Science Campaign

Funding Schedule by Activity

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Science Campaign					
Primary Assessment Technology[a] ……………….	63,619	82,260	81,473	- 787	- 1.0%
Dynamic Materials Properties	84,861	81,779	91,521	+ 9,742	+ 11.9%
Advanced Radiography	67,957	55,665	62,371	+ 6,706	+ 12.0%
Secondary Assessment Technologies.......	44,430	54,144	65,597	+ 11,453	+ 21.2%
Total, Science Campaign....................................	260,867	273,848	300,962	+ 27,114	+ 9.9%

FYNSP Schedule

(dollars in thousands)

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FYNSP Total
Science Campaign						
Primary Assessment Technologies…….	81,473	79,484	79,364	79,662	84,804	404,787
Dynamic Materials Properties ………..	91,521	89,323	85,525	91,512	94,605	452,486
Advanced Radiography……..	62,371	57,263	66,035	69,496	71,461	326,626
Secondary Assessment Technologies…….	65,597	75,312	76,860	87,660	90,158	395,587
Total, Science Campaign...........	300,962	301,382	307,784	328,330	341,028	1,579,486

Description

The Science Campaign supports the Stockpile Stewardship mission of the National Nuclear Security Administration (NNSA) by achieving the following goals: continue the development of 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; develop new materials and technologies that are required to solve identified stockpile issues particularly for the nuclear explosive package; enhance the readiness of the NNSA to conduct underground nuclear testing as directed by the President; and develop and maintain essential scientific capabilities and infrastructure in nuclear weapons unique technologies.

[a] Starting in FY 2005 efforts related to maintaining the readiness of the Nevada Test Site to conduct underground nuclear tests, if directed, have been moved from the Readiness in Technical Base and Facilities Program Readiness activity to the Primary Assessment Technologies component of the Science Campaign. Comparability adjustments are reflected in the amounts of $17,940,000 in FY 2003, $24,744,000 in FY 2004, and $30,000,000 in FY 2005.

Benefits to Program Goal 01.28.00.00 Science Campaign

Within the Science campaign program, the Primary Assessment Technologies, Dynamic Material Properties, Advanced Radiography, and Secondary Assessment Technologies subprograms each make unique contributions to Program Goal 01.28.00.00. In conjunction with Advanced Simulation and Computing the Primary Assessment Technologies subprogram develops the tools, methods, and knowledge required to certify the nuclear safety and nuclear performance of any aged or rebuilt primary to required levels of accuracy without nuclear testing. The Dynamic Material Properties subprogram focuses on the development of accurate modeling for the properties and behavior of materials used within the nuclear explosives package. The Advanced Radiography subprogram develops technologies for three-dimensional imagery of imploding surrogate primaries with sufficient spatial and temporal resolution to experimentally validate computer simulations of the implosion process. The Secondary Assessment Technologies subprogram develops the tools, methods, and knowledge required to certify the nuclear performance of secondaries without nuclear testing.

Annual Performance Results and Targets

FY 2000 Results	FY 2001 Results	FY 2002 Results	FY 2003 Results
Conduct further subsets of the subcritical experiment begun in FY 1999 (Oboe) and one additional subcritical experiment at the Nevada Test Site to provide data on the behavior of nuclear materials during the implosion phase of a nuclear weapon. (MET GOAL)	Meet FY 2001 milestones in the science campaigns to achieve scientific understanding of the nuclear package of weapon systems to sustain our ability to annually certify the nuclear weapon stockpile without underground nuclear testing. (MET GOAL)	Meet the FY 2002 milestones in the science campaign to achieve scientific understanding of the nuclear package of weapon systems to sustain our ability to annually certify the nuclear weapon stockpile without underground nuclear testing. (MET GOAL)	Meet the critical FY 2003 Campaign performance targets contained in the NNSA Future-Year Nuclear Security Program (FYNSP). (MIXED RESULTS)
Ensure that the capability to resume underground nuclear testing is maintained in accordance with the Presidential Decision Directive through a combined experimental and test readiness program. (MET GOAL)	There were no related targets.	There were no related targets.	Implement the recommendations requested by the Nuclear Posture Review to refine test scenarios and evaluate the cost/benefit tradeoffs to sustain optimum test readiness that best supports the New Triad. (MET GOAL)

Annual Performance Results and Targets

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Developments and improvements in the accuracy of predictive models and methodologies used to assess nuclear performance	Completed the first Joint Actinide Shock Physics Experimental Research (JASPER) Plutonium (Pu) shot demonstrating an ability to improve Pu equation of state (EOS) data.	Complete development of Quantitative Margins and Uncertainties (QMU) logic for the W76, incorporate logic in advanced simulation, and conduct peer review.	Complete development of QMU logic for the W88 and conduct peer review.	Deliver, to advanced simulations, experimental data in new pressure and temperature regimes from dynamic and static high-pressure experiments to guide the development on an improved Pu equation of state (EOS).	Deliver a preliminary multi-phase plutonium EOS with quantified uncertainties for incorporation in primary assessment models.	Review the state of the plutonium EOS database to determine further requirements for plutonium experiments and deliver experimental data in specific regimes of interest.	-Complete 100% of QMU work on the W76. -Complete 80% of the QMU work on the W88.	Ongoing

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Improved radiographic capabilities to support the assessment of nuclear performance, as required by the National Hydrodynamics Plan	Demonstrated containment of Beryllium in hydrotests at Lawrence Livermore National Laboratory Site 300 & the Dual-Axis Radiographic Hydrotest (DARHT) facility.	Complete 100% of the external technical review of required work on DARHT facility and plans for completion of DARHT Second Axis improvements.	Evaluate and schedule corrective actions for DARHT Second Axis.	-Implement DARHT Second Axis improvements. -Complete development of stockpile stewardship requirements for radiography experiments and conceptual plans for future facilities.	-Prepare mission need document for future radiography facility. -Execute first 2-axis hydro shot in support of stockpile assessment.	Obtain NNSA decision on need for a future radiography facility.	Prepare Conceptual Design Report on future radiography facility, if required.	Ongoing
Readiness to conduct underground nuclear testing as established by National Security policy and documented in the Program Plan for Test Readiness	-Began transition from 24- to 36-month readiness to 18-month readiness. -Completed resourced-loaded program implementation plan.	-Complete the Master Study for the Device Assembly Facility and implement the Technical Safety Requirements.	-Produce list of possible test scenarios and confirm that plans will enable these tests. -Complete the Timing and Firing Nuclear Explosive Safety Study (NESS). -Achieve 18-month (or currently required) readiness as confirmed by external review board.	-Produce list of possible test scenarios and confirm that plans will enable these tests. -Prepare plan for device-specific NESS.	-Produce list of possible test scenarios and confirm that plans will enable these tests. -Provide capability to produce THREX test diagnostics.	-Produce list of possible test scenarios and confirm that plans will enable these tests. -Conduct external review to confirm maintenance of 18-month (or currently required) readiness.	Produce list of possible test scenarios and confirm that plans will enable these tests.	Ongoing

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Documented National Hydrodynamics Plan, with peer review, to support the assessment of nuclear performance	Completed development of coordinated plan of hydrodynamic experiments.	Execute the planned hydrodynamic experiments on DARHT and Container Firing Facility (CFF)/Flash X-Ray (FXR) at Los Alamos and Lawrence Livermore National Laboratories (LANL & LLNL).	Execute the planned hydrodynamic experiments on DARHT and CFF/FXR at LANL & LLNL.	Execute the planned hydrodynamic experiments on DARHT and CFF/FXR at LANL & LLNL.	Execute the planned hydrodynamic experiments on DARHT and CFF/FXR at LANL & LLNL.	Execute the planned hydrodynamic experiments on DARHT and CFF/FXR at LANL & LLNL.	Execute the planned hydrodynamic experiments on DARHT and CFF/FXR at LANL & LLNL.	Ongoing
Reduced cost of obtaining plutonium experimental data on the Joint Actinide Shock Physics Experimental Research (JASPER) facility to support primary certification models (EFFICIENCY MEASURE)	N/A	Establish the baseline cost for JASPER experiments.	Reduce the costs of similar JASPER shots to 90% of the baseline costs.	Reduce the costs of similar JASPER shots to 85% of the baseline costs.	Reduce the costs of similar JASPER shots to 80% of the baseline costs.	Maintain the costs of similar JASPER shots at 80% of the baseline costs.	Maintain the costs of similar JASPER shots at 80% of the baseline costs.	Ongoing

Detailed Justification

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Primary Assessment Technologies	**63,619**	**82,260**	**81,473**

The primary assessment technologies activity, formerly the Primary Certification Campaign, develops the tools, methods, and knowledge required to certify the nuclear safety and nuclear performance of any aged or rebuilt primary to required levels of accuracy without nuclear testing. As part of this effort, an assessment will be conducted on the accuracy of primary predictions in the W76 and W88 programs.

Principal focus areas of this activity include the development of a better understanding of boost physics and the quantitative role of radiography in primary assessment technologies. This work is closely integrated with and dependent on Advanced Simulation and Computing and is a prerequisite for completing requirements studies for an advanced radiography capability. A majority of the experimental effort is in hydro testing, subcritical experiments, materials science, and dynamic system behavior. The assessment component in this activity examines the effects of improved materials models on primary certification and provides uncertainty guidance. Areas under investigation include: plutonium equation-of-state (EOS) data, thermo-chemically based EOS, plutonium ejecta data from subcritical experiments at the Nevada Test Site, and an interim high explosives model.

Primary Assessment Technologies support Lawrence Livermore National Laboratory (LLNL) experiments at the U1a Complex and JASPER at NTS to create conditions of dynamic high pressure and temperature to enable investigations of the dynamic response of plutonium under shock loading Advanced Simulation and Computing supplies analysis to identify most critical data needs and incorporated new data into simulation. Sandia National Laboratories continues development of compact radiography sources for use at the U1a Complex. This work complements the advanced compact radiography technology work conducted at LLNL. Experiments at Omega are laying the groundwork for a phased set of experiments on NIF that will provide data on material properties at very high pressures. Advanced diagnostics development work is underway to address known deficiencies in essential test capabilities and to examine issues recently highlighted through stockpile surveillance. Also supported is shaped-charge work to validate performance codes on dynamics with high explosives.

In FY 2005, the efforts related to maintaining the readiness of the Nevada Test Site (NTS) to conduct underground nuclear tests, if directed, have been moved to this activity from the Readiness in Technical Base and Facilities (RTBF) Program Readiness activity. The request includes $30 million for this effort with $24.7 million in FY 2004 and $17.9 million in FY 2003. Funding supports activities that are unique to test readiness such as archiving, authorization bases, resumption planning, standby assets, nuclear skills retention, diagnostic refinements and field test neutron generators.

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Dynamic Materials Properties	**84,861**	**81,779**	**91,521**

This activity provides physics-based, well-validated, predictive descriptions and experimental data required to guide and benchmark the development of models for all stockpile materials at the level of accuracy required by the Primary and Secondary Assessment activities, Directed Stockpile Work (DSW) programs, and Advanced Simulation and Computing (ASC) Campaign. The measurement of fundamental materials properties is essential to establish confidence in the materials models used in next generation codes to provide predictive relationships between materials processing and properties and stockpile performance, safety, and reliability.

More specifically, the activity provides predictive descriptions and experimental data for thermodynamic properties such as equation-of-state (EOS) and dynamic mechanical constitutive properties including strength and plasticity, failure, spall, and ejecta under the extreme conditions of interest for weapons. In addition, this activity will investigate the properties of energetic materials, as well as the electronic and optical properties of materials needed for the stockpile. This activity also holds the responsibility for the characterization of materials to enable the assessment of effects on material performance resulting from any process changes or optimization. The latter involves developing a scientific understanding of the inter-relationship of processing, properties, and performance of key stockpile materials.

The focus of this activity in FY 2005 includes EOS and constitutive property determinations and delivery of an improved data set for plutonium, improvements in the diagnostics suite on JASPER, the qualification of a replacement PBX 9501 explosive, and validation of a process model supporting neutron generator production. Experiments at a broad range of facilities are supported, such as subcritical experiments at the Nevada Test Site's U1a Complex underground test facility, experiments on dynamic materials properties at the Atlas Facility, and plutonium experiments at the Joint Actinide Shock Physics Experimental Research Facility (JASPER). At the Los Alamos Neutron Science Center (LANSCE), nuclear physics and materials properties experiments are supported, and experiments studying material response at high-pressure are executed at the Sandia pulsed power Z-facility.

To ensure future stewardship viability, this activity supports a vigorous university partnership program in experimental science of broad relevance to stockpile stewardship. DOE/NNSA realizes the importance of university partnerships to maintain the long term intellectual viability of the NNSA laboratories complex.

Advanced Radiography	**67,957**	**55,665**	**62,371**

Radiographic analysis in conjunction with Advanced Simulation and Computing will enable extraction of quantitative radiographic data to improve the link between radiographic images and the assessment of primary performance. This effort is required to support the certification goals of the primary assessment technologies activity. An Advanced Materials Project effort will develop and

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005

implement a plan for materials and demonstrate an initial processing capability for those materials at LLNL.

Work continues at LLNL to develop a compact radiography source to support advanced U1a Complex subcritical experiments. Proton radiography at the Los Alamos Neutron Science Center (LANSCE) Area C and Brookhaven Laboratory Attenuating Gradient Synchrotron (AGS) provides valuable data for stockpile assessment and certification. Proton radiography experiments are being conducted at LANSCE to develop techniques for studying the surface spall that occurs in shocked weapon materials.

While the principal near-term focus of this campaign is on x-ray radiographic capabilities, for the longer-term a modest effort to explore and develop proton radiography technologies is being conducted. No funding is requested for hardware development that could be used for a proton based Advanced Hydro Facility.

In FY 2005-2006, the focus of this activity is on the commissioning of the Dual-Axis Radiographic Hydrotest (DARHT) facility including the development of solutions to high voltage breakdown problems on the 2nd axis discovered during early commissioning experiments. Optimization includes improving beam spot size and detector developments to improve radiographic image resolution, installation and activation of the second axis beamline hardware and the multi-pulse target assembly. Supporting work includes the development of a composite vessel technology to mitigate the environmental consequences of hydrotests.

Commissioning of the second axis will support hydrotesting for the W76 and B61 DSW efforts and the Dynex experiment for W88 pit certification. Optimization of the LLNL Contained Firing Facility (CFF) Flash X-ray Accelerator (FXR) is also included in this activity.

The two axes of DARHT will provide a capability for achieving the long-term campaign goal of three-dimensional imagery of imploding surrogate primaries with sufficient spatial and temporal resolution to experimentally validate computer simulations of the implosion process.

Secondary Assessment Technologies............................	**44,430**	**54,144**	**65,597**

The secondary assessment technologies activity, formerly the Secondary Certification and Nuclear Systems Margins Campaign, provides modern scientific tools, methods, and knowledge required to certify the performance of nuclear secondaries. In a fundamental way, the effort is focused on developing a predictive capability and advanced simulation for the performance of the nuclear system as a whole. This effort is developing and utilizing a methodology called “Quantification of Margins and Uncertainties” which will be used to support assessment and certification in the future.

This activity is based on the use of low-energy-density (hydrodynamic) and high-energy-density aboveground experiments, as well as past nuclear test data to validate modern 3-dimensional design codes. Increasingly, experiments on high energy density physics facilities, including the National Ignition Facility (NIF), Omega, and Z machine, are used to validate these codes and develop improved models of physical properties and processes at the extreme physics regimes relevant to the goals of this activity. FY 2005 will be the first opportunity for conducting secondary relevant

	(dollars in thousands)	
FY 2003	FY 2004	FY 2005

goals of this activity. FY 2005 will be the first opportunity for conducting secondary relevant experiments with the NIF.

Emphasis in FY 2005 will be placed on radiation case performance and radiation flow phenomena. Complex integrated experiments that validate radiation flow will be executed. Techniques developed will support both near-term DSW activities and long-term stockpile assessment needs.

Another FY 2005 area of emphasis is the development of advanced target fabrication and diagnostic techniques required to support ongoing and planned experiments at Omega, Z machine, and NIF employing advanced materials and detailed features. Advanced diagnostics and target fabrication capabilities are the key to the fielding of increasingly sophisticated experiments on these facilities.

Since secondary performance is essential to the production of a militarily effective output from modern nuclear systems, this activity is also evolving in FY 2005 to add experimental and computational activities that support development of a validated, predictive computational capability for overall weapon yield performance.

	FY 2003	FY 2004	FY 2005
Total, Science Campaign	**260,867**	**273,848**	**300,962**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
▪ **Primary Assessment Technology**	
This decrease reflects a shift in emphasis from subcritical experiments to support LLNL activities to increased reliance on Joint Actinide Shock Physics Experimental Research (JASPER) facility experiments to obtain plutonium data	- 787
▪ **Dynamic Materials Properties**	
Increased funding provides experimental support for JASPER and Atlas, as well as the University programs in high-energy-density physics and high-pressure materials science	+ 9,742
▪ **Advanced Radiography**	
Increase in funding provides funding required to continue the DARHT 2nd axis commissioning to solve high voltage as well as to partially restore funds for proton radiography experiments	+ 6,706
▪ **Secondary Assessment Technology**	
Increase reflects an expanded experimental agenda needed to acquire data supporting the Quantification of Margins and Uncertainties (QMU). Efforts also include upgrading target fabrication capabilities to support high-energy-density physics and radiation flow experiments on National Ignition Facility and pulsed power facilities, and enhanced diagnostic support facilities at Nevada to increase the accuracy and precision of quantitative diagnostics. NIF first becomes available to support these campaign related experiments in FY 2005.......................	+ 11,453
Total Funding Change, Science Campaign	+ 27,114

Capital Operating Expenses and Construction Summary

Capital Operating Expenses [a]

(Dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
General Plant Projects.........................	0	0	0	0	N/A
Capital Equipment...............................	10,751	11,073	11,405	+ 332	+ 3.0%
Total, Capital Operating Expenses	10,751	11,073	11,405	+ 332	+ 3.0%

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2004 and FY 2005 funding shown reflects estimates based on actual FY 2003 obligations.

Engineering Campaign

Funding Schedule by Activity [a]

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Engineering Campaign					
Enhanced Surety	31,588	32,781	38,121	+ 5,340	+ 16.3%
Weapons Systems Engineering Assessment Technology	25,814	27,079	27,270	+ 191	+ 0.7%
Nuclear Survivability	22,521	22,843	24,460	+ 1,617	+ 7.1%
Enhanced Surveillance	74,097	91,252	99,879	+ 8,627	+ 9.5%
Microsystems and Engineering Sciences (MESA) Other Project Costs (OPC)	4,200	4,473	4,600	+ 127	+ 2.8%
Microsystems and Engineering Sciences Application (MESA) Construction	112,282	86,487	48,654	- 37 833	- 43.7%
Total, Engineering Campaign	270,502	264,915	242,984	- 21,931	- 8.3%

FYNSP Schedule

(dollars in thousands)

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FYNSP Total
Engineering Campaign						
Enhanced Surety	38,121	40,039	45,824	48,606	50,091	222,681
Weapons Systems Engineering Assessment Technology	27,270	27,898	30,463	32,259	33,182	151,072
Nuclear Survivability	24,460	24,217	25,700	27,515	28,555	130,447
Enhanced Surveillance	99,879	105,738	112,511	116,537	119,806	554,471
MESA OPCs	4,600	4,751	4,859	5,059	5,204	24,473
MESA Construction	48,654	65,564	7,000	54,044	0	175,262
Total, Engineering Campaign	242,984	268,207	226,357	284,020	236,838	1,258,406

[a] FY 2003 and FY 2004 reflect comparability adjustments of $71,581,000 and $77,461,000, respectively moving Advanced Design and Production Technologies from Engineering Campaign to Readiness Campaign.

Description

The Engineering Campaign provides validated engineering sciences and engineering modeling and simulation tools for design, qualification, assessment, and certification; improved surety technologies, improved radiation hardened design and modeling capabilities; improved microsystems and microtechnologies; component and material lifetime assessments; and predictive modeling capabilities and diagnostics to identify emerging aging concerns.

Benefits to Program Goal 01.29.00.00 Engineering Campaigns

Within the Engineering Campaign program, the Enhanced Surety, Weapons Systems Engineering Assessment Technology, Nuclear Survivability, Enhanced Surveillance, and Microsystems and Engineering Sciences Application (MESA) Complex subprograms each make unique contributions to Program Goal 01.29.00.00. Enhanced Surety demonstrates enhanced use-denial and advanced initiation options for the entire stockpile. Weapons Systems Engineering Assessment Technology (1) establishes a science-based engineering certification methodology and required underlying engineering research and (2) conducts experiments and provides data necessary to develop and validate engineering computational models. Nuclear Survivability develops radiation-hardening approaches and hardened components, develops and validates experimental and analytical tools for qualifying warheads to nuclear survivability requirements, modernizes tools for weapon outputs, and develops and validates tools to translate military effects requirements to warhead design specifications (design-to-effects). Enhanced Surveillance provides component and material lifetime assessments and develops predictive capabilities for early identification of stockpile aging concerns. The Microsystems and Engineering Sciences Application (MESA) Complex is being developed to incorporate modern, survivable, electrical, optical and mechanical control systems into the stockpile where required.

Annual Performance Results and Targets

FY 2000 Results	FY 2001 Results	FY 2002 Results	FY 2003 Results
There were no related targets.	There were no related targets.	There were no related targets.	There were no related targets.

