	0	0	0	0	0	0
NIF Assembly and Installation Program	134,294	55,192	0	0	0	0	0
96-D-111, National Ignition Facility	9,945	0	0	0	0	0	0
Total, Inertial Confinement Fusion Ignition and High Yield Campaign	470,206	436,915	436,915	431,927	430,251	425,234	420,648

Advanced Simulation and Computing Campaign

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Integrated Codes	151,984	138,917	138,475	137,975	137,975	137,975	137,975
Physics and Engineering Models	65,049	49,284	58,762	54,798	58,762	58,762	58,762
Verification and Validation	49,606	50,184	49,781	49,781	49,781	49,781	49,781
Computational Systems and Software Environment	185,637	156,733	150,833	150,833	150,833	150,833	150,833
Facility Operations and User Support	122,261	161,007	158,274	156,389	150,292	143,906	138,069
Total, Advanced Simulation and Computing Campaign	574,537	556,125	556,125	549,776	547,643	541,257	535,420

Readiness Campaign

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Stockpile Readiness	18,562	27,869	5,746	11,199	0	0	0
High Explosives and Weapon Operations	9,647	8,659	4,608	0	0	0	0
Nonnuclear Readiness	25,103	30,000	12,701	7,026	0	0	0
Tritium Readiness	71,831	71,831	68,246	51,371	83,704	82,728	81,835
Advanced Design and Production Technologies	32,945	22,261	8,699	14,433	0	0	0
Total, Readiness Campaign	158,088	160,620	100,000	84,029	83,704	82,728	81,835

Readiness in Technical Base and Facilities

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Operations of Facilities	1,152,455	1,163,331	1,342,303	1,290,006	1,212,085	1,169,649	1,114,853
Program Readiness	70,099	71,626	73,021	70,945	66,075	65,567	65,117
Material Recycle and Recovery	71,567	70,334	69,542	72,091	66,267	66,258	64,959
Containers	21,760	22,696	23,392	28,653	25,658	24,691	23,541
Storage	34,462	31,951	24,708	24,805	23,089	22,975	22,487
Construction	285,038	314,468	203,382	250,279	377,693	387,335	403,267
Total, Readiness in Technical Base and Facilities	1,635,381	1,674,406	1,736,348	1,736,779	1,770,867	1,736,475	1,694,224

Secure Transportation Asset

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Operations and Equipment	128,343	127,701	138,772	158,322	160,165	156,897	159,224
Program Direction	83,180	86,738	96,143	95,580	97,279	98,678	99,922
Total, Secure Transportation Asset	211,523	214,439	234,915	253,902	257,444	255,575	259,146

Nuclear Counterterrorism Incident Response

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Emergency Response	131,455	132,918	139,048	138,939	139,222	139,899	141,100
National Technical Nuclear Forensics	12,000	12,557	10,217	10,384	10,400	10,500	10,400
Emergency Management	6,479	7,428	7,726	7,852	7,500	7,000	6,850
Operations Support	8,721	8,207	8,536	8,675	8,692	8,799	8,750
International Emergency Management and Cooperation	0	4,515	7,181	7,298	7,300	7,310	7,200
Nuclear Counterterrorism	0	49,653	49,228	50,030	49,800	49,000	48,000
Total, Nuclear Counterterrorism Incident Response	158,655	215,278	221,936	223,178	222,914	222,508	222,300

Facilities and Infrastructure Recapitalization Program

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Recapitalization	87,414	69,226	130,507	145,065	142,048	152,073	0
Facility Disposition	21,300	0	0	0	0	0	0
Infrastructure Planning	7,627	10,324	14,452	11,699	12,702	2,614	0
Construction	61,520	67,899	9,963	0	0	0	0
Total, Facilities and Infrastructure Recapitalization Program	177,861	147,449	154,922	156,764	154,750	154,687	0

