

# Science

## FY 2002 Budget Amendment

(B/A in thousands of dollars)

	(dollars in thousands)		
	FY 2002 Pending Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
Science			
Basic Energy Sciences .....	1,004,705		1,004,705
Advanced Scientific Computing Research .....	165,750	-2,700 <sup>a</sup>	163,050
Biological and Environmental Research .....	442,970		442,970
Fusion Energy Sciences.....	238,495	+10,000	248,495
High Energy Physics.....	721,100	-5,000 <sup>a</sup>	716,100
Nuclear Physics.....	360,510		360,510
Energy Research Analyses .....	1,300	-300 <sup>a</sup>	1,000
Multiprogram Energy Laboratories – Facilities Support.....	30,175		30,175
Science Program Direction.....	144,385	-2,000 <sup>a</sup>	142,385
Subtotal, Science.....	3,109,390	0	3,109,390
Safeguards and Security .....	55,412		55,412
Reimbursable Safeguards and Security .....	-4,912		-4,912
Total, Safeguards and Security.....	50,500		50,500
Total Science .....	3,159,890	0	3,159,890

<sup>a</sup> The pending detailed budget justification for the FY 2002 Science account currently reflects the proposed reductions of \$2,700,000 from Advanced Scientific Computing Research; \$5,000,000 from High Energy Physics; \$300,000 from Energy Research Analyses; and \$2,000,000 from Science Program Direction to the proposed \$10,000,000 Amended Request for Fusion Energy Sciences. The Pending Request does not include the proposed \$10,000,000 increase to Fusion Energy Sciences.

# Fusion Energy Sciences

## Program Mission

The pending FY 2002 Congressional Budget Request is \$10,000,000 less than the FY 2001 Appropriation. This amendment will restore funding for the Fusion Energy Sciences (FES) program to the FY 2001 level, consistent with the Department's budget principle to continue basic research and the operation of important scientific facilities in support of the DOE mission. This amendment will limit the impact on the research program and the researchers in FY 2002 to that resulting from the increase in the cost of living from FY 2001 to FY 2002.

The amendment will allocate an additional \$1,000,000 to the management reserve for the Tokamak Fusion Test Reactor (TFTR) Decontamination and Decommissioning (D&D) activity at the Princeton Plasma Physics Laboratory (PPPL). This additional funding will increase the probability that the project will be completed on schedule in a safe and environmentally acceptable manner by the end of FY 2002. The remaining \$9,000,000 was removed from the other elements of the program, on a *pro rata* basis, to maintain the level of effort in all tasks to the extent possible, given the impact of an increasing cost of conducting scientific research.

This amendment proposes to restore the \$1,000,000 to TFTR and the remaining \$9,000,000 to the other program elements on the same *pro rata* basis. Thus, this will continue important fusion research tasks involving 75 experienced personnel that would otherwise be lost from the program, and the major fusion facilities will be able to operate at levels that are only slightly below the FY 2001 level.

## Funding Profile

(dollars in thousands)

	FY 2002 Pending Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
Fusion Energy Sciences			
Science .....	133,440	+5,560	139,000
Facility Operations .....	71,994	+3,250	75,244
Enabling R&D .....	33,061	+1,190	34,251
Total, Fusion Energy Sciences .....	238,495	+10,000	248,495

### Public Law Authorization:

Public Law 95-91, "Department of Energy Organization Act"

Public Law 103-62, "Government Performance and Results Act of 1993"

## Funding By Site

(dollars in thousands)