Annual Performance Results and Targets

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Cumulative percentage of construction of the Microsystem and Engineering Science Application (MESA) facility, as documented in the Engineering Campaign Program Plan.	Completed 22% of MESA construction.	Complete 35% of MESA construction.	Complete 50% of MESA construction.	Complete 65% of MESA construction.	Complete 75% of MESA construction.	Complete 90% of MESA construction.	Complete 100% of MESA construction.	Complete 100% of construction FY 2009
Cumulative percentage of progress towards developing all improved surety improvements for the Life Extension Programs having Phase 6.3 beginning in FY 2010 or later, as documented in the Engineering Campaign Program Plan.	Completed 40% of the surety improvements.	Complete 50% of the surety improvements.	Complete 60% of the surety improvements.	Complete 70% of the surety improvements.	Complete 80% of the surety improvements.	Complete 90% of the surety improvements.	Complete 100% of the surety improvements.	Complete 100% FY 2009
Cumulative percentage of delivery of lifetime assessment, predictive aging models, and surveillance diagnostics toward the goal, as documented in the Engineering Campaign Program Plan.	Delivered the initial 7% of the assessments, aging models, and surveillance diagnostics.	Deliver 14% of the assessments, aging models, and surveillance diagnostics.	Deliver 23% of the assessments, aging models, and surveillance diagnostics.	Deliver 33% of the assessments, aging models, and surveillance diagnostics.	Deliver 43% of the assessments, aging models, and surveillance diagnostics.	Deliver 11% (total 54%) of the assessments, aging models, and surveillance diagnostics.	Deliver 65% of the assessments, aging models, and surveillance diagnostics.	Deliver 100% FY 2012 (Initial task)
Cumulative percentage of completed data sets used in developing tools & technologies to validate structural & thermal models with well-defined ranges of applicability & quantified uncertainties in accordance with the Engineering Campaign Program Plan.	Completed 10% of the scheduled data sets.	Complete 27% of the scheduled data sets.	Complete 55% of the scheduled data sets.	Complete 68% of the scheduled data sets.	Complete 78% of the scheduled data sets.	Complete 93% of the scheduled data sets.	Complete 100% of the scheduled data sets.	Complete 100% of 47 data sets FY 2009 (Initial Task)
Cumulative percentage of progress towards meeting goals identified in the Nuclear Survivability Annex of the Engineering Campaign Program Plan and effectiveness tools & technologies (EFFICIENCY MEASURE)	Completed 10% toward meeting appropriate goals.	Complete 20% toward meeting appropriate goals.	Complete 30% toward meeting appropriate goals.	Complete 40% toward meeting appropriate goals.	Complete 50% toward meeting appropriate goals.	Complete 60% toward meeting appropriate goals.	Complete 70% toward meeting appropriate goals.	Complete 100% towards goals FY 2012

Detailed Justification

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Enhanced Surety	**31,588**	**32,781**	**38,121**

Demonstrates enhanced use-denial and advanced initiation options for the entire stockpile directly supporting the first NNSA goal to ensure the safety, security, and control of the enduring nuclear weapons stockpile. This activity provides validated technology for inclusion in the stockpile refurbishment program to assure that modern nuclear safety standards are fully met and a new level of use-denial performance is achieved. A multi-technology approach is pursued to develop options for possible selection by weapon system designers during scheduled life extension programs (LEP) or other refurbishments. This multi-technology development also opens the design space and results in synergistic improvements in other weapon components

A joint program between laboratories includes the development of a laser fired optical initiation system for the W78 and future Navy Submarine-Launched Ballistic Missile warheads that offers significant improvements in safety by eliminating the possibility of any naturally occurring stimuli (such as lightning) from causing the weapon to initiate, while providing important use control features as well. In FY 2005, the completion of the development of a fiber optic controlled detonator is planned.

In FY 2005, a two-pronged effort in the development of advanced initiation technologies focused at improving safety at the detonator interface to the nuclear explosive package will take place. The first involves the development of an insensitive high explosive booster for stockpile weapons, coupled with a new compact initiator stronglink. The second effort involves the development of miniature, high energy density components.

Weapons Systems Engineering Assessment Technology (Formerly Weapons Systems Engineering Certification)	**25,814**	**27,079**	**27,270**

The Weapons Systems Engineering Assessment Technology activity has two major technical elements: (1) establishing a science-based engineering certification methodology and defining required underlying engineering research; and (2) conducting experiments and providing data necessary to develop and validate engineering computational models in collaboration with Advanced Simulation and Computing. These computational models are used to predict weapon system response to three Stockpile to Target Sequence (STS) 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 campaign's 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 2005, non-intrusive instrumentation and telemetry systems to monitor non-fissile primary

	(dollars in thousands)	
FY 2003	FY 2004	FY 2005

In FY 2005, non-intrusive instrumentation and telemetry systems to monitor non-fissile primary component response during primary detonation will be developed and component tested.

A High Explosive Radio Telemetry (HERT)-instrumented Enhanced Fidelity Instrumentation (EFI)-B-1 flight test unit in support of test FCET-34 is planned. The data and capability to assess the response of explosives in abnormal and hostile environments will be developed with work ranging from material response experiments to weapon system level experiments. Assessments will be made of the response of a Chemical High Explosive (CHE) system to combined abnormal environments.

Weapon qualification and certification efforts support: (1) establishing component design requirements for hostile impulse events for with application to the W76 Life Extension Program (2) conducting validation experiments for two manufacturing processes (neutron tube encapsulation and laser welding) and (3) achieving fully-operational status of the Thermal Test Complex in support of weapon system abnormal thermal environment qualification, and of the Aerial Cable Facility in support of weapon system alteration qualification.

	FY 2003	FY 2004	FY 2005
Nuclear Survivability	**22,521**	**22,843**	**24,460**

The Nuclear Survivability activity develops and validates tools needed to design and qualify nuclear warheads that meet requirements for nuclear survivability and effectiveness. It develops radiation-hardening approaches and hardened components, develops and validates experimental and analytical tools for qualifying warheads to nuclear survivability requirements, modernizes tools for weapon outputs, and develops and validates tools to translate military effects requirements to warhead design specifications (design-to-effects) and to assess and optimize the effectiveness of warhead designs without underground nuclear tests

The nuclear survivability capabilities developed in this activity are driven by the need to improve tools to support near term limited life component replacements, life extension activities, and the long-term stewardship of the stockpile.

Specific efforts in FY 2005 will include developing validated computational tools to re-evaluate the threat posed by nuclear weapon radiation environments and system radiation responses with initial applications of nuclear survivability assessment technologies supporting qualification of replacement limited life components (LLCs) and the life extension program activities.

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Enhanced Surveillance	**74,097**	**91,252**	**99,879**

The Enhanced Surveillance activity provides component and material lifetime assessments and develops predictive capabilities for early identification and assessment of stockpile aging concerns. The activity identifies aging issues with sufficient lead-time to ensure that NNSA can have the refurbishment capability and capacity in place when required. The strategy provides more robust stockpile surveillance for early problem identification, since any future problems would have a greater relative impact on the effectiveness of a smaller nuclear deterrent. The activity works with DSW to deploy new diagnostic tests that enable surveillance to be more predictive in finding defects in weapons sampled from the stockpile. The activity investigates the aging mechanisms in weapons and develops aging models to predict lifetimes of components and materials. The lifetime assessments also support planning for the NNSA facilities and infrastructure needed to replace aging components. The activity contributes current weapon aging information for completing the Annual Assessment Reports to certify to the President that the stockpile is safe and reliable.

As a specific example, Canned Sub-Assemblies (CSAs) lifetime assessments include efforts to develop understanding of the basic aging mechanisms and interactions of CSA materials, accelerated aging experiments to obtain data beyond that obtained by traditional stockpile surveillance, and thermochemical modeling of aging processes. The experiments are also used to validate broader age-aware models that are developed to support CSA lifetime assessments and predictions. This includes assessments of the future behavior of replacements used in the refurbishment of CSAs during the Life Extension Programs (LEPs). The CSA diagnostic projects provide automated techniques for detection and quantification of hydride corrosion and non-destructive evaluation of CSA aging processes.

Specific efforts in FY 2005 include: characterize naturally aged stockpile pits and accelerated pit aging samples to support a key milestone for pit lifetime assessment in FY 2006; install upgraded resolution for x-ray computed tomography of pits; complete lifetime assessments of selected Canned Sub-Assemblies and non-nuclear components; deliver advanced diagnostics and telemetry to support flight test requirements; deploy the first of five modernized system testers at the Weapons Evaluation Test Laboratory; develop new surveillance techniques for tritium reservoirs; conduct aging studies for high explosives, boosters, and detonators; provide a performance assessment model for the warhead electrical systems; and complete the stockpile aging assessment report to support the Annual Assessment Reports.

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Microsystems and Engineering Sciences Application (MESA) Other Project Costs	**4,200**	**4,473**	**4,600**

The Microsystems and Engineering Sciences Application (MESA) Complex is being developed to incorporate modern, survivable, electrical, optical and mechanical control systems into the stockpile where required. These Microsystems are critical for improving the safety, security, and reliability of the stockpile during the life extension program refurbishment activities. Space inside the existing warheads is very limited. Tiny sensors, microcomputers, micromachines, and integrated Microsystems are a vital part of the modernization strategy to ensure that the U.S. nuclear weapons stockpile remains safe, secure, and reliable as possible. Operating funds are required to support other project costs (OPCs) that are related to the proposed MESA line-item construction project but are not capitalized. FY 2005 OPCs will include, but are not limited to: environmental, safety and health activities, the safety assessment and operational support costs during construction.

	FY 2003	FY 2004	FY 2005
Microsystems and Engineering Sciences Application (MESA) Construction (01-D-108)	**112,282**	**86,487**	**48,654**

The Microsystems and Engineering Sciences Applications Complex at Sandia National Laboratories (SNL) in Albuquerque will provide for the design, integration, prototyping and fabrication, and qualification of microsystems into weapon components, subsystems and systems within the stockpile. The Performance Baseline for MESA was established on October 8, 2002. A baseline change to reflect the Congressionally appropriated funding increase in FY 2003 was approved on May 8, 2003, at the same time as Critical Decision 3, Approval to Start Construction. The funding reflects the approved MESA project baseline for each of the years presented. An additional baseline change will be required to incorporate the additional $25.2 million appropriated in FY 2004, though the funding requested in FY 2005 and the outyear funding profile does reflect a shift in recognition of the FY 2003 and FY 2004 increases.

	FY 2003	FY 2004	FY 2005
Total, Engineering Campaign	**270,502**	**264,915**	**242,984**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
▪ **Enhanced Surety** Increase is required to develop and evaluate certain new and innovative delay and denial technologies to enhance nuclear weapon protection. Security and use control features will be integrated into a system that will provide progressively more severe penalties to reduce the likelihood of deliberate unauthorized use. The funding will also enable pre-certification testing of advanced detonator concepts, some of which was deferred from FY 2004, and activity to demonstrate integrated use denial concepts for possible use in future life extension programs	+ 5,340
▪ **Nuclear Survivability** Increase is due to inflation, no significant increase in new work scope.	+ 1,617
▪ **Enhanced Surveillance** The increase provides additional predictive surveillance diagnostic techniques to find problems earlier in aging pits, Canned Sub-Assemblies, tritium reservoirs, and non-nuclear components and materials. The increase supports advanced flight test technology using miniaturized instrumentation and higher fidelity configurations to find stockpile problems that are otherwise difficult to detect. The funding will also enable experiments and modeling needed to understand aging impacts on the lifetimes of additional high priority component and material types that have yet to be sufficiently assessed	+ 8,627
▪ **Engineering Campaigns: Microsystems and Engineering Sciences Application (MESA) Other Project Costs** Increase is consistent with the MESA Project baseline established in May 2003......	+ 127
▪ **Engineering Campaigns: Microsystems and Engineering Sciences Application (MESA) Construction** Decrease shows funding profile adjustments to reflect reduced risk as a result of improved bidding environment for the Micro Fab and Micro Lab construction contracts. MESA project will not be significantly affected. Adjustments will be made by shifting tool procurements to later in the project	- 37,833
Total Funding Change, Engineering Campaign...	- 21,931

Capital Operating Expenses and Construction Summary

Capital Operating Expenses [a]

(Dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
General Plant Projects	175	181	186	+ 5	+ 3.0%
Capital Equipment	4,114	4,237	4,364	+ 127	+ 3.0%
Total, Capital Operating Expenses	4,289	4,418	4,550	+ 132	+ 3.0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior-Year Approp-riations	FY 2003	FY 2004	FY 2005	Unappro-priated Balance
Engineering Campaign: Microsystems and Engineering Sciences Application (MESA) Construction	462,469	87,925	112,282	86,487	48,654	126,608
Total, Construction			112,282	86,487	48,654	

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2004 and FY 2005 funding shown reflects estimates based on actual FY 2003 obligations.

01-D-108, Microsystems and Engineering Sciences Applications (MESA) Complex, Sandia National Laboratories, Albuquerque, New Mexico

Significant Changes

- The FY 2004 Energy and Water Development Appropriations Act, P.L. 108-137, which was enacted December 1, 2003, provided $87,000,000 for MESA, an increase of $25,200,000 above the request. A baseline change will be required to incorporate the schedule impacts of this additional funding, though this data sheet does reflect a shift in the funding profile in recognition of the FY 2003 and FY 2004 increases.

- The FY 2003 Omnibus Appropriations Act provided $113,000,000 for MESA, an increase of $38,000,000 above the request. The appropriation was reduced by $718,000 for a rescission enacted by P.L. 108-7. The additional funding provided in FY 2003 is being used to accelerate the construction of the Microsystems Laboratory (MicroLab) and Weapons Integration Facility (WIF). The Performance Baseline still reflects construction of the three MESA facilities in a sequenced approach based on NNSA mission priority:

  - The Microsystems Fabrication Facility (MicroFab), with required tooling, is the first priority because it will partially replace the outdated Compound Semiconductor Research Laboratory (CSRL) and provide transition space for prototyping new devices.

  - The MicroLab, will complete the replacement of the CSRL and will be used to conduct research critical to the development of microsystems components as well as rapid prototyping and testing of these components.

  - The WIF provides both classified and unclassified facilities that will facilitate design, system integration, and qualification of weapons systems. Unclassified workspaces will encourage and provide the environment necessary for process development and two-way information transfer between partners in industry and academia.

  The sequenced approach to bring the MESA Complex on line meets NNSA's priority mission requirements while at the same time being affordable within the confines of the NNSA Future-Years Nuclear Security Program (FYNSP).

  The impact of the additional FY 2003 funding on the construction schedule for MESA is as follows:

MESA Facility	Start of Construction	Revised Start of Construction	Start of Operations	Revised Start of Operations
MicroFab	3Q FY 2003	3Q FY 2003	3Q FY 2007	3Q FY 2007
MicroLab	2Q FY 2005	4Q FY 2003	1Q FY 2009	4Q FY 2007
WIF	3Q FY 2008	1Q FY 2007	3Q FY 2011	3Q FY 2010

- Critical Decision 3, Approval to Start Construction, was approved on May 8, 2003, for the remaining scope of work for MESA. The remaining scope includes construction of the Microsystems Fabrication Facility, Microsystems Laboratory, and Weapons Integration Facility, and the tooling procurement for the Microsystems Fabrication Facility. Work already approved, and completed or in progress, includes: site utilities; systems upgrades to the support infrastructure in the existing Microelectronics Development Laboratory (MDL); and retooling of the MDL for radiation hardened integrated circuit production and tooling for early critical microsystems research and development.

- MESA Project Engineering and Design activities were completed under budget by $30,827. The project's TEC and TPC have been reduced by this amount.

1. Construction Schedule History

	Fiscal Quarter					
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete	Total Estimated Cost ($000)	Total Project Cost ($000)
FY 2002 Budget Request *(Preliminary Estimate)*…………….	N/A	N/A	2Q 2002	TBD	51,000 [a]	51,000
FY 2001 Congressional Budget Supplemental………………………	N/A	N/A	2Q 2002	TBD	68,000 [b]	68,000
FY 2003 Budget Request *(Preliminary Estimate)*……………	2Q 2001	1Q 2003	3Q 2003 [c]	4Q 2009	453,000	504,000
FY 2004 Budget Request *(Performance Baseline)* [d] ……….	2Q 2001	1Q 2003	3Q 2003 [c]	3Q 2011	462,500	518,500
FY 2005 Budget Request [d] *(Performance Baseline)*…………..	2Q 2001	1Q 2003	3Q 2003 [c]	3Q 2010	462,469	518,469

[a] Preliminary estimate for the MDL retooling only.

[b] Preliminary estimate for the infrastructure upgrades appropriated in 01-D-103, and transferred to this line item by the FY 2001 Supplemental ($17,000,000), and the preliminary estimate for the MDL Rad-Hard IC Retooling ($51,000,000).

[c] Construction of the new facilities included in the scope of this project starts in the 3Q FY 2003. Construction of site utilities and systems upgrades began in the 2Q FY 2002.

[d] The Performance Baseline was established on October 8, 2002.

[e] The PED portion of the project, which was funded under 01-D-103, was completed under budget by $30,827. The TEC and TPC for the project have been reduced by this amount.

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
Design [a]			
2001	10,456	10,456	6,673
2002	4,469	4,469	7,426
2003	0	0	826
Construction			
2001	9,500	9,500	0
2002	63,500 [b]	63,500	32,798
2003	112,282 [c]	112,282	48,564
2004	87,000 [d]	87,000	95,000
2005	48,654	48,654	70,000
2006	65,564	65,564	102,827
2007	7,000	7,000	36,000
2008	54,044	54,044	62,355

3. Project Description, Justification and Scope

Project Description

The Microsystems and Engineering Sciences Applications (MESA) Complex at Sandia National Laboratories (Sandia) in Albuquerque, is a proposed state-of-the-art national complex that will provide for the design, integration, prototyping and fabrication, and qualification of microsystems into weapon components, subsystems, and systems within the stockpile.

The MESA Project will respond to mission needs by providing needed capabilities to:

- Enable integrated teams of weapon system designers, subsystem designers, analysts, and microsystems scientists and technologists to work effectively and efficiently to design, integrate, and qualify for weapon use microsystems-based components and weapons subsystems and ensure their incorporation into weapon systems assemblies;

[a] Design funding was appropriated in 01-D-103, Project Engineering and Design (PED).

[b] Original appropriation of $67,000,000 was reduced by $3,500,000 as part of the Weapons Activities general reduction.

[c] Original appropriation was $113,000,000. This was reduced by $718,000 for a rescission and by $2,562,000 for the Weapons Activities general reduction enacted by P.L. 108-7, FY 2003 Omnibus Appropriations Act, Title VI. The appropriation was increased by $2,562,000 by a reprogramming.

[d] The FY 2004 appropriated amount has not been adjusted for the FY 2004 Congressional Omnibus Appropriations Bill rescission of .59 percent.

- Provide facilities and tooling to support radiation-hardened integrated circuit production and qualification in the event the United States loses the last remaining vendor;
- Conduct R&D, rapid prototyping, pre-production fabrication and analysis, and a war reserve microsystem production capability "of last resort" for DOE/NNSA and the Nuclear Weapons Complex;
- Develop and use predictive codes (characterized by high-performance, nonlinear, full-system, multi-physics models) for microscale physics and for the necessary integration with macroscale codes;
- Develop and use computational tools and capabilities (including visualization-design labs) to support microsystems design, simulation, and manufacturing; weapons performance assessments; renewal process analyses; and qualification of microsystems components, integrated subsystems, and the certification of the overall weapon system;
- Allow technology developers to contribute to both classified stewardship problems and unclassified R&D collaborations with partners in industry and academia; and
- Incorporate cost-effective recycle and reclaim systems that significantly reduce annual water use and result in other secondary benefits including reduced utility costs and bulk chemical storage.

Justification

Management of the stockpile focuses on the surveillance, maintenance, refurbishment, assessment, and certification activities necessary to extend the life of the current stockpile. As weapons approach, or exceed, their useful (warranted) lifetimes, their limited-life components require periodic refurbishment, retrofit and remanufacture. These activities are driven by the Life Extension Program (LEP), an evaluation and prioritization framework for performing systematic, life-extension upgrades on, and replacements of, subsystems and components of nuclear weapons.

The MESA Project is critical to meet NNSA needs. It must deliver capabilities to meet the long term needs of Stockpile Stewardship for continual advances in technologies that improve nuclear weapon surety as well as the more immediate LEP needs of incorporating advanced technologies into upcoming weapon refurbishments, eliminating present safety exceptions in the annual certification process. The microsystems that will be developed in MESA will have the ability to sense, think, act, and communicate within a wide range of environments. They will employ a technology base that spans photonics, mechanics, and radiation-hardened microelectronics on size and integration scales that have not been previously achieved. MESA will radically advance the use of computational modeling and simulation technologies to develop modular design tools for microsystems that can concurrently optimize designs for performance, manufacturability, inspection, qualification, certification, procurement, and cost in the design process. It will create linked virtual prototyping environments in which a microsystem-based product and its manufacturing processes are designed concurrently. Ultimately, the integrated technologies of research, design, and production will contribute to a reduction in the overall part count in a weapon system. It is this reduction in part count that appears to be the most promising approach to achieve needed cost and schedule reductions within the Stockpile Stewardship Program, the Life Extension Program, and related weapon campaigns.

In order to meet stockpile refurbishment requirements, Sandia has developed an integration effort focused on modernizing the non-nuclear components of nuclear weapons. Modern electrical, optical, and mechanical components are required to ensure the continuing safety, security, and reliability of the US nuclear deterrent. Achieving this objective requires integration of activities conducted within several of NNSA's campaigns, and it requires capital investment. To be able to provide modern components, outmoded equipment must be replaced and upgraded. Semiconductor processing equipment, in particular, is expensive and upgrades cost millions of dollars per tool. Commercial integrated circuit technology continues to advance in terms of performance and cost. As stated in the 1997 National Technology Roadmap for Semiconductors, the semiconductor industry has maintained its growth by achieving a 25-30% per-year cost reduction per function throughout its history. Key to this reduction has been a 30% reduction in feature size every three years. The reduction in feature size, and changes in fabrication technology and materials that accompany it, drives changes and consistent improvements in the capital equipment used to fabricate integrated circuits.

Existing Sandia facilities are not adequate in size or function to support the development, prototyping, and use of advanced design and fabrication technologies. Such technologies are critical to support microsystems design, simulation, and manufacturing; weapons performance assessments; renewal process analyses; and qualification of microsystems components, integrated subsystems, and the certification of the overall weapon system. MESA will employ state-of-the-art visualization technologies in support of stockpile stewardship activities. In addition, the retooled, silicon-based production capability (currently located in the existing MDL) and the new compound semiconductor cleanroom, in combination with required new light laboratory and work spaces to replace the CSRL, will allow MESA to conduct R&D, rapid prototyping, pre-production fabrication and analysis, and house a war reserve microsystem production capability for DOE/NNSA and the Nuclear Weapons Complex (NWC).

