Campaigns

Program Mission

Campaigns are multi-year, multi-functional efforts involving, to varying degrees, every site in the nuclear weapons complex. They provide specialized scientific knowledge and technical support to the directed stockpile work on the nuclear weapons stockpile. Deliverables are defined/scheduled in each campaign plan and then coordinated with several key nuclear weapons complex directives, including the current Nuclear Weapons Production and Planning Directive (P&PD), Nuclear Weapons Schedule, Integrated Weapons Activity Plan (IWAP), and specific weapon Program Control Documents (PCDs), Component Description Documents (CDDs), and program planning documents. Current priority for general campaign support is to provide technology for three ongoing Life Extension Programs (LEPs) and to other ongoing refurbishments. Some campaigns focus on near-term deliverables; others on longer-range improvement to specific weapons complex capabilities. A few include directly associated construction projects; most do not. Overall, they all directly support the long-term stewardship of the nuclear weapons stockpile. There are six categories.

- **Science Campaigns** (Primary Certification, Dynamic Materials Properties, Advanced Radiography, and Secondary Certification and Nuclear Systems Margins). These four campaigns develop certification methodologies and the associated capabilities and scientific understanding required to assure the safety and reliability of aged and remanufactured weapons in the absence of nuclear testing. This technology base must be in place to carry out weapons refurbishments and other stockpile support work.
- **Engineering Campaigns** (Enhanced Surety, Weapons System Engineering Certification, Nuclear Survivability, Enhanced Surveillance, and Advanced Design and Production Technologies). These five campaigns and engineering construction activities provide required tools, methods, and technologies for the continued certification and long-term sustainment (via refurbishment) of the nuclear weapons stockpile. Many of the deliverables are timed to coincide with the individual Life Extension Program (LEP) schedule, negotiated with the Department of Defense (DoD), for these refurbishments and, in a number of instances, provide capabilities lost with the cessation of underground nuclear testing.
- **Inertial Confinement Fusion Ignition and High Yield (ICF) Campaign**. This campaign advances the nation's capabilities to achieve inertial confinement fusion ignition in laboratory experiments and addresses high-energy-density physics issues required to understand key weapons physics issues.
- **Advanced Simulation and Computing (ASCI) Campaign**. This campaign provides the simulation and modeling tools that enable the design community to assess and certify the safety, performance and reliability of the U.S. nuclear weapons stockpile. Having evolved from the merging of the Accelerated Strategic Computing Initiative and the ongoing Stockpile Computing program, the Advanced Simulation and Computing campaign continues to use the acronym "ASCI".
- **Pit Manufacturing and Certification Campaign**. This campaign's mission is to regenerate the nuclear weapons complex capability to produce nuclear primaries (pits). In the near term, the campaign will focus mainly on W88 pit manufacturing and certification, while planning for a Modern Pit Facility that is capable of reestablishing and maintaining sufficient levels of production to support

requirements for the safety, reliability, and performance of all forecast U.S. requirements for nuclear weapons.

- **Readiness Campaigns** (Stockpile Readiness, High Explosives Manufacturing and Weapon Assembly/Disassembly Readiness, Nonnuclear Readiness, and Tritium Readiness). These four campaigns are technology base efforts designed to re-establish, maintain, and enhance manufacturing and other capabilities needed for the future production of weapon components, mostly needed for the near-term LEPs.

Program Strategic Performance Goal

- NS 1-2: Develop the scientific, design, engineering, testing, and manufacturing capabilities needed for long-term stewardship of the stockpile.

Performance Indicators

Number of National Ignition Facility (NIF) project major construction milestones completed

Number of weapons systems components analyzed using ASCI codes to annually certify their performance

Amount of individual platform computing capability measured in trillions of operations per second (TeraOPS)

Percentage of major milestones completes towards W88 pit certification

Percentage of major milestones completed towards restoration of capability to manufacture the pit types in the enduring stockpile

Percentage of major milestones completed towards construction of the Modern Pit Facility

Number of tritium rods irradiated in commercial reactors

Percentage of subcritical experiments completed on/ahead of schedule

Percentage of major milestones completed on/ahead of schedule

Annual stockpile aging assessment completion

Annual Performance Results and Targets

FY 2002 Results	FY 2003 Targets	FY 2004 Targets
Successfully completed directive scheduled assessments, tests, experiments, analyses, evaluations, predictions, reports, and/or studies in support of Directed Stockpile Work (DSW).	Complete directive scheduled assessments, tests, experiments, analyses, evaluations, predictions, reports, and/or studies in support of Directed Stockpile Work (DSW), base requirements, and programmatic nuclear upgrades.	Complete three additional NIF major construction milestones for a total of 13 of the 28 milestones completed. Analyze 10 of 31 weapons system components using ASCI codes to certify their performance.

FY 2002 Results	FY 2003 Targets	FY 2004 Targets
Successfully conducted or validated simulations or models in support of specific weapons, and/or the stockpile as a whole.	Conduct or validate directive scheduled simulations or models in support of specific weapons, and/or the stockpile as a whole.	Deliver an ASCI platform which can perform 40 trillion operations per second. Complete 25% of the major milestones towards achieving W88 pit certification in FY2007.
Successfully demonstrated or deployed scheduled improved required capabilities or technologies in support of specific weapon systems and/or the stockpile as a whole.	Demonstrate or deploy 85% of directive scheduled improved required capabilities or technologies in support of specific weapon systems and/or the stockpile as a whole.	Complete 20% of the major milestones towards restoration of the capability to manufacture the pit types in the enduring stockpile in FY2009. Complete 40% of the MPF major milestones towards Critical Decision (CD) -1.
Successfully identified or documented scheduled new/additional system or component requirements in support of specific weapon systems and/or the stockpile as a whole.	Identify or document 95% of new/additional system or component requirements in support of specific weapon systems and/or the stockpile as a whole, as scheduled.	Begin production of tritium by irradiating rods in the Tennessee Valley Authority's (TVA's) Watts Bar reactor. Decide, with the DoD and Nuclear Weapons Council, future tritium requirements and schedule the TVA irradiation services accordingly.
Successfully completed scheduled Critical Decision (CD) milestones for construction of related facilities.	Complete all Critical Decision (CD) milestones for related facility construction, within cost, scope, and schedule.	Complete four scheduled subcritical experiments. Complete 90% of major milestones. Meet all scheduled milestones for NIF, MESA and TEF.
Successfully deployed new/improved equipment, processes, and business practices in support of the directive schedule.	Deploy 95% of new/improved equipment, processes, and business practices in support of the directive schedule.	Complete FY2003 stockpile aging assessment and report in January 2004.

Significant Program Shifts

In FY 2004, the baseline program has been adjusted to reflect the following: slip B61 common radar First Production Unit (FPU) from FY 2008 to FY 2012; delay B61spin rocket motor FPU from FY 2008 to FY 2012; slip B61 use-control upgrade from FY 2008 to FY 2012; and delay W78 high-fidelity Joint Test

Assembly (JTA7) development. Campaign planning and deliverables have been revised to support the revised LEP schedules.

Funding Profile

(dollars in thousands)

	FY 2002 Comparable Appropriation	FY 2003 Request	FY 2004 Request	$ Change	% Change
Primary Certification	50,572	47,159	65,849	18,690	39.6%
Dynamic Materials Properties	90,032	87,594	82,251	-5,343	-6.1%
Advanced Radiography	75,577	52,925	65,985	13,060	24.7%
Secondary Certification & Nuclear Systems Margins	40,885	46,746	55,463	8,717	18.6%
Subtotal, Science Campaigns	257,066	234,424	269,548	35,124	15.0%
Enhanced Surety	32,086	37,713	37,974	261	0.7%
Weapons Systems Engineering	25,595	27,007	28,238	1,231	4.6%
Nuclear Survivability	21,902	23,394	23,977	583	2.5%
Enhanced Surveillance	73,280	77,155	94,781	17,626	22.8%
Advanced Design & Production Technologies	68,225	74,141	79,917	5,776	7.8%
Engineering Campaigns Construction - Operations & Maintenance / Other Project Costs	3,600	4,200	4,500	300	7.1%
01-D-108, Microsystems Engineering Sciences & Applications (MESA) Complex, SNL	63,500	75,000	61,800	-13,200	-17.6%
Subtotal, Engineering Campaigns Construction	67,100	79,200	66,300	-12,900	-16.3%
Subtotal, Engineering Campaigns	**288,188**	**318,610**	**331,187**	**12,577**	**3.9%**
Inertial Confinement Fusion Ignition and High Yield O&M	261,773 [a]	238,792 [a]	316,769	77,977	32.7%
96-D-111, National Ignition Facility	245,000	214,045	150,000	-64,045	-29.9%
Subtotal, Inertial Confinement Fusion and High Yield	**506,773**	**452,837**	**466,769**	**13,932**	**3.1%**
Advanced Simulation and Computing O&M	660,056	669,527	713,326	43,799	6.5%

[a] Reflects a comparability adjustments of $1,400,000 in FY 2002 and $1,044,000 in FY 2003 from the Secondary Certification and Nuclear Systems Margins Campaign to consolidate funding for high energy density physics grants into the Inertial Confinement Fusion Ignition and High Yield Campaign.

