Campaigns

Program Mission

The mission of the Stockpile Stewardship Program is to sustain U.S. nuclear deterrence by maintaining high confidence in the Nation's nuclear weapons stockpile, in the absence of underground nuclear testing, through a science-based program of assessment and certification.

Program Goal

The goal of **Campaigns**, which are focused scientific and engineering efforts involving the three weapons laboratories (Los Alamos, Sandia and Lawrence Livermore National Laboratories), the Nevada Test Site, the weapons production plants (Kansas City, Pantex, Y-12 Plant and the Savannah River Site), and selected external organizations, is to develop and maintain special capabilities and tools needed for continued certification of the stockpile, now and into the future, in the absence of underground nuclear testing.

Program Objectives

The objective of these multi-year, multi-functional campaigns is to provide the capability to address current or future questions or issues concerning the stockpile by employing the best scientists and engineers, and using the most advanced sciences and technologies. Campaigns focus research and development activities on clearly defined deliverables; they have defined milestones, specific work plans, and specific goals. Production readiness campaigns assure the Nuclear Weapons Complex a means of developing and maintaining critical manufacturing capabilities. In FY 2002, funding is requested for 17 individual campaigns, which also include funding requests for several major programmatic line-item construction projects.

Performance Measures

Achieve a robust and vital scientific, engineering and manufacturing capability to enable the future certification of the nuclear weapon stockpile and the manufacture of nuclear weapon components under the nuclear testing moratorium. (NS-2)

Significant Accomplishments and Program Shifts

During the past year, and continuing with the first year of budget and program execution in FY 2001, Defense Programs continues to refine and improve the **integrated budget structure** that was initiated in FY 2001. In response to congressional direction contained in the FY 2001 appropriation and authorization legislation, Defense Programs has made several changes to the budget structure. Some changes are merely a realignment of ongoing activities or projects. For example, activities previously included in the Advanced Simulation and Computing component of RTBF have now been incorporated into the Advanced Simulation and Computing campaign (previously the Defense Computing and Modeling campaign). Likewise, all activities that support the traditional Inertial Confinement Fusion (ICF) program have been moved to the Inertial Confinement Fusion and High Yield campaign. Consistent with FY 2001 congressional direction, several major programmatic construction projects have been co-located with the respective campaign for budget presentation. The Dual-Axis Radiographic Hydrotest Facility project has been included in the Advanced Radiography campaign; the National Ignition Facility has been included with the ICF and High Yield campaign; the four simulation and modeling projects have been included with the Advanced Simulation and Computing campaign; and the Tritium Extraction Facility and the Accelerator Production of Tritium projects have been included in the Tritium

Readiness campaign. The name of the Certification in Hostile Environments campaign has been changed to Nuclear Survivability to better reflect the campaign goals. In addition, we have moved Directed Stockpile Work activities associated with certifying a W88 pit and some associated activities within the Dynamic Materials Properties campaign into the Pit Readiness campaign to form a Pit Manufacturing and Certification campaign.

Within the new budget structure, there is no direct funding for Technology Partnerships. However, Defense Programs will continue to utilize various technology partnerships within campaigns as a means to reach the goals and objectives of the Stockpile Stewardship Program. Funding for ongoing Technology Partnerships activities are budgeted for in the budget elements they support. No funding is requested for the American Textile Partnership or for the Advanced Computing Technology Initiative.

Significant accomplishments of the individual campaigns are described in the Detailed Justification section.

Funding Profile

(dollars in thousands)

Campaigns	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments [a]	FY 2001 Comparable Appropriation	FY 2002 Request
Primary Certification	28,197	41,400	5,922	47,322	55,530
Dynamic Materials Properties	58,211	74,408	-7,163	67,245	97,810
Advanced Radiography O&M	35,647	58,000	-6,428	51,572	60,510
97-D-102, Dual-Axis Radiographic Hydrotest Facility	60,768	35,232	-78	35,154	0
Subtotal, Advanced Radiography	96,415	93,232	-6,506	86,726	60,510
Secondary Certification & Nuclear Systems Margins . . .	41,914	52,964	-9,864	43,100	47,270
Enhanced Surety	36,181	40,600	-6,560	34,040	34,797
Weapons Systems Engineering Certification	14,135	16,300	-964	15,336	24,043
Nuclear Survivability	13,107	15,400	-801	14,599	19,050
Enhanced Surveillance	69,004	106,651	-4,610	102,041	82,333
Advanced Design & Production Technologies	73,617	75,735	4,819	80,554	75,533

[a] See Table Campaigns-1 for detailed explanation of FY 2001 Adjustments.

(dollars in thousands)

Campaigns	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments [a]	FY 2001 Comparable Appropriation	FY 2002 Request
ICF Ignition and High Yield O&M	218,915	250,500	-16,769	233,731	222,943
96-D-111, National Ignition Facility	247,158	199,100	-1,845	197,255	245,000
Subtotal, ICF Ignition and High Yield	466,073	449,600	-18,614	430,986	467,943
Advanced Simulation and Computing O&M	600,998	716,175	-38,831	677,344	711,185
01-D-101, Distributed Information Systems Laboratory	0	2,300	-5	2,295	5,400
00-D-103, Terascale Simulation Facility	1,970	5,000	-111	4,889	5,000
00-D-105, Strategic Computing Complex	31,902	56,000	-123	55,877	11,070
00-D-107, Joint Computational Engineering Laboratory	1,793	6,700	-15	6,685	5,377
Subtotal, Advanced Simulation & Computing	636,663	786,175	-39,085	747,090	738,032
Pit Manufacturing and Certification	107,271	125,038	19,550	144,588	128,545
Secondary Readiness	0	20,000	9,287	29,287	23,169
HE/Assembly Readiness	0	0	1,795	1,795	3,960
Nonnuclear Readiness	0	0	1,339	1,339	12,204
Materials Readiness	21,845	40,511	-28,751	11,760	1,209
Tritium Readiness O&M	99,680	77,000	-1,411	75,589	43,350
98-D-125, Tritium Extraction Facility	32,875	75,000	-165	74,835	81,125
98-D-126, Accelerator Production of Tritium, VL	35,863	15,000	-33	14,967	0
Subtotal, Tritium Readiness . .	168,418	167,000	-1,609	165,391	124,475
Total, Campaigns	1,831,051	2,105,014	-81,815	2,023,199	1,996,413

Public Law Authorization:

Public Law 106-398, “Floyd D. Spence National Defense Authorization Act for FY 2001"
Public Law 106-377, “Energy and Water Development Appropriations Act for FY 2001"

TABLE Campaigns-1

Campaigns
FY 2001 Adjustments & Comparabilities

(dollars in thousands)

Campaigns	FY 2001 Original Appropriation	General Reduction	Safeguards & Security Amendment	Accounting/ Definitional Adjustment	FY 2001 Omnibus Rescission	FY 2002 Structure Comparabilities: Microsystem Infrastructure Readiness	FY 2002 Structure Comparabilities: Pit Manufacturing Certification	FY 2001 Adjustments (Subtotal)	Revised FY 2001 Appropriation
Primary Certification	**41,400**	-101	-2,577	8,704	-104			**5,922**	**47,322**
Dynamic Materials Properties	**74,408**	-183	-4,057	-2,173	-150		-600	**-7,163**	**67,245**
Advanced Radiography O&M	**58,000**	-9,620	-2,506	5,812	-114			**-6,428**	**51,572**
97-D-102, DARHT	**35,232**				-78			**-78**	**35,154**
Subtotal, Advanced Radiography	**93,232**	-9,620	-2,506	5,812	-192	0	0	**-6,506**	**86,726**
Secondary Cert. & Nuclear Systems Margins	**52,964**	-131	-2,793	-6,845	-95			**-9,864**	**43,100**
Enhanced Surety . .	**40,600**	-102	-1,440	-9,954	-64	5,000		**-6,560**	**34,040**
Weapons Systems Engineering Certification	**16,300**	-40	-895	5	-34			**-964**	**15,336**
Nuclear Survivability	**15,400**	-38	-731		-32			**-801**	**14,599**
Enhanced Surveillance	**106,651**	-270	-3,107	-1,008	-225			**-4,610**	**102,041**

(dollars in thousands)

Campaigns	FY 2001 Original Appropriation	General Reduction	Safeguards & Security Amendment	Accounting/ Definitional Adjustment	FY 2001 Omnibus Rescission	FY 2002 Structure Comparabilities: Microsystem Infrastructure Readiness	FY 2002 Structure Comparabilities: Pit Manufacturing Certification	FY 2001 Adjustments (Subtotal)	Revised FY 2001 Appropriation
Advanced Design & Production Technologies	**75,735**	-195	-699	5,891	-178			**4,819**	**80,554**
ICF Ignition and High Yield O&M . .	**250,500**	-8,611	-7,643		-515			**-16,769**	**233,731**
96-D-111, NIF	**199,100**		-1,410		-435			**-1,845**	**197,255**
Subtotal, ICF Ignition and High Yield	**449,600**	-8,611	-9,053	0	-950	0	0	**-18,614**	**430,986**
Advanced Simulation and Computing O&M . .	**716,175**	-9,275	-27,022	-1,041	-1,493			**-38,831**	**677,344**
01-D-101, DISL . . .	**2,300**				-5			**-5**	**2,295**
00-D-103, TSF	**5,000**		-100		-11			**-111**	**4,889**
00-D-105, SSC . . .	**56,000**				-123			**-123**	**55,877**
00-D-107, JCEL . . .	**6,700**				-15			**-15**	**6,685**
Subtotal, Advanced Simulation & Computing	**786,175**	-9,275	-27,122	-1,041	-1,647	0	0	**-39,085**	**747,090**
Pit Manufacturing and Certification . .	**125,038**	-314	-4,424	-3,255	-257		27,800	**19,550**	**144,588**
Secondary Readiness	**20,000**			9,352	-65			**9,287**	**29,287**

(dollars in thousands)

Campaigns	FY 2001 Original Appropriation	General Reduction	Safeguards & Security Amendment	Accounting/ Definitional Adjustment	FY 2001 Omnibus Rescission	FY 2002 Structure Comparabilities: Microsystem Infrastructure Readiness	FY 2002 Structure Comparabilities: Pit Manufacturing Certification	FY 2001 Adjustments (Subtotal)	Revised FY 2001 Appropriation
HE/Assembly Readiness				1,799	-4			**1,795**	**1,795**
Nonnuclear Readiness				1,342	-3			**1,339**	**1,339**
Materials Readiness	**40,511**		-445	-28,280	-26			**-28,751**	**11,760**
Tritium Readiness O&M	**77,000**	-198	-1,046		-167			**-1,411**	**75,589**
98-D-125, TEF	**75,000**				-165			**-165**	**74,835**
98-D-126, APT . . .	**15,000**				-33			**-33**	**14,967**
Subtotal, Tritium Readiness	**167,000**	-198	-1,046	0	-365	0	0	**-1,609**	**165,391**
Subtotal, Operations & Maintenance	**1,710,682**	-29,078	-59,385	-19,651	-3,526	5,000	27,200	**-79,440**	**1,631,242**
Subtotal, Construction	**394,332**	0	-1,510	0	-865	0	0	**-2,375**	**391,957**
Total, Campaigns	**2,105,014**	-29,078	-60,895	-19,651	-4,391	5,000	27,200	**-81,815**	**2,023,199**

Funding by Site

(dollars in thousands)

Campaigns:	FY 2000	FY 2001	FY 2002	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	35,750	0	0	0	0.0%
Kansas City Plant	13,092	32,917	40,006	7,089	21.5%
Los Alamos National Laboratory	477,308	598,863	522,077	-76,786	-12.8%
Pantex Plant	7,632	18,083	15,036	-3,047	-16.9%
Sandia National Laboratories	286,160	328,389	329,348	959	0.3%
Total, Albuquerque Operations Office	819,942	978,252	906,467	-71,785	-7.3%
Chicago Operations Office					
Argonne National Laboratories	2,175	685	600	-85	-12.4%
Brookhaven National Laboratory	44	0	0	0	0.0%
Chicago Operations Office	10,413	41,224	1,000	-40,224	-97.6%
Total, Chicago Operations Office	12,632	41,909	1,600	-40,309	-96.2%
Headquarters	37,773	81,204	152,206	71,002	87.4%
National Engineering Technology Lab	2,000	0	0	0	0.0%
Nevada Operations Office	52,886	46,625	54,958	8,333	17.9%
Oakland Operations Office					
General Atomics	10,083	8,000	7,622	-378	-4.7%
Lawrence Berkeley National Laboratory	30,074	0	0	0	0.0%
Lawrence Livermore National Laboratory	709,948	638,648	678,285	39,637	6.2%
Naval Research Laboratory	14,822	24,015	10,000	-14,015	-58.4%
Oakland Operations Office	6,575	8,192	8,335	143	1.7%
University of Rochester/Laboratory for Laser Energetics	31,493	32,660	33,450	790	2.4%
Total, Oakland Operations Office	802,995	711,515	737,692	26,177	3.7%

(dollars in thousands)

Campaigns:	FY 2000	FY 2001	FY 2002	$ Change	% Change
Oak Ridge Operations Office					
Oak Ridge Operations Office	2,279	0	0	0	0.0%
Oak Ridge National Laboratory	10,098	4,408	4,326	-82	-1.9%
Office of Science and Technology	150	150	156	6	4.0%
Y-12 Plant	17,907	65,496	44,893	-20,603	-31.5%
Total, Oak Ridge Operations Office	30,434	70,054	49,375	-20,679	-29.5%
Richland Operations Office					
Pacific Northwest National Laboratory	23,346	9,280	0	-9,280	-100.0%
Savannah River Operations Office					
Savannah River Site	49,043	84,360	94,115	9,755	11.6%
Total, Campaigns	1,831,051	2,023,199	1,996,413	-26,786	-1.3%

Primary Certification

Mission Supporting Goals and Objectives

Primary Certification supports experimental activities to develop and implement the ability to certify, without nuclear testing, rebuilt and aged primaries to within a stated yield level. The campaign's objective is to develop and demonstrate the tools required to certify the performance and safety of any rebuilt or aged primary to a specific yield.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Boost Physics	2,057	4,479	3,873	-606	-13.5%
Engineering Component Analysis	4,589	100	250	150	150.0%
Materials Science Integration and Analysis	10,746	13,581	13,770	189	1.4%
Integrated Hydro Test Assessment	5,880	1,175	3,855	2,680	228.1%
Subcritical Experiments	1,000	24,510	29,599	5,089	20.8%
Legacy Data Analysis and Archiving	3,925	3,477	4,183	706	20.3%
Total, Primary Certification	28,197	47,322	55,530	8,208	17.3%

Performance Measures

Performance will be demonstrated by:

- Evaluating historical test data for archiving.
- Assessing the effect of engineering and manufacturing technologies on pits.
- Conducting experiments and testing validated computational models.
- Continuing development of an improved dynamic model.
- Obtaining equation of state (EOS) and other data from subcritical experiments.
- Developing thermochemically based high explosive EOS.

Past achievements in this campaign include:

- OBOE 6 subcritical experiment fired successfully and yielded results definitive enough to eliminate the need to fire OBOE 7 before PIANO.
- OBOE 8 and PIANO will be fired in FY 2001.
- Improvements were made to the radiographic scatter reducing collimator that allows flash x-ray radiography of thick weapon geometry objects. This collimator will be used for radiographic experiments when the Contained Firing Facility is completed in FY 2001.
- Two weapon geometry hydros have been fired. Two more are planned during the remainder of FY 2001.
- A new fiber optic diagnostic for measuring high explosive burn front velocity was developed.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Boost Physics	2,057	3,962	3,873
Develop an improved thermonuclear boost model to support the campaign certification goal.			
Engineering Component Analysis	4,589	5,795	250
Assess the impact of new manufacturing technologies on remanufactured components; and develop a pit engineering evaluation of each stockpile weapon system.			
Materials Science Integration and Analysis	10,746	8,844	13,770
Validate improved materials properties models and use these models to improve computational predictions of primary performance.			
Integrated Hydro Test Assessment	5,880	9,124	3,855
Conduct integrated hydrodynamic experiments to validate computational models and to demonstrate a certification methodology for aged and remanufactured components.			
Subcritical Experiments	1,000	15,976	29,599
Conduct integrated subcritical experiments to measure the properties of remanufactured and aged pits.			
Legacy Data Analysis and Archiving	3,925	3,621	4,183
Analyze historical nuclear test data and develop an accessible archive of information relevant to the certification of primaries in the enduring stockpile.			
Total, Primary Certification	**28,197**	**47,322**	**55,530**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Primary Certification	
# Increase supports more complex integrated subcritical experiments for development of simulation codes and weapon certification. In FY 2002, all costs for subcritical experiments conducted by LLNL have been consolidated into this campaign while funding for other primary certification activities has been decreased and redirected to Directed Stockpile Work activities.	8,208

	FY 2002 vs. FY 2001 ($000)
Total Funding Change, Primary Certification	**8,208**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	116	154	154	0	0%
Total, Capital Operating Expenses . .	116	154	154	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
Total, Construction	0	0	0	0	0	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Dynamic Materials Properties

Mission Supporting Goals and Objectives

Dynamic Materials Properties supports the development of physics-based, experimentally validated physical data and materials models of all stockpile materials, at the level of accuracy required by the other campaigns. The campaign's objective is to develop experimentally validated predictive materials models and physical data of all materials required to assess the performance, safety, and reliability of stockpiled weapons.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Stockpile Materials Equation of State (EOS), Melt, and Phase Transitions	12,875	16,684	18,196	1,512	9.1%
Constitutive Properties of Metals: Strength, Spall, and Ejecta	20,594	23,350	35,185	11,835	50.7%
High Explosives (HE) Performance and Safety; Dynamic Loading of Foams and Organics	12,007	12,952	16,174	3,222	24.9%
Materials Processing, Properties and Performance	4,882	10,799	9,895	-904	-8.4%
University Partnerships	7,392	2,500	16,700	14,200	568.0%
Physical Data Computational Support . . .	461	460	156	-304	-66.1%
Nanoscience	0	500	1,504	1,004	200.8%
Total, Dynamic Materials	58,211	67,245	97,810	30,565	45.5%

Performance Measures

Performance will be demonstrated by:

- Extending measurements of the high-pressure / high-temperature phase diagram of plutonium and hydrogen.
- Measuring the dynamic materials properties of plutonium at the Joint Actinides Shock Physics Experimental Research (JASPER) facility at the Nevada Test Site (NTS).
- Performing Isentropic Compression Experiments (ICE) on stockpile-relevant materials beyond 100 Gpa.
- Performing measurements of fundamental plutonium materials properties in support of pit manufacturing and qualification.
- Measuring dynamic strength of materials, experimentally characterizing ejecta, and performing dynamic measurements of interfacial interactions in weapons materials.
- Establishing experimental techniques to benchmark grain-scale high-explosives to validate fundamental

physics-based materials models.