	FY 2002 Pending Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
<b>Albuquerque Operations Office</b>			
Los Alamos National Laboratory.....	7,629	+203	7,832
Sandia National Laboratories .....	2,996	+152	3,148
<b>Total, Albuquerque Operations Office .....</b>	<b>10,625</b>	<b>+355</b>	<b>10,980</b>
<b>Chicago Operations Office</b>			
Argonne National Laboratory .....	2,009	+71	2,080
Princeton Plasma Physics Laboratory .....	66,702	+2,903	69,605
Chicago Operations Office .....	41,803	+1,838	43,641
<b>Total, Chicago Operations Office .....</b>	<b>110,514</b>	<b>+4,812</b>	<b>115,326</b>
<b>Idaho Operations Office</b>			
Idaho National Engineering and Environmental Laboratory .....	2,082	+108	2,190
<b>Oakland Operations Office</b>			
Lawrence Berkeley National Laboratory ..	4,767	+198	4,965
Lawrence Livermore National Laboratory	14,189	+617	14,806
Oakland Operations Office .....	65,483	+2,859	68,342
<b>Total, Oakland Operations Office .....</b>	<b>84,439</b>	<b>+3,674</b>	<b>88,113</b>
<b>Oak Ridge Operations Office</b>			
Oak Ridge Inst. for Science & Education.	798	+32	830
Oak Ridge National Laboratory .....	16,412	+504	16,916
<b>Total, Oak Ridge Operations Office.....</b>	<b>17,210</b>	<b>+536</b>	<b>17,746</b>
<b>Richland Operations Office</b>			
Pacific Northwest National Laboratory.....	1,317	+3	1,320
Washington Headquarters .....	12,308	+512	12,820
<b>Total, Fusion Energy Sciences .....</b>	<b>238,495</b>	<b>+10,000</b>	<b>248,495</b>

# Science

## Mission Supporting Goals and Objectives

The amended budget request supports the mission, goals, and objectives of the Science subprogram. Funds are added to each program element on a *pro rata* basis to limit the number of personnel that will be lost and the reduction in the research effort. There will still be reductions resulting from an increasing cost of conducting scientific research.

## Funding Schedule

(dollars in thousands)

	FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
Tokamak Experimental Research .....	45,014	+1,872	46,886
Alternative Concept Experimental Research...	48,336	+2,014	50,350
Theory .....	25,975	+1,082	27,057
General Plasma Science .....	8,026	+334	8,360
SBIR/STTR .....	6,089	+258	6,347
<b>Total, Science.....</b>	<b>133,440</b>	<b>+5,560</b>	<b>139,000</b>

## Detailed Program Justification

(dollars in thousands)

	FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
<b>Tokamak Experimental Research.....</b>	<b>45,014</b>	<b>+1,872</b>	<b>46,886</b>
▪ <b>DIII-D Research .....</b>	<b>22,723</b>	<b>+947</b>	<b>23,670</b>
<p>The increased funding will be used to reduce the projected staff reduction and increase experiment preparation and the analysis of experimental results in the four key MFE fusion topical science areas — energy transport, stability, plasma-wave interactions, and boundary physics.</p>			
▪ <b>Alcator C-Mod Research.....</b>	<b>7,488</b>	<b>+312</b>	<b>7,800</b>
<p>The increased funding will be used to reduce the projected staff reduction and increase experiment preparation and the analysis of experimental results in the areas of the physics of the plasma edge, power and particle exhaust from the plasma, mechanisms of self-generation of flows in the plasma, and the characteristics of the advanced confinement modes that appear in the plasma when currents are driven by radio waves, techniques for radiating away the large parallel heat flow encountered in the plasma exhaust at high densities, and on visualization diagnostics for turbulence in the edge and core of high density plasmas.</p>			

(dollars in thousands)

FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
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▪ **International Collaborations and Education..... 7,987 +329 8,316**

The increased funding will be used to reduce the projected staff reduction and increase experiment preparation and the analysis of experimental results in the program’s international collaboration activities that focus on ways of using the unique aspects of the international facilities to make progress on the four key MFE issues. Increased funding for educational activities in FY 2002 will allow support to be maintained for research at historically black colleges and universities, graduate and postgraduate fellowships in fusion science and technology, summer internships for undergraduates, general science literacy programs for teachers and students, and broad outreach efforts related to fusion science and technology.

▪ **Experimental Plasma Research (Tokamaks)..... 6,816 +284 7,100**

The increased funding will be used to reduce the projected staff reduction and increase experiment preparation and the analysis of experimental results in the innovative tokamak experiments at universities and the development of diagnostic instruments.