	(dollars in thousands)				
	FY 2002 Comparable Appropriation	FY 2003 Request	FY 2004 Request	$ Change	% Change
01-D-101, Distributed Information Systems Laboratory	8,400	13,305	12,300	-1,005	-7.6%
00-D-103, Terascale Simulation Facility	22,000	35,030	25,000	-10,030	-28.6%
00-D-107, Joint Computational Engineering Laboratory	13,377	7,000	0	-7,000	-100.0%
Subtotal, Advanced Simulation and Computing Campaign	**703,833**	**724,862**	**750,626**	**25,764**	**3.6%**
Pit Manufacturing and Certification . .	248,961 [b]	235,964 [b d]	320,228 [b]	84,264	35.7%
Stockpile Readiness	26,318	38,659	55,158	16,499	42.7%
HE/ Assembly Readiness	6,688	12,093	29,649	17,556	145.2%
Nonnuclear Readiness	17,768	22,398	37,397	14,999	67.0%
Materials Readiness	1,172	0	0	0	N/A
Tritium Readiness, O&M	45,517	56,134	59,893	3,759	6.7%
98-D-125, Tritium Extraction Facility	81,125	70,165 [c]	75,000	4,835	6.9%
98-D-126, Accelerator Production of Tritium, VL	5,847	0	0	0	N/A
Subtotal, Readiness Campaigns . . .	184,435	199,449	257,097	57,648	28.9%
Total, Campaigns	**2,189,256** [d]	**2,166,146**	**2,395,455**	**229,309**	**10.6%**

The FY 2003 Request column includes comparability adjustments as detailed in the footnotes for consistency with the FY 2004 Request.

Public Law Authorization: P. L. 107-314, Bob Stump National Defense Authorization Act for FY 2003

---

[b] Includes comparability adjustment for the transfer of subcritical experiments which support the certification of the W88 pit from Directed Stockpile Work - Research and Development to the Pit Manufacturing and Certification Campaign in FY 2004. Adjustment is $44,500,000 in FY 2002; $41,800,000 in FY 2003 and $43,000,000 in FY 2004.

[c] Pending the enactment of a final FY 2003 appropriation, this amount reflects the FY 2003 Congressional Budget Request; it does not include a reprogramming of $10,000,000 from prior year funding, which was requested in FY 2002, but not approved until December 2002. If the FY 2003 appropriation provides the funding requested in FY 2003, a total of $80,165,000 will be available. An additional $10,000,000 will need to be reprogrammed into Project 98-D-125, Tritium Extraction Facility bringing the total for FY 2003 to $90,165,000.

[d] Reflects adjustment for the rescission of funds in the Weapons Activities account required by the FY 2002 Supplemental Appropriations Act for further Recovery From and Response to Terrorist Attacks on the United States (P.L. 107-206). The total amount rescinded in Campaigns is $11,614,804.

Funding by Site

(dollars in thousands)

Campaigns	FY 2002	FY 2003	FY 2004	$ Change	% Change
Chicago Operations Office					
Argonne National Laboratory	576	400	400	0	0.0%
Chicago Operations Office	2,208	31,900	27,638	-4,262	-13.4%
Subtotal, Chicago Operations Office	2,784	32,300	28,038	-4,262	-13.2%
Idaho Operations Office					
Idaho National Engineering & Environmental Laboratory	250	0	0	0	N/A
Kansas City Site Office					
Kansas City Plant	40,143	42,454	54,205	11,751	27.7%
Livermore Site Office					
Lawrence Livermore National Laboratory	666,912	648,011	645,243	-2,768	-0.4%
Los Alamos Site Office					
Los Alamos National Laboratory	495,998	478,485	523,543	45,058	9.4%
Nevada Site Office					
Nevada Site Office	101,112	82,031	84,205	2,174	2.7%
NNSA Service Center					
General Atomics	7,558	8,695	10,899	2,204	25.3%
Naval Research Laboratory	21,287	10,000	10,467	467	4.7%
University of Rochester/Laboratory for Laser Energetics	34,693	36,400	40,132	3,732	10.3%
Oakland Site Office	5,594	2,960	3,000	40	1.4%
Subtotal, NNSA Service Center	69,132	58,055	64,498	6,443	11.1%
Oak Ridge Operations Office					
Office of Science & Technical Information	149	149	140	-9	-6.0%
Oak Ridge National Laboratory	4,967	4,942	5,141	199	4.0%
Y-12 National Security Complex	47,388	57,791	78,021	20,230	35.0%
Total, Oak Ridge Operations Office	52,504	62,882	83,302	20,420	32.5%
Pantex Site Office					
Pantex Plant	16,554	22,584	41,758	19,174	84.9%

Campaigns	FY 2002	FY 2003	FY 2004	$ Change	% Change
	(dollars in thousands)				
Sandia Site Office					
Sandia National Laboratories	371,606	403,201	397,192	-6,009	-1.5%
Richland Operations Office					
Pacific Northwest National Laboratory	3,548	13,200	12,080	-1,120	-8.5%
Savannah River Operations Office					
Savannah River Site	92,017	90,041	101,999	11,958	13.3%
Washington Headquarters	276,696	232,902	359,392	126,490	54.3%
Total, Campaigns	**2,189,256**	**2,166,146**	**2,395,455**	**229,309**	**10.6%**

Site Descriptions

Los Alamos National Laboratory (LANL): The LANL supports the campaigns through unique capabilities in neutron science required for stockpile stewardship and enhanced surveillance, and shares with LLNL and the Sandia National Laboratories (SNL), the responsibility for the safety, reliability, and performance of the Nation's nuclear weapons. Other activities include plutonium fabrication and processing technology development; oversight of tritium reservoir surveillance, testing, and tritium recycle technology; support of high explosive science focused on safety, reliability and performance; detonator development, production, and surveillance; beryllium fabrication; neutron tube target loading, and pit component production and surveillance.

Among the major specialized facilities at LANL are the TA-55 Plutonium Facility for surveillance of plutonium pits and plutonium pit manufacturing, actinide research, and nuclear waste research and the Los Alamos Neutron Science Center user facility for supporting advanced materials science, nuclear science and particle-beam accelerator technology, in addition to weapons surveillance. The first axis of the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility became operational for experimental use in FY 1999; Phase II is currently over 94% complete with prototype and production hardware well underway. Production of an electron beam the entire length of the second axis is scheduled for early 2003. In addition, the Strategic Computing Complex was completed in FY 2002 to house the next generation 30 TeraOps ASCI *"Q"* supercomputer. A plutonium pit manufacturing capability is being reestablished at LANL to replace units destructively tested in the Stockpile Evaluation Subprogram and to replace pits in the future, should surveillance indicate a problem with a pit.

Sandia National Laboratories (SNL): The SNL engineering efforts meet currently scheduled stockpile refurbishment requirements, and facilities such as the Testing Capabilities Revitalization project and the Microsystem and Engineering Sciences Applications (MESA) complex will provide for the design, integration, prototyping and fabrication, and qualification of microsystems into weapon components, subsystems, and systems within the stockpile. These facilities and the expertise resident at SNL provide the capabilities needed to respond to all facets of anticipated stockpile refurbishment and testing requirements. SNL provides unique capabilities in advanced manufacturing technology, microelectronics, and photonics and maintains distinctive competencies in engineered materials and processes, computational and information sciences, engineering sciences, and pulsed-power technology.

Lawrence Livermore National Laboratory (LLNL): The LLNL supports the campaigns through a broad range of world-class science and engineering capabilities, including nuclear science and technology and advanced sensors and instrumentation. LLNL also supports high explosive safety and assembly/ disassembly operations at the Pantex Plant, and oversight of uranium and case fabrication and processing technology with support from the Y-12 National Security Complex and LANL. LLNL will also conduct studies to provide the basis for an assessment of pit lifetime as well as develop and implement new diagnostics for the Stockpile Evaluation Subprogram. The lifetime work will aid NNSA in assessing the need, timing, and capacity for a large capacity pit manufacturing facility. It will utilize old pits and validated accelerated aging alloys to study the physics, engineering, and materials properties of pertinent Plutonium alloys. The work will include characterization and modeling of aging behavior to assure proper understanding of initiation system components. The final product will be age-aware performance models for use by the Primary Certification and Weapons System Engineering Certification
Campaigns to determine if potential age-induced changes are significant. Support through continuous and innovative improvement of individual manufacturing procedures and development of new technologies or materials to support refurbishments is also provided.

Kansas City Plant (KCP): The KCP provides a broad range of standard industrial processes (e.g., plating, machining, metal deposition, molding, painting, heat treating, and welding), some of which are uniquely tailored to meet special weapon reliability requirements. The Kansas City Plant evaluates components and subsystems removed from the stockpile for reuse or testing. The plant is participating with the other plants and laboratories in the Enhanced Surveillance Campaign to predict component and material lifetimes, critical elements of the Life Extension Programs, the Advanced Design and Production Technologies Campaign to develop modular, scalable, and environmentally sound manufacturing processes, and the Nonnuclear Readiness Campaign to identify, acquire, and sustain technical capabilities and production capabilities to produce nonnuclear products for DSW.

Pantex Plant: Pantex supports the Engineering Campaigns through fabrication of high explosives used in nuclear weapons and performs modifications and surveillance of nuclear weapons scheduled to remain in the enduring stockpile. During FY 2002-FY 2004, Pantex will deploy the integrated pit inspection station (IPIS); provide Engineering System Releases as required by Technical Business Practices for the IPIS to utilize eddy current measurements, acoustic resonance measurements and digital imaging technologies; install 1-2 mil resolution computed tomography for pits, X-Ray fluorescence for cases, and performance diagnostics for insensitive high explosives; provide equipment definition and process development plan for pit refurbishment activities; demonstrate process for synthesis of TATB (an insensitive high explosive small scale) in Pilot Plant; complete the engineering analyses and design for the Intrasite Pit Staging and Transportation Container; provide interfaces for automated uploading and migrate the Integrated Reporting and Information System to an Oracle platform.

Y-12 National Security Complex: Activities conducted at the Y-12 National Security Complex include manufacturing and reworking nuclear weapon components, dismantling nuclear weapon components returned from the national arsenal, serving as the nation's storehouse of special nuclear materials, and providing special production support to other programs.