- Maintaining a robust user program for stockpile stewardship and basic research at the Los Alamos Neutron Science Center (LANSCE) facility.
- Creating a joint theoretical, simulation, and experimental materials science program to predict the processing/structure/properties relationships that control the performance of surfaces and interfaces for microsystems.

Past achievements in this campaign include:

- Measured sound speed in shocked deuterium (D_2) that are consistent with the "soft" Huguenot measured on NOVA.
- Provided technical assistance and guidance to the successful completion of the JASPER facility at NTS.
- Determined the pressure-temperature (p, T) dependence of the large volume collapse transitions in Pr up to 900 K at high pressures.
- Successfully obtained and analyzed data on ejecta and spall from several U1a experiments in the OBOE series.
- Validated a new high explosive reactive flow model for LX-17.
- Combined LANSCE and x-ray spectrographic techniques with ultrasonic methods to determine the high pressure and temperature properties for a new molybdenum equation of state in preparation for plutonium experiments.
- Used intermediate strain-rate constitutive response data to develop a new plutonium strength model to be incorporated in weapons simulation codes. Developed techniques to use magnetically driven Isentropic Compression Experiments (ICE) on the Z-accelerator to obtain high pressure equation of state and strength data, by completing proof of principle measurements on aluminum up to 150 Gpa.
- Measured shock EOS properties on Deuterium to 63 Gpa using flyer-plate techniques on the Z-accelerator.
- Evaluated wear and mechanical performance of electro-composite and nano-laminated LIGA structures.
- Determined constitutive properties of ceramic materials during sintering.

Detailed Program Justification

FY 2001 Item of Congressional Interest: The FY 2001 appropriations act added $10 million for multi-campaign-supporting physics demonstrations for the Atlas pulsed power facility at the Los Alamos National Laboratory (LANL) and the Nevada Test Site (NTS). The funding will be used to initiate operations on Atlas at LANL and begin an experimental campaign to achieve the deliverables required for the Primary Certification, Dynamic Materials Properties, and Secondary Certification campaigns. A joint team of personnel from LANL, Bechtel Nevada, other laboratories, and the Nevada Operations Office are working on the details of the plan to relocate Atlas to an optimum site at the NTS and operate it as a multi-user facility in a cost-effective and schedule-effective manner. The actual relocation costs are funded under the Project Engineering and Design (PED) construction line item, 01-D-103, where FY 2001 funding was appropriated for that purpose.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Stockpile Materials Equation of State (EOS), Melt, and Phase Transitions	12,875	16,684	18,196

Develop physics-based and experimentally-validated data and models for the thermodynamic properties (EOS, melt, phase diagram) of stockpile materials, with emphasis on metals plutonium and other relevant metals, and hydrogen.

Constitutive Properties of Metals: Strength, Spall, and Ejecta	20,594	23,350	35,185

Develop physics-based and experimentally validated data and multi-length-scale models for the mechanical constitutive properties and dynamic response of stockpile materials, with emphasis on plutonium and other metals. Includes $3.5 million to accommodate measurements of fundamental materials properties of plutonium in support of pit manufacturing and certification.

High Explosives (HE) Performance and Safety; Dynamic Loading of Foams and Organics	12,007	12,952	16,174

Develop physics-based and experimentally validated data and models for high explosives, organics and foams as they specifically affect performance and safety.

Materials Processing, Properties and Performance	4,882	10,799	9,895

Develop a quantitative understanding of how process variables determine the microstructure and composition of materials that ultimately control their critical performance properties.

University Partnerships	7,392	2,500	16,700

Conduct university partnerships through a competitively funded program in materials and other research and experimental stockpile stewardship sciences. A number of universities have shown interest in such a program, and the Department agrees that it is important to increase the level of effort in these types of university activities.

Physical Data Computational Support	461	460	156

Provide physical data computational user support.

Nanoscience	0	500	1,504

Develop scientific understanding of novel classes of nanoscale materials structures, properties, and processing techniques, in addition to developing new characterization and synthesis tools for nanostructured materials.

Total, Dynamic Materials Properties	**58,211**	**67,245**	**97,810**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Dynamic Materials Properties	
# Increase accommodates more extensive and comprehensive determination of fundamental plutonium materials properties, including equation of state, phase diagram and constitutive properties, and materials-response under high-pressure, high temperature, and dynamic loading conditions	12,865
# Increase supports expansion of current university partnerships program in experimental science of relevance to the stockpile stewardship program	14,200
# Increase accommodates measurements of fundamental materials properties of plutonium in support of pit manufacturing and certification	3,500
Total Funding Change, Dynamic Materials Properties	**30,565**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	53	70	70	0	0%
Total, Capital Operating Expenses . .	53	70	70	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
Total, Construction	0	0	0	0	0	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Advanced Radiography

Mission Supporting Goals and Objectives

Advanced Radiography supports research and development technologies for multi-view, time-gated images of imploding surrogate primaries, with sufficient spatial resolution to resolve uncertainties in primary performance. This utilizes advanced multi-time, multi-view, x-ray diagnostic techniques on the Dual-Axis Radiographic Hydrotest Facility (DARHT), and further development and evaluation of proton radiography techniques. The campaign's objective is to provide the technology to obtain 3-D motion pictures of imploding surrogate primaries.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
DARHT Optimization	8,305	12,910	14,709	1,799	13.9%
Simulation and Analysis	4,950	3,434	5,159	1,725	50.2%
Provide Required Materials	74	4,569	13,958	9,389	205.5%
Advanced Radiography Requirements and Technology Development	22,318	29,022	21,684	-7,338	-25.3%
Vessel Development and Certification	0	1,637	5,000	3,363	205.4%
Construction	60,768	35,154	0	-35,154	-100.0%
Total, Advanced Radiography	96,415	86,726	60,510	-26,216	-30.2%

Performance Measures

Performance will be demonstrated by:

- Achieving optimum/minimum spot size on a DARHT I target.
- Completing design of a multi-pulse target for DARHT II.
- Completing evaluation of requirements for an advanced radiography facility.
- Identifying a preferred long-term material source.
- Developing plans and technologies for multi-axis confinement systems.

Past achievements in this campaign include:

- Radiographed burning high explosives with protons at LANSCE, demonstrating features of proton radiography including time dependence and obtaining direct data on a stockpile performance issue.
- Demonstrated several capabilities key to DARHT optimization at the ETA-II accelerator, including:
  - First solid-state kicker pulser with 2 kA electron beam, marking the first time that solid-state technology has been used with a relativistic electron beam as a load.
  - Production of submillimeter x-ray spot size on a Tantalum x-ray converter target.

- First double pulse target experiments and demonstration of backstreaming ion suppression.

- Performed benchmarking calculations on the effect of background gas on electron beam stability using the DARHT first axis.
- Developed, procured, and fabricated the diagnostics that will be used to measure long-pulse beam parameters during commissioning of the DARHT second axis injector.
- Performed validation of the DARHT second axis accelerator cell design, vacuum integrity, beam loss effects, and diagnostic utility using the THOR machine.
- Completed several high-precision experiments at the Duke Free-Election Laser facility to measure total photon absorption cross sections at various energies for the materials copper and tungsten, providing very precise cross sections in support of capability to perform highly accurate simulations.
- Development of a deterministic model for calculating proton radiographs incorporating multiple Coulomb scattering, energy loss, magnetic beam-line mapping, and scattering angle cuts.
- Combined PIC (electromagnetic) and MCNP (transport) computer codes in static form to simulate e-beam/target interactions, bremsstrahlung X-ray production, and transport through an object onto a detector.
- Implemented inverse reconstruction accounting for object tilt and applied to analyze X-ray and proton radiographs with tilt up to 45 degrees.
- Completed initial modeling effort on material loss/supply rate estimates
- Completed draft pre-conceptual design report for Advanced Hydrotest Facility (AHF) project.
- Completed 4 key trade studies on synchotron design, beam transport systems, power supplies, and site configuration to develop options for lower project cost for the Advanced Hydrotest Facility project.
- Design and development of a half-scale windowless, aluminum-composite containment vessel in support of multi-axis radiography systems.

Detailed Program Justification

FY 2001 Item of Congressional Interest: The FY 2001 appropriations act added $15 million to support research, development and pre-conceptual design studies leading to an Advanced Hydrodynamic Testing facility. This funding is being used to:

- Revise four key trade studies on: Synchrotron Design; Room-temperature and Super-conducting Beam Transport systems; Power supply and grid; and site configuration.
- Develop and implement Inter-Laboratory Advanced Hydrotest Facility collaboration agreement with LLNL.
- Conduct Technical Advisory Group (TAG) Review of accelerator and beam transport design options.
- Support an External Advisory Committee (EAC) review of the Proton Radiography Technical Contract.
- Begin Engineering Development and Demonstration (ED&D) activities.
- Complete Integrated Design Study Phase.

During FY 2002, Defense Programs may initiate a conceptual design for an AHF, which is expected to cost significantly in excess of $3 million.

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
DARHT Optimization	8,305	12,910	14,709

Optimize experimental use of DARHT. Tasks comprising this effort encompass: reduction of first axis x-ray spot size to explore a wider variety of hydrodynamic phenomena that requires extremely high resolution; and optimizing the second axis detectors and the x-ray source to enhance quality of dynamic images.

Simulation and Analysis	4,950	3,434	5,159

Develop and apply comprehensive radiographic simulation and analysis tools, including accurate simulation capability for x-ray and proton transport, efficient and accurate techniques for characterizing radiographic data, and forward and inverse modeling capabilities to analyze radiographs.

Provide Required Materials	74	4,569	13,958

Develop and implement a plan for materials. Increase in FY 2002 supports development of enhanced recovery techniques and processing capabilities at LANL and development of separation capabilities at LLNL.

Advanced Radiography Requirements and Technology Development	22,318	29,022	21,684

Evaluate, design, and develop advanced radiographic capabilities to provide improved data from hydrodynamic tests to reduce uncertainty in code validation. This focuses on the development of proton radiography technology, including research and development required for a proton-based advanced hydrotest facility.

Vessel Development and Certification	0	1,637	5,000

Begin development and certification of experimental vessels suitable for use in multi-axis radiography.

Construction	60,768	35,154	0

97-D-102, Dual-Axis Radiographic Hydrotest Facility, LANL. Final funding for DARHT was appropriated in FY 2001, and this campaign is currently optimizing the first axis beam on DARHT, which became operational in July 1999. Additional funding of $6.1 million was provided for DARHT in the Cerro Grande Fire appropriation account to mitigate the impacts of the fire on this project.

Total, Advanced Radiography	**96,415**	**86,726**	**60,510**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Advanced Radiography	
# Increase reflects the transition to full operation of the DARHT experimental facility and supports additional research and development of technologies supporting advanced radiography capabilities, specifically in the areas of materials, confinement systems, and simulation	8,938
# Decrease in construction funding in FY 2002 reflects completion of funding for the DARHT line-item construction project in FY 2001	-35,154
Total Funding Change, Advanced Radiography	**-26,216**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	0	450	450	0	0%
Total, Capital Operating Expenses . .	0	450	450	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
97-D-102, Dual-Axis Radiographic Hydrotest Facility, LANL	259,622	163,700	60,768	35,154	0	0

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

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Acceptance Date
Switchyard Kicker	3,400	0	0	1,700	1,200	FY 2003
Total, Major Items of Equipment	3,400	0	0	1,700	1,200	

The Switchyard Kicker is a pulsed electromagnetic deflecting device which will provide the capability for rapid switching of the LANSCE accelerator high energy beam between two beamlines. This will enable real time beam sharing between the proton radiography facility in line C and other operations, most notably those at the Manuel Lujan Neutron Scattering Center. This device will allow both facilities to operate independently, therefore increasing the productivity at both locations.

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[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 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Secondary Certification and Nuclear Systems Margins

Mission Supporting Goals and Objectives

Secondary Certification and Nuclear Systems Margins includes theoretical understanding, along with experimental and computational activities, to achieve the campaign's objective of determining and documenting the minimum primary factors necessary to produce a militarily effective weapon.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Radiation Source	10,761	9,275	8,925	-350	-3.8%
Initial Radiation Case Dynamics	3,778	3,970	6,500	2,530	63.7%
Radiation Flow	16,055	13,336	19,689	6,353	47.6%
Secondary Performance	9,327	12,245	8,219	-4,026	-32.9%
University Grants/Other Support	1,993	4,274	3,937	-337	-7.9%
Total, Secondary Certification and Nuclear Systems Margins	41,914	43,100	47,270	4,170	9.7%

Performance Measures

Performance will be demonstrated by:

- Identifying previously conducted underground tests and aboveground experiments with relevant data, and completing the planned analysis of those tests and experiments.
- Completing the planned activities for the reevaluation of primary-yield determination (radiochemistry and prompt diagnostics analysis).
- Completing the planned activities for the evaluation of material-property sensitivities on secondary performance.
- Identifying issues and relevant underground test data associated with features and aging, and also important to marginal performance.

Past achievements in this campaign include:

- Initial evaluations of the sensitivities of secondaries to material property uncertainties were completed in relation to characterizing the radiation source and radiation flow.
- Underground testing and low energy density above ground experimental data were identified in support of better understanding of initial radiation-case dynamics.
- Initial designs for low energy density AGEX experiments were completed.
- Re-analysis of a relevant past UGT was completed in support of a better understanding of secondary radiation flow.

- Initial high energy density AGEX experiments contributing to understanding secondary performance were conducted on Omega and Z.
- UGT data relevant to supporting establishment of modern computational secondary baselines was identified.
- Performed a series of high explosive detonation "integrated experiments" both at Z and at Omega. Results are helping advanced simulation and computing code validation efforts and serve as a proof-of-principle for follow-on experiments that will help address various current Directed Stockpile Work issues.
- LANSCE (n,2n) neutron cross section measurements on Pu-239 are nearly complete. These data are used in improved primary yield determination.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Radiation Source	10,761	9,275	8,925

Develop a validated, predictive computational capability for primary radiation emission, and complete a modern re-evaluation of primary outputs.

	FY 2000	FY 2001	FY 2002
Initial Radiation Case Dynamics	3,778	3,970	6,500

Determine the effects of high explosive-induced case dynamics and experimentally determine distribution for full-size systems.

	FY 2000	FY 2001	FY 2002
Radiation Flow	16,055	13,336	19,689

Determine other effects of energy flow, including a validated predictive model capability for energy flow associated with primary explosion through to secondary explosion, and develop advanced energy-flow diagnostics for use on NIF and other AGEX facilities.

	FY 2000	FY 2001	FY 2002
Secondary Performance	9,327	12,245	8,219

Determine performance of nominal, aged, and rebuilt secondaries, including development of a validated predictive capability to interpret measurements associated with underground tests, implement advanced computational techniques, develop advanced hydrodynamic diagnostics, and support related university activities.

	FY 2000	FY 2001	FY 2002
University Grants/Other Support	1,993	4,274	3,937

Headquarters supported activities include university grants in high energy density science and support of critical technical needs.