Site Stewardship

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Environmental Projects and Operations	0	0	41,288	39,026	37,468	36,040	36,900
Nuclear Materials Integration	0	0	20,000	15,000	15,000	10,000	10,000
Stewardship Planning	0	0	29,086	13,889	39,168	21,221	158,829
Construction	0	0	0	22,000	0	24,000	40,000
Total, Site Stewardship	0	0	90,374	89,915	91,636	91,261	245,729

Defense Nuclear Security

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Protective Forces	439,106	418,694	443,000	443,360	447,305	465,803	462,947
Physical Security Systems	120,873	77,245	74,000	77,370	74,727	84,602	84,478
Transportation	1,007	420	0	0	0	0	0
Information Security	21,072	25,880	25,300	26,276	27,353	27,664	27,979
Personnel Security	29,460	31,263	30,600	32,116	33,431	33,812	34,196
Materials Control and Accountability	23,978	35,929	35,200	36,495	37,990	38,423	38,859
Program Management	82,527	71,364	83,944	77,588	78,747	92,215	93,263
Technology Deployment, Physical Security	10,000	9,431	8,000	8,028	8,358	8,453	8,549
Graded Security Protection Policy (formerly DBT)	0	19,284	0	0	0	0	0
Construction	71,110	45,698	49,000	52,000	44,430	0	0
Subtotal, Defense Nuclear Security	799,133	735,208	749,044	753,233	752,341	750,972	750,271
Offset for Safeguards and Security Work for Others	-34,000	0	0	0	0	0	0
Total, Defense Nuclear Security	765,133	735,208	749,044	753,233	752,341	750,972	750,271

Cyber Security

(dollars in thousands)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Infrastructure Program	71,777	93,776	99,011	99,697	95,550	95,326	95,211
Enterprise Secure Computing	19,500	25,500	21,500	21,500	25,500	25,500	25,500
Technology Application Development	2,010	2,010	2,000	2,000	2,000	2,000	2,000
Classified Diskless Workstation Operations	12,000	0	0	0	0	0	0
Total, Cyber Security	105,287	121,286	122,511	123,197	123,050	122,826	122,711

Acronyms

B

AAIE	Associate Administrator for Infrastructure and Environment
ACES	Alliance for Computing at the Extreme Scale
ADAPT	Advanced Design and Production Technologies
Alt	alteration
ASC	Advanced Simulation and Computing
BTA	Building Technology Associates, Inc.
C5ISR	command and control communications, computers, cyber, intelligence, surveillance, and reconnaissance.
CASTLE	Collaborative Authorization for Safety-basis Total Lifecycle Environment
CMR	Chemistry and Metallurgy Research Facility
CMRR	Chemistry and Metallurgy Research Replacement Facility
CSA	Canned Subassembly
CSSE	Computational Systems and Software Environment
D&P	Development and Production
DARHT	Dual-Axis Radiographic Hydrodynamic Test Facility
DBT	Design Basis Threat
DCA	Detonator Cable Assembly
DNS	Defense Nuclear Security
DoD	Department of Defense
DOE	Department of Energy
DSW	Directed Stockpile Work
DT	deuterium-tritium
EM	Office of Environment Management
EPO	Environmental Projects and Operations
ESV	Enhanced Surveillance
FBI	Federal Bureau of Investigations
FCI	facility condition index
FIRP	Facilities and Infrastructure Recapitalization Program
FMP	Functional Management Plan
FOUS	Facility Operations and User Support
FPU	first production unit
FY	fiscal year
GCAM	General Campaign Analysis Model
GPRA	Government Performance and Results Act
gsf	gross square feet