Savannah River Site (SRS): The SRS is the National Nuclear Security Administration's center for the supply of tritium to the enduring nuclear weapons stockpile. SRS is the nation's only facility for recycling and reloading of tritium from the weapon stockpile, as well as the unloading and surveillance of tritium reservoirs. A new tritium extraction facility is under construction at SRS to extract new tritium that will be created by TVA's light-water reactor starting in November 2003 and shipped to the site in the fourth quarter of FY 2005. SRS tritium facilities are in the process of being upgraded and consolidated to continue to process the nations tritium.

All Other Sites

Stockpile Stewardship activities are also conducted at several other sites. Inertial fusion research is conducted at the **Naval Research Laboratory**, in Washington, D.C., through the use of its Krypton-fluoride Nike laser. This research will contribute to the direct drive application at the National Ignition Facility (NIF) and, beginning in FY 2003, does not support development of the Krypton-fluoride Nike laser for other applications. In addition, the laboratory has strong capabilities in code development and atomic physics. The **University of Rochester's** Laboratory for Laser Energetics in Rochester, New York, operates the 60-beam glass laser, Omega, primarily for research on direct drive laser fusion. The Omega facility is used to field weapons physics experiments designed by scientists from LLNL and LANL. With the shutdown of the Nova laser at LLNL, Omega is being used more extensively, pending transition to NIF operations. **General Atomics**, located in La Jolla, California, is the current contractor supplying the national laboratories with inertial confinement fusion targets.

Inertial Confinement Fusion Ignition and High Yield

Mission Supporting Goals and Measures

The Inertial Confinement Fusion Ignition and High Yield (ICF) Campaign advances the nation's capabilities to achieve inertial confinement fusion ignition in the laboratory and addresses high-energy-density physics issues required to maintain a safe, secure, and reliable nuclear stockpile. Specific campaign objectives include: (1) demonstration of laboratory inertial confinement fusion ignition; (2) enhancement of high energy density physics (HEDP) experimental capabilities; (3) design, fielding, and analysis of HEDP experiments needed to support development and validation of Advanced Simulation and Computing (ASCI) codes; and (4) assessment of options for high-yield fusion. The ICF Campaign uses a complementary suite of laser and pulsed power facilities to accomplish its mission. Core ICF facilities include the National Ignition Facility (NIF), under construction at Lawrence Livermore National Laboratory (LLNL); the OMEGA laser at the University of Rochester Laboratory for Laser Energetics (UR/LLE); and the Z accelerator at Sandia National Laboratories (SNL). The campaign also currently funds HEDP research and associated operational expenses for the Nike facility at the Naval Research Laboratory and the Trident facility at Los Alamos National Laboratory (LANL).

The FY 2004 budget request contains funding for the NIF Project (including both Total Project Costs and the NIF Demonstration Program), consistent with the approved NIF Project baseline. The project continues to meet all major milestones on or ahead of schedule. In preparation for the first stewardship experiments on NIF in 2004, the budget also includes significant increases for NIF diagnostics, cryogenics, and core scientific programs in ignition and high-energy-density physics. The budget also includes funding for full single shift operation of the Z machine (Z). Refurbishment of the Z accelerator is included under the Readiness in Technical Base and Facilities Program.

High-energy petawatt lasers show considerable promise for enhancing the stewardship capabilities of major ICF compression facilities (OMEGA, Z, NIF). The FY 2004 budget includes the funding for petawatt-laser related technology development, which is the first step towards implementing high-energy petawatt lasers at NNSA facilities.

All funding for university grants in high-energy-density physics is now consolidated in this campaign, including HEDP grants previously provided in the Secondary Certification and Nuclear Systems Margins Campaign.

Funding for the High-Average-Power Laser Program, an activity relevant to inertial fusion energy production but not required by the nuclear weapons program, is not requested by NNSA in FY 2004 due to overall Future Years Nuclear Security Program (FYNSP) fiscal constraints and prioritization of research activities across Defense Programs.

The Inertial Confinement Fusion Ignition and High Yield Campaign supports the Stockpile Stewardship Program (SSP) and the NNSA goal to maintain and enhance the safety, security, and reliability of the nation's nuclear weapons stockpile. This campaign plays an important role in developing the science and technology required for weapons system assessment and certification, now and in the future.

Subprogram Goal

High energy density physics experimental capabilities and results, including fusion ignition, to support current and future Stockpile Stewardship Program requirements for modeling processes relevant to the performance of nuclear weapons and nuclear weapons effects issues.

Performance Indicators

Number of National Ignition Facility (NIF) laser beams commissioned (total number of required beams is 192).

Number of NIF Project major construction Milestones completed on/ahead of schedule (total number of milestones is 28).

Number of annual major performance targets completed for the NIF ignition program element.

Number of annual major performance targets completed for the Assessment of High-Yield Fusion on Z-Pinches program element.

Number of total shot days provided at ICF facilities.

Number of annual major performance targets completed for Stockpile Stewardship Experiments on ICF Facilities program element.

Number of annual major performance targets completed for Experimental Support Technologies program element.

Number of university high energy density physics research grants/research activities supported.

Annual Performance Results and Targets

FY 2002 Results	FY 2003 Targets	FY 2004 Targets
Installed the National Ignition Facility (NIF) Cluster 3 beam path infrastructure. Positioned the NIF Target chamber. Reduced laser non-uniformity on OMEGA to planned specification. Evaluated advanced direct drive laser fusion target concepts on Nike and OMEGA. Conducted the first simultaneous measurements of X-Ray burnthrough and re-emission for Au and cocktail samples on Z OMEGA.	Make NIF Optics Assembly Building operational. Install NIF Target Positioner in target bay. Install NIF First Flashlamp canister in Laser Bay 2. Validate specific aspects of transport and radiation hydrodynamics models using experimental data from both Z and OMEGA. Complete one series of material properties experiments on Nike in coordination with the national laboratories.	Complete three additional major National Ignition Facility (NIF) construction milestones, for a total of 13 of 28. Complete 6 major NIF ignition performance targets (conduct first NIF ignition related experiment; demonstrate technique to fill NIF-scale targets with tritium gas; fabricate first NIF-scale targets using beryllium; validate use of tritium with basic NIF ignition target components; qualify the OMEGA laser facility for performing implosion experiments involving deuterium/tritium targets; and execute a set of scaled experiments on OMEGA to test design concepts for one type of

Completed initial specific coupled radiation transfer/hydrodynamics experiments in support of LEP.

Provided initial cryogenic D2 EOS data on OMEGA.

Demonstrated high temp drive and supersonic transition in radiation transport experiments at the Z facility.

Demonstrated high energy point backlighting of SSP experiments on Z.

Completed prototyping and design of defect driven hydrodynamic experiments.

Achieved 28 km/s velocities in cold Al-Ti magnetic flyer plates on Z to support DMP campaign requirements.

Consolidated management of core diagnostic and cryogenic projects under the NIF Director.

Completed preliminary studies supporting formulation of NNSA performance requirements for HEDP Petawatt laser facilities.

Completed preconceptual design of an enhanced performance high-energy-high-intensity laser modernization of OMEGA.

Completed assembly of the off-axis Final Optics Assembly for Z-Beamlet Backlighter experiments on Z and

Demonstrate imaging X-Rays from the imploded core of a capsule on Z. Provide 9 keV radiograph of an experiment on Z, using Z beamlet.

Perform multi-cone, gas-filled hohlraum symmetry experiments at OMEGA.

Complete initial specifications of first NIF hohlraums and capsules.

Develop sources and diagnostic techniques for equation of state and phase-transition experiments.

Construct NIF diagnostics and prepare for NIF experiments.

Develop sources and debris mitigation on Z to provide experimental data for validating system-generated electromagnetic pulse effects models.

Perform spherical mix experiments on OMEGA using tritium-filled targets.

NIF ignition target).

Complete 1 major performance target for the Assessment of High-Yield Fusion on Z-Pinches (a series of ICF experiments providing data for validating models for interactions between x-rays generated by z-pinches and targets).

Provide 600 shot days at ICF facilities.

Complete 3 major performance targets for Stockpile Stewardship Experiments on ICF facilities (obtain two data sets on deuterium and other materials for the Enhanced Surveillance and Dynamic Materials Properties Campaigns; develop two model validation test beds at ICF facilities to support stockpile stewardship; and conduct first experiments at NIF in support of Science Campaigns).

Complete 3 major performance targets for Experimental Support Technologies (field first two diagnostic data collection systems at the NIF; obtain time-resolved high-energy X-Ray images of experiments at Z; and develop advanced optical components for high energy short-pulsed lasers).

Support 18 university activities (one research center cooperative agreement; eight Stockpile Science Academic Alliance grants; and nine University of demonstrated improved resolution in images of capsule implosions.

Demonstrated enhanced capsule implosion performance on Z.

Supported basic science through 16 High-Energy-Density Science Grants and National Laser User Facility (NLUF) Program. Completed solicitation and merit review process for continuation of program.

Validated performance requirements for Z accelerator refurbishment.

Demonstrated high efficiency electron beam "non intercepting" diode concept on ELECTRA laser.

Achieved "First Light" on Mercury Diode Pumped Solid State Laser (DPSSL).

Rochester Laboratory for Laser Energetics (UR/LLE) National Laser User Facility grants.