	FY 2000	FY 2001	FY 2002
Total, Secondary Certification	**41,914**	**43,100**	**47,270**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Secondary Certification and Nuclear Systems Margins	
# Increase augments efforts toward providing modern computational baselines for stockpile weapon systems and needed experimental diagnostic and shot fielding support for the Atlas pulsed power machine in Nevada. Activities were also realigned into this campaign to better reflect actual work	4,170

Total Funding Change, Secondary Certification and Nuclear Systems Margins	**4,170**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	670	889	889	0	0%
Total, Capital Operating Expenses . .	670	889	889	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
Total, Construction	0	0	0	0	0	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Enhanced Surety

Mission Supporting Goals and Objectives

Enhanced Surety provides validated technology for inclusion in the stockpile refurbishment program to assure that modern nuclear safety standards are fully met and to provide a new level of use-denial performance. The campaign's objective is to demonstrate enhanced use-denial and advanced initiation options for the entire stockpile.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Advanced Initiation	18,790	20,651	21,149	498	2.4%
Enhanced Use Denial	17,391	13,389	13,648	259	1.9%
Total, Enhanced Surety	36,181	34,040	34,797	757	2.2%

Performance Measures

<u>Performance will be demonstrated by</u>:

- Developing Full Scale Engineering Development-ready technologies for improved surety options for the W80 and W76 systems that:
  - employ a container test-bed for evaluation of use-denial technologies; and
  - continue development of a micro-firing system advanced strong link for the W80.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Advanced Initiation	18,790	20,651	21,149
Develop and demonstrate advanced initiation options, to include new concepts in stronglinks and firing systems, which would provide a higher assessed level of nuclear detonation safety.			
Enhanced Use Denial	17,391	13,389	13,648
Develop and demonstrate enhanced use denial options, internal and external to the warhead, which would provide a higher assessed level of performance.			
Total, Enhanced Surety	**36,181**	**34,040**	**34,797**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Enhanced Surety	
# Increase supports acceptance and testing of weapon surety subsystems based on LIGA (German acronym for a technique of fabricating small parts with high precision) and micro system technologies; advanced-container-concept testing and evaluation; and component supplier development and qualification.	757
Total Funding Change, Enhanced Surety	**757**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	124	164	164	0	0%
Total, Capital Operating Expenses . .	124	164	164	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
Total, Construction	0	0	0	0	0	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Weapons Systems Engineering Certification

Mission Supporting Goals and Objectives

Weapons Systems Engineering Certification establishes science-based engineering certification methods in weapons systems within a limited non-nuclear test program. Activities include conducting experiments and providing data necessary to validate computational models. The campaign's objective is to establish the capability to predict engineering margins by integrating numerical simulations with experimental data.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Define Methodology	174	300	600	300	100.0%
Model Validation Experiments	13,729	15,036	23,443	8,407	55.9%
Abnormal and Flight Test Instrumentation	232	0	0	0	0.0%
Total, Weapons Systems Engineering Certification	14,135	15,336	24,043	8,707	56.8%

Performance Measures

Performance will be demonstrated by:

- Postulating joint models – tape/bolted/screw that are necessary for reentry vehicle flight environments.
- Delivering instrumented Nuclear Explosive Package flight-test unit that is necessary for reentry vehicle flight environments.
- Validating capability to predict off-axis crush response of honeycomb necessary for bomb impact environments.

Past achievements in this campaign include:

- Held workshop that identified four key attributes of the engineering certification process based on recent Directed Stockpile Work (DSW) case studies with the three weapons laboratories.
- Generated a draft DOE policy and a Nuclear Weapons Complex Technical Business Practice on engineering certification.
- Completed and documented a technical assessment of engineering computational tools to support the qualification of the W76-1 in abnormal thermal environments and the mechanical response to hostile environments.
- Released a beta version of a material database necessary for advanced simulation tools.
- Demonstrated an in-flight data gathering capability (High Explosive Radio Telemetry) necessary for understanding structural load transmission to the physics package.
- Initiated experimental tasks necessary for model validation data of the physics package (polymer characterization, assembly characterization, and stochastic structural dynamic activities.)

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Define Methodology	174	300	600

Define science-based certification methodology, including key attributes such as validated simulation tools, tests, and expert judgement.

Model Validation Experiments	13,729	15,036	23,443

Conduct model validation experiments to provide experimental data to validate the models and codes provided by the Advanced Simulation and Computing campaign.

Abnormal and Flight Test Instrumentation	232	0	0

Develop the high fidelity instrumentation necessary (primarily for flight tests) to collect the right data with sufficient fidelity to be able to validate codes and models provided by the Advanced Simulation and Computing campaign.

Total, Weapons Systems Engineering	**14,135**	**15,336**	**24,043**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Weapons Systems Engineering Certification	
# Increase responds to a recent review of the DSW requirements for the Advanced Simulation and Computing (ASC) campaign and this campaign through FY 2005. It revealed that ASC's engineering codes wouldn't be validated without a commensurate experimental validation effort in this campaign through FY 2005. Specifically, this campaign will increase activity across a broad spectrum of experimental work, including environment characterization (e.g., abnormal fire environment for W76-1), interfacial transport, material characterization (e.g., required for small neutron generator LLCE's), benchmark experiments and accreditation experiments	8,707
Total Funding Change, Weapons Systems Engineering	**8,707**

Nuclear Survivability

Mission Supporting Goals and Objectives

This campaign (previously Certification in Hostile Environments) demonstrates the capability to support the nuclear survivability of the enduring stockpile, its certification and life extension, without underground tests, through radiation hardening, modeling and validation, and aboveground testing. ~~This~~ The campaign will develop validated computational tools to reevaluate threat nuclear weapon radiation environments and system radiation responses, develop radiation-hardened technologies, and improve radiation sources and diagnostics. The initial applications of nuclear survivability certification technologies will support neutron generator qualifications and the W76 life extension program. The campaign also supports nuclear weapon output and evaluation capability for the DoD.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Modernization of Weapon Outputs	1,314	1,668	3,168	1,500	89.9%
Nuclear Survivability of Nuclear Explosive Packages	100	0	0	0	0.0%
Nuclear Survivability of Nonnuclear Components	5,300	7,434	8,250	816	11.0%
Hardening of Microelectronics and Microsystems	6,393	5,497	7,632	2,135	38.8%
Total, Nuclear Survivability	13,107	14,599	19,050	4,451	30.5%

Performance Measures

<u>Performance will be demonstrated by</u>:

- Completing initial outputs assessments for weapons critical to the W76-1.
- Analyzing DSW pit tests on the W76 and W88, and using the results to improve equations of state, material properties, and analytical methods.
- Developing a high-energy, heavy-ion radiation-effects microscope; developing cable system-generated electro-magnetic pulse design codes for use by the W76-1 refurbishment project; improving the Saturn x-ray source to produce environments required for effects testing; and developing diagnostic upgrades for improved neutron/gamma environment characterizations.
- Fabricating prototype radiation-hardened silicon-on-insulator (SOI) Integrated Circuits (IC) for early use by the W76-1 project; characterizing SOI design logic to establish simulation guidelines; and completing the design

Past achievements in this campaign include:

- Developed the body-under-source field effect transistor (BUSFET), a radiation-hardened silicon-on-insulator (SOI) device structure applicable to both strategic and satellite use.
- Supported reconstitution of the Annular Core Research Reactor (ACRR) for Defense Programs nuclear survivability qualification testing.
- Supported ACORN nuclear survivability qualification testing.
- Supported W76 nuclear component ACRR tests.
- Completed nuclear survivability qualification tools for, and support of, nuclear survivability qualification of the MC4380 Neutron Generator.
- Fabricated at the Microelectronics Development Laboratory and single event upset tested radiation-hardened 64K static random access memory prototypes in 0.35µ technology.
- Assessed options and developed plan for providing fast burst reactor facility that adequately simulates exo-atmospheric environments (SPR III/IIIM).
- Developed and characterized soft x-ray sources on Z.
- Restored Saturn facility source to full operational capability.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Modernization of Weapon Outputs	1,314	1,668	3,168

Develop and validate modern output tools and re-assess nuclear weapons outputs as needed.

Nuclear Survivability of Nuclear Explosive Packages	100	0	0

Develop and validate modeling and experimental nuclear survivability assessment tools for nuclear explosive packages.

Nuclear Survivability of Nonnuclear Components	5,300	7,434	8,250

Develop and validate modeling and experimental nuclear survivability assessment tools for nonnuclear components.

Hardening of Microelectronics and Microsystems	6,393	5,497	7,632

Develop technologies and infrastructure for nuclear survivability of microelectronics, microsystems, and other nonnuclear components.

Total, Nuclear Survivability	**13,107**	**14,599**	**19,050**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Nuclear Survivability	
# Increase supports the neutron generator qualification and the refurbishment of the W76. The design philosophy for weapon electronics is driven by nuclear survivability requirements. The increase supports the assessment and modeling of weapons outputs to provide confidence and reduce programmatic risk in the design of the W76 Arming, Fusing and Firing (AF&F) by assuring that the requirements are correctly specified. The increase also develops radiation hardened microelectronics for the W76 AF&F design and future AF&F refurbishments. This includes fabrication and testing of radiation hardened microcircuits of increasing complexity on 0.35 µm silicon-on-insulator (SOI) technology. The increase also provides for the development and validation of System Generated Electromagnetic Pulse ASC codes needed to support the W76 AF&F certification in the absence of underground testing.	4,451
Total Funding Change, Nuclear Survivability	**4,451**

Enhanced Surveillance

Mission Supporting Goals and Objectives

Enhanced Surveillance provides validated component lifetime assessments to support refurbishment decisions and annual assessment of the stockpile, and have predictive tools in place to identify aging defects prior to any impact to safety, reliability, or performance.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Pits	22,352	16,674	24,901	8,227	49.3%
Canned Subassemblies	8,129	21,844	14,200	-7,644	-35.0%
High Explosives/Energetics	11,619	15,264	7,747	-7,517	-49.2%
Nonnuclear Components	3,984	10,163	9,464	-699	-6.9%
Nonnuclear Materials	5,447	12,580	11,615	-965	-7.7%
Systems	17,473	25,516	14,406	-11,110	-43.5%
Total, Enhanced Surveillance	69,004	102,041	82,333	(19,708)	-19.3%

Performance Measures

<u>Performance will be demonstrated by</u>:

- Conducting vulnerability tests on oldest pits available and validating accelerated aging methods.
- Benchmarking canned subassembly corrosion models with simulated aging tests.
- Completing experiments to confirm high explosive aging mechanisms and benchmarking the model.
- Baselining system electrical models and providing lifetime assessment data for high risk nonnuclear components.
- Assessing selected nonnuclear material properties and aging mechanisms.

<u>Past achievements in this campaign include</u>:

- Demonstrated that high explosive aging does not degrade safety during impacts in accident conditions.
- Developed and delivered several new high explosive tests into the surveillance program (high explosive divergence and detonator booster performance tests).
- Identified self-irradiation (caused by plutonium nuclear decay) as a cause for pit aging and began testing old pit materials.
- Began fabrication of plutonium alloys in which the aging process is accelerated to allow direct measurements of effects of aging on plutonium properties.
- Fielded a suite of experimental diagnostic tools to measure physical properties of new and aged

plutonium samples.

- Utilized new miniaturized instrumentation to characterize key features during missile flight tests while preserving system fidelity to the greatest extent possible.
- Continued and improved development of new diagnostics techniques and began the integration of new diagnostics into the ongoing weapon surveillance program.
- Developed the technical basis for age-driven component refurbishment decisions in support of the W76 and W80 6.2/6.2A studies. (See Directed Stockpile Work for an explanation of the Phase 6.X process which provides a framework to conduct and manage life extension activities for existing weapons.)

Detailed Program Justification

FY 2001 Item of Congressional Interest: The FY 2001 appropriation act increased this campaign by $17 million, which was directed for the following sites and activities: Kansas City, $3 million; Pantex, $7 million; Y-12, $4 million; Savannah River, $1 million; and, $2 million for support activities. This is being allocated to LANL ($1.5 million) and LLNL ($0.5 million) to accelerate the deployment of test and diagnostic equipment.

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Pits	22,352	16,674	24,901

Perform pit aging experiments and modeling to determine whether pit lifetimes equal or exceed 60 years, which would enable substantial deferral or downsizing of a potential new pit manufacturing facility, and develop and implement new, nondestructive examination tools for early detection of potential flaws. Increase supports the overall program focus on pit issues.

Canned Subassemblies	8,129	21,844	14,200

Perform canned subassemblies (CSAs)/aging experiments and modeling to determine when these major components as well as cases need to be replaced and will develop and implement new, nondestructive examination tools for early detection of potential changes in behavior. Decrease reflects the termination of CSA diagnostic projects that were initiated with the congressional add-on in FY 2001.

High Explosives/Energetics	11,619	15,264	7,747

Perform high explosives/energetics aging experiments and modeling to determine when the full range of conventional and insensitive high explosives must be replaced. New diagnostic tools for early detection of potential changes to safety, reliability and performance will be developed and implemented. Decrease reflects a reduction at SNL and LANL supporting aging and life time assessments for the B-61, W-80 and W-76.

Nonnuclear Components	3,984	10,163	9,464

Predict changes in critical nonnuclear material properties for both existing and replacement materials. These materials will be selected based on the highest risk for producing unacceptable degradation in weapon system performance.

Nonnuclear Materials	5,447	12,580	11,615

Inform weapons planning and system refurbishment decisions with validated performance predictions for high-risk, nonnuclear components and identify possible micro-systems failure mechanism and develop a model-based certification process.

Systems	17,473	25,516	14,406

Provide new system-level diagnostics that enhance the ability to detect, assess and predict problems in the stockpile. The FY 2002 request reflects the allocation of resources to higher priority activities in Defense Programs which results in the termination of weapon diagnostic projects initiated with the FY 2001 congressional add-on.

Total, Enhanced Surveillance	**69,004**	**102,041**	**82,333**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Enhanced Surveillance	
# Decrease reflects the termination of diagnostic projects that were initiated in FY 2001. Examples of these terminated or delayed projects include: X-Ray Pit Tomography; CSA Neutron Radiography; W-76 High-Explosive Radio Telemetry; W-87 Enhanced Fidelity Instrumented Joint Test Assembly; Accelerated Aging Unit; and CSA Laser-gas sampling.	-19,708
Total Funding Change, Enhanced Surveillance	**-19,708**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	5,148	6,827	6,827	0	0%
Total, Capital Operating Expenses . .	5,148	6,827	6,827	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
Total, Construction	0	0	0	0	0	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Advanced Design and Production Technologies

Mission Supporting Goals and Objectives

Advanced Design and Production Technologies integrates and systematically deploys capabilities to deliver qualified refurbishment products upon demand. This will be accomplished by developing multiple, fast turnaround engineering options through virtual prototypes and implementing modern product data management and collaboration tools. The campaign's objective is to provide the capability to deliver qualified stockpile life extension refurbishment products upon demand at one-half cost, one-half the current time and with one-tenth the defects. Extensive information on progress and accomplishments in each of these areas is published in an annual report. The success of the ADAPT campaign will contribute to achieving the 36 months weapon refurbishment readiness objective within the Nuclear Weapons Complex.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Process Development Program	29,333	42,060	43,734	1,674	4.0%
Enterprise Integration Program	15,733	15,254	15,579	325	2.1%
Integrated Product and Process Design (IPPD)/Agile Manufacturing	27,749	22,434	16,220	-6,214	-27.7%
Robotics and Intelligent Machines (RIM)	802	806	0	-806	-100.0%
Total, Advanced Design and Production Technologies	73,617	80,554	75,533	-5,021	-6.2%

Performance Measures

Performance will be demonstrated by:

- Deploying access to the Program Control Document (PCD) System at all sites.
- Certifying Need to Know (NTK) architecture for B61 program application.
- Certifying Public Key Infrastructure (PKI) architecture.
- Enabling certified WEB browser access to sites.
- Using Model-Based Design and Manufacturing Tools in the Life Extension Program.
- Completing technical support of Inert Metallography deployment.
- Completing technical support for Vacuum Arc Remelt Furnace process development.

Detailed Program Justification

FY 2001 Item of Congressional Interest: The FY 2001 Authorization Act authorizes the establishment of a Plant Manager Research, Development and Demonstration (PMRDD) program allowing the obligation of up to $3 million per year from funds available in the Advanced Design and Production Technologies campaign to carry out the program. The FY 2001 Appropriations Act includes an allowance of up to 2 percent of allocated national security funding at the nuclear weapons production plants for a directed research and development program. The Department has issued guidance to establish the program, per the Appropriation language. The actual initiation of projects under this authority will take place later this fiscal year or in FY 2002. For purposes of this budget request, the Nevada Test Site is considered to be within the meaning of a "covered nuclear weapons production plant."

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Process Development Program	29,333	42,060	43,734

Focuses on continuous and innovative improvement of individual manufacturing procedures and incorporating advanced systems into plants. Process Development is essential to maintain and improve production capabilities in the weapons complex while satisfying increased environmental constraints, improved product reliability needs, improved manufacturing efficiency and changes in available materials and processes. FY 2002 activities include: complete technical support for Vacuum Arc Remelt Furnace at the Y-12 Plant, Inert Metallography deployment at the Savannah River Site, continuing DP activities which focus on industrial partnerships at the Kansas City Plant, and making Advanced Thermal Cycling Absorption Process (TCAP) test apparatus operational at LANL.

Enterprise Integration Program	15,733	15,254	15,579

Develops, demonstrates and deploys emerging information networking technology to provide high speed, seamless connectivity, provide enterprise systems needed for secure, distributed access to and management of product information, ensure that modern electronic business practices needed to allow new approaches to product realization are in place, and to provide common planning and scheduling tools. FY 2002 activities include: deploy access to the Program Control Document (PCD) system at all sites, certify Need-to-Know architecture for B61 Program application, certify Public Key Infrastructure architecture, create and publish secure e-mail policy and configuration for desktop computing, and enable certified web browser access to all sites.

Integrated Product and Process Design (IPPD)/Agile Manufacturing	27,749	22,434	16,220

Develops, validates, and deploys modern hardware and software tools to institute a flexible system to design and produce optimized products, establishes an advanced system that provides rapid, flexible processes for product qualification and acceptance, and implements a highly automated Computer Aided Design (CAD)-to-part capability that provides fabrication of complex parts in small lots. FY 2002 activities include: increased use of model-based design and manufacturing systems tools for non-War Reserve (WR) parts and use of model-based design and manufacturing tools in a Life Extension Program. Decrease reflects the reduced scope of campaign activities starting in FY 2002 and the decision to fund Plant Technical Partnership activities in the campaigns specifically accruing benefits from those activities.