**Alternative Concept Experimental Research..... 48,336 +2,014 50,350**

▪ **NSTX Research..... 12,000 +500 12,500**

The increased funding will be used to reduce the projected staff reduction both on-site and at collaborating institutions and to reduce the projected slowdown in experiment preparation and the analysis of experimental results. Research will be in the areas of the magnetic reconnection technique called Coaxial Helicity Injection (CHI) which uses an innovative application of direct-voltage and current from the plasma edge to create the plasma; the plasma stability limits with auxiliary heating; and comparing the measured dependence of energy and particle fluxes on background plasma variations, including the twist of the magnetic field lines, and comparing these fluxes with theoretical predictions.

▪ **Experimental Plasma Research (Alternatives)..... 23,184 +966 24,150**

The increased funding will be used to reduce the projected staff reduction and increase experiment preparation and the analysis of experimental results in twelve small experiments, one intermediate level proof-of-principle experiment, and one large study program that is focused on obtaining a design for a compact stellarator proof-of-principle experiment.

▪ **Inertial Fusion Energy Experiments..... 13,152 +548 13,700**

The increased funding will be used to reduce the projected staff reduction and increase experiment preparation and the analysis of experimental results in the inertial fusion energy program. This will allow the continuing development of experimental systems to study beam formation by high current ion sources, beam acceleration and beam focusing.

(dollars in thousands)

FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
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**Theory**..... **25,975**      **+1,082**      **27,057**

The increased funding will be used to reduce the projected staff reduction and increase theoretical research on the behavior of fusion plasmas. This will allow the theorists to continue emphasizing advanced computing and make effective use of rapid developments in computer hardware to attack complex problems involving a large range of scales in time and space. It will promote the use of modern computer languages and advanced computing techniques to bring about a qualitative improvement in the development of models of plasma behavior. This will ensure that advanced modeling tools are available to support a set of innovative national experiments and fruitful collaboration on major international facilities.

**General Plasma Science** ..... **8,026**      **+334**      **8,360**

The increased funding will be used to reduce the projected reduction of university research scientists working on basic plasma science and engineering.

**SBIR/STTR** ..... **6,089**      **+258**      **6,347**

Funding for the SBIR and STTR programs has been increased to meet the requirement for the continuation of those programs consistent with the increase in the total FES budget.

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**Total, Science** ..... **133,440**      **+5,560**      **139,000**

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# Facility Operations

## Mission Supporting Goals and Objectives

The amended budget request supports the mission, goals, and objectives of the Facility Operations subprogram. Funds are added to each program element on a *pro rata* basis to limit the number of personnel that will be lost and to minimize the impact on the operation of the facilities resulting from an increasing cost of conducting scientific research.

## Weeks of Fusion Facility Operation

(Weeks of Operations)

	FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
DIII-D*	14	2	16
Alcator C-Mod	8	2	10
NSTX	11	2	13

## Funding Schedule

(dollars in thousands)

	FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
TFTR	18,000	+1,000	19,000
DIII-D	26,706	+1,174	27,880
Alcator C-Mod	9,600	+400	10,000
NSTX	13,200	+550	13,750
General Plant Projects/Other	1,464	0	1,464
Waste Management	3,024	+126	3,150
Total, Facility Operations	71,994	+3,250	75,244

\* The number of weeks is calculated on the basis of the continuing availability of electrical power at affordable prices, an assumption that is now questionable in California.



## Detailed Program Justification

(dollars in thousands)

	FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
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<b>TFTR</b> .....	<b>18,000</b>	<b>+1,000</b>	<b>19,000</b>
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The additional \$1,000,000 will be used to increase the management reserve to increase the likelihood that the project will be completed in FY 2002.

<b>DIII-D</b> .....	<b>26,706</b>	<b>+1,174</b>	<b>27,880</b>
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The increased funding will be used to reduce the projected staff reduction and increase the operation, maintenance, and improvement of the DIII-D facility and its auxiliary systems, such as the Electron Cyclotron Heating (ECH) systems. With this FY 2002 amendment, these funds will support an additional 2 weeks of plasma operation (dependent upon electrical power availability in California).