Funding Schedule

	(dollars in thousands)				
	FY 2002	FY 2003	FY 2004	$ Change	% Change
Ignition	42,346	47,792	56,068	8,276	17.3%
Support of Stockpile Program	22,811	25,790	31,987	6,197	24.0%
Experimental Support Technologies	41,377	30,362	63,337	32,975	108.6%
High Yield Assessment	5,869	4,040	5,711	1,671	41.4%
University Grants/Other Support	7,413	4,200	7,450	3,250	77.4%
Inertial Fusion Technology	23,977	0	0	0	0.0%
Operations of Facilities	44,280	49,882	55,916	6,034	12.1%
NIF Demonstration Program	72,300	75,732	96,300	20,568	27.2%
NIF Other Project Costs (OPC)	1,400	994	0	-994	-100.0%
Construction	245,000	214,045	150,000	-64,045	-29.9%
Total, Inertial Confinement Fusion	506,773 [a]	452,837 [a]	466,769	13,932	3.1%

The FY 2003 Request column includes comparability adjustments as detailed in the footnotes for consistency with the FY 2004 Request.

Detailed Program Justification

	(dollars in thousands)		
	FY 2002	FY 2003	FY 2004
Ignition	**42,346**	**47,792**	**56,068**

Supports 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 R&D, diagnostics R&D, diagnostics development and fabrication and support for diagnostics, computer codes and modeling essential to ICF campaign efforts. In FY 2004, specific emphasis will be focused on ignition target technology development, laser-plasma interaction investigations and the development of the physics basis for direct drive ignition.

[a] Includes comparability adjustments of $1,400,000 in FY 2002 and $1,044,000 in FY 2003 from the Secondary Certification and Nuclear Systems Margins Campaign to consolidate funding for high energy density physics grants into the Inertial Confinement Fusion Ignition and High Yield Campaign.

Support of Stockpile Program	**22,811**	**25,790**	**31,987**

Funds HEDP experiments at ICF facilities in support of the current scope of the SSP. Provides specific data required for SSP campaigns and activities. Develops experimental capabilities and analytic tools required to perform HEDP experiments and meet requirements for HEDP support identified by SSP campaigns and activities. Includes planning and analysis of experiments as well as related HEDP target fabrication R&D, diagnostics R&D, and ongoing target and diagnostics support.

Experimental Support Technologies	**41,377**	**30,362**	**63,337**

Supports experimental technology including the development of NIF core and advanced diagnostics and calibration systems; definition, prototyping, design, fabrication, testing, and deployment of the NIF cryogenic system and target filling system; fabrication of optical phase plates for NIF; NIF Target Area Systems Support; NIF User Support Organization; development of pulsed power and high-energy petawatt laser technology. Provides target production capabilities for all HEDP laboratories. Activities supported within this element of the campaign are necessary to maximize the utility of ICF facilities, including NIF. During FY 2004, major emphasis will be placed on development and delivery of NIF diagnostic systems, NIF cryogenic target support systems, and fabrication of necessary optics to support experiments.

High Yield Assessment	**5,869**	**4,040**	**5,711**

Supports Pulsed Power experimental program and assessment of pulsed-power for high yield.

University Grants/Other Support	**7,413**	**4,200**	**7,450**

Supports university grants in high-energy-density science, National Laser User Facility (NLUF) activities, and critical needs of the campaign. All university grants for HEDP research are now consolidated within this activity. Previously, HEDP grants were partially funded in the Secondary Certification and Systems Margins Campaign.

Inertial Fusion Technology	**23,977**	**0**	**0**

Develops technology options for inertial fusion and stockpile stewardship through use of high-average power lasers. It is not funded in FY 2004 due to the requirements of higher priority activities within this campaign and within NNSA.

Operations of Facilities	**44,280**	**49,882**	**55,916**

Supports the operation of facilities, including OMEGA, Z, NIKE, and TRIDENT in a safe, secure manner for ICF Ignition and High Yield Campaign activities and other authorized users.

NIF Demonstration Program	**72,300**	**75,732**	**96,300**

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. These transfers employ the Management Pre-Start Review process in which an independent team evaluates readiness (e.g. training and qualification of operators, installation and assembly drawings and procedures, and commissioning test procedures results). Pre-start reviewing, commissioning and testing activities are included in the NIF Demonstration funding.

NIF Other Project Costs (OPC)	**1,400**	**994**	**0**

Supports National Environmental Policy Act (NEPA) documentation, including environmental impact statement and environmental monitoring and permits, and assurances, safety analysis and integration. These activities will be completed by the end of FY 2003.

Construction	**245,000**	**214,045**	**150,000**

96-D-111, National Ignition Facility, Lawrence Livermore National Laboratory. Funding decreases in FY 2004, consistent with the current Project baseline. The major milestone for the Project in FY 2004 is achieving "First Light" to the Target Chamber Center.

Total, Inertial Confinement Fusion	**506,773**	**452,837**	**466,769**

Explanation of Funding Changes

Inertial Confinement Fusion	FY 2004 vs. FY 2003 ($000)
• **Ignition:** Increase supports ignition target design, target fabrication, and diagnostic development; additional support for direct drive cryogenic implosion research and overall ignition risk reduction; and increased ignition related activities at NIF, including preliminary experimentation	8,276
• **Support of Stockpile Program:** Increase supports activities and experiments needed for validation of advanced codes and other stockpile assessments, including target design, target fabrication, and diagnostics development; initiation of stockpile related experiments on NIF; and additional stockpile related experiments on Z	6,197
• **Experimental Support Technologies:** Increase supports accelerated construction of NIF diagnostics and cryogenic target systems to meet milestones of rebaselined ignition plan; fabrication of optical phase plates for NIF, NIF Target Area Systems Support, and NIF User Support Organization; greater target quantities and additional complexity; enhanced Z backlighting as a diagnostic tool; and high-energy petawatt technology development	32,975

- **High Yield Assessment:** Increase supports additional effort for the validation of models used to scale to high yield on pulsed power devices 1,671

- **University Grants/Other Support:** Increase provides additional funding for short-pulse high-intensity laser and other university activities including the National Laser User Facility (NLUF) 3,250

- **Operations of Facilities:** Increase supports full single shift operations at Z 6,034

- **NIF Demonstration Program:** Increase provides full support for the NIF Demonstration Program consistent with the NIF Project baseline established in March 2001, and reflects the ramp-up of activities towards full operation in FY 2009. Included is the assembly, installation, and testing of laser components, including the final optics assembly required to meet the NIF "first light to the target chamber center" milestone. The Management Pre-start Reviews required to support this milestone are also supported by this funding. 20,568

- **NIF Other Project Costs (OPC):** Decrease reflects that FY 2003 is the last year of Other Project Cost (OPC) funding for the NIF project consistent with the NIF Project baseline established in March 2001 . . . . -994

- **Construction:** Decrease in the National Ignition Facility Project line item reflects the NIF Project baseline established in March 2001 . . . . -64,045

Total Funding Change, Inertial Confinement Fusion **13,932**

Capital Operating Expenses and Construction Summary

Capital Operating Expenses [b]

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
General Plant Projects	245	252	260	8	3.00%
Capital Equipment	7,713	7,944	8,183	238	3.00%
Total, Capital Operating Expenses	7,958	8,197	8,443	246	3.00%

[b] 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 2003 and FY 2004 funding shown reflects estimates based on actual FY 2002 obligations.

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

(Changes from the FY 2003 Congressional Budget are denoted with a vertical line [|] in the left margin)

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 2003 Budget Request	1Q 1996	2Q 1998	3Q 1997	4Q 2008	2,094,897	2,248,097	1,200,000	3,448,097
| FY 2004 Budget Request (*Performance Baseline*)	1Q 1996	2Q 1998	3Q 1997	4Q 2008	2,094,897	2,248,097	1,200,000	3,448,097

2. Financial Schedule

TEC Funding

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
1996	37,400	37,400	33,990
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	214,045	200,615
2004	150,000	150,000	164,142
2005	130,000	130,000	126,452
2006	130,000	130,000	135,312
2007	120,000	120,000	129,089
2008	10,139	10,139	24,494

3. Project Description, Justification and Scope

The Project provides for the design, procurement, construction, assembly, and acceptance testing of the National Ignition Facility. 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).

| The NNSA Inertial Confinement Fusion (ICF) Program 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 Program. The NIF is designed to achieve propagating fusion burn and modest (1-10) energy gain within 2-3 years of full operation and to conduct high energy density experiments, both through fusion ignition

[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 for a rescission enacted by Section 1403 of the FY 2001 Consolidated Appropriations Act.

| and through direct application of the high laser power. The NIF will also conduct non-ignition HEDP experiments critical to the success of the SSP. Technical capabilities provided by the ICF program also contribute to other DOE missions including nuclear weapons effects testing and the development of inertial fusion power. Ignition and other goals 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's 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 Stockpile Stewardship program 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 phenonena).

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 (:m) 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, will provide an optically stable and clean environment. This Target Area Building 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 laser building, 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 laser building consists of 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 laser building 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 laser building 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 :m, 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 laser building. 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	Jun 2004
12 bundle	Jun 2007
24 bundles	Sep 2008
Project Complete (CD4)	Sep 2008

Project milestones for FY 2003 include:

- 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

Project milestones for FY 2004 include:

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

4. Details of Cost Estimate

	(dollars in thousands) Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs (Design Drawings and Specifications)	219,573	203,150
Design Management Costs (1.9% of TEC)	39,400	38,400
Project Management Costs (1.9% of TEC)	40,414	39,414
Total Design Costs (14.3% of TEC)	299,387	280,964
Construction Phase		
Improvements to Land	1,800	1,800
Buildings	179,000	173,400
Special Equipment	1,268,281	1,219,828
Utilities	500	500
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	132,566	120,677
Construction Management (0.9% of TEC)	18,000	18,000
Project Management (2.8% of TEC)	59,594	55,594
Total Construction Costs (79.2% of TEC)	1,659,741	1,589,799
Contingencies		
Design Phase (1.0% of TEC; 3.5% of remaining TEC BA)	21,642	40,065
Construction Phase (5.4% of TEC; 18.5% of remaining TEC BA)	114,127	184,069
Total Contingencies (6.5% of TEC; 22.0% of remaining TEC BA)	135,769	224,134
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) 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. DOE/NNSA will maintain oversight and coordination through the National Nuclear Security Administration 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 ROD 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 fiscal year 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 PSAR and NEPA documentation, and planning for and conducting the constructibility reviews.

