FUSION ENERGY SCIENCES

PROGRAM MISSION

The Fusion Energy Sciences program is undergoing a major change following guidance from Congress on budget constraints and program focus. Based on the recommendations of the Fusion Energy Advisory Committee in its report on "A Restructured Fusion Energy Sciences Program" (January 1996), the program is being rapidly restructured to focus on the scientific foundations which underpin the fusion process. The Department has accepted the major recommendations of the FEAC report, although the full $275,000,000 program recommended by the Committee could not be provided within constrained budgets. The new mission of the Fusion Energy Sciences Program is to:

"Advance plasma science, fusion science, and fusion technology -- the knowledge base needed for an economically and environmentally attractive fusion energy source."

The Department's intent is to establish the scientific knowledge base from which a fusion energy technology development program could be undertaken, when appropriate. In pursuing this mission, the fusion program will also foster the advancement of basic plasma science and associated technologies, which have wide applications to other fields of science and to industry.

The policy GOALS of the FUSION ENERGY SCIENCES program are to:

Advance plasma science in pursuit of national science and technology goals

Develop fusion science, technology, and plasma confinement innovations as the central theme of the domestic program

Pursue fusion energy science and technology as a partner in the international effort

PROGRAM MISSION - FUSION ENERGY SCIENCES (Cont'd)

The OBJECTIVES related to these goals are:

1. Advance Plasma Science

The Fusion Energy Sciences program will assume a leadership role within DOE and among other parts of the government in coordinating and strengthening scientific research efforts in basic plasma science. It will build and strengthen this segment of the program to an increased level.

2. Pursue Fusion Science and Technology Through Innovation

The program will maintain and strengthen fusion science core research activities with a focus on innovation in both tokamaks and alternative concepts. The unique science associated with confining ionized gases at stellar temperatures presents a complex range of theoretical, computational, and experimental challenges which require specialized facilities for their resolution. Existing experimental facilities will be used to maximum advantage in carrying out fusion science research efforts; older facilities will be phased out to free up resources for exploration of new scientific areas. Research on enabling technologies such as heating and fueling systems is an integral part of advancing fusion science. Innovation in both science and enabling technologies will be emphasized as the most cost-effective means to achieve the long range goal of developing a practical energy source. Additional cost-effectiveness will be derived from continued and expanded use of international collaboration in virtually all of these technical efforts.

3. Maintain a Partnership Role in International Fusion Energy Development

International collaboration is now focused on the scientific basis, technology development and engineering design necessary to construct a burning plasma experiment, ITER, whose ultimate objective is to demonstrate the scientific and technological feasibility of fusion energy. Within the restructured program, we will meet our commitment to the successful completion of the ITER Engineering Design Activities in July 1998. The Department intends to maintain the option of participation in construction in a way consistent with U.S. program needs and financial limitations. Consequently, the Department is initiating an interagency process seeking government authorization to enter pre-negotiations, non-committal discussions with the other ITER Parties called Explorations on whether acceptable construction arrangements could be envisioned. As part of this approach, given the financial limitations, the Department will not seek to be the host of the ITER facility.

Research on key technologies, such as radiation resistant, low-activation materials, is central to fusion's ultimate environmental and economic attractiveness as an energy source, and is being pursued in collaboration with our international partners.

PROGRAM MISSION - FUSION ENERGY SCIENCES (Cont'd)

PERFORMANCE MEASURES:

The performance measures for a scientific program are primarily qualitative rather than quantitative. The scientific excellence is continually assessed by expert panels, by peer reviews, by publication in scientific journals, and by presentations in international meetings and workshops. Specific performance measures for FY 1997 are:

1. Establish a Basic Plasma Science program as part of a multi-agency effort aimed at support of fundamental science issues associated with the plasma state of matter.

2. Assess scientific progress on the Tokamak Fusion Test Reactor to determine whether to continue the experiments on enhanced energy confinement through FY 1997 or whether to stop operations and begin preparing for decommissioning.

3. Complete and review jointly with our international partners the ITER Detailed Design Report, including cost estimate and safety assessment.