Robotics and Intelligent Machines (RIM)	802	806	0

Develops systems composed of machines, sensors, computers and software capable of executing various tasks with minimal human intervention. These systems have wide ranging applications for solving many operational challenges including weapons manufacturing and dismantlement, accelerating cleanup, and reducing the amount of exposure humans experience from nuclear materials. Decrease reflects deferral of funding in this campaign. RIM activities in support of other campaigns will continue to be funded by those campaigns.

Total, Advanced Design and Production Technologies	**73,617**	**80,554**	**75,533**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Advanced Design and Production Technologies (ADAPT)	
# Decrease mainly reflects a reduced scope of Integrated Product and Process Design (IPPD)/Agile Manufacturing campaign activities and the decision to fund Plant Technical Partnership activities in the campaigns specifically accruing benefits from those activities. A smaller portion of the decrease reflects the deferral of Robotics and Intelligent Machines (RIM) funding in this campaign. RIM activities in support of other campaigns will continue to be funded by those campaigns.	-5,021
Total Funding Change, Advanced Design and Production Technologies (ADAPT) . .	**-5,021**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	1,677	2,224	2,224	0	0%
Total, Capital Operating Expenses	1,677	2,224	2,224	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
Total, Construction	0	0	0	0	0	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Inertial Confinement Fusion Ignition and High Yield

Mission Supporting Goals and Objectives

Inertial Confinement Fusion Ignition and High Yield addresses high energy density physics issues required to maintain a safe, secure, and reliable nuclear stockpile. Specific campaign objectives include the demonstration of laboratory ignition (both direct and indirect drive) using the National Ignition Facility, enhancement of the experimental capabilities needed to support development and validation of advanced computer simulation codes for stockpile stewardship, and assessment of options for high yield fusion. The Inertial Confinement Fusion (ICF) Program uses a complementary suite of laser and pulsed power facilities to accomplish its mission. These include the National Ignition Facility, the Omega laser at the University of Rochester Laboratory for Laser Energetics, and the Z facility at Sandia National Laboratories. The Program also operates the Nike and Trident facilities located at the Naval Research Laboratory and Los Alamos National Laboratory, respectively. The Program is the world leader in high energy density physics.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Ignition	42,834	44,307	43,380	-927	-2.1%
Support of Stockpile Program	16,493	24,254	23,928	-326	-1.3%
ICF/NIF Experimental Support Technologies	25,397	27,474	44,259	16,785	61.1%
High Yield Assessment	4,931	5,648	5,945	297	5.3%
University Grants/Other ICF Support	2,995	5,427	5,386	-41	-0.8%
Inertial Fusion Technology	9,579	24,765	0	-24,765	-100.0%
Operations of Facilities	110,860	96,028	98,708	2,680	2.8%
NIF Other Project Costs (OPC)	5,826	5,828	1,337	-4,491	-77.1%
Construction	247,158	197,255	245,000	47,745	24.2%
Total, Inertial Confinement Fusion Ignition and High Yield	466,073	430,986	467,943	36,957	8.6%

Performance Measures

Performance will be demonstrated by:

- Developing advanced capabilities to improve ICF target physics necessary to achieve ignition on NIF, including measurement of the deuterium equation of state, designs for higher efficiency hohlraums, improved capsule designs, and the operation of the Omega cryogenic target handling system.
- Completing the Z-backlighter at SNL and demonstrating the associated enhancement of the weapons physics capability of the Z-machine.

- Bringing a deuterium cryogenic target test system on line to support ignition target development.
- Completing the Conceptual Design Report for the NIF cryogenic target system and executing planned cryogenic project activities consistent with the detailed baseline that is under development.
- Executing planned NIF core diagnostic design and construction activities consistent with the detailed baseline that is under development.
- Performing approximately 1,600 experiments on Omega and Z in support of ignition and weapons physics campaign goals.
- Performing high-density cryogenic implosions on Omega, and completing a hydrodynamic simulation code for 1D, 2D, and 3D direct- drive target performance evaluations.
- Completing conceptual designs for NIF shock-timing and symmetry diagnostics.
- Certifying to Congress that the requirements contained in the FY 2001 appropriations act for the NIF project have been met.
- Continuing clean assembly of the NIF beam path infrastructure system.
- Assembling line replaceable units in the Optics Assembly Building as defined in the current NIF Project baseline.
- Installing laser equipment in Laser Bay 2 as defined in the current NIF Project baseline.

Past achievements in this campaign include:

- Conducted radiation-flow experiments at Inertial Confinement Fusion facilities: Nova, Omega, and Z. Confirmed that aboveground experiments, coupled with detailed modeling, can achieve weapons physics goals.
- Conducted approximately 1,500 experiments on laser and pulsed power ICF facilities in FY 2000, primarily in the areas of ignition and weapons physics. These experiments enhanced our understanding of areas of physics relevant to a better predictive assessment of nuclear weapons performance.
- Completed 120 shots at the Omega laser through the National Laser Users Facility program in FY 2000 in support of university research.
- Built and demonstrated a cryogenic target handling system for direct-drive ICF targets for the Omega laser at the University of Rochester's Laboratory for Laser Energetics.

Detailed Program Justification

FY 2001 Items of Congressional Interest: The FY 2001 appropriations act provided $199.1 million for the National Ignition Facility (NIF), 96-D-111, and realigned the project into this campaign. This funding was adjusted to $197.3 million to reflect the safeguards and security amendment and application of the across-the-board 0.22 percent rescission. The appropriations act also included statutory language which limited the use of $69.1 million until after March 31, 2001, and only upon certification by the Administrator of the National Nuclear Security Administration that several requirements have been met. Certification that these statutory requirements have been met is expected to include affirmation that the project is on an appropriate path forward for a full-scale NIF and that cost and schedule milestones are being met.

The FY 2001 appropriations act also provided an additional $25 million for high average power lasers within this campaign. This funding was provided in FY 2001 to the Naval Research Laboratory and LLNL to develop laser technology options for weapons and science applications. Funding is not requested for this activity in FY 2002.

The FY 2001 appropriations act directed that within available funding, $2.5 million should be used for the transfer of the Petawatt Laser from LLNL to the University of Nevada-Reno (UNR). LLNL and UNR have been directed to prepare a Petawatt Laser Transfer Plan to implement the transfer of the existing petawatt laser components from LLNL to UNR, and to develop a scope and schedule for the plan which can be accomplished for the $2.5 million. Defense Programs may spend up to another $2.5 million from other accounts for this activity in FY 2002.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Ignition	42,834	44,307	43,380

Conduct calculations and experimental activities aimed at risk reduction and development of the physics basis for indirect drive and direct drive ignition.

Support of Stockpile Program	16,493	24,254	23,928

Execute high energy density physics experiments on ICF facilities in support of the current scope of the Stockpile Stewardship Program.

ICF/NIF Experimental Support Technologies	25,397	27,474	44,259

Support experimental ICF technology including development of pulsed power technology and NIF core and advanced diagnostics and calibration systems; define, prototype, design, fabricate, test and deploy the NIF cryogenic system and target filling system; and provide required target support for all ICF laboratories.

High Yield Assessment	4,931	5,648	5,945

Conduct the necessary experimental program in support of assessment of pulsed-power for high yield.

University Grants/Other ICF Support	2,995	5,427	5,386

Support university grants in high energy density science, National Laser User Facility activities, national ignition program coordination, and critical technical needs of the campaign.

Inertial Fusion Technology	9,579	24,765	0

Develop the technology options for inertial fusion and stockpile stewardship use of high average power lasers. Funding is not requested in FY 2002.

Operations of Facilities	110,860	96,028	98,708

Operate ICF facilities in a safe, secure manner; provide 1600 experiments on Z and Omega, as well as continuing experimental operations on Nike and Trident; operate target fabrication facilities at LANL; and provide reduced support to the National Ignition Facility project. Support for risk reduction and technology development activities related to NIF is not to the level planned in the NIF rebaseline submitted to Congress in September, 2000; however, the increased risk is acceptable within the overall priorities for the Stockpile Stewardship program at the FY 2002 budget request level.

NIF Other Project Costs (OPC)	5,826	5,828	1,337

Complete NEPA documentation, including environmental impact statement and environmental monitoring and permits, and complete assurances, safety analysis and integration.

Construction	247,158	197,255	245,000

96-D-111, National Ignition Facility, LLNL . Funding increases in FY 2002 consistent with the baseline submitted to Congress in September 2000.

Total, ICF and High Yield	**466,073**	**430,986**	**467,943**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Inertial Confinement Fusion Ignition and High Yield	
# Increase in the National Ignition Facility (NIF) line item supports the current NIF project schedule, cost and scope certified by the Secretary of Energy in September, 2000.	47,745
# Funding is not requested in FY 2002 for high average power laser technology for inertial fusion energy and stockpile applications because of the need to direct funding to other higher priority activities that directly support the mission of Defense Programs	-24,935

#	Decrease in the National Ignition Facility (NIF) Other Project Costs consistent with the current NIF project schedule, cost and scope certified by the Secretary of Energy in September, 2000..	-4,504
#	A net increase for the remaining ICF Ignition and High Yield campaign supports development of ICF target layering technology, and the NIF core diagnostic and cryogenics projects. The Department has formally established at LLNL the position of NIF Director (from the facility use perspective) and assigned that person the task of overall coordination of the user program for NIF. The NIF Director is coordinating the development of a formal baseline for NIF diagnostics and the NIF cryogenic target handling and filling system. The requirements for diagnostics and cryogenics will be reevaluated upon the development and review of detailed baselines for these activities	18,651
Total Funding Change, Inertial Confinement Fusion Ignition and High Yield		**36,957**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	647	600	600	0	0%
Capital Equipment	4,745	4,021	4,021	0	0%
Total, Capital Operating Expenses . .	5,392	4,621	4,621	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
96-D-111, National Ignition Facility, LLNL	2,094,897	651,300	247,158	197,255	245,000	754,184

[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 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Advanced Simulation and Computing

Mission Supporting Goals and Objectives

Advanced Simulation and Computing, previously the Defense Applications and Modeling campaign creates simulation capabilities, based on advanced weapon codes and high-performance computing, that incorporate high-fidelity scientific models based on experimental results, past tests, and theory. The resulting predictive simulations play a major role in the assessment and certification of the safety, performance, and reliability of nuclear weapons. The campaign's objective is to provide validated three dimensional (3-D), high-fidelity physics, full-system simulation codes required for engineering, safety, and performance analyses of the stockpile, and to develop computing resources with sufficient power (speed, memory, and storage capacity) to support the stockpile analyses. The Advanced Simulation and Computing campaign has evolved from the Accelerated Strategic Computing Initiative (ASCI), a program begun in FY 1996 and expected to last through FY 2010.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Advanced Applications Development	108,559	119,062	126,134	7,072	5.9%
Materials Physics and Modeling	76,051	83,380	87,015	3,635	4.4%
Verification and Validation	31,951	37,598	37,741	143	0.4%
Ongoing Computing	71,201	93,031	91,572	-1,459	-1.6%
Physical Infrastructure and Platforms	96,994	87,995	143,012	55,017	62.5%
PathForward	27,909	32,364	20,000	-12,364	-38.2%
Distance and Distributed Computing	40,119	46,590	23,586	-23,004	-49.4%
Problem Solving Environments (PSEs)	33,902	51,717	52,038	321	0.6%
Visual Interactive Environment for Weapon Simulation (VIEWS)	63,209	70,074	80,017	9,943	14.2%
University Partnerships	43,925	46,623	42,142	-4,481	-9.6%
ASC Special Projects	7,178	8,910	7,928	-982	-11.0%
Construction	35,665	69,746	26,847	-42,899	-61.5%
Total, Advanced Simulation and Computing	636,663	747,090	738,032	(9,058)	-1.2%

Performance Measures

Performance will be demonstrated by:

- Completing a prototype 3-D full-system coupled simulation.
- Completing a 3-D safety simulation of a complex abnormal explosive initiated scenario.
- Completing a coupled multi-physics simulation for hostile (nuclear) environments.
- Demonstrating initial validation methodology for simulation of normal and abnormal STS environments.
- Completing final delivery and checkout of the 30-TeraOPS ultra-computing platform.

Past achievements in this campaign include:

- Delivery of ASCI White system at 12.3 trillion operations per second (TeraOPS). Continuing operation of ASCI Red system at 3.15 TeraOPS, and ASCI Blue Mountain System at 3.07 TeraOPS, and ASCI Blue Pacific System at 3.89 TeraOPS. Signed contract for delivery of 30 TeraOPS system.
- Delivered computer codes demonstrating prototype capability for performing 3-D analyses of the dynamic behavior of nuclear weapons.
- Developed and implemented visualization, networking and data management systems to efficiently support utilization of ASCI codes and computers across the weapons complex.
- Demonstrated and deployed a parallel high-performance network architecture.
- Provided leading-edge, high-end simulation capabilities supporting numerous stockpile stewardship applications such as:
  - Resolved a nuclear test anomaly by using a 3-D ASCI application code which required four months on ASCI Blue Mountain machine, but would have taken 80 years on a Cray-class supercomputer.
  - Simulated a nuclear-test diagnostic measurement for the first time which required one day on ASCI Blue Mountain machine, but would have required 2-3 years on a Cray-class supercomputer.
  - Simulated re-entry body response to a hostile radiation environment as requested by DoD to define a future Stockpile-to-Target Sequence test program.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Advanced Applications Development	108,559	119,062	126,134

Continue the development of enhanced 3-D computer codes that provide unprecedented levels of fidelity in weapons simulations. These codes will require the performance of the 10 and 30 TeraOPS machines planned for full operation in 2001 and 2002, respectively. Applications will focus on 3-D prototypical codes capable of simulating the dynamic response of a re-entry vehicle system to normal flight environments and the explosion of the nuclear weapon with three-dimensional engineering features.

Materials Physics and Modeling	76,051	83,380	87,015

Continue to incorporate into Advanced Simulation and Computing (ASC) application codes improved models for the behavior of materials that are used in the stockpile weapons as those materials are subjected to the conditions created by a nuclear explosion and as they age.

Verification and Validation	31,951	37,598	37,741

Continue developing and implementing methodologies for assessing the accuracy and fidelity of the ASC weapons simulations by testing code predictions against theory and data from experiments and by developing estimates of overall computational uncertainties.

Ongoing Computing	71,201	93,031	91,572

Support ongoing computer center operations and evolution of existing simulation capability necessary for maintaining the core computational infrastructure and enabling technologies.

Physical Infrastructure and Platforms	96,994	87,995	143,012

Continue acquisition of computer platforms including full deployment of the 10 TeraOPS supercomputer in FY 2001 and final delivery of 30 TeraOPS system in FY 2002. Complete procurement actions for 20 TeraOPS computer to be located at SNL in FY 2003 and begin procurement of 60 TeraOPS computer for LLNL.

PathForward	27,909	32,364	20,000

Support PathForward activities with industrial partnerships to continue developing key interconnect, storage, and software technologies necessary to accelerate the development of balanced 30 to 100 TeraOPS computer systems.

Distance and Distributed Computing	40,119	46,590	23,586

Continue deployment of an enterprise-wide integrated computing architecture capable of supporting application milepost development and execution at remote sites.

Problem Solving Environments (PSEs)	33,902	51,717	52,038

Support projects that include: ASC Software Development Environment, a common software environment for scalable simulation development across ASC platforms; Data Transfer and Storage, for improved tera-scale code execution and data exploration; Distributed Systems for secure networking and security infrastructure; and Management and Integration for integrating the improvements for multi-gigabyte parallel data transfer and multi-petabyte archival mass storage.

Visual Interactive Environment for Weapon Simulation (VIEWS)	63,209	70,074	80,017

Deliver leading edge visualization and data management and developing technologies that contribute to the "see and understand" capabilities required to view, manipulate, and analyze the massive amounts of data generated by the 3-D simulation codes.

University Partnerships	43,925	46,623	42,142

Continue activities aimed at training, recruiting, and collaborating with top researchers in key disciplines for Stockpile Stewardship, including the continued operation of Computer Science Institutes at each of the DP Labs, Graduate Fellowships, and University Alliances. Addressing Chiles Commission issues is a major focus of these activities.

ASC Special Projects	7,178	8,910	7,928

Includes support for Super Computing (SC02) 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, and/or meetings, outreach and crosscuts.