<b>Alcator C-Mod</b> .....	<b>9,600</b>	<b>+400</b>	<b>10,000</b>
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The increased funding will be used to reduce the projected staff reduction and increase the operation and maintenance of C-Mod. With this FY 2002 amendment, these funds will support an additional 2 weeks of plasma operation.

<b>NSTX</b> .....	<b>13,200</b>	<b>+550</b>	<b>13,750</b>
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The increased funding will be used to reduce the projected staff reduction and increase the operation and maintenance of the NSTX facility. With this FY 2002 amendment, these funds will support an additional 2 weeks of plasma operation.

<b>General Plant Projects/General Purpose Equipment</b> .....	<b>1,464</b>	<b>0</b>	<b>1,464</b>
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There is no change in this program element.

<b>Waste Management</b> .....	<b>3,024</b>	<b>+126</b>	<b>3,150</b>
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The increased funding will be used to reduce the projected staff reduction in the waste management activities at the PPPL site.

<b>Total, Facility Operations</b> .....	<b>71,994</b>	<b>+3,250</b>	<b>75,244</b>
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# Enabling R&D

## Mission Supporting Goals and Objectives

The amended budget request supports the mission, goals, and objectives of the Enabling Research and Development subprogram. Funds are added to each program element on a *pro rata* basis to limit the number of personnel that will be lost and to minimize the impact on the research activities resulting from an increasing cost of conducting scientific research.

### Funding Schedule

(dollars in thousands)

	FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
Engineering Research.....	26,461	+1,190	27,651
Materials Research .....	6,600	0	6,600
<b>Total, Enabling R&amp;D .....</b>	<b>33,061</b>	<b>+1,190</b>	<b>34,251</b>

### Detailed Justification

(dollars in thousands)

	FY 2002 Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
<b>Engineering Research .....</b>	<b>26,461</b>	<b>+1,190</b>	<b>27,651</b>
▪ <b>Plasma Technology .....</b>	<b>10,930</b>	<b>+570</b>	<b>11,500</b>
The increased funding will be used to reduce the projected staff reduction and increase plasma technology efforts focused on critical needs of domestic plasma experiments and on the scientific foundations of innovative technology concepts for use in future magnetic and inertial fusion experiments.			
▪ <b>Fusion Technology .....</b>	<b>10,500</b>	<b>+371</b>	<b>10,871</b>
The increased funding will be used to reduce the projected staff reduction and increase fusion technology efforts focused on technology innovations and model improvements needed to resolve critical issues faced by both inertial and magnetic fusion concepts.			
▪ <b>Advanced Design .....</b>	<b>5,031</b>	<b>+249</b>	<b>5,280</b>
The increased funding will be used to reduce the projected staff reduction in design studies research.			
<b>Materials Research.....</b>	<b>6,600</b>	<b>0</b>	<b>6,600</b>
<b>Total, Enabling R&amp;D.....</b>	<b>33,061</b>	<b>+1,190</b>	<b>34,251</b>

# Capital Operating Expenses & Construction Summary

## Capital Operating Expenses

(dollars in thousands)

	FY 2000 Pending Request	FY 2002 Proposed Amendment	FY 2002 Revised Request
General Plant Projects .....	1,369	0	1,369
Capital Equipment.....	4,318	+162	4,480
Total, Capital Operating Expenses.....	5,687	+162	5,849

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

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp- riations	FY 2000 Request	FY 2002 Proposed Amend	FY 2002 Revised Request	Accept- ance Date
DIII-D Upgrade.....	27,203	27,203	0	0	0	FY 2001
NSTX – Neutral Beam.....	5,950	5,950	0	0	0	FY 2000
Alcator C-Mod LH Modification .....	5,200 <sup>a</sup>	2,966	1,167	+49	1,216	FY 2003
Total, Major Items of Equipment .....		36,119	1,167	+49	1,216	

<sup>a</sup> Includes increase in TEC of \$1,018,000 to be provided in FY 2003, and six-month delay based upon results of completion of the design. Such a change would normally be accommodated by contingency funds, but for this relatively modest MIE, such funds were not included in the original cost estimate.