SIGNIFICANT ACCOMPLISHMENTS AND PROGRAM SHIFTS:

1. The world's first opportunity to study the detailed science associated with the production of fusion power has occurred over the last year on the Tokamak Fusion Test Reactor at Princeton. This device has achieved over 10,000,000 watts in a one second pulse of fusion power and provided numerous refined measurements of the fusion heating process. Also, unique diagnostic probes and improved theoretical analyses have contributed to much improved performance of the tokamak facilities needed for high temperature plasma experiments. Recent experimental results on TFTR and DIII-D have shown how to reduce the loss of plasma energy and particles to levels previously thought unattainable. These results continue to demonstrate the progress of scientific understanding towards the ultimate objective of developing simpler, more economical fusion power systems.

2. In response to FY 1996 budget reductions by Congress, the design of the Tokamak Physics Experiment was suspended and the project was terminated. Planning for a demonstration power plant has been eliminated. Also, the level of U.S. support for the ITER Engineering Design Activities (EDA) was restructured in consultation with our partners and the Director. Given congressional guidance that future funding will also be constrained, it is clear that any potential role for the U.S. in the future construction and operation of ITER would have to be at a modest level. The initial response from the other ITER parties in this new situation is aimed at finding a constructive, mutually beneficial approach to inclusion of the United States in future construction and operation.

PROGRAM MISSION - FUSION ENERGY SCIENCES (Cont'd)

3. An initiative in basic plasma science is also a significant shift for the program and opens the way for support of a broader research program that will support not only fusion but other elements of the Department's energy and defense missions.

4. The subcommittee, again through FEAC, will also recommend a strategy for increasing the U.S. effort in alternative confinement concept research. This budget includes funds for an innovative new spherical tokamak experiment as a new thrust in this area.

5. As part of the fusion program restructuring, the research efforts on TFTR will be focused on completing the scientific objectives uniquely attainable in that device before shutting down in order to permit increased efforts on tokamak improvements and alternative concepts using other facilities.

6. The Scientific Issues Subcommittee of the FEAC will play a major role in the restructuring of the program. Having identified TFTR as the first of the major facilities to be phased out, this subcommittee, through FEAC, will also recommend how to make the best scientific use of the major tokamaks in FY 1997. It will also review the work in progress at TFTR in mid-FY 1997 to help the Department decide whether to continue the planned experiments through the rest of the year, into FY 1998 at the latest, or whether to stop scientific operation in mid-year and use the remaining FY 1997 TFTR resources to prepare for decommissioning.

7. Funding for the support for the National Energy Research Supercomputer Center has been transferred to the new Computational and Technology Research Program.

FUSION ENERGY SCIENCES

PROGRAM FUNDING PROFILE

(Dollars in thousands)

	FY 1995 Comparable Appropriation	FY 1996 Original Appropriation	FY 1996 Real & Comp Adjustments	FY 1996 Comparable Adjusted	FY 1997 Budget Request
Research					
Fusion and Plasma Science	$182,542	$149,240	-$7,740 a/	$141,500	$160,333
Fusion Technologies	137,651	82,977	0	82,977	83,980
Program Direction	0	9,010	-9010 b/	0	0
Related Capital Funding	13,099	2,917	0	2,917	11,287
Subtotal Research	333,292 c/	244,144	-16,750	227,394 c/	255,600 c/
Construction	0	0	0	0	0
Subtotal, Fusion Energy Sciences	333,292	244,144	-16,750	227,394	255,600
Adjustment	-1,670 d/	0	0	0	0
Total, Fusion Energy Sciences	$331,622 e/	$244,144	-$16,750	$227,394	$255,600

a/ Comparability transfer to Computational and Technology Research.

b/ Comparability transfer to Energy Research Energy Supply, Research and Development Program Direction.

c/ Program Direction funds in the amount of $9,400,000 in FY 1995, $9,010,000 in FY 1996 and $8,400,000 in FY 1997 are budgeted in the Energy Research Energy Supply, Research and Development Program Direction program.

d/ Share of Energy Supply, Research and Development general reduction for use of prior year balances assigned to this program on a comparable basis. The total general reduction is applied at the appropriation level.

e/ Excludes $6,848,000 which has been transferred to the SBIR program and $342,000 which has been transferred to the STTR program.