Project Scope

Infrastructure Upgrades

The infrastructure upgrades portion of this project includes systems upgrades to the existing Microelectronics Development Laboratory (MDL) and utilities upgrades to reroute existing utilities to enable construction of the MESA Complex.

The systems upgrades to the MDL will repair and modify part of the existing building infrastructure including the acid exhaust system, specialty gas room, process chilled water, make-up air, de-ionized water plant and emergency power. These upgrades are necessary in order to prepare for the equipment retooling of the MDL.

The utilities upgrades work reroutes existing communications, power, sewer, storm drain, steam, gas and water utilities and provides a utilities corridor for the proposed MESA building site.

Microelectronics Development Laboratory (MDL) Rad-hard Integrated Circuit (IC) Retooling

This portion of the project supports the costs of partially retooling the Microelectronics Development Laboratory with the equipment that is required in order to produce radiation hardened integrated circuits and provides the critical microsystem tools to allow R&D to progress during construction of the full MESA project. The MDL currently does not have the complete tool set needed to produce qualified war reserve (WR) radiation-hardened integrated circuits or microsystem products. The existing tool set is developmental in nature, is missing some key tools, and includes critical one-of-a-kind tools with no backup. Many of MDL's fabrication tools are more than 10 years old and have exceeded, or are approaching, the end of their useful lives. Downtime is increasing, supplier support for tool maintenance is decreasing, and spare parts are increasingly unavailable. More importantly, commercial vendors for radiation hardened integrated circuits soon will cease to exist, leaving Sandia as the only supplier for these key weapons components. Therefore, refurbishment of the MDL fabrication toolset is a critical capability that the Department must have. The parts of the MESA project involving retooling of the MDL will play a substantial role in developing weapon refurbishment options. The MDL will be an enduring, critical part of the MESA Complex.

The retooling effort primarily provides for equipment procurement, design and fit-up costs. The average tool delivery time ranges from six to twelve months after order, followed by installation design, installation, inspection and start up time. Tools are ordered in sequence to maximize efficiency and minimize downtime and disruptions to on-going MDL activities.

MESA Complex

- The MESA Project includes some work which is already complete or in progress, including:
- Site utilities (as described above under Infrastructure Upgrades)
- Retooling of equipment and support infrastructure in the existing MDL (as described above under Infrastructure Upgrades and MDL Rad-Hard IC Retooling)
- Critical microsystem retooling for the MDL.

The remaining project efforts, to begin in FY 2003 consistent with the approved Performance Baseline, include:

- A new cleanroom facility, light laboratories, and work spaces for personnel replacing the existing, but antiquated, Compound Semiconductor Research Laboratory (CSRL)
- New capital equipment associated with the cleanroom facility and light labs
- Light laboratories and work group and support spaces for researchers, scientists, and technology developers involved in computation, engineering sciences, microsystems, and weapons design who are focused on incorporating microsystems into planned weapon refurbishments
- Special visualization facilities to enable full deployment of ASC and ADaPT modeling and simulation tools for application to microsystems and full weapon development;
- Advanced communications cabling and network electronics to support unclassified and classified ultra-high speed local computing and inter-connectivity to supercomputing resources; and
- Decontamination and decommissioning of the CSRL once vacated.

The MESA facilities comprise approximately 391,000 gross square feet (gsf) and will include:

Microsystems Fabrication (MicroFab). This facility provides cleanrooms that replace the Compound Semiconductor Research Laboratory, Building 893 (CSRL), and transition cleanroom space for prototyping new devices. Built in the late 1980s as an “interim facility” with a five-year lifetime, Sandia scientists have literally “used up” the CSRL and it is no longer practical or cost effective to maintain this facility. Moreover, the mission of the CSRL has grown over time, and the current facility does not, and cannot, meet functional requirements. Therefore, this project will replace the CSRL with the MicroFab and retool approximately 80% of the existing tools used in this facility.

Microsystems Laboratory (MicroLab). This facility will house microsystems researchers and engineers and a small group of MESA external partners. It will accommodate chemical, electrical and laser light laboratories, workspaces to support approximately 274 personnel and a Design and Education Center. This new building will be used to conduct research and development critical to the development of microsystems components as well as rapid prototyping and testing of these components.

Weapons Integration Facility

Weapons Integration Facility – Classified (WIF-C). This portion of the WIF facility will house weapons designers, analysts and computational and engineering sciences (C&ES) staff. It will include a Visual Interactive Environment for Weapons Simulation (VIEWS) Corridor, visualization lab, primarily electrical and laser light laboratories and workspace to support approximately 274 personnel. This portion of the WIF buildings will facilitate design, system integration, and the qualification of weapons systems.

Weapons Integration Facility – Unclassified (WIF-U). This portion of the WIF facility will house C&ES staff and MESA partners. It will include an advanced scientific visualization laboratory, and workspaces to support approximately 100 personnel. This facility will enable collaboration and proximity between partners from industry and academia and Sandia scientists and engineers. Workspaces will encourage and provide the environment necessary for process development and two-way information transfer.

Project Milestones:

FY 2003:	Start of construction for the MicroFab	3Q
	Award construction procurement for the MicroLab	4Q
FY 2007:	Award construction procurement for the WIF	1Q
FY 2010:	WIF Critical Decision 4, Start of Operations	3Q

4. Details of Cost Estimate [a]

(dollars in thousands)

	Current Estimatee	Previous Estimate
Total, Design Phase (3.2% of TEC) [b c]	14,925	14,956
Construction Phase		
Buildings	170,000	175,000
Special Equipment	140,000	140,400
Utilities	4,300	4,800
Standard Equipment	7,600	7,800
Major Computer Items	16,900	17,500
Inspection, Design and project liaison, testing, checkout and acceptance	21,700	22,500
Construction Management (4.6% of TEC)	21,400	18,700
Project Management (2.8% of TEC)	12,700	13,200
Total Construction Costs (85.3% of TEC)	394,600	399,900
Contingencies		
Construction Phase (11.5% of TEC)	52,944	47,644
Total, Line Item Costs (TEC)	462,469	462,500

5. Method of Performance

Construction contracts will be awarded using Sandia's best value procurement process and will be awarded as firm fixed price contracts. Equipment will be procured using either design procurement and installation contracts or turnkey design/procure/install contracts as appropriate.

[a] The current estimate is based on BCP 03-17, which incorporates changes resulting from the FY 2003 appropriation increase above the request. A baseline change (BCP) will be processed during FY 2004 to incorporate the FY 2004 appropriation increase.

[b] Design funding was appropriated in 01-D-103, Project Engineering and Design (PED).

[c] The PED portion of the project, which was funded under 01-D-103, was completed under budget by $30,827. The TEC and TPC for the project have been reduced by this amount.

6. Schedule of Project Funding

	(dollars in thousands)					
	Prior Years	FY 2003	FY 2004	FY 2005	Outyears	Total
Project Cost						
Facility Cost						
Design [a]	14,099	826	0	0	0	14,925
Construction	32,798	48,564	95,000	70,000	201,182	447,544
Total, Line Item TEC	46,897	49,390	95,000	70,000	201,182	462,469
Total Facility Costs (Federal and Non-Federal)	46,897	49,390	95,000	70,000	201,182	462,469
Other Project Costs [b]						
Conceptual design costs	2,127	0	0	0	0	2,127
Decontamination & Decommissioning costs	0	0	0	0	4,600	4,600
NEPA documentation costs	121	0	0	0	0	121
Other ES&H costs	1,670	400	400	400	600	3,470
Other project-related costs	9,986	3,154	4,100	4,200	24,242	45,682
Total, Other Project Cost	13,904	3,554	4,500	4,600	29,442	56,000
Total Project Costs (TPC)	60,801	52,944	99,500	74,600	230,624	518,469

[a] Design funding was appropriated in 01-D-103, Project Engineering and Design (PED).

[b] Prior year OPC costs were updated to reflect actual costing per element noted above. Total OPC costs did not change.

7. Related Annual Funding Requirements

	(FY 2009 dollars in thousands)	
	Current Estimate	Previous Estimate
Annual facility operating costs [a]	2,900	2,900
Annual facility maintenance/repair costs [b]	1,700	1,700
Programmatic operating expenses directly related to the facility [c]	215,000	215,000
Capital equipment note related to construction but related to the programmatic effort in the facility [d]	18,300	18,300
Utility Costs [e]	2,400	2,400
Total related annual funding (operating from FY 2009 through FY 2038) [f]	240,300	240,300

[a] Average annual facility operating costs for material and labor, including systems engineering, infrastructure operations, custodial, and maintenance and sub-sites management. An average total of 15.5 staff years per year will be required.

[b] Average annual facility maintenance and repair costs for materials and labor. An average of 8.0 craft years per year will be required. Costs include maintenance and ordinary repair, including tasks like removals and replacements, repair and refinishing that result from normal wear and tear and maintenance of the grounds.

[c] Programmatic operating expenses directly related to the MESA complex. This estimate reflects the annual operating expenses associated with programmatic work that will be done within the MESA complex. As such, this estimate reflects funding that is primarily already existing from other established DOE programs (i.e., Engineering Campaigns, Readiness in Technical Base and Facilities, Advanced Simulation and Computing, etc.). This estimate is based on costs for personnel associated with the integrated occupancy of MESA (integration of weapons design personnel, present CSRL personnel, present Microsystems Development Laboratory personnel and computational and engineering sciences personnel). In addition to costs for personnel time, this estimate also reflects costs for benefits, travel, purchases, corporate loads etc.

[d] Capital equipment not related to construction, but related to the programmatic effort in the facility. This reflects the average annual investment that is required in retooling and in replacement of fabrication and computing capital equipment to maintain toolsets one generation behind industry in microsystems technologies and at state-of-the-art in computational capability.

[e] Utility costs reflect the average annual costs for electricity, gas, water and sewer discharges.

[f] The MESA Complex will be fully operational in FY 2010 using a phased approach. Separate Critical Decision 4s (Start of Operation) are planned for each building as follows: MicroFab in FY 2007, the MicroLab in FY 2007and the WIF in FY 2010. FY 2009 was used as a base year in previous data sheets because it represented a midpoint for start of operations. To maintain consistency, annual funding requirements remain in FY2009 dollars despite the accelerated phased CD-4 dates.

Inertial Confinement Fusion Ignition and High Yield Campaign

Funding Schedule by Activity

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Inertial Confinement Fusion Ignition and High Yield Campaign					
Ignition	61,690	68,766	76,437	+ 7,671	11.2%
Support of Stockpile Program	27,608	33,003	38,987	+ 5,984	18.1%
NIF Diagnostics, Cryogenics, and Experiment Support	19,426	34,120	44,023	+ 9,903	29.0%
Pulsed Power Inertial Confinement Fusion	9,740	8,740	10,080	+ 1,340	15.3%
University Grants/Other Support	7,368	11,868	7,776	- 4,092	-34.5%
Facility Operations and Target Production	48,984	57,413	63,056	+ 5,643	9.8%
Inertial Fusion Technology	21,372	28,780	0	- 28,780	
NIF Demonstration Program	75,732	96,300	113,700	+ 17,400	18.1%
High-Energy Petawatt Laser Development	12,271	26,146	7,975	- 18,171	-69.5%
NIF Other Project Costs (OPC)	994	0	0	0	0.0%
NIF Construction	214,045	149,115	130,000	- 19,115	-12.8%
Total, Inertial Confinement Fusion Ignition and High Yield Campaign	499,230	514,251	492,034	- 22,217	-4.3%

FYNSP Schedule

(dollars in thousands)

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FYNSP Total
Inertial Confinement Fusion Ignition and High Yield Campaign						
Ignition........	76,437	90,213	94,006	102,644	105,095	468,395
Support of Stockpile Program	38,987	42,997	45,636	49,089	50,208	226,917
NIF Diagnostics, Cryogenics, and Experiment Support........	44,023	48,928	48,407	46,788	47,663	235,809
Pulsed Power						

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FYNSP Total
Inertial Confinement Fusion	10,080	10,190	10,760	10,940	11,300	53,270
University Grants/Other Support	7,776	7,920	8,123	8,358	8,477	40,654
Facility Operations and Target Production	63,056	65,836	80,181	77,428	211,814	498,315
NIF Demonstration Program.............	113,700	117,260	120,957	124,683	0	476,600
High-Energy Petawatt Laser Development	7,975	7,975	7,000	7,000	6,000	35,950
96-D-111, National Ignition Facility................	130,000	130,000	120,000	10,139	0	390,139
Total, Inertial Confinement Fusion Ignition and High Yield Campaign	492,034	521,319	535,070	437,069	440,557	2,426,049

Description

This program develops laboratory capabilities to create and measure extreme conditions of temperature, pressure, and radiation approaching those in a nuclear explosion and conducts weapons related research , including nuclear burn, in these environments; this capability is required to support assessments and certification of the nation's nuclear weapons stockpile.

With the FY 2004 Inertial Confinement Fusion Ignition and High Yield (ICF) Campaign appropriation, the Congress advised NNSA to fund all National Ignition Facility (NIF)-related ICF Campaign experimental support activities as a separate budget item. In response to this recommendation, ICF Campaign subprograms have been restructured. All funding for ICF experimental support activities that are not related to the NIF has been shifted to the appropriate subprogram and the former Experimental Support Technologies subprogram has been re-named NIF Diagnostics, Cryogenics and Experiment Support. The name of the High-Yield Assessment subprogram has been changed to Pulsed Power Inertial Confinement Fusion; Operations of Facilities has been changed to the Facility Operations and Target Production subprogram, and now includes all funding for target production and delivery to ICF facilities; and, a new subprogram has been created for High-Energy Petawatt Laser Development funding.

Benefits to Program Goal 01.30.00.00 Inertial Confinement Fusion Ignition and High Yield
Within the Inertial Confinement Fusion Ignition and High Yield program , 10 subprograms each make unique contributions to Program Goal 01.30.00.00. The Ignition subprogram provides calculations, planning, target design, and experimental activities aimed at demonstrating laboratory ignition and assessing weapon performance issues related to thermonuclear burn. The Support of Stockpile Program subprogram provides calculations, planning, design and experimental activities for non-fusion ignition research related to weapon assessment and certification. Within the Ignition subprogram, both ignition and non-ignition activities rely on advanced simulation and computing for designing experiments and apply experimental results to validate computational capabilities and simulations subsequently applied to warhead analysis. Other subprogram efforts include National Ignition Facility (NIF) construction, NIF Demonstration Program, NIF Diagnostics, Cryogenics, and Experiment Support, Inertial Fusion Technology, Facilities Operations and Target Production, University Grants, Pulsed Power Inertial Confinement Fusion, and High-Energy Petawatt Laser Development. The subprogram for High-Energy Petawatt Laser Development includes construction of the OMEGA Extended Performance (OMEGA EP) laser project at the University of Rochester Laboratory for Laser Energetics.

Program Assessment Rating Tool (PART)
The OMB used PART to review this program for the FY 2005 budget. The NNSA Inertial Confinement Fusion Ignition and High Yield Campaign received a rating of Moderately Effective from the OMB. The OMB assessment found that clear and succinct performance measures were difficult to articulate for the program. In response to OMB's recommendations, NNSA is continuing to refine these performance measures during the FY 2006 PPBE process. Additionally, the OMB assessment found that the program appears to be better managed than it was several years ago. However, OMB encouraged frequent monitoring by independent evaluators to include those retained by the Department of Defense.

Annual Performance Results and Targets

FY 2000 Results	FY 2001 Results	FY 2002 Results	FY 2003 Results
Continue construction of the National Ignition Facility (NIF), and rebaseline future construction plans, total costs, and schedules by June 2000. (MET GOAL)	Implement the Secretary's Six Point Plan to improve project management of the National Ignition Facility (NIF) project and approve a new baseline. (FMFIA) (MET GOAL)	There were no related targets.	There were no related targets.

Annual Performance Results and Targets

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Cumulative percentage of progress towards creating and measuring extreme temperature and pressure conditions for the 2010 nuclear stockpile stewardship requirements.	Completed 56% of progress toward creating and measuring extreme conditions	Complete 63% of progress toward creating and measuring extreme conditions	Complete 68% of progress toward creating and measuring extreme conditions.	Complete 73% of progress toward creating and measuring extreme conditions .	Complete 79% of progress toward creating and measuring extreme conditions .	Complete 82% of progress toward creating and measuring extreme conditions .	Complete 91% of progress toward creating and measuring extreme conditions .	Complete 100% FY 2010.
Cumulative percentage of progress towards demonstrating ignition (simulating fusion conditions in a nuclear explosion) at the National Ignition Facility (NIF) to increase confidence in modeling weapons performance.	Completed 55% of progress toward demonstrating ignition.	Complete 63% of progress toward demonstrating ignition.	Complete 68% of progress toward demonstrating ignition.	Complete 72% of progress toward demonstrating ignition.	Complete 78% of progress toward demonstrating ignition.	Complete 82% of progress toward demonstrating ignition.	Complete 86% of progress toward demonstrating ignition.	Demonstrate ignition FY 2014.
Cumulative percentage of construction completed on the 192-laser beam NIF.	Completed 65% of NIF construction.	Complete 74% of NIF construction.	Complete 81% of NIF construction.	Complete 88% of NIF construction.	Complete 96% of NIF construction.	Complete 100% of NIF construction.	N/A	Complete NIF construction. FY 2008.
Cumulative percentage of equipment fabricated to support ignition experiments at NIF	Completed 7% of equipment fabrication.	Complete 16% of equipment fabrication.	Complete 30% of equipment fabrication.	Complete 44% of equipment fabrication.	Complete 58% of equipment fabrication.	Complete 72% of equipment fabrication.	Complete 86% of equipment fabrication.	Complete 100% of equipment fabrication. FY 2010.
Annual number of days available to conduct stockpile stewardship experiments, totaled for all ICF facilities. (EFFICIENCY MEASURE)	Provided 580 days for experiments.	Provide 500 days for experiments.	Provide 500 days for experiments.	Provide 500 days for experiments.	Provide 500 days for experiments.	Provide 500 days for experiments.	Provide 800 days for experiments.	Ongoing

Detailed Justification

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Ignition..	**61,690**	**68,766**	**76,437**

Supports application of ASCI derived capabilities in calculations, planning, design and experimental activities aimed at risk reduction and development of the physics basis for indirect drive and direct drive inertial confinement fusion ignition. Includes related ignition target fabrication research and development (R&D), exploration of diagnostic techniques to support ignition research, and computer codes and modeling improvements essential to ICF Campaign efforts. In FY 2005, specific emphasis will be focused on supporting activities related to initial NIF ignition experiments, development of ignition targets, and continuation of efforts to develop the physics basis for direct drive ignition.

Support of Stockpile Program......................................	**27,608**	**33,003**	**38,987**

Funds non-ignition High Energy Density Physics (HEDP) experiments at ICF facilities in support of the current scope of the Stockpile Stewardship Program (SSP). Provides specific data required for SSP campaign activities and advanced simulations. Develops experimental capabilities and analytic tools required to perform HEDP experiments and validate ASCI simulations to meet support requirements identified by SSP campaigns and activities. In FY 2005, specific emphasis will be focused on preparing and conducting initial experiments utilizing NIF and performing OMEGA and Z experiments to validate computational models relevant to specific stockpile issues.

NIF Diagnostics, Cryogenics and Experiment Support..	**19,426**	**34,120**	**44,023**

Supports technologies needed to execute SSP and ICF Campaign experiments at NIF. Includes the engineering and fabrication of NIF core and advanced diagnostics; definition, prototyping, design and construction of the NIF cryogenic target system; fabrication of diffractive optics for NIF experiments; integration and operation of the NIF Target Area; and funding for the NIF User Support Office . During FY 2005, major emphasis will be placed on design and development of NIF cryogenic target support systems; development and delivery of NIF diagnostic systems, and support for experiments.

Pulsed Power Inertial Confinement Fusion.................	**9,740**	**8,740**	**10,080**

Supports activities at Sandia National Laboratories needed to establish the technical basis for assessing the feasibility for pulsed power z pinches to produce ignition and significant neutron yield. Completion of the Pulsed Power ICF technical assessment is planned for FY 2008.

	FY 2003	FY 2004	FY 2005
	(dollars in thousands)		
University Grants/Other Support	**7,368**	**11,868**	**7,776**

Supports university grants and research programs in high-energy-density science, National Laser User Facility (NLUF) activities on OMEGA, and critical needs of the campaign.

Facility Operations and Target Production	**48,984**	**57,413**	**63,056**

Supports the operation of facilities, including OMEGA, Z machine, Nike, and Trident, in a safe, secure manner for ICF Ignition and High Yield Campaign activities and other authorized users. Includes funding for ICF target production and delivery to ICF facilities, data collection and archiving, routine facility maintenance and engineering support, and support for facility-supplied diagnostics. Commissioning of NIF laser systems will be funded through the NIF Demonstration Program until the facility's entire complement of laser systems is fully operational at the end of FY 2008, at which time NIF operational funding will be included in this subprogram.

Inertial Fusion Technology	**21,372**	**28,780**	**0**

Develops technology options for inertial fusion and stockpile stewardship using high-average power lasers (HAPL) and z-pinches. It is not funded in FY 2005 due to the requirements of higher priority activities.

NIF Demonstration Program..	**75,732**	**96,300**	**113,700**

Consistent with the approved NIF Project baseline, this funding element supports the activities associated with completing the NIF to the point where full operations commence and includes costs for the integration, planning, assembly, installation, and activation for the NIF. Included is the phased turnover of lasers to commissioning and operations teams, an area of increased activity and key importance for FY 2005 through FY 2008.

High-Energy Petawatt Laser Development	**12,271**	**26,146**	**7,975**

This new subprogram supports development of high-energy petawatt (HEPW) laser technology, including diffraction gratings, for existing and future major ICF facilities. Supports design and construction of OMEGA Extended Performance laser beam lines at the University of Rochester Laboratory for Laser Energetics OMEGA facility. NNSA plans to construct a 2-beam petawatt laser system at OMEGA. A separate data sheet describing planned OMEGA Extended Performance activities and funding levels is included with this budget submission.

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
NIF Other Project Costs..	**994**	**0**	**0**

Supports National Environmental Policy Act (NEPA) documentation, including environmental impact statement and environmental monitoring and permits, and assurances, safety analysis and integration. Final increment of funding required for these activities was provided in FY 2003.