Title I Design was completed in November 1996 and was followed by an ICE 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, 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, 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, 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 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 experiments and NIF 192-beam operation, and the results will be validated by the National Nuclear Security Administration Office of the NIF Readiness Assessment. The first experiment and 192-beam Readiness Assessment requires that the FSAR 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 Critical Decision 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*. These are the criteria that NIF is required to meet when fully operational. However, early test operation of NIF by the Program through a series of turnovers controlled by Management Pre-Start Reviews will be achieved by a phased transition to Program operations for user tests before Project completion. This enables the Program to begin experimental operations 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 2002	FY 2003	FY 2004	Outyears	Total
Project Cost						
Facility Costs						
Design	303,171	8,872	7,300	670	1,016	321,029
Construction	729,470	273,281	193,315	163,472	414,330	1,773,868
Total, Line item TEC	1,032,641	282,153	200,615	164,142	415,346	2,094,897
Other Project Costs						
R&D necessary to complete construction [a]	102,342	1,517	536	0	0	104,395
Conceptual design costs [b]	12,300	0	0	0	0	12,300
NEPA documentation costs [c]	5,514	616	975	384	3,016	10,505
Other project-related costs [d]	21,460	505	1,589	740	1,706	26,000
Total, Other Project Costs	141,616	2,638	3,100	1,124	4,722	153,200
Total Project Cost (TPC)	1,174,257	284,791	203,715	165,266	420,068	2,248,097
Other Related Operations and Maintenance Costs - NIF Demonstration Program	474,078	76,781	71,719	86,258	491,164	1,200,000
TOTAL Project and Related Costs	1,648,335	361,572	275,434	251,524	911,232	3,448,097
Budget Authority (BA) requirements [e]						
TEC (capital funding)	1,095,713	245,000	214,045	150,000	390,139	2,094,897
OPC (O&M funding)	150,806	1,400	994	0	0	153,200
NIF Demonstration Program (O&M funding) [f]	479,068	72,300	75,732	96,300	476,600	1,200,000
Total, BA requirements	1,725,587	318,700	290,771	246,300	866,739	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 campaign is required to maintain the Project baseline. The outyear funding profile is $96,300,000 in FY 2004; $113,700,000 in FY 2005; $117,260,000 for 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]	36,670	35,916
Annual facility maintenance/repair costs [b]	65,209	63,868
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	216	212
GPP or other construction related to the programmatic effort in the facility	216	212
Utility costs [d]	13,944	13,657
Other costs [e]	1,777	1,740
Total related annual funding (estimate based on operating life of FY 2009 through FY 2038)	118,032 [f]	115,605 [g]

[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; previous estimate was based on an average of shots over the life of the facility.

[b] Includes refurbishment of laser and target systems, building maintenance, and component procurement based on 746 shots in FY 2011 (204 personnel); previous estimate was based on an average number of shots over the life of the facility.

[c] For these costs, refer to the National Stockpile Stewardship Program; previous estimate included the LLNL ICF Program-related costs.

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

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

[f] In FY 2004 dollars.

[g] In FY 2003 dollars.

Advanced Simulation and Computing

Mission Supporting Goals and Measures

The core mission of the Advanced Simulation and Computing (ASCI) Campaign is to provide the tools that enable the weapons design community to assess and certify the safety, performance, and reliability of the nuclear weapons stockpile.

The ASCI Campaign is creating simulation capabilities that incorporate modern physics and engineering models validated against experimental data from both above ground and past underground nuclear testing. These baseline models are the repositories of expert designer judgment as well as the best scientific representations of our current knowledge of the performance of the complex devices currently in the stockpile. These simulation capabilities are essential if the National Nuclear Security Administration (NNSA) is to continue to meet its statutory responsibility to the nation to assess and certify the stockpile on an annual basis. The ASCI Campaign provides the means to integrate the theoretical and experimental efforts taking place within the Stockpile Stewardship Program (SSP). The products of this integration are the simulation tools that are being developed and deployed.

At the same time that ASCI continues an aggressive development of the most powerful capabilities for the future, the modern simulation tools previously developed by ASCI are being applied day-to-day to address immediate stockpile concerns. ASCI codes are being used to close Significant Finding Investigations (SFIs) as well as to support the Life Extension Programs (LEPs) for individual weapon systems. These activities are enabled by the ongoing supercomputing infrastructures at the National Laboratories, encompassing both continuing operations as well as research in new techniques for storage, visualization, networking, and all aspects of the structure that is required by the modern generation of computing capabilities.

The ASCI Campaign is integrating its efforts more tightly with the needs of Directed Stockpile Work (DSW) and other campaigns. A major manifestation of this renewed commitment to DSW is the alignment of the series of major milestones with the work that the code users must perform in support of assessment and certification. These milestones, which are reviewed semi-annually by an external review committee of experts in scientific computation, ensure a steady improvement in simulation capabilities focused on the performance of the NNSA core mission–maintaining a safe, secure, and reliable nuclear weapons stockpile.

By FY 2008, ASCI will deliver a high fidelity, full-system physics characterization of a nuclear weapon. At that time, the campaign will deliver a suite of validated codes, running on supercomputer platforms, acquired through open procurement, with user-friendly environments, advanced visualization tools for analysis, and the entire support structure to integrate the components together. Other program deliverables include high-performance storage and high-bandwidth networks. In support of a true integrated SSP effort, the ASCI Campaign continues to push the envelope in distance computing as well as in advanced encryption techniques and other approaches to ensure secure networking.

Through its University Alliances partners and through the basic research activities at the national laboratories, ASCI continues to look to the future to meet its responsibility to ensure that the tools needed to support the simulation of the most complex physics devices ever modeled will be ready when needed. The science for realistic models and a predictive capability must be available to the code developers and the weapons designers to allow them to stay ahead of the problems presented by the effects of aging on the weapons in the nuclear stockpile.

ASCI's Ongoing Computing program element has been split into two elements titled 1.) Computational Systems and 2.) Simulation Support. The primary reason for this split is for the programmatic visibility and understanding of driving factors and trends for ASCI computing center costs. This split is wholly contained by what was the Ongoing Computing program element and does not shift costs from or to the other ASCI program elements. The Computational Systems and Simulation Support elements were derived through tri-lab collaborations and apply to all three computing centers.

FY 2002 Performance Report: The ASCI Campaign successfully performed a prototype calculation of a full weapon system with three-dimensional engineering features. The result was conducted at Los Alamos National Laboratory for the W-76 and Lawrence Livermore National Laboratory for the W-80 warheads using the ASCI "White"supercomputer at Lawrence Livermore National Laboratory, as briefed to the Nuclear Weapons Council Standing and Safety Committee on June 13, 2002.

ASCI actively participated in the recent Office of Management and Budget's Program Assessment using the Program Assessment Rating Tool (PART). The PART assessment noted that the Program was well managed earning OMB's highest rating of "Effective". OMB's focus on ensuring that planned growth in the program meets requirements specifically related to the weapons stockpile and that the program does not develop unneeded redundancy is on target. In FY2004 ASCI will commission an independent review of stockpile computational requirements and will remain sensitive to unneeded redundancy, redirecting work authorizations where it is identified.

Subprogram Goal

Predictive simulation and modeling tools, supported by necessary computing resources, to maintain long-term stewardship of the stockpile.

Performance Indicators

Peer-reviewed progress, according to schedule, toward a validated full-system, high-fidelity simulation capability

Number of weapon system components analyzed using ASCI codes to annually certify their performance (as part of annual assessments and certifications process or Life Extension Program (LEP) activity)

The maximum individual platform computing capability measured in trillions of operations per second (TeraOPS)

The total computing capability of all platforms, measured in trillions of operations per second (TeraOPS), taking into consideration procurements and retirements of systems.

Annual Performance Results and Targets

FY 2002 Results	FY 2003 Targets	FY 2004 Targets
Demonstrated a proof-of-principle capability for 3-Dimensional (3-D) full-system studies of weapons systems (the high quality prototype simulations shed new light on the complex	Deliver an enhanced capability for nuclear weapon primary performance assessment. Deliver an enhanced capability to study secondary design and	Complete sufficient milestones to achieve high-fidelity primary simulation and Stockpile to Target Sequence (STS) abnormal environments.

coupled dynamics of weapons, producing relevant information for comparison with nuclear test data, including the primary and secondary yields; these calculations show that it is possible to simulate an entire explosion, both primary and secondary, in three dimensions with a single computational code). Demonstrated prototype 3-D simulations for full-system weapon stockpile to target sequence (STS) abnormal environments. Demonstrated key 3-D mechanical responses of a re-entry vehicle system to normal flight environments using ASCI software. Conducted a Software Quality Assessment (this is an important part of delivering validated 3-D codes to weapon designers and other code users). Completed a new mathematical framework enabling the reconstruction and restoration of 3-D radiographic imaged objects; this contributed to the "see and understand" effort to deliver adequate user environments to the user community. Developed the initial software development environment for the 12 teraOPS computer system, ASCI White, providing the necessary compilation, debugging, middleware, Input/Output services	Directed Stockpile Work (DSW) issues. Demonstrate 3-Dimensional safety simulation of a scenario involving abnormal high-explosive initiation. Demonstrate the ability to evaluate the response of a weapon's electrical system to a hostile environment; specifically, this target will evaluate ASCI tools for predicting the transient response of electrical components in an X-Ray environment. Demonstrate a user environment that provides application development and execution, data analysis and visualization and distance computing in accordance with the ASCI Q platform and application requirements. Complete acquisition of 30 teraOPS "Q" super computer at LANL	Analyze 10 of 31 weapons systems components. Acquire : 40 teraOps; 10 Terabytes of Memory; and 240 Terabytes of Storage at Sandia National Laboratories. Acquire/maintain total ASCI capacity of 85 teraOPS.

and solver libraries required by ASCI and Directed Stockpile Work (DSW) applications; this work made ASCI White available and usable for developers, designers, and analysts from all three weapons laboratories.

