Detailed Justification

(dollars in thousands)

	FY 2007	FY 2008	FY 2009
Life Extension Program (LEP)	**273,624**	**234,121**	**211,385**

NNSA developed the LEP to extend the expected stockpile lifetime of a warhead or warhead components at least 20 years with a goal of 30 years. NNSA, in conjunction with the applicable service from the DoD, executes an LEP following the procedural guidelines of the Phase 6.x process. The activities comprise the research, development, and production work required to ensure weapons will continue to meet requirements.

- **B61 Life Extension Program** **58,160** **61,908** **2,189**

  This LEP extends the life of the B61 Mods 7 and 11 Canned Subassemblies (CSA) for an additional 20 years. The CSA is a major component of the nuclear explosive package. The B61 LEP includes refurbishment of the CSA and replacement of associated seals, foam supports, cables and connectors, the group X kit (e.g., washers, o-rings, etc.), and limited life components. This budget element does not include any work associated with needed non-nuclear refurbishment of the B61, which will be a follow-on program, if approved.

  In FY 2009, programmatic activities will include completing production. Specifically, the laboratories will provide production liaison support and the plants will continue production rates that meet DoD requirements. All sites will complete actions needed to close out the program.

- **W76 Life Extension Program** **207,312** **172,213** **209,196**

  The W76 LEP will extend the life of the W76 for an additional 30 years with the first production unit (FPU) targeted in FY 2008. Activities include design, qualification, certification, production plant Process Prove-In (PPI), and Pilot Production. The pre-production activities will ensure the design of refurbished warheads meets all required military characteristics. Additional activities include work associated with the manufacturability of the components including the nuclear explosive package; the Arming, Fuzing, and Firing system; gas transfer system; and associated cables, elastomers, valves, pads, cushions, foam supports, telemetries, and miscellaneous parts. Final design of the CSA depends on resolution of a major technical challenge with the production of a critical material. Planned FY 2009 workscope is predicated on successful resolution of this technical challenge in FY 2008. To ensure a successful resolution in FY 2008, NNSA will continue to aggressively work to resolve the material issue and pursue an alternate material study. Production activities will continue, allowing the Pantex Plant to build and dismantle prototype units with surrogate CSAs that will provide important surveillance data. DSW will use cost control measures as Defense Programs endeavors to meet the rebaselined delivery to the DoD in support of Initial Operational Capability (IOC) requirements and achieve production rates consistent with the P&PD. Hardware production will continue at an optimized rate to maintain production certification requirements. In addition, the program will work to maintain the baseline plan for purchase of materials with sufficient lead time for the economical purchasing strategy, fabrication of required subassembly at Y-12, and purchase of critical tooling for production capacity at Pantex.

  Based upon the resolution of the material issue in FY 2008, NNSA will ramp up to full production in FY 2009 in accordance with the approved baseline. Additionally, laboratories will provide production liaison support at the plants including systems design support for production of piece parts by the production plants, initiate necessary production definition changes to improve manufacturability and

(dollars in thousands)

	FY 2007	FY 2008	FY 2009

production through FY 2010 of environmental sensing devices, firing sets, and lightning arrestor connectors in support of surveillance rebuilds; restarting production of other Neutron Generator components in support of future builds; developing a new W87 stockpile flight test vehicle; conducting disassemblies and inspections of stockpile laboratory test units and stockpile flight test units; production of joint test assemblies and test beds; and providing range support and data collection of W87 stockpile flights.

	FY 2007	FY 2008	FY 2009
▪ **W88 Stockpile Systems**	**45,510**	**55,462**	**49,854**

The W88 is the warhead used in the Navy's Mk-5 re-entry body on the Trident II SLBM.

In FY 2009, activities include: providing laboratory and management support to the POG and DoD Safety Studies; supporting resolution of SFIs; submitting data for surveillance cycle reports; conducting integrated experiments as stated in the approved baseline plan; supporting the annual assessment and certification process; conducting disassembly and inspection of stockpile laboratory test units and stockpile flight test units; producing joint test assemblies and test beds; SS-21 authorization activities at Pantex; continuing production of 4T reservoir and forging procurements; and production of W88/Mk5 warheads using Los Alamos National Laboratory (LANL) produced pits and 4T gas transfer systems.