Construction	35,665	69,746	26,847
01-D-101, Distributed Information Systems Laboratory, (DISL,) at Sandia National Laboratories in California	0	2,295	5,400
00-D-103, Terascale Simulation Facility (TSF) at Lawrence Livermore National Laboratory in California	1,970	4,889	5,000
00-D-105, Strategic Computing Complex (SCC,) at Los Alamos National Laboratory New Mexico	31,902	55,877	11,070
00-D-107, Joint Computational Engineering Laboratory (JCEL) at Sandia National Laboratories in New Mexico	1,793	6,685	5,377
Total, Advanced Simulation and Computing	**636,663**	**747,090**	**738,032**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Advanced Simulation and Computing	
# Higher computing infrastructure costs are planned due to increased reliance on large platform computing. Continued platform advancements of the 20TeraOPS at SNL, 30TeraOPS at LANL and the 60TeraOPS at LLNL are necessary to meet the Program's milestones, (+$53,558) and are offset by a reduction in scope of Distance and Distributed Computing (DISCOM2) strategy, (-$23,004). The PathForward strategy budget reflects fewer new starts and the completion of several existing contracts, (-$12,364). The Visual Interactive Environment for Weapon Simulation (VIEWS) budget increases to create the data understanding infrastructure needed to handle the terabyte datasets being created by applications codes running on ASC platforms, (+$9,943). A decrease in the One Program\Three Labs strategy (-$982) relates to planned workload levels	27,151
# Increase for personnel costs based on estimated salaries and benefits needed to attract and retain competent personnel, as well as planned workload, in the Advanced Applications, Verification and Validation, Materials and Physics Modeling and Problem Solving Environments strategies	11,171
# Decreases in the Computational Institutes at the labs and Technology Demonstration Centers are a result of scaling back these programs to more focused scopes of effort	-4,481
# Net decrease supports ongoing construction profiles for the Terascale Simulation Facility (TSF) (+$500), the Strategic Computing Complex (SCC) (-$44,800), the Joint Computational Engineering Laboratory (JCEL) (-$1,300), and the Distributed Information Systems Laboratory (DISL) (+$3,100). The TEC/TPC, funding profile and schedule milestone dates for TSF, JCEL and DISL reflected in this data sheet are preliminary. The TEC/TPC, outyear funding profile, and schedule have not been validated and may be modified further after completion of a thorough review and validation. In addition, the Administration is conducting an on-going review of the strategic nuclear mission of the United States, which could impact funding requirements and schedules.	-42,899
Total Funding Change, Advanced Simulation and Computing	**-9,058**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	2,451	869	869	0	0%
Capital Equipment	37,623	36,115	36,115	0	0%
Total, Capital Operating Expenses . .	40,074	36,984	36,984	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
01-D-101, Distributed Information Systems Laboratory, (DISL,) at Sandia National Laboratories in California	35,500		0	2,295	5,400	TBD
00-D-103, Terascale Simulation Facility (TSF) at Lawrence Livermore National Laboratory in California	88,900		1,970	4,889	5000	TBD
00-D-105, Strategic Computing Complex (SCC,) at Los Alamos National Laboratory New Mexico	98,849		31,902	55,877	11,070	0
00-D-107, Joint Computational Engineering Laboratory (JCEL) at Sandia National Laboratories in New Mexico	28,855		1,793	6,685	5,377	TBD
Total, Construction	98,849	0	35,665	69,746	26,847	TBD[b]

[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 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

[b] The TEC/TPC, funding profile and schedule milestone dates for TSF, JCEL and DISL reflected in this summary are preliminary. The TEC/TPC, outyear funding profile, and schedule have not been validated and may be modified after completion of a thorough review and validation. In addition, the Administration is conducting an on-going review of the strategic nuclear mission of the United States, which could impact funding requirements and schedules.

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

(Changes from FY 2001 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

| # The TEC/TPC, funding profile and schedule milestone dates reflected in this data sheet are preliminary. The TEC/TPC, outyear funding profile, and schedule have not been validated and may be modified after completion of a thorough review and validation. In addition, the Administration is conducting an on-going review of the strategic nuclear mission of the United States, which could impact funding requirements and schedules.

| # This facility is being designed to be capable of meeting Top-Secret Restricted-Data (TSRD) security requirements. The Total Project Cost (TPC) for the project increased by $48,000 for costs associated with the evaluation of the TSRD requirements as well as added program management project review costs and associated documentation.

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 *(Current Baseline Estimate)*	1Q 2001	1Q 2002	TBD	TBD	35,500	38,148

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
| 2001	2,295 [a]	2,295	2,200
| 2002	5,400 [b]	5,400	5,200
| 2003	TBD	TBD	TBD

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[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 appropriation amount.

[b] The FY 2002 funding for this project has been reduced to $5,400,000 due to budget priorities. The detailed scope, schedule, and cost impact on the overall project has not been determined. The President has directed a strategic review of our national security activities. The Department will update this data sheet after completion of that review and will provide an updated project data sheet to the Authorization and Appropriation committees.

(dollars in thousands)

2004	TBD	TBD	TBD

3. Project Description, Justification and Scope

The Distributed Information Systems Laboratory (DISL) is a proposed new research facility at Sandia National Laboratories to develop and implement distributed information systems for Defense Programs (DP). It consolidates at one accessible location all activities focused on incorporating those systems to support DP'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 future 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 approximately 70,400 gross square feet (gsf) of space to house 130 people needed to perform the necessary research and associated functions. Space will be provided for laboratories, research and development offices, collaborative and meeting areas, management and administrative areas, and public and support areas. Laboratory space will include a central distributed computing and networking laboratory, an advanced visualization laboratory complex, and smaller ancillary laboratories. The research and development offices will house Sandia technical staff and visiting researchers, and will accommodate multiple computer workstations with monitors and peripherals.

Collaborative and meeting areas will include demonstration and conference rooms to facilitate work with industry and academia. The laboratories, collaborative areas, and office areas will be constructed as secure vault-type rooms to provide the capability to allow classified or unclassified work to be performed simultaneously should the facility not be upgraded to TSRD level. If the facility is upgraded to TSRD, these areas will support individual programs with common need-to-know information. These areas will be interconnected with a large amount of fiber-optics communications to accommodate the work there. A lobby, reception area, and typical building support space, such as storage and break/vending areas, will also be included in the facility.

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. The planned location for the facility is currently occupied by Sandia's Building 913, which is in the process of being decontaminated and demolished using operations and maintenance funding. If demolition is not completed in time to allow DISL construction at the preferred location, DISL will be constructed at a nearby alternative location within the central SNL/CA site. The project scope is the same for either location.

Standard equipment will include new and relocated furniture, and multimedia and video conferencing equipment to facilitate collaborations with others offsite. Research and development equipment (Major Computer Items) will include high-performance design, analysis, and graphics workstations ($1,635,000), a high-performance storage system ($470,000), multi-processor and multimedia servers ($1,681,000), advanced visualization systems, including a video wall ($1,572,000), communications plant system ($1,532,000), communications switches, routers, and encrypters ($1,206,000), an immersive collaborative engineering system ($897,000), and equipment cabinets and ancillary networking equipment ($538,000).

Justification:

Defense Programs is responsible for the management of the NWC. Changes in the military-political landscape, including the cessation of underground testing and a significantly smaller nuclear weapons manufacturing complex, require DP to find new ways of ensuring a safe, reliable, and secure nuclear weapon stockpile while meeting unchanged certification requirements. How DP will meet these challenges, the "must, should, and could" stockpile refurbishment decisions and schedule, are defined by the Stockpile Life Extension Program (SLEP). To meet DP mission goals and SLEP requirements, DP has developed a Stockpile Stewardship Program 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 DP efforts that support the Stockpile Stewardship Program include:

- The Advanced Simulation and Computing (ASC) Campaign, (formerly the Accelerated Strategic Computing Initiative (ASCI)), 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 ASM Campaign, which will accelerate the ability of DP 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 (EI) strategy, which will:
  - Create seamless, secure, and connected communications.
  - Create products and process information systems that allow rapid access to weapons information.
  - Encourage streamlined business and engineering practices that are more responsive and productive.

With these and other Programs, DP envisions a highly distributed, but totally integrated, system of facility nodes that support information networking and provide cost-effective information integration, access, and preservation.

To realize the mission objectives outlined above, DP must have the ability to access information from across the NWC, fully integrate the design and re-manufacture of nuclear weapons (and components) 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.

The 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. DISL will serve as a connectivity node, connecting people to people, people to machines, and machines to machines, allowing access, integration, and preservation of information across the entire NWC.

The DISL will focus on research and development that will greatly enhance the integration of design and manufacturing tasks and thus reduce the time required to redesign nuclear weapons in the enduring stockpile. DISL will house weapon systems engineers together with computer scientists to foster the interchange necessary to ensure that the right technologies for the weapons program are developed when and as they are needed. Specifically, the long-term objective of DISL is to bring together prototype technologies to develop a distributed information systems infrastructure that will be incorporated into DP's virtual enterprise for SSP.

The DISL will serve as a technology deployment center/user facility to accelerate the introduction of advanced information systems technology into the NWC. DP 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, ASM, and DisCom^2, and, therefore, is a cornerstone of the DISL. In addition, the existence of DISL will create opportunities for the DP 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 DP's distributed information systems requirements exist at SNL/CA, the necessary facilities are absent—either they do not have laboratory areas with appropriate infrastructure (computer raised floor; heating, ventilating and air conditioning (HVAC); 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 DP 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 that DP can meet its critical mission responsibilities related to SSP.

The President has mandated that the nuclear weapons stockpile be safe, secure, and reliable. All U.S. weapons require periodic refurbishment and remanufacture, because they contain components that have limited lifetimes. DP's SLEP 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, and test and implement them in 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) is assembled. SLEP calls for refurbishment in the near-term on the W80 (FPU in FY 2005), in the mid-term on the B83 and W78 (FPU in FY 2007), and in the longer-term on the W76 (FPU in the FY 2007—2011 time frame).

To meet the SLEP 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 3 years from the 6 required in the past. With present technology, this cannot be done. DISL, planned to be operational in FY 2004, will provide by FY 2006 the technology to enable this reduction in schedule, and is therefore an essential part of DP's plan to meet the SLEP goals. In the specific case of the W76, DISL-provided technology will enable the FSED to be completed in the 2006—2008 time frame, thus enabling FPU to occur on schedule.

There is no facility available that is adequate in its current state to support the distributed information systems research and development activities required to meet DP programmatic goals.

Project Milestones:

Physical Construction Start TBD

4. Details of Cost Estimate

	(dollars in thousands)	
	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs (Design Drawings and Specifications - $1,136)	TBD	1,620
Design Management Costs (1.3% of TEC)	TBD	467
Project Management Costs (0.6% of TEC)	TBD	199
Total Design Costs (6.4% of TEC)	TBD	2,286
Construction Phase		
Improvements to Land	TBD	269
Buildings	TBD	14,996
Utilities	TBD	303
Standard Equipment	TBD	1,530
Major Computer Items	TBD	9,531
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	TBD	619
Construction Management (2.6% of TEC)	TBD	934
Project Management (1.2% of TEC)	TBD	423
Total Construction Costs (80.6% of TEC)	TBD	28,605
Contingencies		
Design Phase (0.9% of TEC)	TBD	325
Construction Phase (12.1% of TEC)	TBD	4,284
Total Contingencies (13.0% of TEC)	TBD	4,609
Total Line Item Costs (TEC)	TBD	35,500

This estimate was prepared by GEZ Architects-Engineers and Sandia on the basis of the DISL conceptual design report dated March 1998. Escalation is based on the January 1999 Update of the Departmental Price Change Index for DOE Construction Projects, using the Defense Programs and General Construction guidance.

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 2000	FY 2001	FY 2002	Outyears	Total
Project Cost						
Facility Costs						
Design	0	0	2,200	410	TBD	TBD
Construction	0	0	0	4,790	TBD	TBD
Total, Line item TEC	0	0	2,200	5,200	TBD	TBD
Total Facility Costs (Federal and Non-Federal)	0	0	2,200	5,200	TBD	TBD
Other Project Costs						
Conceptual design costs	637	0	0	0	TBD	TBD
Other project-related costs [c]	311	550	250	300	TBD	TBD
Total, Other Project Costs	948	550	250	300	TBD	TBD
Total Project Cost (TPC)	948	550	2,450	5,500	TBD	TBD

7. Related Annual Funding Requirements

(FY 2004 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs [d]	290	290
Annual facility maintenance/repair costs [e]	80	80
Programmatic operating expenses directly related to the facility [f]	30,000	30,000

[c] 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.

[d] 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.

[e] 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.

[f] 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
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 2001 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

| # The TEC/TPC, funding profile and schedule milestone dates reflected in this data sheet are preliminary. The TEC/TPC, outyear funding profile, and schedule have not been validated and may be modified after completion of a thorough review and validation. In addition, the Administration is conducting an on-going review of the strategic nuclear mission of the United States, which could impact funding requirements and schedules.

| # This data sheet also reflects a reprogramming of $6,000,000 in FY 2000 which was used to fund stockpile-related workload issues at the Los Alamos National Laboratory (LANL). This funding has been added back into the project in the outyears.

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 (*Current Baseline Estimate*) . . .	3Q 2000	3Q 2001	4Q 2001	2Q 2006	89,000	92,200
FY 2002 Budget Request (*Current Baseline Estimate*) . . .	1Q 2001	1Q 2002	TBD	TBD	88,900 [a]	92,100

[a] The TEC/TPC, funding profile and schedule milestone dates reflected in this data sheet are preliminary. The TEC/TPC, outyear funding profile, and schedule have not been validated and may be modified further after completion of a thorough review and validation. In addition, the Administration is conducting an on-going review of the strategic nuclear mission of the United States, which could impact funding requirements and schedules. The FY 2001 Appropriation reduced the TEC/TPC by $100,000 for the Safeguards and Security (S&S) amendment.

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2000	1,970 [b]	1,970	200
2001	4,889 [c] [d]	4,889	6,659
2002	5,000	5,000	4,980
2003	TBD	TBD	TBD
2004	TBD	TBD	TBD
2005	TBD	TBD	TBD
2006	TBD	TBD	TBD

3. Project Description, Justification and Scope

Description

The project provides for the design, engineering and construction of the Terascale Simulation Facility (TSF - Building 453) which will be capable of housing the 100 TeraOps-class computers required to meet the Accelerated Strategic Computing Initiative (ASCI). The building will encompass approximately 270,000 square feet. The building will contain a multi-story office tower with an adjacent computer center. The Terascale Simulation Facility (TSF) proposed here is designed from inception to enable the very large-scale weapons simulations essential to ensuring the safety and reliability of America's nuclear stockpile. The timeline for construction is driven by requirements coming from the ASCI within the Stockpile Stewardship Program (SSP). The TSF will manage the computers, the networks and the data and visualization capabilities necessary to store and understand the data generated by the most powerful computing systems in the world.

Justification

The Advanced Simulation and Computing (ASC) Campaign (previously the Accelerated Strategic Computing Initiative) has as its mission the acceleration of simulation to meet the demands of the

[b] 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.

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

[d] 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.

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

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

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

Scope

The TSF project will construct a building (Building 453) of approximately 270,000 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 building will be initially built with enough power and cooling to support two terascale systems. The computer center and electrical rooms will be designed so that power and cooling capacity can be shifted to areas requiring greater or lesser load. 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.

Project Milestones

Start Construction	TBD

4. Details of Cost Estimate

(dollars in thousands)

	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs (Design Drawings and Specifications – $3,800)	TBD	5,050
Design Management Costs (0.8% of TEC)	TBD	750
Project Management Costs (0.7% of TEC)	TBD	600
Total Design Costs (7.2% of TEC)	TBD	6,400
Construction Phase		
Improvements to Land	TBD	2,100
Buildings	TBD	47,850
Utilities	TBD	10,600
Standard Equipment	TBD	1,500
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	TBD	3,800
Construction Management (3.8% of TEC)	TBD	3,400
Project Management (1.9% of TEC)	TBD	1,650
Total Construction Costs (79.7% of TEC)	TBD	70,900
Contingencies		
Design Phase (1.1% of TEC)	TBD	1,000
Construction Phase (12.0% of TEC) [a]	TBD	10,700
Total Contingencies (13.1% of TEC)	TBD	11,700
Total, Line Item Costs (TEC) [b]	TBD	89,000

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 FY 2001 DOE escalation multiplier tables dated January, 1999.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2000	FY 2001	FY 2002	Outyears	Total
Project Cost						
Facility Costs						
Design	0	200	6,659	230	TBD	TBD
Construction	0	0	0	4,750	TBD	TBD
Total, Line item TEC	0	200	6,659	4,980	TBD	TBD
Total Facility Costs (Federal and Non-Federal)	0	200	6,659	4,980	TBD	TBD
Other Project Costs						
Conceptual design costs	1,300	0	0		TBD	TBD
NEPA documentation costs	150	0	0		TBD	TBD
Other project-related costs [a]	930	0	0		TBD	TBD
Total, Other Project Costs	2,380	0	0	0	TBD	TBD
Total Project Cost (TPC)	2,380	200	6,659	4,980	TBD	TBD

7. Related Annual Funding Requirements

(FY 2006 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs [b]	1,500	1,500
Programmatic operating expenses directly related to the facility [c]	56,200	56,200

[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. Also reflected here is the FY 2001 Appropriation reduction of $100,000 for the Safeguards and Security (S&S) amendment.

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

[c] The annual operating expenses for the Terascale Simulation Facility are estimated at $ 56,200,000 based on representative current operating expenses of 300 personnel. The majority of this funding is expected to come from DOE/DP for activities in support of the Nuclear Weapons Stockpile Stewardship Program.

	(FY 2006 dollars in thousands)	
	Current Estimate	Previous Estimate
Utility costs [a]	8,500	8,500
Total related annual funding (operating from FY 2006 through FY 2025)	66,200	66,200

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

00-D-105, Strategic Computing Complex (SCC) Los Alamos National Laboratory, Los Alamos, New Mexico

(Changes from FY 2001 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

The TEC for this project was reduced by the FY 2001 Consolidated Appropriations Act from $98,972,000 to $98,849,000. The recission will be absorbed within project contingency and, therefore, will not affect the project scope.