NIF Construction...	**214,045**	**149,115**	**130,000**

96-D-111, National Ignition Facility, Lawrence Livermore National Laboratory. Funding decreases in FY 2005 are consistent with the current Project baseline. Major milestones for FY 2005 include: commissioning first laser beam bundle (8 individual laser beams), obtaining NNSA concurrence on NIF Final Safety Analysis Report, and completing laser glass melting.

Total, Inertial Confinement Fusion Ignition and High Yield Campaign..	**499,230**	**514,251**	**492,034**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
▪ **Ignition**	
Funding increase supports investigation of new concepts in ignition target design and fabrication, expanded research in direct-drive cryogenic target implosions, initial NIF laser-plasma interaction experiments, development of ignition diagnostics, and experiments to guide selection of an initial NIF phase plate set to support ignition research..	+ 7,671
▪ **Support of Stockpile Program**	
Increase supports planning, execution and analysis of stockpile related experiments needed to validate advanced ASCI codes and that support stockpile assessment and certification. Provides funding for design and fabrication of increasingly complex non-ignition targets and diagnostics development for stockpile related experiments. This increase also reflects expansion in the use of NIF to conduct experiments to support the stockpile	+ 5,984
▪ **NIF Diagnostics, Cryogenics and Experiment Support**	
Funding increases reflect planned increases in the use of NIF for ICF experimental activities. Major efforts receiving increases in funding include NIF user support, construction and operational support for diagnostics, cryogenic systems design and development activities, and diffractive optics............................	+ 9,903
▪ **Pulsed Power Inertial Confinement Fusion**	
Increase supports activities at Sandia National Laboratories needed to establish the technical basis for assessing the feasibility for pulsed power z-pinches to produce ignition and significant neutron yield. Includes expansion of computational activities and some supporting experiments to determine the potential of z-pinches to produce high yield	+ 1,340
▪ **University Grants/Other Support**	
Decrease reflects Congressional funding additions provided in the FY 2004 appropriation for the ICF Campaign to support university activities in short-pulse high-intensity laser development	- 4,092

	FY 2005 vs. FY 2004 ($000)
▪ **Facility Operations and Target Production**	
Funding increase provides for additional utilization of the Z Beamlet backlighter in support of planned experiments and increases in target production to support research programs at ICF facilities, including the NIF. Increase also reflects costs associated with additional complexity in targets and experimental support technologies required to support expansion in ICF research at OMEGA and Z machine	+ 5,643
▪ **Inertial Fusion Technology**	
Decrease reflects funding provided by Congress in the FY 2004 appropriation to support inertial fusion technology development (High Average Power Lasers and Z-Pinch Inertial Fusion Energy) above the request for the ICF Campaign.	- 28,780
▪ **NIF Demonstration Program**	
Increase supports the approved NIF baseline and reflects planned shift in activity for major portions of the NIF from construction to engineering integration, test and activation. Funding supports assembly, installation, and testing of laser components and laser commissioning activities including Management Pre-start Reviews. During FY 2005, commissioning and turnover for laboratory use will be completed for the 1st laser beam bundle (8 individual laser beams)	+ 17,400
▪ **High-Energy Petawatt Laser Development**	
This request reflects the plan for completing a 2-beam petawatt laser for the OMEGA EP facility at the University of Rochester Laboratory for Laser Energetics and developing diffractive gratings........	- 18,171
▪ **Construction**	
Decrease is consistent with the approved NIF baseline. It reflects the planned shift for major portions of the NIF from construction to engineering integration, test, and activation........	- 19,115
Total Funding Change, Inertial Confinement Fusion Ignition and High Yield Campaign	**- 22,217**

Capital Operating Expenses and Construction Summary

Capital Operating Expenses [a]

(Dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
General Plant Projects..........................	1,614	1,662	1,712	+ 50	+ 3.0%
Capital Equipment	18,050	26,202	11,358	-14,844	-56.7%
Total, Capital Operating Expenses	19,664	27,864	13,070	-14,794	-53.1%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior-Year Approp-riations	FY 2003	FY 2004	FY 2005	Unappro-priated Balance
96-D-111, National Ignition Facility	2,094,897	1,340,713	214,045	149,115	130,000	261,024
Total, Construction			214,045	149,115	130,000	

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2004 and FY 2005 funding shown reflects estimates based on actual FY 2003 obligations, and the actual or requested funding for the OMEGA EP, which when completed, will be DOE-owned capital equipment. The decrease in FY 2005 is due to the reduction in the funding for OMEGA EP.

96-D-111, National Ignition Facility (NIF), Lawrence Livermore National Laboratory, Livermore, California

Significant Changes

- None.

1. Construction Schedule History

	Fiscal Quarter				Total Estimated Cost ($000)	Total Project Cost ($000)	Other Related Costs ($000)	Total Project-Related Costs ($000)
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete				
FY 1996 Budget Request (*Preliminary Estimate*)	1Q 1996	1Q 1998	3Q 1997	3Q 2002	842,600	1,073,600	N/A	N/A
FY 1998 Budget Request (*Title I Baseline*)..................	1Q 1996	1Q 1998	3Q 1997	3Q 2003	1,045,700	1,198,900	N/A	N/A
FY 2000 Budget Request.......	1Q 1996	2Q 1998	3Q 1997	3Q 2003	1,045,700	1,198,900	N/A	N/A
FY 2001 Budget Request..........	1Q 1996	2Q 1998	3Q 1997	3Q 2003	1,045,700	1,198,900	833,100	2,032,000
FY 2001 Amended Budget Request....................................	1Q 1996	2Q 1998	3Q 1997	4Q 2008	2,094,897	2,248,097	1,200,000	3,448,097
FY 2005 Budget Request (*Current Baseline Estimate*)	1Q 1996	2Q 1998	3Q 1997	4Q 2008	2,094,897	2,248,097	1,200,000	3,448,097

2. Financial Schedule

Total Estimated Cost (TEC) Funding

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
1996	37,400	37,400	33,991
1997	131,900	131,900	74,294
1998	197,800	197,800	165,389
1999	284,200	284,200	251,476
2000	247,158[a]	247,158	252,766
2001	197,255[b]	197,255	254,725
2002	245,000	245,000	282,153
2003	214,045[c]	214,045	215,060
2004	150,000[d]	150,000	154,150
2005	130,000	130,000	130,000
2006	130,000	130,000	130,000
2007	120,000	120,000	120,000
2008	10,139	10,139	30,893

3. Project Description, Justification, and Scope

The Project provides for the design, procurement, construction, assembly, and acceptance testing of the National Ignition Facility (NIF). The NIF is an experimental inertial confinement fusion facility intended to achieve controlled thermonuclear fusion in the laboratory by imploding a small capsule containing a mixture of the hydrogen isotopes, deuterium and tritium. The NIF is being constructed at the Lawrence Livermore National Laboratory (LLNL), Livermore, California as determined by the Record of Decision made on December 19, 1996, as a part of the Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSM PEIS).

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[a] Original appropriation was \$248,100,000. This was reduced by \$942,000 for the FY 2000 rescission enacted by P.L. 106-113.

[b] The FY 2001 amended budget request of \$209,100,000 was reduced by Congress to \$199,100,000. The appropriation of \$199,100,000 was reduced by \$1,410,000 due to the Safeguards and Security (S&S) amendment, and by \$435,000 by a rescission enacted by Section 1403 of the FY 2001 Consolidated Appropriations Act.

[c] Original appropriation was \$214,045,000. This was reduced by \$1,360,000 for a rescission and by \$4,853,000 for the Weapons Activities general reduction enacted by P.L. 108-7, FY 2003 Omnibus Appropriations Act, Title VI. The appropriation was increased by \$6,213,000 by a reprogramming.

[d] The FY 2004 appropriated amount has not been adjusted for the FY 2004 Congressional Omnibus Appropriations Bill rescission of .59 percent.

The NNSA Inertial Confinement Fusion (ICF) Campaign carries out many of the high energy density physics (HEDP) experiments required for success of the Stockpile Stewardship Program (SSP). The demonstration of fusion ignition in the laboratory is an important component of the SSP Program and a major goal of NIF and the ICF Campaign. The NIF is designed to provide the experimental capability required for the ICF Campaign to achieve propagating fusion burn and modest (1-10) energy gain (currently planned for within 4-5 years of full operation) and to conduct high-energy-density experiments, through both fusion ignition and direct application of the high laser power. The NIF will also provide the capability to conduct non-ignition HEDP experiments critical to the success of the SSP. Technical capabilities provided by the ICF Campaign also contribute to other DOE/NNSA requirements including nuclear weapons effects testing and the development of inertial fusion power. Ignition and other objectives for NIF were identified in the NIF Justification of Mission Need, which was endorsed by the Secretary of Energy. Identification of target ignition as the next important step in ICF development for both defense and non-defense applications is consistent with the earlier (1990) recommendation of DOE's Fusion Policy Advisory Committee, and the National Academy of Sciences Inertial Fusion Review Group. In 1995, the DOE Inertial Confinement Fusion Advisory Committee affirmed the program's readiness for an ignition experiment. A review by the JASONs in 1996 affirmed the value of the NIF for stockpile stewardship.

The NIF project supports the DOE mandate to maintain nuclear weapons science expertise required for stewardship of the stockpile. After the United States announcement of a moratorium on underground nuclear tests in 1992, the Department established the SSP to ensure the preservation of the core intellectual and technical competencies in nuclear weapons. The NIF is one of the most vital facilities in that program. The NIF will provide the capability to conduct laboratory experiments to address the high energy density and fusion aspects that are important to both primaries and secondaries in stockpile weapons.

At present, the Nation's computational capabilities and scientific knowledge are inadequate to ascertain all of the performance and safety impacts from changes in the nuclear warhead physics packages due to aging, remanufacturing, or engineering and design alterations. Such changes are inevitable if the warheads in the stockpile are retained well into this century, as expected. In the past, the impacts of such changes were evaluated through nuclear weapon tests. Without underground tests, we will require better, more accurate computational capabilities to assure the reliability and safety of the nuclear weapons stockpile for the indefinite future.

To achieve the required level of confidence in our predictive capability, it is essential that we have access to near-weapons conditions in laboratory experiments. The importance of nuclear weapons to our national security requires such confidence. For detonation of weapon primaries, that access is provided in part by hydrodynamic testing. For secondaries and for some aspects of primary performance, the NIF will be a principal laboratory experimental physics facility.

The most significant potential commercial application of ICF in the long term is the generation of electric power. Consistent with the recommendations of the Fusion Policy Advisory Committee, the NIF will provide a unique capability to address critical elements of the inertial fusion energy program by: exploring moderate gain (1-10) target designs, establishing requirements for driver energy and target illumination for high gain targets, and developing materials and technologies useful for civilian inertial fusion power reactors.

The ignition of an inertial fusion capsule in the laboratory will produce extremely high temperatures and densities in matter. Thus, the NIF will also become a unique and valuable laboratory for experiments relevant to a number of areas of basic science and technology (e.g., stellar phenomena).

The NIF is an experimental fusion facility consisting of a laser and target area, and associated assembly and refurbishment capability. The laser will be capable of providing an output pulse with an energy of 1.8 megajoules (MJ) and an output pulse power of 500 terawatts (TW) at a wavelength of 0.35 micrometers (μm) and with specified symmetry, beam balance and pulse shape. The NIF design is an experimental facility housing a multibeam line, neodymium (Nd) glass laser capable of generating and delivering the pulses to a target chamber. In the target chamber, a positioner will center a target containing fusion fuel, a deuterium-tritium mixture, for each experiment.

The NIF experimental facility, titled the Laser and Target Area Building (LTAB), will provide an optically stable and clean environment. The LTAB will be shielded for radiation confinement around the target chamber and will be designed as a radiological, low-hazard facility capable of withstanding the natural phenomena specified for the LLNL site. The baseline facility is for one target chamber, but the design shall not preclude future upgrade for additional target chambers.

The NIF project consists of conventional and special facilities:

- Site and Conventional Facilities include the land improvements (e.g., grading, roads) and utilities (electricity, heating gas, water), as well as the LTAB, which has an approximately 20,300 square meters footprint and 38,000 square meters in total area. It is a reinforced concrete and structural steel building that provides the vibration-free, shielded, and clean space for the installation of the laser, target area, and integrated control system. The LTAB has two laser bays, each 31 meters (m) by 135 m long, and a central target area--a heavily shielded (1.8 m thick concrete) cylinder 32 m in diameter and 32 m high. The LTAB includes security systems, radioactive confinement and shielding, control rooms, supporting utilities, fire protection, monitoring, and decontamination and waste handling areas. Optics assembly and refurbishment capability is provided for at LLNL by incorporation of an optics assembly area attached to the LTAB and minor modifications of other existing site facilities.

- Special facilities include the Laser System, Target Area, Integrated Computer Control System, and Optics.

  - The laser system is designed to generate and deliver high power optical pulses to the target chamber. The system consists of 192 laser beams configured to illuminate the target surface with a specified symmetry, uniformity, and temporal pulse shape. The laser pulse originates in the pulse generation system. This precisely formatted low energy pulse is amplified in the main amplifier. To minimize intensity fluctuation, each beam is passed through a pinhole in a spatial filter on each of the four passes through the amplifier and through a transport spatial filter. The beam transport directs each high power laser beam to an array of ports distributed around the target chamber where the frequency of the laser light is tripled to 0.35 μm, spatially modulated and focused on the target. Systems are provided for automatic control of alignment and the measurement of the power and energy of the beam. Structural support and auxiliary systems provide the stable platform and utilities required.

- The target area includes a 10 m diameter, low activation (i.e., activated from radiation) aluminum vacuum chamber located in the Target Area of the LTAB. Within this chamber, the target will be precisely located. The chamber and building structure provide confinement of radioactivity (e.g., x-rays, neutrons, tritium, and activation products). Diagnostics will be arranged around the chamber to demonstrate subsystem performance for project acceptance tests. Structural, utility and other support systems necessary for safe operation and maintenance will also be provided in the Target Area. The target chamber, the target diagnostics, and staging areas will be capable of conducting experiments with cryogenic targets. The Experimental Plan indicates that cryogenic target experiments for ignition will be needed 2-3 years after completion of the project. Therefore, the targets and this cryogenic capability will be supplied by the experiments. The NIF project will make mechanical and electrical provisions necessary to position and align the cryogenic targets within the chamber. The baseline is for indirectly driven targets. An option for future modifications to permit directly driven targets is included in the design.

- The integrated computer control system includes the computer systems (note: no individual computer will cost over $100,000) required to control the laser and target systems. The system will provide the hardware and software necessary to support initial NIF acceptance and operations checkout. Also included is an integrated timing system for experimental control of laser and diagnostic operations, safety interlocks, and personnel access control.

- Thousands of optical components will be required for the 192-beamlet NIF. These components include laser glass, lenses, mirrors, polarizers, deuterated potassium dihydrogen phosphate crystals, potassium dihydrogen phosphate crystals, pulse generation optics, debris shields and windows, and the required optics coatings. Optics includes quality control equipment to receive, inspect, characterize, and refurbish the optical elements.

Project Milestones:

Major milestones and critical decision points have not changed:

Milestones	Date
Approval of Mission Need (CD1)	Jan 1993
Title I Initiated	Jan 1996
NEPA Record of Decision	Dec 1996
Approval to Initiate Construction (CD3)	Mar 1997
Start Special Equipment Installation	Nov 1998
1st light to Target Chamber Center	Jun 2004
12 bundles Commissioned	Jun 2007
24 bundles Commissioned	Sep 2008
Project Complete (CD4)	Sep 2008

Project milestones for FY 2003 included:

- Laser Bay 2, Cluster 3 Beampath installed — 1Q (completed 1Q FY2002)
- First Laser Bay 2 Flashlamp installed — 2Q (completed 4Q FY2002)
- Optics Assembly Building operational — 3Q (completed 1Q FY2003)
- Target Positioner (TARPOS) installed in Target Bay 2 — 3Q (completed 2Q FY2003)

Project milestones for FY 2004 include:

- First Light to Target Chamber Center — 3Q (completed 2Q FY2003)
- Achieve 10 kilo-joules 1 omega light — 4Q (completed 1Q FY2003)
- Switchyard 2 Beampath to Commissioning — 4Q (completed 1Q FY2003)

Project milestones for FY 2005 include:

- Glass Melting complete — 1Q
- FSAR concurrence — 2Q
- First Bundle commissioned — 3Q

4. Details of Cost Estimate

	(dollars in thousands)	
	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs (Design Drawings and Specifications)	245,000	219,573
Design Management Costs (2.0% of TEC)	41,500	39,400
Project Management Costs (2.0% of TEC)	42,450	40,414
Total Design Costs (15.7% of TEC)	328,950	299,387
Construction Phase		
Improvements to Land	1,800	1,800
Buildings	179,000	179,000
Special Equipment	1,260,859	1,268,281
Utilities	500	500
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	139,566	132,566
Construction Management (0.9% of TEC)	18,000	18,000
Project Management (2.9% of TEC)	61,594	59,594
Total Construction Costs (79.3% of TEC)	1,661,319	1,659,741
Contingencies		
Design Phase (.5% of TEC; 2.2% of remaining TEC BA)	9,727	21,642
Construction Phase (4.5% of TEC; 21.8% of remaining TEC BA)	94,901	114,127
Total Contingencies (5.0% of TEC; 24.0% of remaining TEC BA)	104,628	135,769
Total, Line Item Costs (TEC)	2,094,897	2,094,897

The cost estimate assumes a project organization and cost distribution consistent with the management requirements appropriate for a DOE Major System as outlined in the NIF Project Execution Plan. Actual cost distribution will be in conformance with accounting guidelines in place at the time of project execution.

5. Method of Performance

The NIF Project Office (consisting of LLNL, Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL), and University of Rochester Laboratory for Laser Energetics (UR/LLE) representation, and supported by competitively selected contracts with Architect/Engineering firms, an integration management and installation contractor, equipment and material vendors, and construction firms) will prepare the design, procure equipment and materials, and perform conventional construction, safety, system analysis, and acceptance tests. The DOE/NNSA will maintain oversight and coordination through the NNSA Office of the NIF Project. All activities are integrated through the guiding principles and five core functions of the DOE Order on Integrated Safety Management Systems (ISMS) (DOE P450.4). DOE conducted the site selection and the NEPA determination in the SSMPEIS. LLNL was selected as the construction site in the Record of Decision made on December 19, 1996.

5.1 NIF Execution

5.1.1 Conceptual and Advanced Conceptual Design

The conceptual design was completed in May 1994 by the staff of the participating laboratories. Keller and Gannon contractors provided designs of the conventional facilities and equipment.

Design requirements were developed through the Work Smart Standards (WSS) Process approved by the Director of the Oakland Operations Office. New requirements have been defined since the original WSS was placed in Contract 48 in 1997. A gap analysis will be performed, and if changes are required a revision will be prepared.

The Conceptual Design Report was subjected to an Independent Cost Estimate (ICE) review by Foster Wheeler USA under contract to the DOE. The advanced conceptual design phase further developed the design, and is the phase in which all the criteria documents that govern Title I Design were reviewed and updated.

5.1.2 Title I Design

In FY 1996, Title I Design began with the contract award for the Architect/Engineers (Parsons and AC Martin) and a Construction Management firm (Sverdrup) for the design and the constructiblity reviews of the: (1) NIF Laser and Target Area Building, and (2) Optics Assembly Building. Title I Design included developing advanced design details to finalize the building and the equipment arrangements and the service and utility requirements, reviewing project cost estimates and integrated schedule, preparing procurement plans, conducting design reviews, completing the Preliminary Safety Analysis Report and National Environmental Protection Act (NEPA) documentation, and planning for and conducting the constructibility reviews.

Title I Design was completed in November 1996 and was followed by an Independent Cost Estimate review.

5.1.3 Title II Design

The participants in Title II (final design) include LLNL, LANL, SNL, Parsons, AC Martin, and Jacobs/Sverdrup (constructibility reviews). The Title II Design provides construction subcontract packages and equipment procurement packages, construction cost estimate and schedule, Acceptance Test Procedures, and the acceptability criteria for tested components (e.g., pumps, power conditioning, and special equipment), and environmental permits for construction (e.g., *Storm Water Pollution Prevention Plan*).

5.1.4 Title III Design

The Title III engineering participants include LLNL, Parsons, AC Martin, and Jacobs/Sverdrup. Title III engineering represents the engineering necessary to support the construction and equipment installation, including inspection and field engineering. The main activities are to perform the engineering necessary to resolve issues that may arise during construction (e.g., fit problems and interferences). Title III engineering will result in the final as-built drawings that represent the NIF configuration.

5.1.5 Construction and Equipment Procurement, Installation, and Acceptance

Based on the March 7, 1997, Critical Decision 3 (CD-3), construction began with site preparation and excavation of the Laser Target Area Building (LTAB) forming the initial critical-path activities. The NIF Construction Safety program was approved and sets forth the safety requirements at the construction site for all LLNL and non-LLNL (including contractor) personnel. There was sufficient Title II Design completed to support bid of the major construction and equipment procurements. The conventional facilities are designed as construction subcontract bid packages and competitively bid as firm fixed price procurements. The initial critical-path construction activities include both the Laser and Target Area Building and the Optics Assembly Building (where large optics assembly and staging will take place). In addition, the site support infrastructure needed to support construction of conventional facility, beampath infrastructure installation, and line replaceable equipment and optics staging are being put in place. At the same time, procurements on the critical path (e.g., target chamber) began following the established *NIF Acquisition Plan*.

The next major critical path activity is the assembly and installation of the Beampath Infrastructure Systems. These are the structural and utility systems required to support the line replaceable units. The management and installation of the Beampath Infrastructure System is being contracted to an Integration Management and Installation Contractor. This was done to fully involve industry in the construction of NIF as directed in the Secretary of Energy's 6-Point Plan and recommended by the Secretary of Energy Advisory Board interim report in January 2000. During the period of Beampath Infrastructure System installation, line replaceable unit and optics procurements continue.

The line replaceable unit equipment will be delivered, staged, and installed as phased beneficial occupancy of the Laser and Target Area Building is achieved. This is a complex period in which priority conflicts may occur because construction, equipment installation, and acceptance testing will be occurring. The Product Line Managers, Area Integration Managers, and Integration Management and Installation Contractor will manage and integrate the activities to avoid potential interferences affecting the schedule. The construction, equipment installation, and acceptance testing will be supported by Title III inspection and field engineering, which will include resolving construction and installation issues and preparing the final as-built drawings.