	FY 2007	FY 2008	FY 2009
Reliable Replacement Warhead	**35,846**	**0**	**10,000**

Congress did not provide funding for the RRW program in FY 2008 and called for the Administration to submit a comprehensive nuclear weapons strategy for the 21st century.

The funding will enable maturation of the RRW design to address questions raised by the JASON review of RRW feasibility study activities. Design refinement is necessary to establish parameters for potential impact on certification among other things. Without further design work, there is insufficient detail available to use this design to resolve certification questions raised by the JASONs review. This funding will also facilitate continued progress on the Phase 2A RRW work, that has been completed through 2007 (prior to the FY 2008 Consolidated Appropriations Act (P.L. 110-161)) to support future administration decisions on options for our nuclear weapons stockpile. The Department of Defense and the Joint DoD-DOE Nuclear Weapons Council fully support continuing efforts to examine how the RRW concept can address issues of safety, security and long-term reliability of the nation's nuclear deterrent.

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Fogbank

- Performed one-dimensional experiments with commercial materials in the technology development of a multi-point safety concept.

Weapons Systems Engineering Assessment Technology
- Completed experiments for developing and assessing models for micro-scale friction and provided model development and validation data to characterize: 1) the effect of time/age dependencies, 2) the effects of hold force, and 3) the effects of bifurcation behaviors;
- Completed heat flux experiments on objects as well as experiments characterizing propellant fire particle concentration, composition and gas temperatures for sizes and orientations of interest for weapon qualification;
- Completed a set of multiple-aperture coupling experiments, which provided data to characterize cavity response to non-ionizing electromagnetic radiation (EMR);
- Completed impact sensitivity characterization for Lawrence Livermore National Laboratory (LLNL) high explosives LX-04, LX-07 and LX- 10, to determine shock initiation criteria in accident-relevant low-amplitude regimes; and
- Completed experiments for characterizing the kinetics of a W76-1 abnormal thermal environment.

Nuclear Survivability
- Completed System Generated Electromagnetic Pulse (SGEMP) studies at varying pressure levels,
- Performed diagnostic development to improve both accuracy and precision of reactor environments for future uncertainty quantification; and
- Improved mechanical response instrumentation development for experimentation and uncertainty qualification needs was done to develop the technologies and capabilities required to ensure nuclear survivability of future replacement systems;
- Completed irradiation source characteristics, including uncertainty quantification, to support the Qualification Alternatives to the Sandia Pulse Reactor (QASPR) approach; and
- Assessed damage relationships for silicon prototypes irradiated at different QASPR relevant facilities.

Enhanced Surveillance
- Provided new Canned Sub-Assembly (CSA) non-destructive testing capability and material aging analyses to support the ongoing W76-1 design and manufacturing efforts necessary to achieve the First Production Unit (FPU);
- Completed an Enhanced Surveillance stockpile aging assessment report to support the annual assessment process;
- Completed selected aging and lifetime assessments to support the W76-1 LEP certification, including work on polymeric materials, XYCE fireset electrical model, commercial off the shelf (COTS) integrated circuits, gel-mylar capacitor, removable encapsulant, and thermal battery;
- Test Program Validation (TPV) activities for the deployment of the W76-1 System Tester for surveillance testing at Weapons Evaluation Test Laboratory (WETL) has been successfully completed and issued Qualification Engineering Release (QER);
- Established initial component and material evaluation capabilities to respond to the new challenges associated with reduced reliance on system-level testing;
- Demonstrated embedded stockpile evaluation test bed relevant to future stockpile modifications, alterations, LEPs, or replacement systems;
- Provided initial aging and lifetime assessments to support future weapon refurbishment or replacement options for sufficient longevity of materials and components; and

can the National Nuclear Security Administration (NNSA) determine the effects of changes to current systems as well as calculate confidence levels of future untested systems.

The ASC tools are also used to address areas of national security beyond the U.S. nuclear stockpile. Through coordination with other government agencies, the ASC tools play an important role in supporting nonproliferation, emergency response, and attribution activities. They have been used in the field to identify and characterize special nuclear material (SNM) threat materials and devices. There is a growing effort to enhance the capabilities of these tools -- for example, an enhanced capability to allow the identification of a perpetrator or supporting state through forensic analysis of post-explosion radio nuclei debris. The ASC simulation capabilities have been used by Department of Homeland Security (DHS) to assess various mitigation strategies, and the results have been published in peer-reviewed journals.