Provided a common "tri-lab" security infrastructure with cross-site authentication and distributed file system enabling greater access to a secure, integrated environment; this contributed to the delivery of a proper environment to the user community and supported the platform strategy requirement for distance computing.

Supported laboratory computing centers operations and administration 24 hours/day, 7 days/week, as well as archival storage resources, local and wide-area networking and help desk; this supported all work being done within the computing centers and included troubleshooting, back-up, communications, and improved efficiency in resource usage.

Completed an Alliance program review with the decision to renew contracts for another five-year term (during the review, the important role these university partnerships play was made evident; the ASCI Alliances are all involved in large-scale simulation and provide access to some of academia's brightest minds to support science-based weapon stewardship).

Dedicated the Nicholas C. Metropolis Strategic Computing Complex at Los Alamos National Laboratory; construction was finished early and below the original cost estimate and the complex with a resident “Q” machine will be fully operational in FY 2003.

Installed 20 teraOps of the Q system at Los Alamos; when completely installed, this system will have a 30 teraOps supercomputer operating in the classified environment and a 2.5 teraOps system in the open--ASCI Q enables required DSW analysis work as well as ASCI programmatic milestones.

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Advanced Applications Development	147,812	144,769	144,019	-750	-0.5%
Verification and Validation	40,766	42,401	44,293	1,892	4.5%
Materials and Physics Modeling	67,702	69,931	69,931	0	0.0%
Problem Solving Environment (PSE)	41,489	42,148	42,198	50	0.1%
Distance Computing	28,791	16,300	16,601	301	1.8%
PathForward	10,114	14,550	15,000	450	3.1%
Visual Interactive Environment for Weapon Simulation (VIEWS)	63,006	61,260	62,298	1,038	1.7%
Physical Infrastructure and Platforms	100,300	102,000	140,000	38,000	37.3%
Computational Systems	53,729	62,739	66,534	3,795	6.0%
Simulation Support	45,770	52,978	57,102	4,124	7.8%
Advanced Architectures	5,600	5,500	0	-5,500	-100.0%
University Partnerships	48,300	47,600	47,600	0	0.0%
ASCI Integration	6,677	7,351	7,750	399	5.4%
Construction	43,777	55,335	37,300	-18,035	-32.6%
Total, ASCI	703,833	724,862	750,626	25,764	3.6%

Detailed Program Justification

(dollars in thousands)

	FY 2002	FY 2003	FY 2004
Advanced Applications Development	**147,812**	**144,769**	**144,019**

Advanced Applications is develops enhanced 3D computer codes that provide an unprecedented level of physics and geometric fidelity for full-system, component, and scenario weapons simulations. These codes are run in direct support of the Stockpile Stewardship Program and will require the integration of all the elements of ASCI, particularly the materials and physics models currently being developed and the 30 teraOPS platform planned for full operation in FY 2003. In FY 2004, Advanced Applications will focus on the 3D codes capable of simulating the high-fidelity physics for primary performance and the coupled response of re-entry vehicle systems to abnormal Stockpile to Target Sequence (STS) environments. These increased capabilities are of use today in support of Directed Stockpile Work (DSW) and compliment the work currently underway in other campaigns.

Verification and Validation	**40,766**	**42,401**	**44,293**

Assesses models and simulation designs against experimental data to establish confidence in the simulation used for nuclear weapon certification and for resolving high consequence nuclear stockpile problems thus supporting stockpile stewardship. Activities include: quantifiable assessment of the accuracy of thermal response models in stockpile-to-target sequence abnormal environments; quantitative assessments of the physics models and simulation capability used to complete a simulation related to secondary capability; and quantifiable assessment of primary capability and nuclear safety of a complex abnormal environment.

Materials and Physics Modeling	**67,702**	**69,931**	**69,931**

Develop models for physics, material properties and transport processes which are essential to the simulation of weapons under all conditions relevant to their life cycle. As platforms are allowing simulations of higher resolutions, models are becoming more detailed, providing improved confidence in the simulations. In FY 2004, new models for material properties, high explosive detonation and transport will be incorporated into weapons codes for the high-fidelity, primary burn initial capability milestone.

Problem Solving Environment (PSE)	**41,489**	**42,148**	**42,198**

Develop a computational infrastructure to allow applications to execute efficiently on ASCI computing platforms and allow accessibility from the desktops of scientists. This computational infrastructure includes of local-area networks, wide-area networks, advanced storage facilities, and software development tools. In FY 2004, PSE will deliver a common and usable application development environment for ASCI computing platforms such as Q and Red Storm systems; an end-to-end, high-performance Input/Output and storage infrastructure; and a secure and appropriate access to ASCI supercomputers and other ASCI resources across the three weapons labs, so that ASCI compute platforms are fully usable for local code development and execution.

Distance Computing (DISCOM)	**28,791**	**16,300**	**16,601**

Secure computing at a distance is required in ASCI in order to enable any of the NNSA labs to gain access to any ASCI platform. This involves application development, debugging, milepost development and execution, DSW execution and visualization activities from remote sites. As a result this element is key to the successful completion of the FY 2004 ASC targets as it provides the secure, high bandwidth, high availability infrastructure (both hardware and software) required by the engineers and scientists.

PathForward	**10,114**	**14,550**	**15,000**

Stimulate development and engineering activities with U.S. computer industry in technology areas such as interconnect, runtime system, visualization, and storage, to advance commercial-off-the-shelf (COTS) technologies needed for future ASCI-class computer systems.

Visual Interactive Environment for Weapon Simulation (VIEWS)	**63,006**	**61,260**	**62,298**

Deliver leading-edge visualization and data management software and hardware to provide the "see and understand" capabilities needed to view, interact and analyze the terascale size data produced by ASCI simulations. VIEWS provides delivery of high-end graphics to offices, enabled by emerging technologies such as improved Liquid Crystal Display (LCD) monitors, video delivery over gigabit ethernet, PC-cluster-based scalable rendering, and software to exploit such technologies. VIEWS' support of both multi- and single-user visualization capabilities will play a pivotal role in application development, debugging and assessment in performance of the FY 2004 targets.

Physical Infrastructure and Platforms (PI&P)	**100,300**	**102,000**	**140,000**

Acquire the computational platforms to support the Stockpile Stewardship Program. The 30 teraOPS ASCI Q will be deployed in FY 2003 at LANL; the Red Storm system at Sandia will be completed in FY 2004; and the major 100 teraOPS ASCI Purple is scheduled for full delivery and installation at Lawrence Livermore Laboratory in FY 2005, with an early technology demonstration system in FY 2003 and the buildup of the system in FY 2004.

Computational Systems	**53,729**	**62,739**	**66,534**

This new MTE was previously part of Ongoing Computing. The Ongoing Computing MTE has been split into two MTE's: Simulation Support and Computational Systems. The primary reason for this split is for the programmatic visibility and understanding of driving factors and trends for ASCI computing center costs. This split is wholly contained by what was the Ongoing Computing program element. Computational Systems provide for the production computational and data storage systems and their networking infrastructure at the three NNSA laboratories. For all three laboratory centers, this includes the systems management personnel, maintenance contracts, and capital operating equipment for these systems. Efforts in FY 2004 will emphasize different phases of major platform deliveries in progress. It is expected that LANL will be providing tri-lab computational support on the Q machine. At Sandia, the Red Storm system will be in its delivery and integration phases, and at LLNL, emphasis in FY 2004, will be on the integration and early use of the initial delivery system for the Purple contract and preparation for the delivery of the full Purple system in FY 2005.

Simulation Support	**45,770**	**52,978**	**57,102**

This new MTE was previously part of Ongoing Computing. The Ongoing Computing MTE has been split into two MTE's: Simulation Support and Computational Systems. The primary reason for this split is for the programmatic visibility and understanding of driving factors and trends for ASCI computing center costs. Simulation Support 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 support the usability, accessibility and reliable operation of high-performance, institutional, and desktop computing resources at the three NNSA laboratories.

Advanced Architectures	**5,600**	**5,500**	**0**

Address the long-term platform risk issues of cost, power, performance and size by the study of alternative architectures that have the potential to make future ASCI platforms more cost effective. By working directly with high-end computing resource providers (both current and potential new participants), this element provides an opportunity for these providers to explore innovative and novel solutions addressing ASCI's aggressive computing requirements.

University Partnerships	**48,300**	**47,600**	**47,600**

Included are activities aimed at training, recruiting and collaborating with top researchers in key disciplines required by Stockpile Stewardship in order to help establish and validate large-scale, multi-disciplinary, modeling and simulation as a viable scientific approach. The operating of Computer Science Institutes at each of the NNSA laboratories, Graduate Fellowships and University Alliances are all part of this program element.

ASCI Integration	**6,677**	**7,351**	**7,750**

Support for Super Computing research exhibit projects and the One Program/Three Lab integration strategy for collaborations across the three labs for program collaboration meetings, program planning, topical investigations, meetings, outreach and crosscuts.