5.1.6 Operational Testing and Commissioning

After installation, the facility and equipment will be commissioned prior to the phased turnover to the operations organization. The transfer points employ the Management Pre-Start Review process in which an independent team evaluates the readiness (e.g., training and qualification of operators, Commissioning Test Procedures results, and as-built drawings) and recommends turnover by the NIF Project Manager. The NIF Project Manager approves the transfer of responsibility for ISMS Work Authorization.

The integrated system activation will begin with the commissioning of the first bundle. Management Pre-Start Reviews (MPRs) will be used by the Project Manager to control each system turnover. In specific cases, such as first light, first tritium experiment, and ignition readiness, the DOE/NNSA Field Office will oversee and concur in the MPR. A sequence of MPRs are scheduled to ensure a disciplined and controlled turnover of NIF systems from construction to activation. MPRs will be conducted by LLNL prior to the start of first tritium experiments and NIF 192-beam operation, and the results will be validated by National Nuclear Security Administration Office of the NIF Project readiness assessments (RA-1 and Full NIF RA. respectively). The first tritium experiment and 192-beam readiness assessments require that an FSAR evaluating the appropriate set of hazards be completed and approved (including the documented operating/maintenance procedures, operating staff training, and as-built design documentation). The 192-beam Readiness Assessment results are a key input for CD-4 (Project closeout) by the Acquisition Executive.

5.1.7 Project Completion

The complete set of NIF criteria is contained in the *NIF Functional Requirements and Primary Criteria*. This is the criteria that NIF is required to meet when fully operational. However, early experimental capability at the NIF is achieved before Project completion through a series of turnovers controlled by Management Pre-Start Reviews. This enables the Program to begin experiments in support of Stockpile Stewardship and other programmatic missions at the earliest possible date, as NIF performance capability is building up toward the eventual goals set out in the *NIF Functional Requirements and Primary Criteria* and *Project Completion Criteria*.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2003	FY 2004	FY 2005	Outyears	Total
Project Cost						
Facility Costs						
Design	312,043	13,434	8,900	3,000	1,300	338,677
Construction	1,002,751	201,626	145,250	127,000	279,593	1,756,220
Total, Line item TEC	1,314,794	215,060	154,150	130,000	280,893	2,094,897
Other Project Costs						
R&D necessary to complete construction [a]	103,859	81	0	0	0	103,940
Conceptual design costs [b]	12,300	0	0	0	0	12,300
NEPA documentation costs [c]	6,130	729	303	1,090	3,438	11,690
Other project-related costs [d]	21,965	385	526	684	1,710	25,270
Total, Other Project Costs	144,254	1,195	829	1,774	5,148	153,200
Total Project Cost (TPC)	1,459,048	216,255	154,979	131,774	286,041	2,248,097
Other Related Operations and Maintenance Costs– NIF Demonstration Program	550,859	74,542	96,300	113,700	364,599	1,200,000
TOTAL Project and Related Costs	2,009,907	290,797	251,279	245,474	650,640	3,448,097
Budget Authority (BA) requirements [e]						
TEC (capital funding)	1,340,713	214,045	150,000	130,000	260,139	2,094,897
OPC (O&M funding)	152,206	994	0	0	0	153,200
NIF Demonstration Program(O&M funding) [f]	551,368	75,732	96,300	113,700	362,900	1,200,000
Total, BA requirements	2,044,287	290,771	246,300	243,700	623,039	3,448,097

[a] Costs include optics vendor facilitization and optics quality assurance.

[b] Includes original conceptual design report completed in FY 1994 and the conceptual design activities for the optical assembly and refurbishment capability and site infrastructure.

[c] Includes preparation of the NIF portion of the Stockpile Stewardship and Management Programmatic Environmental Impact Statement, NIF Supplemental Environmental Impact Statement and environmental monitoring and permits; OSHA implementation.

[d] Includes engineering studies (including advanced conceptual design) of project options; assurances, safety analysis, and integration; start-up planning, management, training and staffing; procedure preparation; startup; and Operational Readiness Review.

[e] Long-lead procurements and contracts require BA in advance of costs.

[f] Funding requested and appropriated in the Inertial Confinement Fusion program and, beginning in FY 2001, under the Inertial Confinement Fusion Ignition and High Yield (ICF) Campaign is required to maintain the Project baseline. The out-year funding profile is $117,260,000 in FY 2006; $120,957,000 in FY 2007; and $124,683,000 in FY 2008.

7. Related Annual Funding Requirements

	Current Estimate	Previous Estimate
Annual facility operating costs [a]	40,666	36,670
Annual facility maintenance/repair costs [b]	73,186	65,209
Programmatic operating expenses directly related to the facility [c]	0	0
Capital equipment not related to construction but related to the programmatic effort in the facility	221	216
GPP or other construction related to the programmatic effort in the facility	221	216
Utility costs [d]	14,237	13,944
Other costs [e]	1,814	1,777
Total related annual funding (estimate based on operating life of FY 2009 through FY 2038)	130,345[f]	118,032[g]

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[a] Includes all NIF support personnel who are not in facility maintenance as described in note b (198 personnel). This is based on the latest facility use projection of 746 shots in FY 2011.

[b] Includes refurbishment of laser and target systems, building maintenance, and component procurement based on 746 shots in FY 2011 (213 personnel).

[c] For these costs, refer to the National Stockpile Stewardship Program.

[d] Estimate of electricity costs based on currently projected rates.

[e] Facility usage estimate of industrial gases (argon, synthetic air).

[f] In FY 2005 dollars.

[g] In FY 2004 dollars.

OMEGA Extended Performance (EP) Project, University of Rochester / LLE, Rochester, New York

- This is the first time this Operating Expense-funded project data sheet is being submitted. Funding was first appropriated for this project in FY 2003, with additional funding provided in the FY 2004 Energy and Water Development Appropriations Act.

- The project is still in the Planning Phase. As a result, the cost and schedule are preliminary estimates and are subject to change once the Performance Baseline is approved by the Acquisition Executive at the completion of the preliminary design (Critical Decision 2).

1. Laser Construction Schedule

	Fiscal Quarter				Total Estimated Cost ($000)	Total Project Cost ($000)
	Design Work Initiated	Design Work Completed	Physical Construction Start	Physical Construction Complete		
FY 2005 Budget Request *(Current Estimate)*…………	1Q 2003	2Q 2004	2Q 2004	4Q 2009	67,000	77,700

2. Financial Schedule

Operating Expense Funded
(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2003	13,000 [a]	13,000	13,000
2004	21,000 [b]	21,000	21,000
2005	6,000	6,000	6,000
2006	7,000	7,000	7,000
2007	7,000	7,000	7,000
2008	7,000	7,000	7,000
2009	6,000	6,000	6,000

[a] Initial Congressional O&M funding was provided in the FY 2003 Energy and Water Development Appropriations Act (P.L. 108-7).

[b] Funding was provided in the FY 2004 Energy and Water Development Appropriations Act (P.L. 108-137)

3. Project Description, Justification and Scope

Project Description

The OMEGA EP project is the design, manufacture, assembly, and testing of two short pulse laser beams to complement the existing capability of the OMEGA laser system. The two new beamlines are to be built in a new building that is being funded by the University of Rochester at the Laboratory for Laser Energetics site. Many aspects of the NIF and the OMEGA architectures will be used to produce the high-energy beams. The intended use of the two beams is to backlight events created by the OMEGA laser for greater understanding of implosion events. The project is broken down into six primary technical areas:

Laser Sources - The laser sources provide the pulses to be input into a NIF-like beamline.

Laser Amplifiers – Mechanical systems that adapt the Multi-Segment-Amplifier of the NIF to a Single-Segment-Amplifier as required by the OMEGA EP architecture.

Power Conditioning – Energy storage system to energize the flash lamps of the laser amplifiers

Opto-Mechanical Beamlines – All lenses, mirrors, deformable mirrors, diffraction gratings, Plasma-Electrode-Pockels-Cells, and laser diagnostics to transport the energy from the laser sources through the amplifiers and to the target.

Experimental, Vacuum Systems, and Structures – The structures, vacuum vessels and interfaces to the Opto-Mechanical systems required for beamline support.

Control Systems – The hardware and software necessary to control the laser through all of the component elements. Remote control from a centralized control room will be provided

Project Justification

The OMEGA laser at the University of Rochester's Laboratory for Laser Energetics (LLE) is a critical facility needed to support ICF goals. The OMEGA Extended Performance (EP) project will provide advanced radiographic capabilities that currently do not exist. This technology will facilitate the longer-term goal of demonstrating ignition and future SSP experiments on the National Ignition Facility (NIF). Specifically, OMEGA EP will provide the following:

- high-energy, short-pulse backlighters necessary for imaging direct-drive ignition implosions along two axes,
- capability to develop weapons science applications of petawatt lasers in areas such as high-energy x-ray backlighting and the production of matter under extreme conditions of temperature and density,
- a unique means for evaluating the fast-ignition concept, which could increase the likelihood of eventually achieving ignition and high gain on the NIF,
- a new capability for exploring basic science through ultrahigh-intensity lasers,

- an important facility upgrade to maintain the vitality of the scientific program at the Laboratory for Laser Energetics, consistent with the recommendation of the recent National Research Council report on High-Energy-Density Physics,
- an important capability to probe matter under extreme astrophysical conditions, consistent with recommendations contained in the recent National Research Council report on the Physics of the Universe, and
- enhanced viability of LLE to support NNSA and attract new talent into the SSP.

Project Scope

The scope of the project includes all of the design, development, and installation of the laser systems. At the conclusion of the project, the primary functional requirements will be met and performance verified by an independent panel. Subsequently, the laser will be available to conduct the ICF missions specified above under separate funding.

Project Milestones:

FY 2004	Establish Performance Baseline / Approve CD-2/3	Q2
FY 2005	Grating Tiling Assembly / Mounts Complete	Q1
FY 2007	Beam 1 fired at low power	Q2
FY 2007	First light to EP TC	Q3
FY 2009	Beam 2 fired at low power	Q2
FY 2009	First light to OMEGA TC	Q1
FY 2009	Achieve laser performance requirements	Q4
FY 2009	Approval of CD-4	Q4

4. Details of Cost Estimate

	(dollars in thousands) Current Estimate	Previous Estimate
Laser Construction Phase		
Special Equipment:		
Laser Sources	4,366	N/A
Laser Amplifiers	3,530	N/A
Power Conditioning	3,655	N/A
Optomechanical Beamlines	12,016	N/A
Experimental Systems	10,219	N/A
Control Systems	5,538	N/A
Total, Special Equipment (58.7% of TEC)	39,324	N/A
Project Office (23.8% of TEC)	15,958	N/A
Total, Laser Construction Costs (82.5% of TEC)	55,282	N/A
Contingency (17.5% of TEC)	11,718	N/A
Total, OMEGA EP (TEC)	67,000	N/A

5. Method of Performance

LLE will execute the project under the terms of the current cooperative agreement with between the University of Rochester and NNSA. LLE's make-or-buy decisions will be made on the basis of cost, schedule, quality, and technical performance. Vendors will be selected based on their ability to offer the best combination of these metrics with the highest probability of success. The preferred method of procurement will be competitive outsourcing using the University's DOE-approved purchasing system. If a satisfactory item or service is not available off-the-shelf, LLE's decision will be to either manufacture to specification, manufacture to print, or make in-house.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2003	FY 2004	FY 2005	Outyears	Total
Project Costs						
Total Estimated Cost	0	13,000	21,000	6,000	27,000	67,000
Other Project Costs						
Conceptual design cost	2,000	0	0	0	0	2,000
NEPA documentation costs	0	2,400	3,300	3,000	0	8,700
Total Other Project Costs	2,000	2,400	3,300	3,000	0	10,700
Total Project Cost (TPC)	2,000	15,400	24,300	9,000	27,000	77,700

7. Related Annual Funding Requirements

(FY 2009 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs	5,000	N/A
Total related annual funding	5,000	N/A

Advanced Simulation and Computing Campaign

Funding Schedule by Activity

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Advanced Simulation and Computing Campaign					
Advanced Applications Development	139,380	144,226	150,793	+ 6,567	+ 4.6%
Verification and Validation	40,116	47,675	49,780	+ 2,105	+ 4.4%
Materials and Physics Modeling	66,304	69,291	72,062	+ 2,771	+ 4.0%
Problem Solving Environment (PSE)	38,170	43,982	45,072	+ 1,090	+ 2.5%
Distance Computing (DisCom)	14,803	16,514	17,068	+ 554	+ 3.4%
Pathforward	12,703	17,800	18,000	+ 200	+ 1.1%
Visual Interactive Environment for Weapons Simulation (VIEWS)	57,588	59,791	61,635	+ 1,844	+ 3.1%
Physical Infrastructure & Platforms	76,339	106,977	140,000	+ 33,023	+ 30.9%
Computational Systems	63,883	62,091	64,081	+ 1,990	+ 3.2%
Simulation Support	57,861	58,437	59,413	+ 976	+ 1.7%
Advanced Architectures	3,500	0	3,000	+ 3,000	+ 0.0%
University Partnerships	43,396	47,687	47,980	+ 293	+ 0.6%
ASCI Integration	6,219	9,826	9,148	- 678	- 6.9%
Construction Projects	54,191	37,079	3,228	- 33,851	- 91.3%
Total, Advanced Simulation and Computing Campaign..	674,453	721,376	741,260	+ 19,884	+ 2.8%

FYNSP Schedule

(dollars in thousands)

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FYNSP Total
Advanced Simulation and Computing Campaign						
Advanced Applications Development	150,793	159,579	166,671	174,080	181,821	832,947
Verification and Validation................	49,780	53,812	56,143	58,579	61,126	279,440
Materials and Physics Modeling.....	72,062	76,304	79,693	83,234	86,936	398,229
Problem Solving Environment (PSE) ..	45,072	47,051	49,119	51,279	53,537	246,058
Distance Computing (DisCom)................	17,068	17,532	18,018	18,525	19,055	90,198
Path forward...........	18,000	15,000	15,000	15,000	15,000	78,000
Visual Interactive Environment for Weapons Simulation (VIEWS).................	61,635	63,374	65,191	67,088	69,073	326,361

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FYNSP Total
Physical Infrastructure & Platforms................	140,000	164,000	170,000	165,000	165,000	804,000
Computational Systems.................	64,081	65,239	74,241	71,686	69,111	344,358
Simulation Support ..	59,413	60,555	69,540	66,962	64,303	320,773
Advanced Architectures	3,000	3,000	3,000	3,000	3,000	15,000
University Partnerships	47,980	48,564	49,175	49,812	50,479	246,010
ASCI Integration......	9,148	7,499	9,914	9,915	9,915	46,391
Construction...........	3,228	0	0	0	0	3,228
Total, Advanced Simulation and Computing Campaign..............	741,260	781,509	825,705	834,160	848,359	4,030,993

Description

The Advanced Simulation and Computing (ASCI) Campaign's vision for the future is to predict, with confidence, the behavior of Nuclear Weapons, through comprehensive, science-based simulations. In order to achieve this state, ASCI provides leading edge, high-end simulation capabilities needed to meet weapons assessment and certification requirements. These capabilities include developing weapon codes, weapon science, platforms, computer facilities and the necessary support to make the system operate together.

ASCI investments are leveraged with other federal agencies and industrial partners. High-end computing collaborations include: joint efforts with the DOE Office of Science; participation in interagency efforts including DARPA High Productivity Computing Systems, High-End Computing Revitalization Task Force, and the Interagency High-End Computing working group; collaboration through new DoD/DOE/NNSA Memorandum of Understanding; collaboration with the NSA; work with industrial partners on selected path-forward activities.

Benefits to Program Goal 01.31.00.00 Advanced Simulation and Computing

Within the Advanced Simulation and Computing program, 14 subprograms each make unique contributions to Program Goal 01.31.00.00. These include developing weapon codes, weapon science, platforms, computer facilities and the necessary support to make the system operate together.

Annual Performance Results and Targets

FY 2000 Results	FY 2001 Results	FY 2002 Results	FY 2003 Results
Demonstrate a computer code capable of performing a three-dimensional analysis of the dynamic behavior of a nuclear weapon primary, including a prediction of the total explosive yield, on an Accelerated Strategic Computing Initiative (ASCI) computer system. (EXCEEDED GOAL)	Meet the FY 2001 ASCI Program Plan milestones for development of modeling and simulation tools and capabilities required for design and certification of the nuclear weapons stockpile. (MET GOAL)	Perform a prototype calculation of a full weapon system with three-dimensional engineering features. (MET GOAL)	There were no related targets.

Annual Performance Results and Targets

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Peer-reviewed progress, according to a schedule in the Advanced Simulation and Computing (ASCI) Campaign Program Plan, toward a validated full-system, high fidelity simulation capability	Completed sufficient milestones to achieve enhanced primary, focused secondary physics capability, and Q user environment.	Complete sufficient milestones to achieve high-fidelity primary simulation and Stockpile to Target Sequence (STS) abnormal environments.	Complete sufficient milestones to achieve high fidelity secondary simulation, Initial Validated (IV) STS hostile environment, IV high-fidelity physics primary, and Red Storm [40 trillions of operations per second (TeraOPS)] user environment.	Complete sufficient milestones to achieve IV focused, high-fidelity physics secondary, and Purple (100 TeraOPS) user environment.	Complete sufficient milestones to achieve IV STS normal environment.	Complete sufficient milestones to achieve initial high-fidelity physics, full-system, Coupled STS abnormal environment, and 200T user environment.	Complete modern baseline of all enduring stockpile systems.	Ongoing
Number of weapon system components, primary/secondary/ engineering system, analyzed using ASCI codes, as part of annual assessments & certifications	Analyzed 7 of 31 weapon systems.	Analyze 10 of 31 weapon systems.	Analyze 12 of 31 weapon systems.	Analyze 16 of 31 weapon systems.	Analyze 21 of 31 weapon systems.	Analyze 27 of 31 weapon systems.	Analyze 30 of 31 weapon systems.	For current measure--31 weapon systems FY 2010
The maximum individual platform computing capability delivered, measured in trillions of operations per second (TeraOPS)	Attained maximum individual platform	Attain maximum individual platform capacity of 40	Attain maximum individual platform capacity of 100	Complete the initial 25% of deliverables towards delivery	Attain maximum individual platform capacity of 200		Attain maximum individual platform capacity of 350	Ongoing

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
per second (TeraOPS)	platform capacity of 20 TeraOPS (with 22 TeraBytes (TB) memory & 400 TB storage.	capacity of 40 TeraOPS (with 10 TB memory & 240 TB storage.	capacity of 100 TeraOPS (with 50 TB memory & 1 PetaByte (PB) storage.	towards delivery of the 200 TeraOPS system.	capacity of 200 TeraOPS (with 100 TB memory & 4 PB storage.		capacity of 350 TeraOPS.	
Total capacity of ASCI production platforms attained, measured in TeraOPS, taking into consideration procurements & retirements of systems	Attained total production platform capacity of 41 TeraOPS.	Attain total production platform capacity of 75 TeraOPS.	Attain total production platform capacity of 172 TeraOPS.	Attain total production platform capacity of 160 TeraOPS.	Attain total production platform capacity of 360 TeraOPS.	Attain total production platform capacity of 470 TeraOPS.	Attain total production platform capacity of 980 TeraOPS.	Ongoing total capacity of 360 TeraOPS FY 2007
Average cost per TeraOPS of delivering, operating, & managing all Stockpile Stewardship Program production systems in a given fiscal year (EFFICIENCY MEASURE)	Attained average cost of $11.64 M.	Attain average cost of $8.15 M.	Attain average cost of $5.7 M.	Attain average cost of $3.99 M.	Attain average cost of $2.79 M.	Attain average cost of $1.96M.	Attain average cost of $1.37 M.	Ongoing

Detailed Justification

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Advanced Applications Development	**139,380**	**144,226**	**150,793**

Develops enhanced three-dimensional (3-D) computer codes that provide an unprecedented level of physics and geometric fidelity for full-system, component, and scenario weapons simulations. Delivers these weapons performance, safety, and engineering simulation tools for validation and subsequent use by weapons designers and experimentalists to support the Stockpile Stewardship Program (SSP). Improves, not only the code capabilities, but also the performance and efficiency of the codes on the massively parallel platforms procured by ASCI. FY 2005 activities include initial Directed Stockpile Work (DSW) secondary baseline development and 3-D ASCI simulations supporting a Dual-Axis Radiography Hydrodynamic Test (DARHT) certification experiment, as well as enhanced 3-D primary simulation capability to support Life Extension Programs (LEPs) and demonstration of full-system weapon simulation capability. Also, in FY 2005, applications will deliver new code capabilities for aerodynamics Micro-systems and new algorithms for scalable multi-level solvers are planned.

Verification and Validation (V&V)...............................	**40,116**	**47,675**	**49,780**

Develops and Implements tools to rigorously assess accuracy in physics modeling and computational simulations in order to establish confidence in the simulation used for nuclear weapon certification and for resolving high consequence nuclear stockpile problems. Activities in FY 2005 include: assess the accuracy of improved fidelity engineering shock response calculations; deliver complete end-to-end calculations of a nuclear weapon test for at least two stockpile systems, with the emphasis on validation of the secondary modeling; complete a focused quantitative V&V assessment of the physics and simulation capability used for Enhanced Primary and Complex Safety calculations; support the stockpile life extension program by assessing the computational capabilities supporting development of the W80 system and emphasize capabilities to evaluate two required safety themes. Focus on providing a complete analysis of a primary implosion and burn calculation for at least one stockpile system. Support the W76-1 LEP by conducting validation for blast/impulse in hostile environment.

Materials and Physics Modeling (M&PM)..................	**66,304**	**69,291**	**72,062**

Develops models for physics, material properties and transport processes, which are essential to the simulation of weapons under all conditions relevant to their life cycle. This activity provides the theory, analysis, and modeling necessary to develop such models for integration into advanced application codes. In FY 2005, implementation into ASCI codes of improved failure models validated for several specific materials is planned.