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)*	1Q 2000	4Q 2000	1Q 2000	2Q 2002	100,000	106,800
FY 2001 Budget Request	1Q 2000	4Q 2000	1Q 2000	2Q 2002	98,972	106,617
| FY 2002 Budget Request *(Current Budget Estimate)*	1Q 2000	4Q 2000	1Q 2000	2Q 2002	98,849	106,494

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2000	31,902 [a]	31,902	20,977
2001	55,877 [b]	55,877	61,175
2002	11,070 [c]	11,070	16,697

[a] Original appropriation was $26,000,000. This was reduced by $98,000 for the FY 2000 rescission enacted by P.L. 106-113.

[b] Original appropriation was $56,000,000. This was reduced by $123,000 for a rescission enacted by Section 1403 of the FY 2001 Consolidated Appropriations Act.

[c] FY 2002 funding reflects a $6,000,000 decrease which was a corresponding increase in FY 2000 funding which was based on a Congressionally approved reprogramming.

3. Project Description, Justification and Scope

Justification

Without nuclear testing, large-scale computations are the only means of predicting the safety, reliability, and yield of a nuclear weapon. The nuclear stockpile is aging. Generically, aging produces effects that introduce small three-dimensional defects which break the symmetries which designers have invoked in the past when designing nuclear weapons. We are also faced with the issue of the aging of the weapon scientists and engineers that were responsible for developing and testing the weapons in our stockpile. The new simulation models being developed for the stockpile can best be validated by these weapon scientists and engineers. Consequently, greatly enhanced computational requirements in both speed and memory are needed in the near future. It is estimated that assessing the safety and performance of the stockpile will require a factor of 100,000 increase in computational power over what has been required to design new weapons. The Advanced Simulation and Computing (ASC) campaign, formerly the Accelerated Strategic Computing Initiative (ASCI), one of the highest priority programs within the Stockpile Stewardship Program, is designed to maintain the safety, reliability, and performance of the nuclear weapons in the stockpile, and is dedicated, and on track, to achieving this goal in less than a decade.

Numerical simulations are now the most important mechanism for the integration of the many complex processes which take place in a thermonuclear weapon. This means that the continued certification of the safety and reliability of the nation's nuclear stockpile relies to a greater extent on computer simulations. To respond to this challenge, the Strategic Computing Complex (SCC) at Los Alamos will be capable of initially supporting a 30 TeraOps (30 trillion floating point operations per second) computer platform and be capable of expanding to 100 TeraOps before 2004. To meet urgent national security requirements associated with nuclear weapons Stockpile Stewardship, this facility must be operational by the 2nd quarter of FY 2002. There is no other facility capable of housing and powering the ASCI supercomputer planned for the SCC.

The SCC and its associated information infrastructure—the high-speed networks, workstations, visualization centers, interactive data-analysis tools and collaborative laboratories—will support the Stockpile Stewardship Program and, potentially, other research efforts involving the simulation of complex phenomena of national importance. The SCC will enable the fulfillment of the prime stewardship mission to ensure the safety, reliability and performance of the Nation's nuclear weapons stockpile without underground nuclear testing. For example, it will be possible to simulate weapons safety scenarios at a multiscale level, beginning with the weapon in its transport container and going through detailed descriptions of components all the way down to the microstructure of the aged high-explosive material.

Description and Scope

The SCC will be a three-story structure with approximately 291,000 gross square feet which will house the world's largest and most capable computer (initially 30 TeraOps) in a specially designed 43,500 net square-foot computer room. This room will be supported by electrical and mechanical rooms in excess of 60,000 square feet.

The facility will provide a dynamic environment for approximately 300 nuclear weapons designers, computer scientists, code developers, and university and industrial scientists and engineers to collaborate to extend the cutting edge of simulation and modeling development in support of nuclear weapons stockpile stewardship requirements. These scientists and engineers will work together, with support personnel, in simulation laboratories (approximately 200 in classified and 100 in unclassified areas). The facility will be located in Technical Area 3 (TA-3) at the Los Alamos National Laboratory.

The SCC features a visualization environment consisting of two immersive theaters, one in the classified area and one in the unclassified area. These theaters will have overhead projection and wrap-around features supporting the latest virtual-reality and visionarium environments. These theaters represent the highest-end capability available for data viewing analysis.

A powerwall theater in the secure environment will provide high-resolution interleaved displays that fill a wall with the latest projection technology. In addition to the powerwall display, this theater will contain conference capability, multiple display monitors, and electronic white-boards to promote effective teaming and collaborative discussions.

A third simulation environment promoting collaborations among teams is supplied by the areas designated as collaboratories. There are four of these areas, and they will contain conference space, a media-stack including laser-disc recorders for animation production and viewing, an immersadesk for compact virtual-reality (VR) analysis, multiple high-resolution graphics heads, electronic white-board, video teleconferencing tools, and electronic collaborative tools for effective interaction with researchers at open and secure sites. The collaboratory provides the users, code developers, and managers with an informal, information- and technology-rich environment with systems for simulation development, collaboration, discussion, media-development, presentation, and problem analysis. The SCC will bring together weapons code development teams to integrate experiments, material, physical computer and experimental sciences in support of the Stockpile Stewardship Program.

An auditorium with seating for approximately 200 people will be provided to serve both classified and unclassified meetings. Conference rooms will be available in the classified and unclassified areas.

The proposed facility concept consists of a three-story structure that includes offices, simulation laboratories, collaboratories, a power wall, and a visualization theater. Site utilities directly related to this facility will be extended and upgraded as necessary.

The mechanical systems will be designed for maximum flexibility. The computer-room cooling system is planned to be adaptable for air-cooled computers, water-cooled computers, or a combination of both types. The simulation laboratory spaces are heated, cooled, and ventilated with modular, variable-volume air handling units, with separate air handling unit systems for classified and unclassified areas. Energy conservation is provided by the use of cooling-tower heat exchangers that are used to meet cooling requirements without running chillers during winter and cooler months.

The SCC facility will be fed by two different 13.2 kV underground power sources and is configured with double-ended switchgear and unit substations to allow switching for maintenance and isolation of faults. The proposed design consists of power conditioners, K-rated transformers, and distribution equipment rated for the high harmonics generated by the computer. The system is modular and expandable to allow growth and easy modification. A grounding ring surrounds the building in addition to a signal reference grid in the computer room to reduce electrical noise. A lightning protection system is incorporated into the facility. A fire detection system will be installed to monitor the entire building, as will a highly sensitive smoke detection system under the computer-raised floor. Communication lines will service the facility through an underground ductbank system utilizing fiber optic cable for both secure and open systems. Copper lines will be used for the voice communication system.

The facility infrastructure is designed to be scalable. At construction completion, the facility will have mechanical and electrical equipment installed to support up to 30 TeraOps. As requirements go beyond the 30 TeraOps capability, mechanical and electrical equipment can be added within the building in increments as required to support the computer technology at that time. This scalable feature of the SCC includes future installation of chillers, cooling towers, computer room air-conditioning units, substations, motor-generator power-conditioners, transformers, and panelboards. Scalability provides the Department of Energy (DOE) with a cost-effective option of not installing additional support equipment until it is needed and the ability to capitalize on technological advances in computing technology, as well as in the support equipment. The computers and simulation equipment to be housed in the SCC are not funded as part of this project, they are funded as part of the ASC campaign.

Project Milestones:

FY 2002:	Complete Construction	2Q
	Operational Start	3Q

4. Details of Cost Estimate

(dollars in thousands)

	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs (Design, Drawings and Specifications - $2,875)	3,764	3,764
Design Management Costs (0.3% of TEC)	298	298
Project Management Costs (0.8% of TEC)	816	816
Total Design Costs (4.9% of TEC)	4,878	4,878
Construction Phase		
Improvements to Land	3,505	3,505
Buildings	58,139	58,139
Utilities	8,059	8,059
Standard Equipment	2,231	2,231
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	4,184	4,184
Construction Management (5.1% of TEC)	5,067	5,067
Project Management (1.7% of TEC)	1,658	1,658
Total Construction Costs (83.7% of TEC)	82,843	82,843
Contingencies		
Design Phase (0.9% of TEC)	880	880
Construction Phase (10.3% of TEC)	10,248	10,371
Total Contingencies (11.3% of TEC)	11,128	11,251
Total, Line Item Costs (TEC) [d]	98,849	98,972

5. Method of Performance

Design, construction, and procurement was accomplished by a competitive best value fixed-price design-build contract. Design-build is a project delivery system where a single entity performs both the design and construction. Some advantages of design-build include a single source for construction activities, cost control and accountability. The removal of existing utilities located on the SCC site and installation of new perimeter utilities plus the construction of electrical services to the site will be performed by the site services contractor under fixed price contracts.

[d] Escalation rates taken from the January 1999 DOE escalation multiplier tables.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2000	FY 2001	FY 2002	Outyears	Total
Project Cost						
Facility Costs						
Design	0	5,327	431	0	0	5,758
Construction	0	15,634	60,760	16,697	0	93,091
Total, Line Item TEC	0	20,961	61,191	16,697	0	98,849
Total Facility Costs (Federal and Non-Federal)	0	20,961	61,191	16,697	0	98,849
Other Project Costs						
Conceptual design costs	2,395	52	0	0	0	2,447
NEPA documentation costs	128	41	43	39	0	251
Other ES&H costs	86	12	12	70	0	180
Other project-related costs [a]	2,050	614	445	1,658	0	4,767
Total, Other Project Costs	4,659	719	500	1,767	0	7,645
Total Project Cost (TPC)	4,659	21,680	61,691	18,464	0	106,494

[a] Project Execution Plan, Feasibility Studies, Estimating Support, Scheduling and Controls Support, Safeguards and Security Analysis, Design-Build Source Selection Committee work, Value Engineering Study, Fire Hazards Assessment, Site Surveys, Soil Reports, Permits, Administrative Support, Operations and Maintenance Support, ES&H Monitoring, Operations Testing, and Readiness Assessment.

7. Related Annual Funding Requirements

(FY 2002 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs [a]	650	650
Annual facility maintenance/repair costs [b]	1,270	1,270
Programmatic operating expenses directly related to the facility [c]	55,000	55,000
Utility costs	6,600	6,600
Total related annual funding (operating from FY 2002 through FY 2021)	63,520	63,520

[a] When the facility is operational in the 2nd Quarter of FY 2002, costs will average $650,000 for labor and material per year. An average of 3.0 staff years will be required to operate the facility.

[b] Based on projected annual costs for LANL site services subcontractor as derived from historical maintenance and repair costs for the LDCC facility.

[c] Annual programmatic operating expenses are estimated at $55,000,000 based on representative operating expenses of 300 people. The majority of this funding is expected to come from DOE/DP for activities in support of the Stockpile Stewardship Program.

00-D-107, Joint Computational Engineering Laboratory, Sandia National Laboratories, Albuquerque, New Mexico

(Changes from FY 2001 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

| # The TEC/TPC, funding profile and schedule milestone dates reflected in this data sheet are preliminary. The TEC/TPC, outyear funding profile, and schedule have not been validated and may be modified after completion of a thorough review and validation. In addition, the Administration is conducting an on-going review of the strategic nuclear mission of the United States, which could impact funding requirements and schedules.

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 2000	2Q 2001	3Q 2001	4Q 2003	28,870	30,303
FY 2002 Budget Request *(Current Budget Estimate)*	1Q 2001	1Q 2002	TBD	TBD	28,855 [a]	30,428

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2000	1,793 [b]	1,793	0
2001	6,685 [c]	6,685	1,193
2002	5,377	5,377	1,205
2003	TBD	TBD	TBD
2004	TBD	TBD	TBD

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[a] The TEC/TPC, funding profile and schedule milestone dates reflected in this data sheet are preliminary. The TEC/TPC, outyear funding profile, and schedule have not been validated and may be modified further after completion of a thorough review and validation. In addition, the Administration is conducting an on-going review of the strategic nuclear mission of the United States, which could impact funding requirements and schedules.

[b] Original FY 2000 appropriation was $1,800,000. This was reduced by $7,000 for the FY 2000 rescission enacted by P.L. 106-113.

[c] Original appropriation was $6,700,000. This was reduced by $15,000 for a rescission enacted by Section 1403 of the FY 2001 Consolidated Appropriations Act

3. Project Description, Justification and Scope

Description:

The Joint Computational Engineering Laboratory (JCEL) will be a new, state-of-the-art facility at Sandia National Laboratories for research, development, and application of leading-edge, high-end computational and communications technologies. JCEL will provide office space and laboratories for 175 people in a building with a total of approximately 55,200 gross square feet. JCEL will be the center of Sandia's computational modeling, analysis, and design community, and will be constructed in close proximity to Sandia's existing computer and communications building, presently occupied by part of this community.

Justification:

The primary mission of JCEL is to ensure the rapid development and application of high performance computing, modeling, analysis, design, and simulation, which forms the foundation of DOE's Science-Based Stockpile Stewardship (SBSS) vision and, more specifically, supports the Advanced Simulation and Computing (ASC) campaign, formerly the Accelerated Strategic Computing Initiative (ASCI). The goal of ASC is to accelerate the development of simulation capabilities that are needed to ensure the confidence of the stockpile.

JCEL will primarily focus on computational simulation and virtual-prototyping. JCEL focuses on modeling and simulation to support model- and simulation-based life cycle engineering and to serve as a testbed for and a prototype of the "virtual enterprise." In essence, JCEL's mission is to develop advanced Stockpile Stewardship Program (SSP) tools. In JCEL, design alternatives will be explored using iterative simulations of virtual prototypes. Surety and reliability assessments will be model-based and incorporate fundamental understanding of critical component response to the full range and all credible combinations of environmental inputs by DoD. Tools developed within JCEL will ultimately support manufacturing efforts elsewhere within Sandia and the NWC by enabling product design alternatives to be modeled, analyzed, evaluated, and modified as necessary by engineers—all through the use of simulation.

As required by the ASM, JCEL is critical to Sandia's mission role to serve as integrator of the Nuclear Weapons Complex (NWC) into a "virtual enterprise." JCEL will lead the way with campus-wide distributed technologies, "data everywhere/people-anywhere" data management and data interpretation technologies, and the computational plants to enable it. JCEL will serve as a major integration node—connecting people to people, people to machines, and machines to machines, allowing access, integration, and preservation of information across the entire Sandia, NM site. JCEL will serve as a prototype of the "virtual enterprise," which will serve as a model for how to integrate the many heterogeneous nodes of the existing NWC into a virtual business enterprise for affordable and effective stockpile stewardship.

JCEL will utilize key expertise to create strategic simulations and advanced collaborative environments. Increased interaction, collaboration, and teamwork are essential for shifting more rapidly to science-based methods and for effective stewardship of the nuclear stockpile. JCEL will provide classified space at the TSRD level to facilitate collaboration between the users of high-end simulation technology and the developers, while maintaining strict security of classified weapon information. JCEL will also include space designed to encourage interaction and collaboration among the scientists and engineers occupying the building and will provide work space tailored for multidisciplinary, high-performance teams who will develop computer codes and analyze nuclear weapons.

JCEL will provide labs for developing, prototyping and using Virtual Environment Technology, where designers, analysts, and experimenters can interact with each other as if they were in the same room. Moreover, JCEL will use, as well as develop, this leading-edge technology. It will prototype and demonstrate a science and engineering workplace of the 21st century.

The communications networks will enable JCEL's occupants to use the supercomputers in the DOE complex. To display the extensive results of complicated, three-dimensional simulations of nuclear weapons, the JCEL project will also provide computer equipment for virtual reality and advanced visualization techniques, graphics workstations and printers, and video equipment.

To achieve its goals, the JCEL project will provide:

- A facility of approximately 55,200 gross square feet located in Technical Area I of Sandia National Laboratories on Kirtland Air Force Base in Albuquerque, New Mexico.
- Laboratory space, office space, management and administrative space, and interaction and meeting space.
- A facility which will meet Top-Secret Restricted-Data (TSRD) security requirements.
- Classified communications within the facility and between the facility and the rest of Sandia and DOE complex.
- Computer equipment for displaying and printing the results from complex, three-dimensional computer simulations of nuclear weapons.
- Classified computer workstations for use by leading engineers and scientists from the NWC.
- Video equipment for video conferencing, displaying, and editing video images produced by computer simulations.

Benefits

- Reduced program costs through use of high-fidelity computer simulations developed through JCEL programs to reduce the scope of costly test programs.
- Faster response on stockpile stewardship issues that will arise.
- Rapid interchange of appropriate technology.
- Accelerated Defense Programs technology development.
- Cost savings in the development of Sandia research foundation technology base.

Scope:

Plan, design, and construct a new, three-story building to accommodate a total of about 175 people, which will provide classified (at the TSRD level) space in close proximity to the Sandia Central Computing Facility in building 880. The project will provide computer equipment to: display three-dimensional simulations; support engineers and scientists and provide video conferencing capability. Computer equipment includes: Visualization Laboratory display facilities ($3,145,000); and Advanced Conference Room Equipment ($425,000). In addition, the project will move existing furniture and install some new furniture. Site landscaping, parking, pedestrian access improvements, signage, and fencing improvements will be provided.