Simulation is basic to the performance of a transformed nuclear weapons complex. Any future transformation of the stockpile or the Complex will rely heavily on ASC simulation codes and computational infrastructure.

Federal Leadership of ASC
There have been significant strides during the past three years to sharpen the engagement of Headquarters (HQ) management in the ASC Campaign.

- Through implementation of the new Business Model, headquarters used its increased visibility into laboratory projects to provide programmatic guidance.

- Informed by the assessments and recommendations of the ASC Predictive Science Panel (a group of subject matter experts from industry, laboratories and academia), headquarters sets high-level technical directions.

- Phase two of the siting capability study was initiated to evaluate cost-effective strategies for siting future NNSA capability platforms.

- The ASC Roadmap for national program was established and published.

The ASC contributes to Governmental Performance and Results Act (GPRA) Unit Program Goal 2.1.30.00 by providing leading edge, high-end simulation capabilities through investments made in five subprograms that support activities in the areas of weapon codes, weapon science, computational infrastructure, and computing center operations.

Major FY 2007 Achievements

Adoption of the ASC Modern Codes
- Developed a new energy-conserving algorithm to allow simulations of kinetic plasma at two to three orders of magnitude higher density than previously possible. For weapon System-Generated Electromagnetic Pulse (SGEMP) analyses, this enables simulations to model the entire range of air pressure from vacuum to one atmosphere.
- Recently discovered W76 alternate materials simulation needs are being addressed using ASC codes and are being run on Roadrunner base capacity system. This demonstrates the critical ability of the

Detailed Justification

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Enhanced Surety	**26,666**	**34,137**	**35,641**

A multi-technology approach is pursued by the Enhanced Surety subprogram to develop options for weapon system designers during stockpile alterations, modifications, and transformations. This approach will also address other refurbishments and stockpile improvement projects needed to meet future Department of Defense (DoD) requirements. Multi-technology development and integration opens the design space and offers opportunity for synergistic improvements in other weapon components.

In FY 2009, the multi-lab development of a laser-fired optical initiation system will continue with the maturation and integration of a direct optical initiation fire-set and an optical detonator. The resulting advanced initiation system will offer significant improvements in nuclear detonation safety by eliminating the possibility of any naturally occurring stimuli, such as electrostatic discharge and lightning, from causing the weapon to initiate. Other advanced initiation work includes the development of high performance strong links, an insensitive high explosive booster for miniature high energy density components, and a replacement for sunset material used in thermal weak link. Approaches to integrated safety, security, and use control will continue to be developed to provide enhanced area denial and to better address the design basis threat requirements and will include demonstration of the effectiveness of the technologies in realistic environments. Advances in the ability to synthesize responses from networks of security sensors and in the technology readiness of modern use control technologies responsive to the post 9/11 threat environment will also be pursued.

Weapons Systems Engineering Assessment Technology	**21,102**	**19,314**	**17,105**

The Weapons Systems Engineering Assessment Technology (WSEAT) subprogram uses engineering computational models in collaboration with the Advanced Simulation and Computing (ASC) Campaign to predict weapon system response to three Stockpile-to-Target Sequence environments: normal, abnormal, and hostile. The activity also supports manufacturing development of critical components and subsystems; e.g., neutron generators, gas transfer systems, and microsystems. The subprogram objective is to establish the capability to predict engineering margins by integrating numerical simulations with experimental data. Validated computational tools are required to explore the operational parameter space of the nuclear weapons stockpile. Exploration of operational parameter space identifies failure modes and boundaries, thus, establishing engineering margins.

In FY 2009, the subprogram will focus on producing data sets for code validation in support of current weapon alterations and modifications and legacy stockpile support. Combined efforts between the ASC Verification & Validation and Physics & Engineering Models programs is a key principle of WSEAT and provides validated modeling and simulation capability for multi-scale and multi-physics problems encountered in qualification and certification activities. Work will continue on non-intrusive instrumentation and high explosive structural property measurements supporting model development for improved assessments of structural response, and margins for insensitive high explosive main charge materials.