Problem Solving Environment (PSE)............................	**38,170**	**43,982**	**45,072**

Develops a computational infrastructure to allow ASCI applications to execute efficiently on ASCI computing platforms and allows accessibility to these platforms from the scientists' desktops. This computational infrastructure includes local-area networks, wide-area networks, advanced storage facilities, and software development tools. In FY 2005, there will be intensive development, deployment and testing of equipment and systems to enable user environments for the ASCI Red Storm, Purple, Blue Gene (G/L) and Linux clusters.

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Distance Computing (DISCOM)	**14,803**	**16,514**	**17,068**

Provides secure, high-speed remote access to ASCI platforms. This distance capability involves the creation of a high-speed, parallel secure architecture (both hardware and software); development and implementation of monitoring and testing capabilities; as well as development of service applications and user support. It also entails partnering with the PSE and VIEWS program elements to integrate services and security functions necessary for efficient remote access. In FY 2005, general release of the ASCI Red Storm distance-computing environment is planned. Additionally, delivery of communication technologies to efficiently integrate ASCI Purple and Blue G/L is planned.

Pathforward..	**12,703**	**17,800**	**18,000**

Stimulates U.S. computer industry in the development and engineering of technology areas such as interconnects, runtime system, visualization, storage, and advanced commercial-off-the-shelf (COTS) technologies needed for future ASCI-class computer systems. Emphasis in FY 2005 will be on file systems, optical switching technology, and open source software needed for future ASCI systems.

The optical switch technology is co-funded hardware with the National Security Agency. Ongoing collaboration with the DOE Office of Science in open source software is important to the application of open source software to high-end computing.

Visual Interactive Environment for Weapon Simulation (VIEWS)..	**57,588**	**59,791**	**61,635**

Research, development, engineering, deployment, and applications support of visualization, data management, and data exploration technology and services to support needs of the nuclear weapon design and analysis community. Equipment procured and deployed includes data and visualization services, archival storage, office displays and visualization facilities. VIEWS staff provide general tool and specialized data analysis support to designers and analysts. There is a large research and development component in VIEWS to develop new capabilities for quantitative and comparative analysis and simulations data discovery to meet future needs of the program. In FY 2005, the deployment of a visualization capability for ASCI Red Storm, Purple and Blue G/L is planned. A specific research and development effort planned will deliver an integrated parallel rendering framework to support ASCI Purple. In addition, a web-based tool will be deployed to improve the efficiency of simulation scientists.

Physical Infrastructure and Platforms (PI&P)............	**76,339**	**106,977**	**140,000**

Acquires the computational platforms to support the Stockpile Stewardship Program. The ASCI Q and subsequent platform contracts include a five-year maintenance contract in the acquisition cost. In FY 2005, the 20 teraOPS ASCI Q will continue to operate as a tri-lab resource; the 40 teraOPS Red Storm system will begin integration and acceptance; and the 100 teraOPS ASCI Purple is scheduled for full delivery and installation.

Computational Systems	**63,883**	**62,091**	**64,081**

(dollars in thousands)

	FY 2003	FY 2004	FY 2005

Provides the production computational and data storage systems and their networking infrastructure at the three NNSA laboratories. This includes the systems management personnel, maintenance contracts, and capital operating equipment. Maintenance for pre-Q platforms is included in this program element. Efforts in FY 2005 will emphasize different phases of major platform integration into the SSP computational complex. Los Alamos National Laboratory (LANL) will be providing tri-lab computational support on the Q machine. At Sandia National Laboratory (SNL), the Red Storm system will be in its integration phases, and at the Lawrence Livermore National Laboratory (LLNL), delivery and integration of the full Purple system will be the focus. Also in FY 2005, LLNL will be activating the Terascale Simulation Facility (TSF) as the Livermore Computing Center is moved to the new facility.

Simulation Support	**57,861**	**58,437**	**59,413**

Provides support services for computing, data storage, networking, and their users. This includes facilities and operations of the computer centers, user help desk services, training, and software environment development that supports the accessible and reliable operation of high-performance, institutional, and desktop computing resources at the three NNSA laboratories. Emphasis in FY 2005 will be on developing and providing support infrastructure for Red Storm and Purple.

Advanced Architectures	**3,500**	**0**	**3,000**

Addresses the long-term platform risk issues of cost, power, performance and size by studying alternative architectures that have the potential to make future ASCI platforms more cost effective.

Funding in FY 2004 was zeroed in order for the Integrated Computing Systems portion of the program (Physical Infrastructure and Platforms, Computational Systems, Simulation Support and Advanced Architectures) to focus on the Purple and Red Storm procurements. In FY 2005, emphasis will be placed on studying these alternative and Advanced Architectures.

University Partnerships	**43,396**	**47,687**	**47,980**

Funds activities associated with the ASCI Academic Strategic Alliances Program through which five universities are developing new computational frameworks while they pursue scientific advances in several areas that are similar in size, scope and complexity to the stewardship simulation efforts. This effort also funds doctoral fellowships in computational science, as the number of U.S. citizen graduates is otherwise insufficient to meet the increasing ASCI program demands. The ASCI Computer Science Institutes serve as focal points for laboratory-university interactions and foster advanced scientific research at the laboratories. ASCI co-funds the development of critical skills in the area of computational science with the DOE Office of Science.

ASCI Integration...	**6,219**	**9,826**	**9,148**

Supports the One Program/Three Laboratory integration strategy for collaborations across the three laboratories including strategic planning outreach and crosscuts. Specific examples of activities funded include: program wide technical project reviews, Alliance interaction support, implementation and program plan production and contracts office support. Supports Supercomputing Conference research exhibits.

	FY 2003	FY 2004	FY 2005
	(dollars in thousands)		
ASCI Construction..	**54,191**	**37,079**	**3,228**

New Computational Facilities to house the computational capabilities are reaching completion in FY 2005 as well as final funding for the Terascale Simulation Facility (TSF). This profile reflects the approved Project Execution Plans.

Total, Advanced Simulation and Computing Campaign..	**674,453**	**721,376**	**741,260**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
Advanced Applications Development This increase reflects emphasis on development of the codes' capabilities, as well as performance and efficiency of the codes on the ASCI platforms	+ 6,567
Verification and Validation (V&V) As development of the ASCI codes mature, verification and validation becomes a more prevalent part of the process. The increase in FY 2005 reflects more V&V involvement	+ 2,105
Materials and Physics Modeling (M&PM) The increase supports realization of more complete and complex physics in simulation codes	+ 2,771
Problem Solving Environment (PSE) The increase is related to the additional work associated with the installation of several new platforms and enabling the computing environment for each of those platforms	+ 1,090
Distance Computing (DISCOM) The increase can be attributed to the ongoing need to maintain the network among the labs	+ 554
Visual Interactive Environment for Weapons Simulation (VIEWS) The increase can be attributed to the ongoing need to maintain and develop visualization capabilities at the labs as new platforms come on-line	+ 1,844
Physical Infrastructure and Platforms This increase funds the current procurement of the 40 teraflop ASCI Red Storm (SNL) and 100 teraflop ASCI Purple (LLNL) platforms. This increase in computational capability will allow the improving, modern ASCI codes to be more readily applied to the life extension programs activities and the SSP mission in general	+ 33,023
Computational Systems The increase provides for the integration of several platforms at various stages of delivery and installation, as well as operations of the new Terascale Simulation facility	+ 1,990
Simulation Support The increase reflects the increased requirement for supporting a network with several platforms at various stages of delivery and installation	+ 976

	FY 2005 vs. FY 2004 ($000)
▪ **Advanced Architectures**	
The increase in funding reflects the restart of this program to study alternative computational architectures	+ 3,000
▪ **University Partnerships**	
The increase in funding demonstrates the intent to maintain current level of effort.	+ 293
▪ **ASCI Integration**	
The decrease in funding allows for necessary increases in other ASCI activities	- 678
▪ **ASCI Construction**	
The decrease reflects reductions in funding for completion of the Distributed Information Simulation Laboratory (DISL) and the final year of funding for the Terascale Simulation Facility, in-accordance with the approved Project Execution Plans	- 33,851
Total Funding Change, Advanced Simulation and Computing Campaign	+ 19,884

Capital Operating Expenses and Construction Summary

Capital Operating Expenses [a]

(Dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
General Plant Projects	4,492	4,627	4,766	+ 139	+ 3.0%
Capital Equipment	71,225	73,362	75,563	+ 2,201	+ 3.0%
Total, Capital Operating Expenses	75,717	77,989	80,329	+ 2,340	+ 3.0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior-Year Approp-riations	FY 2003	FY 2004	FY 2005	Unappro-priated Balance
00-D-103, Terascale Simulation Facility (TSF)	91,101	28,859	34,014	24,852	3,228	0
00-D-107, Joint Computational Engineering Laboratory (JCEL)	28,811	21,855	6,956	0	0	0
01-D-101, Distributed Information Systems Laboratory, (DISL)	36,216	10,695	13,221	12,227	0	0
Total, Construction			54,191	37,079	3,228	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2004 and FY 2005 funding shown reflects estimates based on actual FY 2003 obligations.

00-D-103, Terascale Simulation Facility, Lawrence Livermore National Laboratory, Livermore, California

Significant Changes

The original FY 2003 appropriation was $35,030,000. This was reduced by $222,000 by a rescission and $794,000 by the Weapons Activities general reduction enacted by P.L. 108-7, FY 2003 Omnibus Appropriations Act, Title VI. The TEC and TPC were reduced accordingly.

1. Construction Schedule History

	Fiscal Quarter				Total Estimated Cost ($000)	Total Project Cost ($000)
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
FY 2000 Budget Request *(Preliminary Estimate)*	2Q 2000	2Q 2001	4Q 2000	4Q 2004	83,500	86,200
FY 2001 Budget Request ...	3Q 2000	3Q 2001	4Q 2001	2Q 2006	89,000	92,200
FY 2002 Budget Request	1Q 2001	1Q 2002	2Q 2002	2Q 2006	88,900	92,100
FY 2003 Budget Request *(Title I Baseline)*	1Q 2001	1Q 2002	3Q 2002	4Q 2006	92,117	95,317
FY 2004 Budget Request	1Q 2001	1Q 2002	3Q 2002	4Q 2006	92,117	95,317
FY 2005 Budget Request *(Current Baseline Estimate).*	1Q 2001	1Q 2002	3Q 2002	4Q 2006	91,101	94,301

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2000	1,970 [a]	1,970	200
2001	4,889 [b] [c]	4,889	4,642
2002	22,000	22,000	12,092
2003	34,014 [d]	34,014	41,180
2004	25,000 [e]	25,000	29,627
2005	3,228	3,228	2,920
2006	0	0	440

3. Project Description, Justification, and Scope

Description

The project provides for the design, engineering and construction of the Terascale Simulation Facility (TSF - Building 453) which will be capable of housing the 100 TeraOps-class computers required to meet the milestones and objectives of the Advanced Simulation and Computing (ASCI) Campaign (previously the Accelerated Strategic Computing Initiative). The building will encompass approximately 253,000 square feet and will contain a multi-story office tower with an adjacent computer center. The Terascale Simulation Facility (TSF) proposed here is designed from inception to enable the very large-scale weapons simulations essential to ensuring the safety and reliability of America's nuclear stockpile. The timeline for construction is driven by requirements coming from the ASCI Campaign within the

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[a] Original appropriation of $8,000,000 was reduced by $30,000 for the FY 2000 rescission enacted by P.L. 106-113 and the remaining value of $7,970,000 was reduced by $6,000,000 as a result of a reprogramming action to fund Stockpile-related workload issues at Los Alamos National Laboratory (LANL).

[b] Appropriation of $5,000,000 was reduced by $100,000 by the Safeguards and Security (S&S) amendment. The comparable S&S amount for FY 2000 for this project was $39,000; the comparable appropriation amount was $1,931,000.

[c] Revised appropriation was $4,900,000. This was reduced by $11,000 by a rescission enacted by Section 1403 of the FY 2001 Consolidated Appropriations Act. There is no change to the TEC due to a corresponding increase to the FY 2005 appropriation amount.

[d] Original appropriation was $35,030,000. This was reduced by $222,000 by a rescission and $794,000 by the Weapons Activities general reduction enacted by P.L. 108-7, FY 2003 Omnibus Appropriations Act, Title VI. The TEC and TPC were reduced accordingly.

[e] The FY 2004 appropriated amount has not been adjusted for the FY 2004 Congressional Omnibus Appropriations Bill rescission of .59 percent.

Stockpile Stewardship Program (SSP). The TSF will house the computers, the networks and the data and visualization capabilities necessary to store and understand the data generated by the most powerful computing systems in the world.

Justification

The Advanced Simulation and Computing (ASCI) Campaign has as its mission the acceleration of simulation to meet the demands of the nation's nuclear defense mission. The challenge is to maintain confidence in the nuclear stockpile without nuclear testing. Along with sub-critical experiments, one of the primary tools employed will be three-dimensional (3-D) scientific weapons calculations of unprecedented computational scope. As has been emphasized in the ASCI Campaign Program Plan, it is the rapid aging of both the stockpile and the designers with test experience that is at the heart of the issue and the reason for acceleration. The most critical period is between 2003 and 2010. By 2003, the number of designers with test experience will be reduced by about 50 percent from 1990. By 2010, the percentage will be further reduced (to about 15 percent). By 2003, most of the weapons in the stockpile will be in transition from their designed field life to beyond field life design. By 2010, about half will be in the beyond-field-life design stage. Therefore, some validated mechanism or capability must be available soon to certify the safety and reliability of this aging stockpile. A major element of this capability will be the ASCI applications codes and the associated terascale simulation environment. The ASCI Ccampaign intends by the middle of the decade, to reach a threshold state simulation capability in which the first functional "full system calculation" generation of codes requiring a 100+ TeraOps computer will be used to certify the stockpile. The remaining designers and analysts with test experience will be an indispensable part of this process, because they will validate the models and early simulation results.

The ASCI applications codes and the weapons analysts who make use of these applications require a supporting simulation infrastructure of major proportions, which includes:

1. Terascale computing platforms (ASCI Platforms)
2. A supporting numerical environment consisting of data management, data visualization and data delivery systems (Visual Interactive Environment for Weapons Simulation)
3. Sophisticated computer science and numerical methods research and development teams (ASCI Problem Solving Environment (PSE) and Alliances)
4. A first rate operations, user services and systems team
5. Data and visualization corridor capability including data assessment theaters, high performance desktop visualization systems and other innovative technologies.

To house, organize and manage these simulation systems and services requires a new facility with sufficient electrical power, mechanical support, networking infrastructure and space for computers and staff. The proposed TSF at LLNL will meet these requirements.

Scope

The TSF project will construct a building (Building 453) of approximately 253,000 square feet located adjacent to an existing (but far less capable) computer facility, Building 451, on the LLNL main site. The building will contain a multi-story office tower with an adjacent computer center. The computer center will house computer machine rooms totaling approximately 47,500 square feet. The computer machine rooms will be clear span (without impediments) and of an aspect ratio designed to minimize the maximum distance between computing nodes and switch racks. The ceiling height will be sufficiently high to assure proper forced air circulation. A raised access floor will be provided in order to allow adequate room for air circulation, cabling, electrical, plumbing, and fire/leak detection equipment.

The first computer structure will be available for occupancy in FY 2004. The building will be initially built with enough power and cooling to support two terascale systems, the first to be installed in FY 2004. As a risk reduction strategy, the building will be further designed so that power and mechanical resources can be easily added in the event that systems sited in the future will require higher levels of power. However, it is expected that by the middle of the decade the rate of growth of the peak capability of installed computers will relax. Therefore, the building should have enough power and cooling to accept any system procured after that time.

The TSF will include meeting rooms, offices, and a data and visualization capability. Scientists will be able to utilize innovative visualization technologies, including an Assessment Theater. The theater will be used for both prototyping advanced visualization concepts and ongoing data analysis and data assimilation by weapons scientists. In short, the theater represents the area where physical and computer scientists, working together, will visualize and make accessible to the human eye and mind the huge data sets generated by the computers. This will allow workers to understand and assess the status of the immensely complex weapons systems being simulated.

The office space will accommodate staff and scientists who require access to both classified and unclassified workstations. Vendors, and operational and problem solving environment staff must have immediate access to computer systems, since the simulation environment will require very active support. A key principle underlying all TSF planning is tight coupling between stockpile stewardship elements and the platforms. Thus, the TSF will also house the nucleus of the classified and unclassified (LabNet) networks. To assure the efficient operation of remote Assessment Theaters high speed networking hubs will connect the computers seamlessly to key weapons scientists and analysts at the highest performance available.

Office space vacated by the completion of TSF will be returned to the institution through Space & Site Planning for reassignment or demolition, depending on site-wide needs and the quality of available facilities at that time. Specific impacts of TSF vacancies occurring in FY 2004 to FY 2006 cannot be directly identified at this time, but will be administered by this process and subject to reporting and oversight of the NNSA Livermore Site Office.

Project Milestones

FY 2004:	Computer Area One Complete	3Q
FY 2005:	Office Tower Complete	3Q
FY 2006:	Computer Area Two Complete	3Q

4. Details of Cost Estimate

	(dollars in thousands) Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs (Design Drawings and Specifications – $4,800)	5,640	5,640
Design Management Costs (0.9% of TEC)	810	810
Project Management Costs (0.6% of TEC)	504	504
Total Design Costs (7.6% of TEC)	6,954	6,954
Construction Phase		
Improvements to Land	1,680	1,510
Buildings	56,190	51,880
Utilities	9,825	9,630
Standard Equipment	0	0
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	4,480	4,516
Construction Management (5.7% of TEC)	5,190	5,175
Project Management (3.5% of TEC)	3,150	3,402
Total Construction Costs (88.4% of TEC)	80,515	76,113
Contingencies		
Design Phase (0% of TEC)	0	0
Construction Phase (4.0% of TEC).	3,632	9,050
Total Contingencies (4.0% of TEC)	3,632	9,050
Total, Line Item Costs (TEC) [a]	91,101	92,117

5. Method of Performance

Design was performed under a negotiated best value architect/engineer contract. Construction and procurement shall be accomplished by fixed-price contracts based on competitive bidding and best value award.

[a] Escalation rates are taken from the DOE Construction Project and Operating Expense Escalation Rate Assumptions, dated January 2001.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2003	FY 2004	FY 2005	Outyears	Total
Project Cost						
Facility Costs						
Design	6,842	0	112	0	0	6,954
Construction	10,092	41,180	29,515	2,920	440	84,147
Total, Line item TEC	16,934	41,180	29,627	2,920	440	91,101
Total Facility Costs (Federal and Non-Federal)	16,934	41,180	29,627	2,920	440	91,101
Other Project Costs						
Conceptual design costs	1,300	0	0	0	0	1,300
NEPA documentation costs	150	0	0	0	0	150
Other project-related costs [a]	930	0	335	280	205	1,750
Total, Other Project Costs	2,380	0	335	280	205	3,200
Total Project Cost (TPC)	19,314	41,180	29,962	3,200	645	94,301

7. Related Annual Funding Requirements

(FY 2006 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs [b]	1,500	1,500
Programmatic operating expenses directly related to the facility [c]	56,200	56,200
Utility costs [d]	8,500	8,500
Total related annual funding (operating from FY 2006 through FY 2025)	66,200	66,200

[a] Including tasks such as Project Execution Plan, Pre-Title I Development, Design Criteria, Safeguards and Security Analysis, Architect/Engineer Selection, Value Engineering Study, Independent Cost Estimate, Energy Conservation Report, Fire Hazards Assessment, Site Surveys, Soil Reports, Permits, Administrative Support, Operations and Maintenance Support, ES&H Monitoring, Operations Testing, Energy Management Control System Support, Readiness Assessment.

[b] Facility operating costs are approximately $ 1,500,000 per year (which also includes facility maintenance and repair costs), when facility is operational in 4th Qtr. FY 2006. Costs are based on the LLNL internal indirect rate Laboratory Facility Charge (LFC) for facility operating costs.

[c] The annual operating expenses for the Terascale Simulation Facility are estimated at $ 56,200,000 based on representative current operating expenses of 300 personnel. The majority of this funding is expected to come from NNSA for activities in support of the nuclear weapons stockpile.

[d] Costs are based on LLNL utility recharge rates.

Pit Manufacturing and Certification Campaign

Funding Schedule by Activity

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Pit Manufacturing and Certification Campaign					
W88 Pit Manufacturing.......	109,871	125,035	132,005	+ 6,970	+ 5.6%
W88 Pit Certification...........	105,055	108,592	101,470	- 7,122	- 6.6%
Pit Manufacturing Capability...........................	1,159	10,000	20,992	+ 10,992	+ 109.9%
Modern Pit Facility...............	4,242	10,810	29,800	+ 18,990	+ 175.7%
Pit Campaign Support Activities at NTS................	41,480	42,353	52,206	+ 9,853	+ 23.3%
Total, Pit Manufacturing and Certification Campaign....................................	261,807	296,790	336,473	+ 39,683	+ 13.4%

FYNSP Schedule

(dollars in thousands)

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FYNSP Total
Pit Manufacturing and Certification Campaign						
W88 Pit Manufacturing..	132,005	132,645	139,870	0	0	404,520
W88 Pit Certification......	101,470	88,861	45,310	15,760	0	251,401
Pit Manufacturing Capability......................	20,992	23,252	34,430	37,385	53,000	169,059
Modern Pit Facility.........	29,800	43,291	94,570	101,434	105,168	374,263
Pit Campaign Support Activities at NTS...........	52,206	35,459	0	0	0	87,665
Total, Pit Manufacturing and Certification Campaign.....................	336,473	323,508	314,180	154,579	158,168	1,286,908

Description

The Pit Manufacturing and Certification Campaign goal is to restore the capability and some limited capacity to manufacture pits of all types required by the nuclear weapons stockpile including planning the design and construction of a Modern Pit Facility (MPF) to support long-term pit manufacturing.