Subtotal, ASCI	**660,056**	**669,527**	**713,326**
Construction			
01-D-101, Distributed Information Systems Laboratory, (DISL) at Sandia National Laboratories in California	8,400	13,305	12,300
00-D-103, Terascale Simulation Facility (TSF) at Lawrence Livermore National Laboratory in California	22,000	35,030	25,000
00-D-107, Joint Computational Engineering Laboratory (JCEL) at Sandia National Laboratories in New Mexico	13,377	7,000	0
Total, ASCI	**703,833**	**724,862**	**750,626**

Explanation of Funding Changes

	FY 2004 vs. FY 2003 ($000)
ASCI	
• Higher computing maintenance costs are associated with all currently operating ASCI platforms including Red, Blue Pacific, Blue Mountain, and White Q. Increases related to maintenance are the result of the machines aging, end of existing support contracts and power rate changes (Computational Systems, +$3,795; Simulation Support, +4,124). The remaining increase is the result of planned workload levels for the ASCI program elements (Advanced Applications, -$750; Verification and Validation, +1,892; Materials Physics and Modeling, +$0; Problem Solving Environment, +$50; DISCOM, +$301; Pathforward +$450; VIEWS +$1,038; One Program-Three Labs, +$399)	11,299

- Planned hardware procurement profile (Physical Infrastructure & Platforms, +$38,000; Advanced Architectures, -$5,500). This increase allows ASCI to maintain the goal of delivering a 100 teraOPS platform in FY 2005 needed to support ongoing computing requirements, support Life Extension Program schedules and continue the development, production and validation of the ASCI 3D codes 32,500
- Supports the approved construction profiles for the Terascale Simulation Facility (TSF)(-$10,030), the Joint Computational Engineering Laboratory (JCEL) (-$7,000), and the Distributed Information Systems Laboratory (DISL) (-$1,005) . . . . -18,035

Total Funding Change, ASCI 25,764

Capital Operating Expenses and Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
General Plant Projects	5,832	6,007	6,187	180	3.00%
Capital Equipment	128,887	132,754	136,736	3,983	3.00%
Total, Capital Operating Expenses	134,719	138,761	142,923	4,163	3.00%

[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 2003 and FY 2004 funding shown reflects estimates based on actual FY 2002 obligations.

01-D-101, Distributed Information Systems Laboratory (DISL) Sandia National Laboratories, Livermore, California

(Changes from FY 2003 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

- Updated to reflect progress to date and approved CD-2/3 baseline schedule milestones and budget.

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 2001 Budget Request *(Preliminary Estimate)*	2Q 2001	2Q 2002	3Q 2002	1Q 2004	35,500	38,100
FY 2002 Budget Request	1Q 2001	1Q 2002	TBD	TBD	35,500	38,100
FY 2003 Budget Request	1Q 2001	1Q 2002	3Q 2002	1Q 2004	36,300	38,008
FY 2004 Budget Request *(Performance Baseline)*	1Q 2001	1Q 2002	3Q 2002	1Q 2004	36,300	38,008

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2001	2,295[a]	2,295	1,919
2002	8,400	8,400	2,499
2003	13,305	13,305	17,792
2004	12,300	12,300	12,651
2005	0	0	1,439

[a] Original appropriation was $2,300,000. This was reduced by $5,000 for 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 2003 budget request.

3. Project Description, Justification and Scope

The Distributed Information Systems Laboratory (DISL) is a proposed new facility at Sandia National Laboratories to develop and implement distributed information systems for the National Nuclear Security Administration (NNSA). It consolidates at one accessible location all activities focused on incorporating those systems to support NNSA's Stockpile Stewardship Program (SSP). Research at DISL will concentrate on secure networking, high performance distributed and distance computing, and visualization and collaboration technologies that do not exist today, yet need development to help create design and manufacturing productivity environments for the Nuclear Weapons Complex (NWC). The major objective of DISL is to bring together these technologies to develop a distributed information systems architecture that will link the NWC of the future.

Description:

The proposed facility requires 71,516 gross square feet of space to house 126 employees and up to 50 visiting researchers. Space will be provided for laboratories, technology deployment facilities, individual workspaces, collaborative areas, management and administrative areas, and public and support areas. Laboratory and other specialized space will be used for research and development of distributed computing and visualization, networking, information security, and collaborative environments technologies, and for deployment and use of those technologies by weapon project teams. Individual workspaces, located in a number of separate suites within the facility, will house Sandia technical staff and visiting researchers and will accommodate multiple computer workstations with monitors and peripheral equipment. Collaborative areas include conference and meeting rooms and informal common areas throughout the facility. Management and administration space and typical building support space, such as storage and break/vending areas, will also be included. The facility will be interconnected with a large amount of fiber-optics communications to accommodate the work there.

The laboratories, conference rooms, and individual workspace suites will have access controls and be acoustically constructed to enable simultaneous occupancy by different need-to-know workgroups in adjacent areas within the facility. Some laboratories, technology deployment facilities, and project team areas will be built as secure vault-type rooms. Most DISL space will be classified, with a portion located in the unclassified area for collaborations and shared research with academia and private industry. The entire facility is designed to meet Top Secret Restricted Data (TSRD) requirements if needed in the future.

DISL will be situated in the central part of Sandia's California (SNL/CA) site, near existing development, parking, and utilities, and easily accessible to visiting working partners. Improvements to land include site work such as new curbs and gutters at existing streets, walkways, planters, minor paving, and landscaping and irrigation surrounding the facility. Utilities work includes extensions of existing nearby water, storm and sanitary sewer, and electrical power and communications systems to the building.

Standard equipment will include new furniture and video conferencing equipment. Specialized equipment (Major Computer Items) necessary to create the communications network, visualization, and collaborative environments infrastructure in DISL includes visualization and computational equipment such as multi-processor and multimedia servers, high performance storage systems, and display systems; communications equipment such as switches, routers, network analyzers, racks and connectors; computational, display, and videoconferencing equipment for collaborative environments; and analyst workstations and associated equipment for project teams.

Justification:

The National Nuclear Security Administration (NNSA) is responsible for the management of the Nuclear Weapons Complex (NWC). Changes in the military-political landscape, including the cessation of underground testing, reduced defense budgets, and a significantly smaller nuclear weapons manufacturing complex, require NNSA to find new ways of ensuring a safe, reliable, and secure nuclear weapon stockpile while meeting unchanged certification requirements. NNSA's Directed Stockpile Work (DSW) Plan defines the stockpile refurbishment decisions and schedule necessary to maintain this deterrent. To meet NNSA mission goals and DSW requirements, NNSA has developed a Stockpile Stewardship Program (SSP) that plans to use technology to monitor, remanufacture, and test, through simulation, weapons in the current and future stockpiles. The NWC of the future will be linked by a distributed information architecture which will be developed, in large part, at DISL.

Examples of NNSA efforts that support the SSP include:

- The Advanced Simulation and Computing (ASC) Campaign, which will create the leading-edge computational modeling and simulation capabilities to help weapons designers shift from test-based methods to computation-based methods for stockpile certification.
- The Distance Computing and Distributed Computing ($DisCom^2$) Program within the ASC Campaign, which will accelerate the ability of NNSA labs and plants to apply vital high-end and distributed resources (from desktops to teraops [1 teraop = 10^{12} floating-point operations per second]) across thousands of miles to meet the urgent and expansive design, analysis, and engineering needs of stockpile stewardship.
- The Advanced Design and Production Technologies (ADAPT) Initiative's Enterprise Integration strategy, which will:
  - Create seamless, secure, and connected communications.
  - Create products and process information systems, which allow rapid access to weapons information.
  - Encourage streamlined business and engineering practices, which are more responsive and productive.

With these and other Programs, NNSA envisions a highly distributed, yet totally integrated, system of facilities within the NWC that support information networking and provide cost-effective information integration, access, and preservation.

Safe, effective, and efficient product realization, weapon surveillance, and material disposition are the core issues involved in the SSP. Research toward successful resolution of these issues necessitates distributed/distance computing capabilities, and will depend on information-based resources that are accessible across the NWC. For these systems to be developed, SSP will need the technical skills of the best scientists and engineers working in academia, industry, and government agencies, in addition to those currently working for the national laboratories. It is important that NNSA laboratories (Sandia National Laboratories, Lawrence Livermore National Laboratory and Los Alamos National Laboratory) encourage partnerships with industry and academia when conducting this research. Partnerships leverage professional skills and costs associated with research, thereby improving the research process and the resultant product.

To realize the mission objectives outlined above, NNSA must have the ability to access information from across the NWC, fully integrate the design and manufacture of nuclear weapons so as to reduce the redesign time for nuclear weapons by half, and have a means to incorporate emerging information systems technology from the private sector and academia as rapidly as possible. The proposed DISL at SNL will provide the means to accomplish these goals. DISL will provide technologies that will allow seamless, secure, reliable access to scientific and engineering and business information by the many geographically dispersed elements of the NWC, including laboratories, production facilities, and DOE offices.

Research and development in DISL will focus on developments that will greatly enhance the integration of design and manufacturing tasks. DISL will house weapon systems engineers together with computer scientists to foster the interchange necessary to ensure the development of a design-to-analysis-to-manufacturing enterprise, allowing researchers, weapons designers, analysts, product realization specialists and others to systematically reduce the time and cost required to design new nuclear weapons or redesign and refurbish existing ones. The long-term objective of DISL is to bring together prototype technologies to develop a distributed information systems infrastructure that will be incorporated into NNSA's virtual enterprise for the SSP.