Project Milestones:

Physical Construction Start TBD

4. Details of Cost Estimate

(dollars in thousands)

	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs (Design Drawings and Specifications)	TBD	1,604
Design Management Costs (.7% of TEC)	TBD	213
Project Management Costs (.6% of TEC)	TBD	178
Total Design Costs (6.9% of TEC)	TBD	1,995
Construction Phase		
Improvements to Land	TBD	1,056
Buildings	TBD	12,076
Utilities	TBD	719
Communication/Voice Networking Equipment	TBD	2,431
Standard Computer/Visualization Equipment	TBD	5,676
Furniture and Office Equipment [a]	TBD	0
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	TBD	895
Project Moves [b]	TBD	0
Construction Management (1.6% of TEC)	TBD	463
Project Management (0.9% of TEC)	TBD	255
Total Construction Costs (81.6% of TEC)	TBD	23,571
Contingencies		
Design Phase (0.9% of TEC)	TBD	263
Construction Phase (10.5% of TEC)	TBD	3,041
Total Contingencies (11.4% of TEC)	TBD	3,304
Total, Line Item Costs (TEC) [c]	TBD	28,870

5. Method of Performance

Architectural and engineering design and inspection will be performed by Sandia Facilities Departments and/or under a competitive-bid fixed-price contract based on capability and capacity to perform the work. Construction will be performed under a competitive-bid fixed-price contract or multiple

[a] Furniture and Office Equipment was originally part of the Standard Equipment figure.

[b] Project moves were originally part of the building construction figure.

[c] Escalation rates taken from the FY 1999 DOE escalation multiplier tables (FY 2000 tables are not available).

competitive-bid fixed-price contracts.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2000	FY 2001	FY 2002	Outyears	Total
Project Cost						
Facility Costs						
Design	0	0	1,193	1,205	TBD	TBD
Construction	0	0	0	115	TBD	TBD
Total, Line item TEC	0	0	1,193	1,320	TBD	TBD
Total Facility Costs (Federal and Non-Federal)	0	0	1,193	1,320	TBD	TBD
Other Project Costs						
Conceptual design costs [a]	989	0	0	0	TBD	TBD
Other project-related costs [b]	289	168	95	95	TBD	TBD
Total, Other Project Costs	1,278	168	95	95	TBD	TBD
Total Project Cost (TPC)	1,278	168	1,288	1,415	TBD	TBD

7. Related Annual Funding Requirements

(FY 2003 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs [c]	267	259
Annual facility maintenance/repair costs [d]	122	118

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[a] Includes NEPA documentation costs.

[b] 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, Fire Hazards Assessment, Permits, Administrative Support, Operations and Maintenance Support, ES&H Monitoring, Operations Testing, Energy Management Control System Support, Readiness Assessment, Facility Security Requirements, and External Independent Review.

[c] When all facilities are operational, average $267,000 for labor and materials per year. An average of 3.4 staff years will be required to operate the facility.

[d] A total of 1.0 staff years per year are required to maintain the facility.

	(FY 2003 dollars in thousands)	
	Current Estimate	Previous Estimate
Programmatic operating expenses directly related to the facility [e]	52,530	51,000
Utility costs	202	196
Total related annual funding (operating from FY 2003 through FY 2032)	53,121	51,573

[e] Annual programmatic operating expenses are estimated at $52,530,000, based on representative current operating expenses of 175 people. The majority of this funding is expected to come from DOE/DP for activities in support of the Nuclear Weapons Stockpile Stewardship Program. Lesser amounts are expected from other sources for activities which are mutually beneficial to the funding source and DOE/DP. By bringing these activities together in one building, we expect the effectiveness of this work to be increased by at least 10% and probably much more. This would correspond to a savings of at least $5 million per year of DOE/DP operating funds.

Pit Manufacturing and Certification

Mission Supporting Goals and Objectives

Pit Manufacturing and Certification, previously called Pit Manufacturing Readiness, has been restructured to incorporate pit certification activities which were previously included in Directed Stockpile Work and the Dynamic Materials Properties campaign. In the near term, this campaign will focus mainly on W88 pit manufacturing and certification. However, in addition to meeting the W88 surveillance requirements, the DP is committed "to reestablishing and maintaining sufficient levels of production to support requirements for the safety, reliability, and performance of United States nuclear weapons" as delineated in the January 26, 1996, START II Treaty Ratification Text.

The abrupt closure of the Rocky Flats Plant stopped production of W88 pits before sufficient pits were produced to meet the stockpile surveillance requirements for the projected 20-year design life of the W88 warhead. There is only one W88 surveillance pit remaining for destructive evaluation for the surveillance program. DP is working closely with the Navy's Strategic Systems Program Office to ensure that military requirements are met.

In the absence of nuclear testing, the fabrication and certification of pits that meet quality requirements for the nuclear weapon stockpile war reserve, remains a major challenge. The draft W88 Pit Manufacturing and Certification Integrated Project Plan has identified approximately 18,000 activities and 350 individual work packages to complete the pit production and certification task reflecting the magnitude of this major challenge.

The early years of the pit project are dominated by manufacturing process development for the W88 pit. During this period, certification tests are focused on examining fundamental material properties and improving simulation codes. Following successful completion of process development pits and establishment of the requisite quality assurance infrastructure, the first certifiable pit will be fabricated to be followed by qualification and production pits. During the ensuing qualification period, certifiable pits will be manufactured for use in experiments and for comparison to Rocky Flats produced pits. A minimum set of certification experiments to determine product equivalency have been identified. The schedule for the certification of pits for stockpile deployment remains under review.

The goals of the campaign are to:

- Manufacture a certifiable W88 pit by 2003;
- Establish a limited production capability for W88 pits to meet the programmatic needs of the DoD;
- Plan the certification requirements and processes to certify the W88 pit built at LANL without underground nuclear testing;
- Reestablish the full capability to manufacture all pit types within the stockpile; and
- Plan for the long term manufacturing support of pits.

Funding Schedule

	(dollars in thousands)				
	FY 2000	FY 2001	FY 2002	$ Change	% Change
W88 Pit Manufacturing	85,242	112,003	103,700	-8,303	-7.4%
W88 Pit Certification	20,800	27,800	18,845	-8,955	-32.2%
Pit Manufacturing Capability	1,229	2,785	2,000	-785	-28.2%
Modern Pit Facility	0	2,000	4,000	2,000	100.0%
Total, Pit Manufacturing and Certification	107,271	144,588	128,545	-16,043	-11.1%

Performance Measures

Performance will be demonstrated by:

- Manufacturing two development pits in FY 2002.
- Completing implementation of manufacturing and quality infrastructure in FY 2002.
- Establishing production controls and quality infrastructure in FY 2003.
- Manufacturing of a development pit and the Certifiable Pit in FY 2003.
- Establishing limited manufacturing capacity in FY 2007.
- Conducting initial materials experiments in FY 2002.
- Conducting LANL/LLNL peer review workshop in FY 2002.
- Completing design of components for material property tests in FY 2002.
- Completing peer reviews in FY 2003.
- Completing the reestablishment of key manufacturing technologies associated with the W87 and B61-7 pits as demonstrated through manufacture of development pits by FY 2007.
- Providing documentation required to support a critical decision to initiate development of a conceptual design for a Modern Pit Facility in FY 2002.

There are a number of facilities and activities that must be supported to ensure success for this campaign, but are appropriately requested in other budget elements in FY 2002. The total funding supporting pit manufacturing and certification in FY 2002 is $217.7 million. The Dynamic Materials campaign includes $3.5 million to support measurements of fundamental materials properties of plutonium in support of pit manufacturing and certification. Within RTBF, Materials Recycle and Recovery includes $3.8 million to support materials requirements related to this campaign. Also within RTBF, Operations of Facilities, funding is included for a number of facilities at LANL, including $81.9 million for the CMR and TA-55. These facilities and activities are critical to the success of the Pit Manufacturing and Certification Campaign.

Detailed Program Justification

FY 2001 Items of Congressional Interest: The FY 2001 appropriations act provided $2 million to begin conceptual design activities for a modern pit facility. These funds are being used for preconceptual design planning activities. The FY 2001 Energy and Water Development Appropriations Conference Report 106-907 directed the National Nuclear Security Administration to submit a W88 Pit Manufacturing and Certification status report. An interim report was provided to the Congress in December 2000. A final report will be submitted to the Congress following this budget request.

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
W88 Pit Manufacturing	85,242	112,003	103,700

Development pits will be manufactured while manufacturing processes are defined and qualified. As a part of reestablishing the capability to manufacture war reserve pits, the production controls and quality infrastructure necessary to meet quality requirements and consistency of product will be established. Once completed, the first Qualification Pit will be manufactured as a "certifiable" pit. Further Qualification Pits will be manufactured to support engineering and physics testing for certification of the manufactured pits.

W88 Pit Certification	20,800	27,800	18,845

To confirm nuclear performance of the W88 pit without underground nuclear testing, the draft W88 Pit Manufacturing and Certification Integrated Project Plan (W88 PMCIPP) identifies the required engineering tests, physics experiments, dynamic experiments and integral experiments. A thorough peer review of the plan and activities required for W88 pit certification and manufacturing will be performed.

Engineering tests will be identified and scheduled for use in evaluating the intrinsic radiation signature, and structural response to environments delineated in the Stockpile-to-Target-Sequence including deployment and flight thermal and mechanical environments, and long-term material compatibility. Physics laboratory experiments will be planned and scheduled to confirm that Los Alamos National Laboratory plutonium fabrication techniques produce equivalent compositions, microstructures and mechanical properties when compared to Rocky Flats manufactured material. Data from these material property experiments will be used to confirm consistent production results; to improve physics models used in ASCI simulation codes; and to help predict and compare military performance. Integral tests will include explosively driven experiments to extrapolate material performance models in more realistic weapons environments, provide data to compare Rocky Flats material properties to LANL material properties, and to assist in development of advanced diagnostic techniques for more complex follow-on experiments. Additional integral dynamic tests will use actual geometry experiments to quantify performance differences that may result from differences in manufacturing between Rocky Flats and LANL. These experiments will also be the principal basis for computational ties to the prior nuclear test database.

	FY 2000	FY 2001	FY 2002
	(dollars in thousands)		
Pit Manufacturing Capability	1,229	2,785	2,000

Pit manufacturing and certification activities not specifically supporting the W88 are conducted in the third element of the restructured campaign. These activities include identifying and scheduling the reestablishment of key manufacturing technologies for the W87 and B61-7 pits which, together with the W88, span technical variations of pits within the stockpile, and capturing lessons learned from reconstituting pit manufacturing and the initial certification of a pit without the conduct of nuclear testing.

Modern Pit Facility	0	2,000	4,000

The limited manufacturing capacity being established to support the W88 requirements is insufficient to meet manufacturing requirements for the long term support of the stockpile. The nuclear weapons production complex must respond to ongoing surveillance requirements and have a readiness capability and capacity to respond to unforeseen requirements for pit manufacturing. Planning for a modern pit facility with the capability to meet requirements is essential to establish a viable readiness posture. Preconceptual design activities were initiated in FY 2001 and need to be continued through the development of a conceptual design report.

Total, Pit Manufacturing and Certification	**107,271**	**144,588**	**128,545**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Pit Manufacturing & Certification	
# The decrease does not reflect the proposal, submitted to the Congress on March 30, 2001, to realign $26.9 million from Pit Manufacturing and Certification campaign to RTBF-Operations of Facilities to support pit manufacturing and certification activities at the Los Alamos National Laboratory. If this realignment is approved, the FY 2002 request would reflect an increase of $18.6 million to support the W88 pit manufacturing project including, establishment of a quality infrastructure (including facilities, equipment, technologies, processes, and personnel and management systems)	-8,303
# Decrease reflects reduced support of engineering tests, physics experiments, dynamic experiments, and other pit certification activities of the W88 Pit Manufacturing and Certification Integrated Project Plan (W88 PMCIPP)	-8,955

# Decrease reflects reduced efforts to support development of Modern Pit Production technologies	-785
# Increase supports the planned Conceptual Design for the Modern Pit Facility	2,000
Total Funding Change, Pit Manufacturing Readiness	**-16,043**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	1,111	1,474	1,474	0	0%
Total, Capital Operating Expenses . .	1,111	1,474	1,474	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
Total, Construction	0	0	0	0	0	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Secondary Readiness Campaign

Mission Supporting Goals and Objectives

Ensures present and long-term manufacturing capabilities (equipment, people, processes) for production of secondaries. The campaign's objective is to develop the capability to deliver a first production unit secondary within 36 months of receiving a request.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Modernize Manufacturing Facilities	0	15,421	11,500	-3,921	-25.4%
Establish Near-Term Process Capability	0	13,866	11,669	-2,197	-15.8%
Total, Secondary Readiness	0	29,287	23,169	-6,118	-20.9%

Performance Measures

Performance will be demonstrated by:

- Identifying scoping requirements on special materials for recertifying/remaking parts in support of the B61-7/11 First Production Unit (FPU) and the W76 FPU.
- Completing installation of special equipment in support of the B61-7/11 FPU.
- Finalizing design criteria in support of the Special Materials Complex.
- Releasing the Master Planning Document to scope the overall Y-12 Plant Modernization.
- Completing the initial analysis associated with Enriched Uranium Manufacturing in preparation for a Critical Decision-0 request on this facility.

Detailed Program Justification

<u>FY 2001 Item of Congressional Interest</u>: The FY 2001 appropriations act increased this campaign by $5 million to address capabilities at the Y-12 Plant, which will support the achievement of capabilities necessary for the B61 Life Extension Program.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Modernize Manufacturing Facilities	0	15,421	11,500

Supports modernization of the Y-12 Plant's manufacturing facilities and infrastructure which is being driven by the need to: ensure the retention of a viable production capability and facilities well into the 21st century; ensure that the plant is integrated with the laboratory design and analysis functions, as the technology demands for science-based stockpile assurance requires; reduce the growing operation and maintenance costs resulting from deferred maintenance and operating efficiencies of aging facilities and processes; reduce reliance on personnel protective equipment by implementing engineered barriers for protection of workers; and meet current and future requirements for the protection of the public and environment using new technologies and processes which reduce or eliminate harmful effluents. Decrease reflects a non-recurring congressional add-on in FY 2001.

	FY 2000	FY 2001	FY 2002
Establish Near-Term Process Capability	0	13,866	11,669

Addresses those activities required to ensure readiness to meet near-term Stockpile Life Extension Program secondary manufacturing requirements, as well as to respond to near-term stockpile surge manufacturing needs. This initiative also addresses processes related to other traditional Y-12 Plant parts that are not contained in the secondary, such as radiation cases. "Near Term Processes" is defined as those processes that are not addressed, in the time frame needed, by the Modernization effort or are not contained within its scope. This initiative will place major emphasis on ensuring manufacturing capability and capacity through minimal upgrade and reconfiguration of existing facilities and processes, with cost-effectiveness addressed to the extent possible.

	FY 2000	FY 2001	FY 2002
Total, Secondary Readiness	**0**	**29,287**	**23,169**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Secondary Readiness	
# Decrease reflects non-recurring congressional add-on to the FY 2001 funding provided to address capabilities at Y-12 supporting achievement of capabilities necessary for the B61 LEP	-6,118

	FY 2002 vs. FY 2001 ($000)
Total Funding Change, Secondary Readiness	**-6,118**

High Explosives Manufacturing and Weapons Assembly/Disassembly Readiness

Mission Supporting Goals and Objectives

Ensures present and long-term manufacturing capabilities for high explosive fabrication and weapon assembly/disassembly operations. The campaign's overall objective is to transform the nuclear weapons complex manufacturing operations to meet stockpile requirements with lower costs and faster responses to changing needs. Specifically, the campaign will develop the capability for HE/assembly readiness, by providing the technologies, facilities, and personnel for high-explosives component manufacturing, production re-qualification, and weapon assembly/disassembly operations to support a Phase 4 cycle time of 19 months out of the 36-month goal for correcting stockpile defects.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Implementation of New Processes/ Technologies	0	1,795	3,960	2,165	120.6%
Total, High Explosives Manufacturing and Weapons Assembly/Disassembly Readiness	0	1,795	3,960	2,165	120.6%

Performance Measures

Performance will be demonstrated by:

- Deploying SecureNet backbone to support Integrated Product and Process scheduling of all joint test assembly and flight test activities.
- Deploying special equipment for pre-screening and characterization of pits for the surveillance program.
- Implementing an interactive database that provides the laboratories with Record of Assembly, surveillance, and characterization data.
- Initiating a conceptual design for the Special Nuclear Material Requalification Facility in support of the W76 LEP.
- Implementing a process to produce and qualify war reserve TATB from machine cuttings as starting material.
- Demonstrating production and qualification of war reserve HMX and TATB, using alternative synthesis process.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Implementation of New Processes/Technologies	0	1,795	3,960

Supports the establishment of capability and capacity to provide necessary high explosive components. FY 2002 activities include the establishment of production scale high explosive manufacturing and qualification capability, deployment of technologies and facilities to support production requalification, and implementation of Enterprise Integration and Collaborative Manufacturing as pilot projects for demonstration and validation.