Benefits to Program Goal 01.32.00.00 Pit Manufacturing and Certification

Within the Pit Manufacturing and Certification program, the W88 Pit Manufacturing, W88 Pit Certification, Pit Manufacturing Capability, and Modern Pit Facility (MPF) subprograms each make unique contributions to Program Goal 01.32.00.00. The W88 Pit Manufacturing subprogram goal is to restore the capability to produce W88 pits in limited quantities. The W88 Pit Certification subprogram goal is to confirm the nuclear performance of the W88 pit without underground nuclear testing through a required set of engineering tests and physics experiments in addition to a comprehensive analytical effort to develop a computational baseline that will provide confidence in future simulation capability. The Pit Manufacturing Capability subprogram goal is to establish technologies for the production of the W87 and B61-7 pits. The Modern Pit Facility subprogram goal is to design and build an agile pit manufacturing infrastructure with sufficient capability to provide for the long-term safety and reliability of the Nation's nuclear weapon stockpile. An interim pit manufacturing capability of 10-20 pits per year is currently being re-established at Los Alamos National Laboratory (LANL), but this capability will not be sufficient to support the long-term requirements of the nuclear weapons deterrent.

Annual Performance Results and Targets

FY 2000 Results	FY 2001 Results	FY 2002 Results	FY 2003 Results
There were no related targets.	There were no related targets.	There were no related targets.	There were no related targets.

Annual Performance Results and Targets

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Number of W88 pits manufactured	-Manufactured first certifiable pit and 1 qualification pit (total 2). -Issued Engineering Release to document completion of the pit qualification plan.	Manufacture 6 certifiable pits (total 8 pits).	Manufacture 6 certifiable pits (total 14 pits).	Manufacture 7 certifiable pits (total 21 pits).	Manufacture 1 War Reserve pit (total 22 pits).			Manufacture 22 Pits FY 2007
Cumulative percentage of major milestones, documented in the Pit Manufacturing and Certification Campaign Program Plan, completed on/ahead of schedule toward restoration of capability to manufacture the pit types in the enduring stockpile in FY 2009 and manufacture initial Engineering Development Units (EDUs) in FY 2012	Implemented integrated technology plan to support recapture of pit manufacturing capability.	Complete initial 5% of major manufacturing capability milestones.	Complete 15% (total 20%) of major manufacturing capability milestones.	Complete 15% (total 35%) of major manufacturing capability milestones.	-Complete 20% (total 55%) of major manufacturing capability milestones. -Establish robust 10 pits per year manufacturing capacity for W88 pits TA-55 at Los Alamos National Laboratory (LANL).	Complete 20% (total 75%) of major manufacturing capability milestones.	Complete 25% (total 100%) of major manufacturing capability milestones.	Establish capability to manufacture the pit types in the enduring stockpile in FY 2009. Manufacture EDUs for B61 and W87 pits by FY 2012

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Cumulative percentage of major milestones, documented in the Pit Manufacturing & Certification Campaign Program Plan, completed on/ahead of schedule toward FY 2007 W88 Pit Certification	-Completed required engineering certification tests. -Established pit certification peer review process.	Complete 25% of major milestones.	Complete 25% (total 50%) of major milestones.	Complete 25% (total 75%) of major milestones.	-Complete 25% (total 100%) of major milestones. -Issue a major assembly release (MAR) for LANL-built W88 pits.	Complete documentation archives on W88 pit certification.	N/A	Issue a major assembly release (MAR) for LANL-built W88 pits.
Cumulative percentage of major milestones, documented in the Pit Manufacturing & Certification Campaign Program Plan, completed on/ahead of schedule toward completion of the Modern Pit Facility (MPF) (EFFICIENCY MEASURE)	-Completed Draft Environmental Impact Statement for MPF. -Initiated conceptual design of the MPF.	Complete initial 20% of the major milestones required for Critical Decision (CD)-1 approval.	Complete 30% (total 50%) of the major milestones required for CD-1 approval.	Complete 40% (total 90%) of the major milestones required for CD-1 approval.	-Complete 10% (total of 100%)of the major milestones required for CD-1 approval. -Obtain approval of CD-1.	Complete initial 40% of the major milestones required for CD-2 approval.	-Complete 60% (total 100%) of the major milestones required for CD-2 approval. -Obtain approval of CD-2.	Operations startup in 2019. Full production capability achieved in 2021.
Completion of Nevada Test Site (NTS) milestones, documented in the Pit Manufacturing & Certification Campaign Program Plan, completed on/ahead of schedule toward execution of Los Alamos National Laboratory (LANL) major subcritical experiment (SCE) activities in support of the Pit Campaign	Completed all FY 2003 milestones in support of the planned SCEs.	Complete all FY 2004 milestones in support of the planned SCEs.	Complete all FY 2005 milestones in support of the planned SCEs.	Complete all FY 2006 milestones in support of the planned SCEs.				Complete all major SCE activities FY 2006

Detailed Justification

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
W88 Pit Manufacturing	**109,871**	**125,035**	**132,005**

Following the manufacture of six certifiable W88 pits in FY 2004, at least six certifiable W88 pits will be manufactured in FY 2005. These pits will be used in tests needed to support the goal of FY 2007 W88 pit certification. Restoring the capability to manufacture and certify pits for the nuclear stockpile remains a central challenge of the stockpile stewardship program. Test items other than pits to be used in certification tests will also be manufactured. Additionally, the increased funding for the project supports a multi-year effort by the National Nuclear Security Administration (NNSA) to reorganize activities and process lines at the TA-55 plutonium facility as well as purchase and install new and/or backup equipment necessary to support achievement of a sustained W88 manufacturing capacity. The increased funding also provides for essential improvements to the quality infrastructure to ensure consistency and quality of product at a sustained manufacturing capacity.

W88 Pit Certification..	**105,055**	**108,592**	**101,470**

To confirm nuclear performance of the W88 pit without underground nuclear testing, a required set of engineering tests and physics experiments, in addition to a comprehensive analytical effort to develop a computational baseline that will provide confidence in future simulation capability, is required. The major focus of FY 2005 activities is preparation for and conduct of two complex subcritical experiments. The subcritical experimental plan was re-baselined in FY 2003 to support the acceleration of W88 pit certification from FY 2009 to FY 2007. FY 2005 efforts will focus on completing authorization basis activities at the Nevada Test Site, fielding and executing confirmatory experiments, and conducting the live experiments. Current milestones for significant pit certification activities are:

Unicorn Final Dry Run – First Quarter, FY 2005

Kerinei – Preparatory experiment for Krakatau –Second Quarter, FY 2005

Krakatau Final Dry Run – Fourth Quarter, FY 2005

Pit Manufacturing Capability.......................................	**1,159**	**10,000**	**20,992**

Pit manufacturing technologies for the W87 and B61-7 pits must be established. These technologies together with the W88 pit manufacturing technology will enable the manufacture of other pit types within the stockpile. Additionally, this technology will support the MPF project design goals that include producing significantly less waste and radiation dose to operators, and operating at a lower cost and more efficiently than a comparable plant with the manufacturing systems used at the Rocky Flats Plant or the plutonium facility at TA-55. Pit Manufacturing Capability is linked via an integrated plan with W88 pit manufacturing and the MPF project to ensure development of technologies, both near and long-term, required to support the nuclear weapons stockpile in manufacture of all pit types.

Modern Pit Facility (MPF)..	**4,242**	**10,810**	**29,800**

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005

The MPF project is developing an agile pit manufacturing infrastructure with sufficient capability to provide for the long-term safety and reliability of the Nation's nuclear weapon stockpile. Since 1989, the United States has been without the capability to produce stockpile-certified plutonium pits that are an essential component of modern nuclear weapons. An interim pit manufacturing capability of 10-20 pits per year is currently being re-established at the Los Alamos National Laboratory (LANL), but this capability is not sufficient to support the long-term requirements of the nuclear weapons deterrent. Planning for a Modern Pit Facility with the capability to meet requirements is essential to establish a viable readiness posture.

Under the National Environmental Policy Act (NEPA) process, if the Secretary of Energy decides to proceed with the MPF project in 2004, a site-specific NEPA process will be initiated in FY2005. Environmental documentation will be prepared in FY 2005 to support a FY 2007 Record of Decision on specific features of a Modern Pit Facility and its exact location on the host site.

Funding in FY 2005 will provide for the continuation of design studies required to complete a Conceptual Design Report (CDR). The CDR will support a Critical Decision (CD)-1 (Critical Decision on System Requirements and Alternatives) in FY 2007. With CD-1 approval, an architect/engineering organization will be selected to initiate preliminary (Title-1) design in FY 2008. Development of the Acquisition Execution Plan required to support solicitation of an architect/engineering organization will be initiated with FY 2005 funding.

The increased funding in FY 2005 also provides for timely evaluation of key technologies prior to decisions that will be made during the final design. MPF activities are being organized consistent with the requirements of a major systems acquisition project, including implementation of an earned value management system.

Pit Campaign Support Activities at NTS	**41,480**	**42,353**	**52,206**

The major activities in FY 2005 include final setup and execution of the major subcritical experiments as defined in the W88 pit certification plan. Specific activities covered include, supporting conduct of the Unicorn experiment in early FY 2005; setting up diagnostic screen rooms and cabling in support of the Kerinei and Krakatau experiments; and potentially mining additional racklet holes for follow-on subcritical experiments. The request also supports development of advanced diagnostic techniques and provides post-shot data analysis capability for all preparatory and actual tests conducted in support of the pit certification project.

Total, Pit Manufacturing and Certification Campaign	**261,807**	**296,790**	**336,473**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
▪ W88 Pit Manufacturing The increase in funding reflects a significant effort to support the manufacturing needs of pit certification. Installation of additional equipment and removal of old equipment to enable the plutonium facility at LANL TA-55 to achieve, by FY 2007, a sustained manufacturing rate of 10-20 pits/year will continue. Funding will allow manufacturing and quality infrastructure improvements to sustain consistency of the manufactured product. At least 6 certifiable W88 pits will be manufactured in FY 2005	+ 6,970
▪ W88 Pit Certification While a significant portion of the design and analysis work for several major experiments is planned to be conducted or completed in FY 2005, a large portion of the preparatory work was funded in prior years. Since the DynEx experiment has been rescheduled, this funding decrease is consistent with present plans. The FY 2005 budget is required to complete planned activities and remain on schedule for FY 2007 completion of certification..........	- 7,122
▪ Pit Manufacturing Capability Funding will be used to ensure progress in re-establishing the capability to manufacture the B61 and W87 pits in FY 2009 and in manufacturing development pits for the B61 and W87 in FY 2012. Restoring this capability is essential to ensure that pits other than the W88 can be manufactured and the process extended to manufacture of other pit types. The technology developed as part of Pit Manufacturing Capability will also be used to make technology decisions for Modern Pit Facility (MPF) and will support MPF goals to significantly reduce the radiation dose to operators as well as the waste that will be produced by the facility. The increase of funding from FY 2004 supports the continued development of existing pit manufacturing processes, including completion of the design of an advanced pit casting and shaping module that supports W87 and B61 manufacture. This work integrates with technology development required for upgrades to TA-55 at LANL and the Modern Pit Facility	+ 10,992
▪ Modern Pit Facility (MPF) The funding increase is necessary to support expansion of the scope for design, safety and environmental compliance, technology development, and project management activities that are typical of a multi-billion dollar, major systems acquisition project in the early stages of development. The FY 2005 request will maintain the current baseline schedule to obtain approval for start of operations (CD-4) in FY 2018. FY 2005 is a key year for activities to complete the Conceptual Design Report needed to support a CD-1 decision in early FY 2007. The increase in funding also supports development of manufacturing	

	FY 2005 vs. FY 2004 ($000)
FY 2007. The increase in funding also supports development of manufacturing equipment, material transport systems, and other facility support systems required to ensure that the MPF design will be modern, safe, secure, and environmentally compliant. This development is essential for making scheduled design decisions. In addition, a draft environmental impact statement required to support specific host site decisions will be initiated in FY 2005 to maintain scheduled design activities between FY 2007 and FY 2009	+ 18,990
▪ **Pit Campaign Support Activities at NTS**	
The increase will support preparations required to conduct subcritical experiments supporting the W88 pit certification project. In particular, the funding supports the development of the infrastructure for the Unicorn and Krakatau experiments	+ 9,853
Total Funding Change, Pit Manufacturing and Certification Campaign	**+ 39,683**

Capital Operating Expenses and Construction Summary

Capital Operating Expenses

(Dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
General Plant Projects	7,319	7,538	7,764	+ 226	+ 3.0%
Capital Equipment	18,447	19,000	19,570	+ 570	+ 3.0%
Total, Capital Operating Expenses	25,766	26,538	27,334	+ 796	+3.0%

Major Items of Equipment *(TEC $2 million or greater)*

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior-Year Approp-riations	FY 2003	FY 2004	FY 2005	Acceptance Date
Assembly Chamber and ancillary infrastructure at LANL	7,573	0	0		3,000	FY 2005
Total, Major Items of Equipment	7,573	0	0	0	3,000	

Description/Justification:

The DynEx Project proposes to procure a transportable, assembly chamber and ancillary infrastructure that house mechanical and electrical equipment supporting assembly operations for experiments vital to the certification process. The DynEx experiment will be assembled, radiographed, and inserted into a confinement vessel within the assembly chamber. The confinement vessel containing the experiment will then be transported to the DARHT firing point. The assembly chamber is required to mitigate the dispersal consequences of an accident where high explosives and special nuclear material are collocated to below the DOE evaluation guidelines. The proposed assembly chamber and the accompanying support trailers will initially be located in the proximity of R 183, Access Control so as to allow second axis commissioning activities at DARHT to proceed unencumbered by the presence of DynEx, yet remain clear of the DARHT hazard circle. In subsequent DynEx experiments, the assembly chamber and the support trailers will be re-located to a site that is in proximity to the DARHT firing point in order to reduce the alignment integrity risk that arises when transporting the confinement vessel containing the experiment from the assembly chamber to the DARHT firing point. After conclusion of the experiment, the assembly chamber and the support trailers will be re-located back to the initial site to allow full flexibility of DARHT operations.

Readiness Campaign

Funding Schedule by Activity

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Readiness Campaign					
Stockpile Readiness	36,630	60,628	45,812	- 14,816	- 24.4%
HE & Weapon Operations............	11,742	23,510	34,220	+ 10,710	+ 45.6%
Nonnuclear Readiness.................	20,392	33,202	35,457	+ 2,255	+ 6.8%
Tritium Readiness........................	46,674	59,557	58,850	- 707	- 1.2%
Tritium Readiness Construction...	83,128	74,558	21,000	- 53,558	- 71.8%
Advanced Design & Production Technologies..............................	71,581	77,461	84,788	+ 7,327	+ 9.5%
Total, Readiness Campaign..................	270,147	328,916	280,127	- 48,789	- 14.8%

FYNSP Schedule

(dollars in thousands)

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FYNSP Total
Readiness Campaign						
Stockpile Readiness..............	45,812	74,999	92,840	94,874	101,931	410,456
HE & Weapon Operations.....	34,220	31,718	23,156	35,081	36,102	160,277
Nonnuclear Readiness..........	35,457	36,770	33,887	45,853	47,268	199,235
Tritium Readiness..................	58,850	73,356	68,059	85,586	91,637	377,488
Tritium Readiness Construction	21,000	24,452	0	0	0	45,452
Advanced Design & Production Technologies......	84,788	89,506	89,441	95,633	99,522	458,890
Total, Readiness Campaign..............................	280,127	330,801	307,383	357,027	376,460	1,651,798

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[a] The FY 2004 amount for Stockpile Readiness reflects a comparability adjustment of $5,795,000 moving MIE - Computer Numerical Controller Lathe and Glovebox from Directed Stockpile Work.

[b] The FY 2003 and FY 2004 amounts for Advanced Design and Production Technologies reflect comparability adjustments of $71,581,000 and $77,461,000, respectively moving Advanced Design and Production Technologies from Engineering Campaign.

Description

The Readiness Campaign is an essential component of the Stockpile Stewardship Program with the responsibility for developing or reestablishing new manufacturing processes and technologies for qualifying weapon components for reuse.

The Readiness Campaign is playing a critical role in revitalizing the nuclear weapons manufacturing infrastructure. The investments from this Campaign will improve both the responsiveness for the infrastructure and its technology base. A truly responsive infrastructure is the cornerstone of the new nuclear defense triad as outlined in the Administration's Nuclear Posture Review. To be considered a credible deterrent, this infrastructure must include a manufacturing capability with state-of-the-art equipment combined with cutting-edge applications of technology, and an ability to quickly provide modified or enhanced capabilities and products to meet emerging threats. The Readiness Campaign contributes substantially to these goals.

Following the cessation of the nuclear weapons complex production mission ten years ago, the production sites downsized. As a result, some of the capabilities and capacity need to be reconstituted to produce weapon components and reassemble weapons required to refurbish the stockpile as defined by the Life Extension Programs (LEPs). The gaps in the complex's production readiness capability, which have been evaluated and documented, also reflect the reality that the production capabilities and capacity needed for the future are much different than those used to build the existing stockpile. There are several efforts ongoing to define how the Production Agencies must modernize to establish flexible, agile, lean and efficient production capabilities and capacity. At the same time that the production sites are filling these gaps in production readiness, they must also address the modernization of these capabilities to establish a flexible, agile and efficient production infrastructure that will enable the complex to meet future expectations.

Benefits to Program Goal 01.33.00.00 Readiness Campaign

Within the Readiness Campaign program, five subprograms [Stockpile Readiness, High Explosives and Weapon Operations (HEWO)(previously called High Explosives Manufacturing and Weapon Assembly/Disassembly (HEMWAD)), Nonnuclear Readiness, Advanced Design and Production Technologies (ADAPT), and Tritium Readiness] each make unique contributions to the Program Goal 01.33.00.00. Stockpile Readiness is replacing or restoring Y-12 National Security Complex production capability and revitalizing aging processes. Nonnuclear Readiness provides the electrical, electronic, and mechanical production capabilities required to weaponize a nuclear explosive. Tritium Readiness establishes and operates the Commercial Light-Water Reactor (CLWR) Tritium Production System to produce tritium, maintaining the national inventory of tritium to support the nuclear weapons stockpile. ADAPT activity integrates and systematically develops new technologies and enhanced capabilities to improve the effectiveness of the production complex and to deliver qualified refurbishment products upon demand. HEWO ensures that the capability to requalify nuclear assembly components; manufacture and assemble high explosive components; and to assemble, disassemble, and perform surveillance on nuclear weapons is adequate.

Annual Performance Results and Targets

FY 2000 Results	FY 2001 Results	FY 2002 Results	FY 2003 Results
There were no related targets.	There were no related targets.	Meet the FY 2002 milestones in the production readiness campaigns to address issues associated with high explosives, materials, and non-nuclear technologies. (MIXED RESULTS)	**FY 2001 Results** There were no related targets.

Annual Performance Results and Targets

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Quantity of the major FY 2004-2012 milestones, documented in the Readiness Campaign Program Plan, for advanced design and production technology (ADAPT) development completed on/ahead of schedule, including model-based manufacturing, enterprise integration, and process development	N/A	N/A	Complete initial 18 advanced major technology milestones.	Complete 8 advanced major technology milestones (total of 26).	Complete 6 advanced major technology milestones (total of 32).	Complete 4 advanced major technology milestones (total of 36).	Complete 1 advanced major technology milestone (total of 37).	Complete 37 advanced major technology milestones FY 2009
Quantity of the major FY 2004-2012 milestones, documented in the Readiness Campaign Program Plan, for major manufacturing processes (high explosives and weapon operations, stockpile readiness, and nonnuclear readiness), concerning new/upgraded capabilities completed, including foundry, machining, recovery, assembly, inspection, and verification processes to support stockpile production and Life Extension Program requirements	N/A	Complete initial 5 major manufacturing process milestones.	Complete 8 major manufacturing process milestones (total of 13).	Complete 6 major manufacturing process milestones (total of 19).	Complete 4 major manufacturing process milestones (total of 23).	Complete 1 major manufacturing process milestone (total of 24).	N/A	Complete 27 major manufacturing process milestones FY 2012 (Initial task)
Quantity of coated cladding tubes acquired for Tritium-Producing Burnable Absorber Rods	N/A	Acquire 317 coated cladding tubes (total of 317).	Acquire 620 coated cladding tubes (total of 937).	Acquire 860 coated cladding tubes (total of 1,797).	Acquire 1,000 coated cladding tubes (total of 2,797).			Acquire 1,000 coated cladding tubes FY 2007 (Initial task)

Performance Indicators	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Endpoint Target Date
Cumulative percentage of Tritium Extraction Facility (TEF) construction phase completed (EFFICIENCY MEASURE)	Completed 50% of TEF construction phase.	Complete 90% of TEF construction phase.	Complete 100% of TEF construction phase.					Complete TEF construction FY 2005
Cumulative percentage of Tritium Extraction Facility (TEF) project completed (total project cost), while maintaining a Cost Performance Index of 0.9-1.15 (EFFICIENCY MEASURE)	Completed 64% of TEF project.	Complete 80% of TEF project.	Complete 87% of TEF project.	Complete 96% of TEF project.	Complete 100% of TEF project.			Complete 100 % of project FY 2007

Detailed Justification

	(dollars in thousands)		
	FY 2003	FY 2004	FY 2005
Stockpile Readiness	**36,630**	**60,628**	**45,812**

Within this activity, the Y-12 National Security Complex (Y-12) is replacing or restoring production capability and revitalizing aging processes. These efforts will result in Y-12's ability to meets its mission requirements in a more efficient and cost effective manner and provide capability for the future needs of the complex. At present, critical manufacturing capabilities are required for weapons refurbishments planned for FY 2006 and beyond within elements of the production site. The Stockpile Readiness activity is the primary vehicle for this revitalization and is tasked with providing virtually all new processing, machining, and inspection equipment required for the Directed Stockpile Work (DSW) effort needed in the intermediate to long range future. As much of Y-12’s current capability is based on 20 to 40 year old technology, the Stockpile Readiness activity is charged with improving basic manufacturing capability and appropriately deploying much needed related technology developed by the ADAPT activity and other technology programs.

In FY 2005, this activity will install the scanning electron microscope, high precision mills, forming equipment, electron beam welder, electro polisher, metal working, and coordinate measuring machines. It will also support intelligent manufacturing, digital radiography, science and model based manufacturing, and certification of key materials.

High Explosives and Weapon Operations	**11,742**	**23,510**	**34,220**

The HEWO activity, formerly High Explosives Manufacturing and Weapons Assembly/Disassembly Readiness, conducted at the Pantex Plant and involving other Nuclear Weapons Complex sites as appropriate, ensures that the capability to requalify nuclear assembly components; manufacture and assemble high explosive (HE) components, both main charge and small energetic; and assemble, disassemble, and perform surveillance on nuclear weapons is adequate to meet the current and projected needs of the nation’s nuclear weapon stockpile, consistent with national goals and policies. This activity is planned and structured to address the capability, capacity, infrastructure, workforce and facility issues that must be resolved and will serve as the vehicle to implement technologies demonstrated by other programs.