GSP	Graded Security Protection
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
HSPD	Homeland Security Presidential Direction
HSS	Office of Health, Safety, and Security
IC	Integrated Codes
ICF	Inertial Confinement Fusion
IND	improvised nuclear device
ISITS	Integrated Security Issues Tracking System
IT	information technology
JASPER	Joint Actinide Shock Physics Experimental Research Facility
KCP	Kansas City Plant
KCRIMS	Kansas City Responsive Infrastructure Manufacturing and Sourcing
KrF	Krypton Fluoride
LANL	Los Alamos National Laboratory
LBPG	Large Bore Powder Gun
LEP	Life Extension Program
LEU	low enriched uranium
LLE	Laboratory for Laser Energetics
LLNL	Lawrence Livermore National Laboratory
LTS	Long-Term Stewardship
M	million
MC&A	Materials Control and Accountability
Mod	modification
MTE	Major Technical Effort
MTP	Management, Technology, and Production
NCT	Nuclear Counterterrorism
NCTIR	Nuclear Counterterrorism Incident Response
NEP	nuclear explosive package
NIC	National Ignition Campaign
NIF	National Ignition Facility
NNC	nonnuclear component
NNR	Nonnuclear Readiness
NNSA	National Nuclear Security Administration
NPR	Nuclear Posture Review
NRC	Nuclear Regulatory Commission
NSO	Nevada Site Office
NTS	Nevada Test Site
NWBS	National Work Breakdown Structure
NWE	nuclear weapon effects
NWSP	Nuclear Weapons Stockpile Plan

OCIO	Office of the Chief Information Officer
OMEGA EP	OMEGA Extended Performance
OPSEC	Operations Security
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
PMM	Program Management Manual
QASPR	Qualification Alternatives to the Sandia Pulse Reactor
QMU	Quantification of Margins and Uncertainties
R&D	research and development
RAMP	Roof Asset Management Program
RDD	radiological dispersal device
RMI	Requirements Modernization integration
ROD	record of decision
RTBF	Readiness in Technical Base and Facilities
SARP	Safety Analysis Report for Packages
SFI	Significant Finding Investigation
SFPI	Safeguards First Principles Initiative
SGEMP	System Generated Electromagnetic Pulse
SGT	Safeguards Transport
SIP	Security Improvement Project
SLC	Security Leadership Coalition
SNL	Sandia National Laboratories
SNM	special nuclear material
SPaSM	Scalable Parallel Short-Range Molecular
SPEIS	Supplemental Programmatic Environmental Impact Statement
SR	Stockpile Readiness
SRS	Savannah River Site
SS-21	Seamless Safety in the 21st Century
SSP	Stockpile Stewardship Plan
ST&E	Scientific, Technological, and Engineering
STA	Secure Transportation Asset
TPBAR	Tritium Producing Burnable Absorber Rod
TQP	Technical Qualification Program
TR	Tritium Readiness
TRL	technology readiness level
TSCM	technical surveillance countermeasures
U.K.	United Kingdom
U.S.	United States
UQ	Uncertainty Quantification

V&V	Verification and Validation
V/VTR	Vault/Vault-Type Room
VPP	Voluntary Protection Program
VTR	Vault-Type Room
WDD	Weapons Dismantlement and Disposition
WSEAT	Weapons Systems Engineering Assessment Technology
WSI	Wakenhut Services, Inc.

UNITED STATES ACTIVE NUCLEAR WEAPONS STOCKPILE

Bomb	Weapon System	Laboratories	Mission	Military Service
B61-3/4	F15, F16, and certified NATO aircraft	Los Alamos/ Sandia	Air to Surface	Air Force
B61-7	B-52 and B-2	Los Alamos/ Sandia	Air to Surface	Air Force
B61-11	B-2	Los Alamos/ Sandia	Air to Surface	Air Force

B61

W62/W78/W87

Warhead	Weapon System	Laboratories	Mission	Military Service
W62	Minuteman III ICBM	Livermore/ Sandia	Surface to Surface	Air Force
W78	Minuteman III ICBM	Los Alamos/ Sandia	Surface to Surface	Air Force
W87	Minuteman III ICBM	Livermore/ Sandia	Surface to Surface	Air Force

Warhead	Weapon System	Laboratories	Mission	Military Service
W76	D5 Missile, Trident Submarine	Los Alamos/ Sandia	Underwater to Surface	Navy
W88	D5 Missile, Trident Submarine	Los Alamos/ Sandia	Underwater to Surface	Navy

W76/W88

B83

Bomb	Weapon System	Laboratories	Mission	Military Service
B83	B-2	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