Total, High Explosives Manufacturing and Weapons Assembly/Disassembly Readiness	**0**	**1,795**	**3,960**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
HE/Assembly Readiness	
# Increase supports establishment of production scale HE manufacturing and qualification capability, deployment of technologies and facilities to support product requalification, and implementation of Enterprise Integration and Collaborative Manufacturing as pilot projects for demonstration and validation	2,165
Total Funding Change, HE/Assembly Readiness	**2,165**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	277	368	368	0	0%
Total, Capital Operating Expenses . .	277	368	368	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
Total, Construction	0	0	0	0	0	0

[a] Since funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects, we no longer budget separately for capital equipment and general plant projects. FY 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

Nonnuclear Readiness

Mission Supporting Goals and Objectives

Nonnuclear Readiness ensures present and long-term manufacturing capabilities for nonnuclear production. The campaign's objective is to bring all identified production vulnerabilities to an acceptable level of risk capable of yielding defect-free products within 36 months after the need is defined.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Optimize Supply Chain	0	500	2,700	2,200	440.0%
Enhance Processes for New Weapons Designs	0	0	1,175	1,175	N/A
Modernize Current Manufacturing Capabilities	0	150	4,750	4,600	3066.7%
Implement Rapid Manufacturing Methods	0	689	3,579	2,890	419.4%
Total, Nonnuclear Readiness	0	1,339	12,204	10,865	811.4%

Performance Measures

Performance will be demonstrated by:

- Supporting B61-7/11, W80 and W76 life extension programs through deploying commercial components methodologies for War Reserve Applications; deploying and characterizing modern gas transfer system methodologies; applying science based manufacturing techniques of modeling and simulation to achieve programmatic goals.
- Modifying existing tritium loading and cleaning facilities in support of the weapons LEPs.
- Establishing detonator production capability and neutron tube target loading.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Optimize Supply Chain	0	500	2,700

Focuses on improving the quality of the supply chain for future nuclear weapons complex needs addressing quality, delivery, and cost issues in three areas: procurement or certification of raw and existing materials or material parts; reliability assessments and qualification of commercial components in weapons environments including radiation; and, ensuring custom production capability for specialized parts not commercially available.

Enhance Processes for New Weapons Designs	0	0	1,175

Addresses the deployment of new manufacturing processes required to meet next generation weapon systems. Focuses on advanced production technologies enabling new opportunities for weapon surety through miniaturization and reduction in part count, as well as significant enhancement in data acquisition and monitoring during flight tests.

Modernize Current Manufacturing Capabilities	0	150	4,750

Upgrades the capabilities and capacities of our present production manufacturing infrastructure in two major areas: direct manufacturing and support services including modernizing the Flexible Manufacturing System (FMS), and active testers and their related information systems; improving high power detonator products, neutron generator capability, and gas transfer systems; and upgrading capital equipment used for materials, analysis, testing Sciences and metrology.

Implement Rapid Manufacturing Methods	0	689	3,579

Addresses the utilization of new tools, methodologies and approaches to manufacturing including optimizing processes and flowtimes through improved facility layout and supporting supply linkages; simulating and visualizing processes prior to production using virtual prototyping and other database tools; and creating a robust multi-skilled rapidly redeployable workforce.

Total, Nonnuclear Readiness	**0**	**1,339**	**12,204**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Nonnuclear Readiness	
Increase in funding reflects the first year of fully funding this campaign, which was initiated in FY 2001, and includes support for upgrades to the Heartland supercomputer at the Kansas City Plant required to support DSW and an upgrade of the High Powered Detonator Facility at LANL..	10,865
Total Funding Change, Nonnuclear Readiness	**10,865**

Materials Readiness

Mission Supporting Goals and Objectives

This campaign covers both Materials Readiness and Materials Surveillance. The Materials Readiness Campaign provides the means to analyze and identify shortfalls of nuclear and critical nonnuclear weapons materials, improved material capabilities and technologies and establishes a comprehensive integrated materials information database for the Stockpile Stewardship Program. Materials Surveillance provides for warehousing of U-233, management of excess materials at DP sites, uranium scrap recovery, and DOE Business Center for Precious metals, Sales, and Recovery.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Materials Supply/Demand and Planning . . .	1,915	0	0	0	0.0%
Material Processing and Disposition Capability	0	0	530	530	100.0%
Material Storage Optimization	3,367	0	0	0	0.0%
Enabling Processes, Technology, and Analytical Tools	2,092	2,941	0	-2,941	-100.0%
Materials Packages and Containers	383	0	0	0	0.0%
Materials Surveillance	14,088	8,819	679	-8,140	-92.3%
Total, Materials Readiness	21,845	11,760	1,209	-10,551	-89.7%

Performance Measures

Performance will be demonstrated by:

- Completing a survey of national security materials and requirements.
- Completing gap analysis and identifying a strategy or program elements for filling gaps.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	**FY 2001**	**FY 2002**
Materials Supply/Demand Assessment and Planning	1,915	0	0

Identified national security materials on hand and needed in the future, and gaps and processes needed to transform materials into forms needed and surplus materials and associated disposition paths.

Material Processing and Disposition Capability	0	0	530

Addresses the production and recovery of additional materials and upgrades/modifications to equipment used to process materials and the restart of process equipment. Funding in FY 2002 supports the DOE Business Center for Precious Metals.

Material Storage Optimization	3,367	0	0

Identified enhancements to storage infrastructures and develop strategy for, and defines the needs for storage of materials.

Enabling Processes, Technology, and Analytical Tools	2,092	2,941	0

Identified/developed processes, technology, and analytical tools needed to enable the other MRC major elements including monitoring technologies and robotics. The decrease in funding in FY 2002 reflects a realignment of activities at Y-12 and other sites to other programs as the purpose of the campaign is further refined.

Materials Packages and Containers	383	0	0

Ensured the availability of new containers and packaging for storage and transportation of national security and surplus nuclear materials.

Materials Surveillance	14,088	8,819	679

In FY 2001, $5.6 million was identified as a source for a reprogramming transmitted to Congress on March 1, 2001. The balance of the decrease in funding in FY 2002 reflects a realignment of activities at the Y-12 Plant and other sites to other programs as the purpose of the campaign is further refined.

Total, Materials Readiness	**21,845**	**11,760**	**1,209**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Materials Readiness	
# Increase provides funding for the DOE Business Center for Precious Metals.	530
# Decrease reflects a realignment of activities at Y-12 and other sites to other programs as the purpose of the campaign is further refined	-11,081
Total Funding Change, Materials Readiness	**-10,551**

Tritium Readiness

Mission Supporting Goals and Objectives

Tritium Readiness implements the Secretarial Record of Decision, which selected the Commercial Light Water Reactor (CLWR) option as the primary technology for the production of tritium and designated the Accelerator Production of Tritium (APT) as the backup technology. The campaign's objective for the primary technology (CLWR) is to establish the production systems and operations systems to produce tritium in a commercial reactor so that tritium can be delivered to the stockpile. The campaign's objective for APT within the requested funding is to document and archive the results of completed APT engineering development and demonstration and preliminary design and to close out the APT project beginning in the third quarter of FY 2001.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Commercial Light Water Reactor	48,373	57,149	42,350	-14,799	-25.9%
Accelerator Production of Tritium (APT) . .	51,307	18,440	1,000	-17,440	-94.6%
Construction	68,738	89,802	81,125	-8,677	-9.7%
Total, Tritium Readiness	168,418	165,391	124,475	(40,916)	-24.7%

Performance Measures

Performance for the primary technology (CLWR) will be demonstrated by:

- Initiating tritium-producing rod assembly by the commercial fabricator (WesDyne International) using components procured by the Pacific Northwest National Laboratory. Completing component fabrication and rod assembly according to the integrated schedule.
- Completing documentation of extraction tests and destructive examinations of tritium-producing rods irradiated in the Watts Bar reactor.
- Modifying reactor sites for handling tritium-producing rods. The Nuclear Regulatory Commission will conduct its regulatory process for amending the reactors' operating licenses.

Performance for the backup technology (APT)will be demonstrated by:

- Initiate process for documenting, archiving and closeout of the APT project in third quarter of FY 2001 and complete in FY 2002.

Detailed Program Justification

<u>FY 2001 Item of Congressional Interest</u>: In FY 2001, $19 million operating was requested for the Accelerator Production of Tritium Project, however $19 million operating and $15 million capital was appropriated to continue engineering development and demonstration and design work of APT as the backup tritium production technology. The funding enabled the Department to initiate in FY 2001 a joint Defense Programs and Nuclear Energy program for Advanced Accelerator Applications that will merge the APT program in the Office of Defense Programs with the Accelerator Transmutation of Waste (ATW) program in the Office of Nuclear Energy, Science and Technology.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
# **Commercial Light Water Reactor**	48,373	57,149	42,350
Establishes a tritium production system based on using a highly reliable and technically mature technology, CLWR, with tritium producing burnable absorber rods and construction of a tritium extraction facility at the Savannah River Site. The decrease in funding reflects the integrated funding profile of the project (planned baseline).			
# **Accelerator Production of Tritium (APT)**	51,307	18,440	1,000
The campaign's objective for APT within the requested funding is to document and archive the results of completed APT engineering development and demonstration and preliminary design and to closeout the APT project beginning in the third quarter of FY 2001 and complete closeout in FY 2002.			
# **Construction**	68,738	89,802	81,125
Project 98-D-125, Tritium Extraction Facility, Savannah River Site	32,875	74,835	81,125
Project 98-D-126, Accelerator Production of Tritium, various locations	35,863	14,967	0
Total, Tritium Readiness	**168,418**	**165,391**	**124,475**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Tritium Readiness	
# Decrease is consistent with the longstanding baseline plan for the Commercial Light Water Reactor (CLWR) Project and is due primarily to the completion of tritium-producing rod technology development and testing.	-14,799
# The decrease in funding for the Accelerator Production of Tritium (APT) Project reflects the closeout of the APT project beginning in the third quarter of FY 2001 and completion in FY 2002 per the Administration's priority to emphasize CLWR source for tritium. Planning and design activities for a backup technology for tritium production are reduced to provide resources for the more cost effective CLWR strategy.	-17,440
# The funding decrease associated with the Accelerator Production of Tritium construction project, 98-D-126, reflects closeout of the APT project beginning in the third quarter of FY 2001 and completion in FY 2002	-14,967
# Increase in the Tritium Extraction Facility, 98-D-125, reflects approved project funding profile	6,290
Total Funding Change, Tritium Readiness	**-40,916**

Capital Operating Expenses & Construction Summary

Capital Operating Expenses [a]

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects	0	0	0	0	N/A
Capital Equipment	300	300	300	0	0%
Total, Capital Operating Expenses . .	300	300	300	0	0%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000	FY 2001	FY 2002	Unapprop-riated Balance
98-D-125, Tritium Extraction Facility, Savannah River Site . . .	323,000	15,650	32,875	74,835	81,125	118,515
98-D-126, Accelerator Production of Tritium, various locations	138,695 [b]	87,865	35,863	14,967	0	0
Total, Construction	461,695	103,515	68,738	89,802	81,125	118,515

[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 2001 and FY 2002 funding shown reflects estimates based on actual FY2000 obligations.

[b] Assumes closeout of project beginning in FY 2001.

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

(Changes from FY 2001 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

None.

1. Construction Schedule History

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

[a] Consistent with OMB Circular A-11, Part 3, full funding was requested for only preliminary and final design of the CLWR TEF in FY 1998.

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
1998	9,650	9,650	6,911
1999	6,000	6,000	5,889
2000	32,875 [a]	32,875	32,003
2001	74,835 [b]	74,835	76,733
2002	81,125	81,125	70,369
2003	55,000	55,000	63,233
2004	53,000	53,000	57,230
2005	10,000	10,000	10,282
2006	515	515	350

3. Project Description, Justification and Scope

Tritium is a radioactive isotope of hydrogen used in all of the Nation's nuclear weapons. Without tritium, nuclear weapons will not work as designed. At present, no tritium is produced by the U.S. for the nuclear weapons stockpile. Radioactive decay depletes the available tritium by approximately 5.5% each year. In order for these weapons to operate as designed, tritium must be periodically replaced. Although tritium has not been produced by the U.S. for the stockpile since the shutdown of the last production reactor in 1988, tritium requirements have been met through reuse of tritium recovered from dismantled weapons. In order to maintain the Strategic Arms Reduction Treaties (START) 1 force structure and five-year reserve approved by the President in the 1996 Nuclear Weapons Stockpile Memorandum, a new production capability should come on line approximately 2005. To meet this date, site preparation and construction of the Tritium Extraction Facility (TEF) began in FY 2000. As part of the dual track production strategy, stated in the Record of Decision for the Tritium Supply and Recycling Final Programmatic Environmental Impact Statement, issued on December 5, 1995, the Commercial Light Water Rector (CLWR) Tritium Extraction Facility shall be constructed at the Savannah River Site. The CLWR TEF shall provide the capability to receive and extract gases containing tritium from CLWR Tritium Producing Burnable Absorber Rods (TPBAR), or other targets of similar design. The TEF will provide shielded remote TPBAR handling for the extraction process, clean-up systems to reduce environmental impact from normal processing and accidental releases, and delivery of extracted gases

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

[b] Original appropriation was $75,000,000. This was reduced by $165,000 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 2006 appropriation amount.

containing tritium to the Tritium Recycle Facility for further processing.

The TEF will consist of a concrete industrial facility constructed partly below grade. The facility is divided into two major areas: (1) a 15,500 square foot remote handling area (RHA) and (2) a 26,500 square foot tritium processing building. The tritium processing building will be entirely above-ground; the floor of the RHA will be below grade. Major processes and operations systems included within the TEF will be: (1) the Receiving, Handling, and Storage System that will support all functions related to the receipt, handling, preparation, and storage of incoming TPBAR and outgoing radioactive waste materials; (2) the Tritium Extraction System that will remove tritium and other gases from the TPBARs, remove contaminates from the gas stream, and store the tritium/helium mixture; (3) the Tritium/Product Process Systems that will separate and purify process gases from the irradiated TPBARs; (4) the Tritium Analysis and Accountability Systems that will support monitoring and tritium accountability; (5) the Solid Waste Management System that will receive solid waste generated by TEF for management and storage prior to disposal in the E-Area vaults; and (6) the Heating, Ventilation, and Air Conditioning System that would provide and distribute conditioned supply air to the underground RHA and the above ground tritium processing area and also discharge exhaust air to the environment via a 100-foot stack.

With CLWR as a basis, the TEF will provide steady-state production capability to the Tritium Recycle Facility (Building 233-H) of as much as 3Kg of tritium per year, if needed. Final purification of gases containing tritium shall be performed in the augmented process equipment located in the Tritium Recycle Facility.

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

Project Milestones

As baselined, the TEF will be dependent on the SMRI Tritium Facility Modernization and Consolidation, SRS. With this project being completed during 3rd Quarter FY 2004, the final tritium systems will be available for processing extraction gases to ensure weapons stockpile requirements will be met in CY 2006.

FY 1998: Initiation of Preliminary Design
Completion of Preliminary Design
FY 1999: Critical Decision (CD) 2B Approval to Begin Final Design
Initiation of Final Design
CD-3 - Approval to Begin Construction
FY 2000: Initiation of Site Preparation
FY 2001: Completion of Final Design
Completion of Site Preparation
Initiation of Facility Construction
FY 2004 Completion of Facility Construction (Final system turnover to integrated system testing)
FY 2005: Initiation of Integrated System Testing with Tritium
FY 2006: Project Completion
CD-4 - Start of Facility Operations

4. Details of Cost Estimate

	(dollars in thousands) Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design Costs (Design Drawings, Specifications and Construction Support)	58,741	58,741
Design Management Costs (1.0% of TEC)	3,092	3,092
Project Management Costs (1.4% of TEC)	4,404	4,404
Total, Design Costs (20.8% of TEC)	66,237	66,237
Construction Phase		
Improvements to Land	4,719	4,719
Buildings	61,329	61,329
Special Equipment	75,377	75,377
Standard Equipment	24,043	24,043
Major Computer Items	3,496	3,496
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	22,291	22,291
Construction Management (2.5% of TEC)	8,024	8,024
Project Management (2.4% of TEC)	7,515	7,515
Total, Construction Costs (63.5% of TEC)	206,794	206,794
Contingencies		
Design Phase (6.3% of TEC)	20,000	20,000
Construction Phase (9.4% of TEC)	29,969	29,969
Total, Contingencies (15.7% of TEC)	49,969	49,969
Total, Line Item Costs (TEC)	323,000	323,000

5. Method of Performance

The Savannah River Site M&O Contractor, Westinghouse Savannah River Company (WSRC) will be responsible for the design, construction, inspection and commissioning of the TEF to be built at the Savannah River Site. All conceptual and Preliminary Design work has been completed by site forces. Final Design will be performed by site forces. Based on competitive bid process, a general construction subcontractor was selected to perform construction and checkout activities through non-radioactive gas testing. Start-up testing with radioactive gases will be performed by site forces.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2000	FY 2001	FY 2002	Outyears	Total
Project Cost						
Facility Cost						
Design [a]	12,800	25,864	53,872	46,747	26,367	165,650
Construction	0	6,139	22,861	23,622	104,728	157,350
Total, Line item TEC	12,800	32,003	76,733	70,369	131,095	323,000
Total Facility Costs (Federal and Non-Federal)	12,800	32,003	76,733	70,369	131,095	323,000
Other Project Costs						
Conceptual design cost	3,541	0	0	0	0	3,541
NEPA documentation costs	1,858	0	0	0	0	1,858
Other project costs	8,601	2,000	1,000	3,000	58,000	72,601
Total, Other Project Costs	14,000	2,000	1,000	3,000	58,000	78,000
Total, Project Cost (TPC)	26,800	34,003	77,733	73,369	189,095	401,000

7. Related Annual Funding Requirements

(dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs	1,550	1,550
Annual facility maintenance/repair costs	2,500	2,500
Programmatic operating expenses directly related to the facility	6,800	6,800
Capital equipment not related to construction but related to the programmatic effort in the facility	700	700
GPP or other construction related to the programmatic effort in the facility	400	400
Utility costs	950	950
Total related annual funding (operating from FY 2006 through FY 2045)	12,900	12,900

[a]Design includes cost of engineered equipment.