It will provide the equipment, infrastructure, and workforce required, as well as operating support for construction projects needed to accommodate the new capabilities. This campaign is charged with appropriately deploying much needed related technology developed by the ADAPT activity and other technology programs.

The request in FY 2005 supports the implementation of equipment, and the initial startup activities for HE manufacturing and product requalification. In the HE manufacturing area, technical input will be provided to support the High Explosives Pressing Facility Line Item which has design funding included in 04-D-103, Project Engineering and Design, with a planned construction start of FY 2006. Several large pieces of equipment, HE machining centers, machine controllers that support models-based manufacturing, and test equipment will be implemented in the production environment to begin work on the W76-1/Mk4A. In the product requalification activity, three new capabilities will be demonstrated by ADAPT and transitioned to this program for implementation. Equipment to implement in the production environment will be purchased. The initial start up activities for the pit implement in the production environment will be purchased. The initial start up activities for the pit requalification and surveillance in the Special Nuclear Material Component Requalification Facility (SNMCRF) will be provided. In addition, Information Technology (IT) infrastructure to support science based manufacturing, computing hardware for model-based design simulation and analysis and connectivity to support the enterprise product planning and interactive electronic procedures for weapon assembly and disassembly activities will be implemented.

Nonnuclear Readiness	**20,392**	**33,202**	**35,457**

The Nonnuclear Readiness activity provides the electrical, electronic, and mechanical production capabilities required to weaponize a nuclear explosive. This activity, primarily involving the Kansas City Plant, the Sandia National Laboratories/New Mexico, and the Los Alamos National Laboratory, deploys the product development and production capabilities required to support nonnuclear product requirements. Nonnuclear functions range from weapon command and control to examining performance during deployment simulations, including weapon structural features, neutron generators, tritium reservoirs, detonators and component testers. The Nonnuclear Readiness activity has three major functions: 1) eliminate gaps in product development and production capabilities required to perform the authorized base workload 2) and authorized life extension programs, and 3) achieve operational readiness of all product development and production capabilities as required by the known and anticipated requirements of the Stockpile Stewardship Program. In addition to the major weapon program planning documents, the Applied Technology Roadmap and Responsive Infrastructure information are used as guidance.

In FY 2005, this activity supports the replacement of product testers and the deployment of production equipment required to manufacture and accept new products supporting the Life Extension Programs. Equipment includes electronic component packaging for flight testing, mechanical component fabrication, engineered material production, and material evaluation and qualification. The request also reflects implementation of as-built/design model archiving and transfer capabilities, and automated feature-based manufacturing development, manufacturing, and inspection for production of W76 components.

Tritium Readiness..	**46,674**	**59,557**	**58,850**

The Tritium Readiness activity establishes and operates the Commercial Light-Water Reactor (CLWR) Tritium Production System to produce tritium, maintaining the national inventory of tritium to support the nuclear weapons stockpile. Production of tritium in the Tennessee Valley Authority's (TVA) Watts Bar reactor began in October 2003. Irradiated rods will be removed in FY 2005 and transported to a temporary storage location awaiting completion of the Tritium Extraction Facility (TEF). This action will complete the production-development-and-demonstration portion of the campaign. Tritium will also be produced in subsequent operating cycles of the reactor as required by the stockpile size. Although the TVA's Sequoyah reactors will be capable of tritium production, it will remain in a "stand-by" tritium production mode for the foreseeable future.

Major activities in FY 2005 include: $33.6 million for completion of the first irradiation cycle; initiation of the second irradiation cycle including incremental reactor fuel costs; handling and transportation of irradiated tritium-producing rods; fabrication of rods for the third irradiation cycle; and $25.3 million for other project costs (OPC) associated with equipment and systems testing, crew and $25.3 million for other project costs (OPC) associated with equipment and systems testing, crew training, and other activities in preparation of the completion and startup of the Tritium Extraction Facility.

	FY 2003	FY 2004	FY 2005
Tritium Readiness Construction	**83,128**	**74,558**	**21,000**

Project 98-D-125, TEF, Savannah River Site will provide the capability to receive and extract gases containing tritium from the CLWR Tritium Producing Burnable Absorber Rods (TPBARs) or other targets of similar design. The TEF will provide shielded remote TPBAR handling for the extraction process, clean-up systems, and delivery of extracted gasses containing tritium to the Tritium Recycle Facility for further processing. The TEF facility construction will be completed in FY 2005 to support start up of facility operations planned to begin in FY 2007. The TEF will provide steady-state production capability of as much as several Kg of tritium per year and will have an operational life span of at least 40 years. This will provide an initial capability. Capacity can be sized as the stockpile requirements change.

	FY 2003	FY 2004	FY 2005
Advanced Design & Production Technologies	**71,581**	**77,461**	**84,788**

The Advanced Design and Production Technologies (ADAPT) activity (previously included under Engineering Campaigns) integrates and systematically develops new technologies and enhanced capabilities to improve the effectiveness of the production complex and to deliver qualified refurbishment products upon demand. Developing fast turn-around-engineering options through virtual prototypes and implementing modern product data management and collaboration tools are a means to achieve this goal. ADAPT's guiding vision for the future is to become an essential resource for identification, development and integration of applied technology capabilities to achieve rapid product realization meeting nuclear weapons complex requirements and related national security needs. ADAPT develops qualified manufacturing processes and capabilities for deployment by other programs for sustained manufacturing. These qualified manufacturing processes support directed production schedules or Life Extension Programs (LEPs).

In FY 2005, ADAPT will balance near term LEP requirements and Advanced Technology Roadmap strategies. Major focus areas for near-term requirements include: developing capabilities and improvements to tritium processing, "Quarter Cost" Arming, Fusing, and Firing W76 subassembly production, hazardous materials production processes, improving secure connectivity of electronic data within the nuclear weapons complex, and developing minimum capability to produce War Reserve mechanical hardware with qualified Model Based processes. Advanced technology focus areas address standardization of nuclear weapons complex business methods and expanding Model Based and Non-contact gauging capabilities.

	FY 2003	FY 2004	FY 2005
Total, Readiness Campaign	**270,147**	**328,916**	**280,127**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
▪ **Stockpile Readiness**	
In FY 2005, this activity will continue to fund the highest priority projects slated to restore the machining, radiography, inspection, and testing capabilities and equipment required to support LEP baselines.	- 14,816
▪ **HE and Weapon Operations**	
This increase supports the science based manufacturing necessary to meet requirements for the W76-1 and other LEPs. Some of the products include models-based design, engineering, and manufacturing for the B61-7/11; deployment of pit qualification workstations; and models-based product definition for the W76-1	+ 10,710
▪ **Nonnuclear Readiness**	
This increase reflects expanded funding of on-going projects and initial funding of new projects, including neuton generator production testers and process improvements to support replacement or development of production capability at Kansas City Plant, Sandia National Laboratories/New Mexico, and Los Alamos National Laboratory.	+ 2,255
▪ **Tritium Readiness**	
This decrease reflects the Tritium Readiness activity baseline schedule, which completes the transition from the Commercial Light Water Reactor (CLWR) Program, not including the Tritium Extraction Facility (TEF), to full production-scale operation of the tritium production system using a single reactor.	- 707
▪ **Tritium Readiness Construction**	
This decrease is consistent with the baseline goals. It is consistent with the 2nd Quarter FY 2003 baseline for the project and will enable the project to meet its end-point milestones as scheduled	- 53,558
▪ **Advanced Design & Production Technologies**	
This request for additional funding reflects increased work in process development to support tritium consolidation (TCON) plans and the necessary improved capabilities for the Tritium Extraction Facility (TEF), increased work in science-based manufacturing to meet directed stockpile workload needs such as development of new manufacturing techniques for engineering development of stronglink design modifications, new cable testing processes and equipment, and some additional emphasis on raising the minimum level of connectivity and capability of the secure, electronic nuclear weapons "enterprise" to improve speed	

	FY 2005 vs. FY 2004 ($000)
capability of the secure, electronic nuclear weapons “enterprise” to improve speed and cycle times of design-to-production for DSW	+ 7,327
Total Funding Change, Readiness Campaign	**- 48,789**

Capital Operating Expenses and Construction Summary

Capital Operating Expenses[a]

(Dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
General Plant Projects..........................	27,790	28,624	29,482	+ 858	+ 3.0%
Capital Equipment	31,674	50,000	51,500	+1,500	+ 3.0%
Total, Capital Operating Expenses	59,464	78,624	80,982	+2,358	+ 3.0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior-Year Approp-riations	FY 2003	FY 2004	FY 2005	Unappropriated Balance
Project 98-D-125, TEF................................	408,065	204,485	83,128	74,558	21,000	24,894
Total, Construction			83,128	74,558	21,000	

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2004 and FY 2005 funding shown reflects estimates based on actual FY 2003 obligations.

Major Items of Equipment *(TEC $2 million of greater)*

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior-Year Approp-riations	FY 2003	FY 2004	FY 2005	Acceptance Date
Jig Borer #1	3,100	1,868	-768	2,000	0	FY 2005
Procure and install a high precision mill to replace an obsolete less efficient piece of equipment.						
Disassembly Glovebox	15,000	7,900	6,140	960	0	FY 2004
Procure and install a glovebox to support a new production requirement.						
Coordinate Measuring Machine #1	7,597	0	3,041	3,400	1,156	FY 2005
Procure and install a CMM to replace obsolete equipment that is no longer supported by the vendor.						
Coordinate Measuring Machine #2	4,100	0	200	3,900	0	FY 2005
Procure and install a CMM to replace obsolete equipment that is no longer supported by the vendor.						
Electron Beam Welder	9,206	0	3,100	6,106		FY 2006
Procure and install an electron beam welder to replace an inoperable piece of equipment.						
Metal Working Equipment	4,782	0	1,178	3,500	104	FY 2006
Procure and install new metal working equipment to meet production requirements.						
Hydroforming Unit	3,295	0	0	2,630	665	FY 2006
Purchase and install a hydroforming unit to meet production requirements.						
Computer Numerical Controller Lathe and Glovebox	8,295	0	0	5,795[a]	2,500	FY 2006
Procure and install CNC lathe and glovebox enclosure for special materials. The existing capability is difficult to maintain, and outdated raising reliability concerns.						
Vacuum Annealing Equipment	3,693	0	0	2,358	1,335	FY 2006
Purchase and install vacuum annealing equipment to meet production requirements.						
Low Energy X-Ray Machine	4,783	0	0	1,643	2,400	FY 2006
Procure and install a low energy X-ray machine to restore a radiography capability.						
Scanning Electron Microscope	8,900	0	1,700	0	2,000	FY 2007
Install a larger chamber Scanning Electron Microscope in order to support a new material specification.						

[a] Reflects a comparability adjustment of $5,795,000 from Directed Stockpile Work.

	(dollars in thousands)					
	Total Estimated Cost (TEC)	Prior-Year Approp-riations	FY 2003	FY 2004	FY 2005	Acceptance Date
Electro Polisher	2,681	0	0	778	1,903	FY 2006
Procure and install an electropolisher system. The condition and reliability of the current system has deteriorated as a result of chemical exposure during its 20 years of service.						
Microwave Deployment	3,700	0	0	0	500	FY 2006
Procure and install new machine for production use, based on operational lessons learned from prototype installed in 2003.						
2 MeV Linac	2,000	0	0	0	2,000	FY 2006
Procure and install a 2 MeV Linac to replace existing one originally installed in the early 1970's which is no longer supported by the vendor						
9 MeV Linac	3,917	0	0	0	2,000	FY 2007
Procure and install a 9 MeV Linac to replace existing one originally installed in the early 1970's which is no longer supported by the vendor to support production radiography requirements.						
Coordinate Measuring Machine #3	5,345	0	0	0	5,345	FY 2007
Procure and install a CMM to replace obsolete equipment that is no longer supported by the vendor.						
Electron Beam Weld Inspection	2,500	0	0	500	1,000	FY 2007
Installs a new, non-destructive analytical and certification capability for the welded components on a major weapons system.						
Total, Major Items of Equipment			14,591	33,570	31,908	

98-D-125, Tritium Extraction Facility, Savannah River Site
Aiken, South Carolina

Significant Changes

- The need to reprogram $10,000,000 into this project in FY 2003 was identified in the FY 2004 Congressional Budget request. However, as a result of recent project developments in the disposal options for the extracted Tritium Producing Burnable Absorber Rods, part of this requirement was deferred, and the FY 2003 reprogramming, which was approved, was reduced to $5,000,000.

- The funding profile has been adjusted to move $15,000,000 from FY 2005 to FY 2006 to reflect NNSA's need to address high priority requirements in FY 2005, including implementation of the new Design Basis Threat (DBT). The risk to the successful completion of the project from this funding shift is minimal.

1. Construction Schedule History

	Fiscal Quarter				Total Estimated Cost ($000)	Total Project Cost ($000)
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
FY 1998 Budget Request *(Preliminary Estimate)*…………….	1Q 1998	4Q 2002	1Q 1999	3Q 2005	TBD [a]	TBD
FY 2000 Budget Request………..	1Q 1998	3Q 2001	1Q 2000	4Q 2004	285,650	390,650
FY 2001 Budget Request *(Revised Baseline Estimate)*…….	1Q 1998	3Q 2001	1Q 2000	4Q 2004	323,000	401,000
FY 2002 Budget Request………..	1Q 1998	3Q 2001	1Q 2000	4Q 2004	323,000	401,000
FY 2003 Budget Request………..	1Q 1998	3Q 2001	1Q 2000	4Q 2004	323,000	401,000
FY 2004 Budget Request *(Performance Baseline)*……….....	1Q 1998	3Q 2001	1Q 2000	4Q 2007	408,065	506,439
FY 2005 Budget Request………..	1Q 1998	3Q 2001	1Q 2000	4Q 2007	408,065	506,439

[a] Consistent with OMB Circular A-11, Part 3, full funding was requested for only preliminary and final design of the Commercial Light Water Reactor Tritium Extraction Facility in FY 1998.

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
1998	9,650	9,650	6,911
1999	6,000	6,000	5,889
2000	32,875 [a]	32,875	32,003
2001	74,835 [b]	74,835	56,618
2002	81,125	81,125	74,392
2003	83,128 [c]	83,128	88,311
2004	75,000 [d]	75,000	78,500
2005	21,000	21,000	40,989
2006	24,452	24,452	22,452
2007	0	0	2,000

3. Project Description, Justification, and Scope

Tritium is a radioactive isotope of hydrogen used in all of the Nation's nuclear weapons. Without tritium, nuclear weapons will not work as designed. At present, no tritium is produced by the U.S. for the nuclear weapons stockpile. Radioactive decay depletes the available tritium by approximately 5.5% each year. In order for these weapons to operate as designed, tritium must be periodically replaced. Although tritium has not been produced by the U.S. for the stockpile since the shutdown of the last production reactor in 1988, tritium requirements have been met through reuse of tritium recovered from dismantled weapons. To replenish the tritium needs of the nuclear weapons stockpile, a new production capability is required to be on line by 2007, in accordance with the President's 1996 Nuclear Weapons Stockpile Memorandum. To meet this date, site preparation and construction of the Tritium Extraction Facility (TEF) began in FY 2000. As part of the dual track production strategy, stated in the Record of Decision for the Tritium Supply and Recycling Final Programmatic Environmental Impact Statement, issued on December 5, 1995, the Commercial Light Water Rector (CLWR) Tritium Extraction Facility shall be constructed at the Savannah River Site (SRS). The CLWR TEF shall provide the capability to

[a] The original appropriation was $33,000,000. This was reduced by $125,000 by the FY 2000 rescission enacted by P.L. 106-113.

[b] The original appropriation was $75,000,000. This was reduced by $165,000 by a rescission enacted by Section 1403 of the FY 2001 Consolidated Appropriations Act.

[c] The original appropriation was $70,165,000. This was increased by a reprogramming of $10,000,000 from prior year funding which was requested in FY 2002, but not approved until December 2002, and by an FY 2003 reprogramming of $5,000,000. The appropriation was reduced by $446,000 by a rescission and by $1,591,000 for the Weapons Activities general reduction enacted by P.L. 108-7, FY 2003 Omnibus Appropriations Act, Title, VI.

[d] The FY 2004 appropriated amount has not been adjusted for the FY2004 Congressional Omnibus Appropriations Bill rescission of .59 percent.

receive and extract gases containing tritium from CLWR Tritium Producing Burnable Absorber Rods (TPBARs), or other targets of similar design. The TEF will provide shielded remote TPBAR handling for the extraction process, clean-up systems to reduce environmental impact from normal processing and accidental releases, and delivery of extracted gases containing tritium to the Tritium Recycle Facility for further processing.

The facility includes two major buildings: (1) a 15,250 (approx) square foot Remote Handling Building (RHB) and (2) a 26,500 (approx) square foot Tritium Processing Building (TPB). The TPB will be built above ground, while the RHB will be partially below ground. Major processes and operations systems included within the TEF will be: (1) the Receiving, Handling, and Storage System that will support all functions related to the receipt, handling, preparation, and storage of incoming TPBAR and outgoing radioactive waste materials; (2) the Tritium Extraction System that will perform initial cleanup of extracted gasses; (3) the Tritium Process Systems that will separate process gases from the irradiated TPBARs; (4) the Tritium Analysis and Accountability Systems that will support monitoring and tritium accountability; (5) the Solid Waste Management System that will receive solid waste generated by TEF for management and storage prior to disposal in the E-Area vaults, which will be upgraded by TEF to accommodate that disposal; and (6) the Heating, Ventilation, and Air Conditioning System that would provide and distribute conditioned supply air to the underground RHA and the above ground tritium processing area and also discharge exhaust air to the environment via a 100-foot stack.

The TEF will provide steady-state production capability to the existing SRS tritium facility of as much as 3Kg of tritium per year, if needed. Final purification of gases containing tritium shall be performed in the augmented process equipment located in the existing SRS tritium facility.

The TEF shall have an operational life span of at least 40 years, minimize radiological and chemical releases to the environment; and minimize waste generation. The security requirements shall be such that TEF is designated as an exclusion area.

Project Milestones

As baselined, the operation of the TEF will be dependent on the completion and operation of the Tritium Facility Modernization and Consolidation Project. With this project being completed during 3rd Quarter, FY 2005, the final tritium systems will be available for processing extraction gases to ensure weapons stockpile requirements will be met in CY 2007.

FY 1998: Initiation of Preliminary Design (Complete)
Completion of Preliminary Design (Complete)
FY 1999: Critical Decision (CD) 2B Approval to Begin Final Design (Complete)
Initiation of Final Design (Complete)
CD-3 - Approval to Begin Construction (Complete)
FY 2000: Initiation of Site Preparation (Complete)
FY 2001: Completion of Final Design (Complete)
Completion of Site Preparation (Complete)
Initiation of Facility Construction (Complete)
FY 2005: Completion of Facility Construction (Final system turnover to startup testing)

FY 2007: Initiation of Integrated System Testing with Tritium
Project Completion
CD-4 - Start of Facility Operation

4. Details of Cost Estimate

	(dollars in thousands)	
	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design Costs (Design Drawings, Specifications and Construction Support)	62,268	62,268
Design Management Costs (0.4% of TEC)	1,649	1,649
Project Management Costs (1.4% of TEC)	5,872	5,872
Total, Design Costs (17.1% of TEC)	69,789	69,789
Construction Phase		
Improvements to Land	6,801	6,801
Buildings	124,083	124,083
Special Equipment	85,178	85,178
Standard Equipment	8,403	8,403
Major Computer Items	7,630	7,630
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	26,173	26,173
Construction Management (3.5% of TEC)	14,307	14,307
Project Management (4.3% of TEC)	17,619	17,619
Total, Construction Costs (71.1% of TEC)	290,194	290,194
Contingencies		
Construction Phase (11.8% of TEC)	48,082	48,082
Total, Contingencies (11.8% of TEC)	48,082	48,082
Total, Line Item Costs (TEC)	408,065	408,065

5. Method of Performance

The Savannah River Site Managing and Operating (M&O) Contractor, Westinghouse Savannah River Company (WSRC), will be responsible for the design, construction, inspection and commissioning of the TEF to be built at the Savannah River Site. All conceptual, preliminary, and detail design work has been completed by site forces. Site preparation and construction of the Civil/Structural portion of the project has been completed. The remainder of the plant construction is in progress by the Savannah River Site M&O contractor, with a portion of the work awarded to fixed price subcontractors. System turnover to startup testing will begin in 2003, with turnover of the electrical system, and will run through 2006. The remainder of the plant construction will be completed in FY 2005. Final startup testing with radioactive gases will be performed by site forces beginning in FY 2007.

6. Schedule of Project Funding [a]

(dollars in thousands)

	Prior Years	FY 2003	FY 2004	FY 2005	Outyears	Total
Project Costs						
Facility Costs						
Design	132,510	32,310	8,700	5,500	3,344	182,364
Construction	43,303	56,001	69,800	35,489	21,108	225,701
Total, Line Item TEC	175,813	88,311	78,500	40,989	24,452	408,065
Other Project Costs						
Conceptual design cost	3,541	0	0	0	0	3,541
NEPA documentation costs	1,858	0	0	0	0	1,858
Other project-related costs	11,163	3,719	17,500	24,600	35,993	92,975
Total Other Project Costs	16,562	3,719	17,500	24,600	35,993	98,374
Total Project Cost (TPC)	192,375	92,030	96,000	65,589	60,445	506,439

[a] Design includes cost of engineered equipment.

7. Related Annual Funding Requirements

	(dollars in thousands)	
	Current Estimate	Previous Estimate
Annual facility operating costs	1,750	1,750
Annual facility maintenance/repair costs	2,800	2,800
Programmatic operating expenses directly related to the facility	7,600	7,600
Capital equipment not related to construction but related to the programmatic effort in the facility	800	800
GPP or other construction related to the programmatic effort in the facility	450	450
Utility costs	1,050	1,050
Total related annual funding (operating from FY 2006 through FY 2045)	14,450	14,450