Public Law Authorization:
Pub. Law 95-91, DOE Organization Act (1977)

FUSION ENERGY SCIENCES
(Dollars in thousands)

PROGRAM FUNDING BY SITE

Field Offices/Sites	FY 1995 Comparable Appropriation	FY 1996 Original Appropriation	FY 1996 Real & Comp Adjustments	FY 1996 Comparable Adjusted	FY 1997 Budget Request
Albuquerque Operations Office					
Los Alamos National Laboratory	$7,150	$4,297	$0	$4,297	$3,715
Sandia National Laboratories	8,208	5,723	0	5,723	5,560
Chicago Operations Office					
Argonne National Laboratory	7,743	5,025	0	5,025	4,070
Brookhaven National Laboratory	83	97	0	97	97
Princeton Plasma Physics Laboratory	118,726	60,431	0	60,431	67,810
Idaho Operations Office					
Idaho National Engineering Laboratory	3,223	2,732	0	2,732	2,323
Oakland Operations Office					
Lawrence Berkeley National Laboratory	6,066	5,080	0	5,080	5,305
Lawrence Livermore National Laboratory	16,162	17,133	-7,740	9,393	8,659
Stanford Linear Accelerator Center	50	50	0	50	50
Oak Ridge Operations Office					
Oak Ridge Institute for Science & Education	1,100	1,000	0	1,000	0
Oak Ridge National Laboratory	27,863	19,477	0	19,477	19,300
Continuous Electron Beam Accelerator Facility	0	5	0	5	0
Richland Operations Office					
Pacific Northwest Laboratory	2,733	1,592	0	1,592	1,730
Savannah River Operations Office					
Savannah River Tech Center	378	282	0	282	400
All Other Sites	133,807	121,220	-9,010	112,210	136,581
Subtotal	333,292	244,144	-16,750	227,394	255,600
Adjustment	-1,670 a/	0	0	0	0
TOTAL	$331,622	$244,144	-$16,750	$227,394	$255,600

a/ Share of Energy Supply, Research and Development general reduction for use of prior year balances assigned to this program on a comparable basis. The total general reduction is applied at the appropriation level.

FUSION ENERGY SCIENCES
PROGRAM OBJECT CLASS SUMMARY
(Dollars in thousands)

		FY 1995		FY 1996		
	Direct Funding:	Comparable	Non.-Comp.	Comparable	Non-Comp.	FY 1997
	Personnel compensation:					
11.1	Full-time permanent		$5,189		$5,812	$5,248
11.3	Other than full-time permanent		39		95	97
11.5	Other personnel compensation		194		266	292
11.8	Special personal services payments		0		0	0
11.9	Total personnel compensation	0	5,422	0	6,173	5,637
12.1	Civilian personnel benefits		878		1,334	1,305
13.0	Benefits for former personnel		126		200	280
21.0	Travel and transportation of persons		419		510	495
22.0	Transportation of things					
23.1	Rental payments to GSA					
23.2	Rental payments to others					
23.3	Communications, utilities, and miscellaneous charges					
24.0	Printing and reproduction					
25.1	Advisory and assistance services	0	1,835	0	1,340	514
25.2	Other services	0	179	0	734	369
25.3	Purchases of goods and services from Government accounts					
25.4	Operation and maintenance of facilities	190,651	200,351	112,144	119,884	111,899
25.5	Research and development contracts	66,373	66,373	65,196	65,196	78,944
25.7	Operation and maintenance of equipment					
26.0	Supplies and materials					
31.0	Equipment	11,069	11,069	1,950	1,950	10,287
32.0	Land and structures	1,913	1,913	1,013	1,013	1,000
41.0	Grants, subsidies and contributions	61,041	61,041	47,412	47,412	44,870
99.0	Subtotal, obligations	331,047	349,606	227,715	245,746	255,600
	Reimbursable Obligations		-	-		
99.9	Total Obligations	331,047	349,606	227,715	245,746	255,600
	Recovery of prior year obligations	-78	-78	-47	-47	
	Unobligated balance avail, start of year	-57	-1,297	-274	-1,555	
	Unobligated balance avail, end of year	710	1,991			
	Budget Authority	$331,622	$350,222	$227,394	$244,144	$255,600

FUSION ENERGY SCIENCES

Fusion and Plasma Science
(Tabular dollars in thousands, Narrative in whole dollars)

I. Mission Supporting Goals and Objectives:

The mission of the Fusion and Plasma Science subprogram is to support fundamental research in plasma physics and to advance the knowledge base in fusion science, especially in the high-leverage areas where the U.S. retains a strong leadership role, such as plasma theory and computation, concept innovation, and plasma diagnostics.