The DISL will serve as a technology deployment center/user facility to accelerate the introduction of advanced information systems technology into the NWC. NNSA laboratories can neither create a virtual enterprise nor sustain a vibrant high-performance computing market on their own, and so must work closely with industry and academia to develop critical new information technology. Extensive collaboration with industry and academia is a major strategy of ADAPT, ASC, and DisCom^2, and, therefore, is a cornerstone of DISL. In addition, the existence of DISL will create opportunities for NNSA laboratories to influence the course of technology development in the private sector and maximize benefits to their related core programs.

Existing facilities within the NWC cannot satisfy the need for the development of integrated information systems required to support SSP and its programs. While many of the elements needed to support NNSA's distributed information systems requirements exist at SNL/CA, the necessary facilities are absent — either they do not have laboratory areas with appropriate infrastructure (air conditioning and communications) and size to support required technologies, or they must remain completely classified. DISL must have space for classified activities, but must also facilitate unclassified exchanges. Thus SNL proposes to create DISL as a single facility — one that consolidates activities and equipment, is sized appropriately, provides space for visiting personnel from the private sector, academia, and other laboratories, and possesses a suitable technological infrastructure to ensure NNSA can meet its critical mission responsibilities related to the SSP.

The President has mandated that the nuclear weapon stockpile be safe, secure, and reliable. All US weapons require periodic refurbishment and remanufacture, because they contain components that have limited lifetimes. NNSA's DSW Planning schedule lays out the schedule of weapon system alterations, modifications, and improvements to be completed in the coming decades. A major step in the refurbishment and remanufacture of a weapon is Full-Scale Engineering Development (FSED), the step during which weapon designers and systems engineers develop engineering designs, qualify them, and implement them at the production plants. After a weapon has been redesigned through FSED, it goes into production in the weapon plants. A key milestone is the date when the first production unit (FPU) assembly is completed. The DSW Planning Schedule calls for refurbishment in the near-term on the W80 (FPU in FY2006), in the mid-term on the B83 ALT353 (FPU in FY2007), and in the longer-term on the W76-1 (FPU in the FY2007-2008 time frame).

To meet the DSW Planning Schedule, significant reductions in FSED time for weapon systems will be required within a decade. For example, FSED of weapon arming, fuzing and firing subsystems need to be reduced to three years from the six required in the past. With present technology, this cannot be done. DISL, planned to be operational in FY2004, will provide by FY 2006 the technology to enable this reduction in schedule, and is therefore an essential part of NNSA's plan to meet the DSW milestones. In the specific case of the W76-1, DISL-provided technology will enable the FSED to be completed in the 2006-2007 time frame, thus enabling FPU to occur on schedule.

There is no facility that is adequate in it's current state to support the distributed information systems research and development activities required to meet NNSA programmatic goals.

Project Milestones:

FY 2004: Physical Construction Complete 1Q 2004

4. Details of Cost Estimate

(dollars in thousands)

	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design	1,684	1,683
Design Management (1.4% of TEC)	508	396
Contracted Professional Management Services (0.6% of TEC)	200	160
Project Management (o.6% of TEC)	229	195
Total Design Phase (7.22% of TEC)	2,2,621	2,434
Construction Phase		
Building Construction	17,400	16,727
Standard Equipment	1,574	1,574
Major Computer Items	8,630	8,630
Project Liaison, Checkout, and Acceptance	800	1,033
Contracted Professional Management Services (1.8% of TEC)	650	643
Project Management (2.0% of TEC)	750	774
Total Construction Phase (82% of TEC)	29,804	29,381
Contingency		
1.3.1 Design Phase	0	37
1.3.2 Construction Phase (10.7% of TEC)	3,875	4,448
1.3 Total Contingency (10.7% of TEC)	3,875	4,485
1 Total Estimated Costs (TEC)	36,300	36,300

5. Method of Performance

Design will be performed by an architect-engineer under a fixed-price contract. Construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bidding and best value strategies.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2002	FY 2003	FY 2004	Outyears	Total
Facility Costs						
Design	1,919	700	0	0	0	2,621
Construction	0	1,795	17,792	12,651	1,439	33,679
Total, Line item TEC	1,919	2,499	17,792	12,651	1,439	36,300
Total Facility Costs (Federal and Non-Federal)	1,919	2,499	17,792	12,651	1,439	36,300
Other Project Costs						
Conceptual design costs	637	0	0	0	0	637
Other project-related costs [a]	626	0	12	251	182	1,071
Total, Other Project Costs	1,263	0	12	251	182	1,708
Total Project Cost (TPC)	3,182	2,499	17,804	12,902	1,621	38,008

7. Related Annual Funding Requirements

(FY 2004 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs [b]	290	290
Annual facility maintenance/repair costs [c]	80	80

[a] Includes funding to complete: Project Execution Plan, TSRD Study, Value Engineering Study, Bridging Document, Internal Non-Advocate Review, External Independent Review, Design Criteria, AE Selection and Award, Independent Cost Estimate, Construction Project Data Sheet, Validation, Readiness Assessment, Start-up, Move-in, Program Management Support, Project Close-out, and Final Cost Report.

[b] Average annual facility operating costs for materials and labor, including systems operations and custodial services, beginning when the facility is operational in the 3rd Quarter of FY 2004. An average total of 4.3 staff years per year will be required to operate the facility. The new facility will be built at the location where a previous facility existed; however, the new facility does not replace the old one.

[c] Average annual facility maintenance and repair costs for materials and labor, beginning when operational in the 3rd Quarter of FY 2004. An average total of 0.4 staff years per year will be required to maintain and repair the facility.

[d] Annual programmatic operating expenses based on representative current operating expenses of 130 people. The majority of this funding is expected to come from the DOE-DP Office of Advanced Simulation and Computing. Lesser amounts are expected from other DOE-DP Offices for activities that support their mission needs for engineering information management.

(FY 2004 dollars in thousands)	Current Estimate	Previous Estimate
Programmatic operating expenses directly related to the facility [d]	30,000	30,000
Capital equipment not related to construction but related to the programmatic effort in the facility [a]	2,500	2,500
Utility costs	310	310
Total related annual funding (operating from FY 2004 through FY 2034)	33,180	33,180

[a] Because information technology evolves with a cycle of 1 to 2 years, DISL activities will require this annual capital equipment outlay.

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

(Changes from FY 2003 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

None

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 *(Performance Baseline)* ……	1Q 2001	1Q 2002	3Q 2002	4Q 2006	92,117	95,317

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	35,030	35,030	39,343
2004	25,000	25,000	31,380
2005	3,228	3,228	3,230
2006	0	0	1,230

3. Project Descriptions, 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 (ASC) 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 ASC within the 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.

[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 LANL.

[b] Appropriation of $5,000,000 was reduced by $100,000 by the Safeguards and Security (S&S) amendment.

[c] Revised appropriation was $4,900,000. This was reduced by $11,000 for 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.

Justification

The Advanced Simulation and Computing (ASC) 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 3-D scientific weapons calculations of unprecedented computational scope. As has been emphasized in the ASC 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 their numbers in 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 ASC applications codes and the associated terascale simulation environment. The ASC campaign 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 ASC 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 (ASC 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 (ASC 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 both for prototyping advanced visualization concepts and for 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 both to classified and unclassified workstations. Vendors, 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 Program 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 FY04 to FY06 can not be directly identified at this time, but will be administered by this process and subject to reporting and oversight of the DOE/OAK NNSA Site Office.

Project Milestones

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

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	5,450
Design Management Costs (0.9% of TEC)	810	703
Project Management Costs (0.5% of TEC)	504	610
Total Design Costs (7.5% of TEC)	6,954	6,763
Construction Phase		
Improvements to Land	1,510	1,510
Buildings	51,880	51,670
Utilities	9,630	9,280
Standard Equipment	0	0
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	4,516	4,100
Construction Management (5.6% of TEC)	5,175	5,320
Project Management (3.7% of TEC)	3,402	3,150
Total Construction Costs (82.6% of TEC)	76,113	75,030
Contingencies		
Design Phase (0% of TEC)	0	179
Construction Phase (9.8% of TEC).[a]	9,050	10,145
Total Contingencies (9.8% of TEC)	9,050	10,324
Total, Line Item Costs (TEC).[b]	92,117	92,117

5. Method of Performance

Design shall be 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] 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.

[b] Escalation rates 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 2002	FY 2003	FY 2004	Outyears	Total
Project Cost						
Facility Costs						
Design	4,842	2,002	110	0	0	6,954
Construction	0	10,090	39,233	31,380	4,460	85,163
Total, Line item TEC	4,842	12,092	39,343	31,380	4,460	92,117
Total Facility Costs (Federal and Non-Federal)	4,842	12,092	39,343	31,380	4,460	92,117
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	0	0	820	1,750
Total, Other Project Costs	2,380	0	0	0	820	3,200
Total Project Cost (TPC)	7,222	12,092	39,343	31,380	5,280	95,317

[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.

7. Related Annual Funding Requirements

(FY 2006 dollars in thousands)

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

8. Design and Construction of Federal Facilities

All DOE facilities are designed and constructed in accordance with applicable Public Laws, Executive Orders, OMB Circulars, Federal Property Management Regulations, and DOE Orders. The total estimated cost of the project includes the cost of measures necessary to assure compliance with Executive Order 12088, "Federal Compliance with Pollution Control Standards"; Section 19 of the Occupational Safety and Health Act of 1970, the provisions of Executive Order 12196, and the related Safety and Health provisions for Federal Employees (CFR Title 29, Chapter XVII, Part 1960); and the Architectural Barriers Act, Public Law 90-480, and implementing instructions in 41 CFR 101-19.6.

[a] 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.

[b] 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 DOE/DP for activities in support of the Nuclear Weapons Stockpile Stewardship Program.

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