Plasma physics is the study of the behavior of ionized gases -- ranging from fluorescent lights to stars -- that make up 99% of the known universe. It contributes not only to fusion energy research, but also to many national science and technology goals, ranging from astrophysics to industrial processing and national security. One of the objectives of the Fusion and Plasma Science subprogram is to broaden the intellectual and institutional base in fundamental plasma physics and attendant enabling technologies, preferentially in partnership with other agencies.

Fusion science represents a combination of interrelated disciplines that advance through a balance between large- and small-scale experimentation. In this regard the tokamak plasma science activity is focused on gaining a predictive understanding of the behavior of hot confined plasmas using existing U.S. research facilities (e.g., the Tokamak Fusion Test Reactor, Alcator C-MOD, and DIII-D) and through international collaborations on state-of-the-art foreign experimental facilities. Research on alternative confinement concepts will be pursued at the proof-of-principal level to identify confinement approaches which offer insights into tokamak plasma physics and innovations which hold promise for future development as economically and environmentally attractive fusion energy sources.

A particularly critical component of fusion science is the development and use of theoretical and computational tools to provide and verify detailed scientific understanding of the physical phenomena that govern the confinement of high temperature plasmas.

II. Funding Schedule: FUSION AND PLASMA SCIENCES

Program Activity	FY 1995	FY 1996	FY 1997	$ Change	% Change
Fusion Experimental Research . . .	$165,017	$124,646	$138,333	$+13,687	+ 9.9%
Fusion Theory	16,940	16,634	18,000	+ 1,366	+ 7.6%
Basic Plasma Science	585	220	4,000	+3,780	+94.5%
Total, Fusion and Plasma Science	$182,542	$141,500	$160,333	$+18,833	+ 11.7%

III. Performance Summary: FUSION AND PLASMA SCIENCES

FY 1995 Accomplishments:

- Continued TFTR experiments to study the physics of deuterium - tritium plasmas and achieved another world record, 10.7 million watts of fusion power for about 1 second. Made preliminary observations of plasma self-heating (a key to achieving net energy output in ITER), and energy confinement in deuterium - tritium plasmas.

- Conducted experiments on TFTR and DIII-D that demonstrated improved understanding of the effect of modifying the twist of magnetic field lines, sometimes referred to as reversed sheer, in a tokamak for enhanced confinement.

- Conducted coordinated experiments on DIII-D and the European tokamaks (TEXTOR, ASDEX-UG, and JET) to study the physics of removing helium (a fusion reaction product) from the plasma fuel to maintain its purity.

- Took a pioneering step toward interconnecting major research facilities by operating MIT's Alcator C-Mod tokamak from a remote control room at Lawrence Livermore National Laboratory in California using a high speed computer link.

- Completed a competitive re-evaluation of all small scale toroidal experiments as part of shifting emphasis in small-scale experiments to more innovative alternatives. Began phasing out lower rated experiments.

- Obtained substantial improvement in the computer modeling of experimental results on the Numerical Tokamak Project, a "Grand Challenge" scale computational effort to simulate tokamak physics behavior.

III. Performance Summary: FUSION AND PLASMA SCIENCES (Cont'd)

- Terminated the TPX project in an orderly manner, ensuring documentation of the design and close-out of all industrial contracts.

- Reviewed a proposal from PPPL, ORNL, and the University of Wisconsin to build a National Spherical Tokamak Experiment (NSTX) at Princeton, which would test the merits of an extremely compact, high performance alternative confinement concept.

- Funding in the amount of $3,424,000 and $171,000 have been transferred to SBIR and STTR, respectively.

FY 1996 Accomplishments (to date and planned):

- Analyze data from the world's first series of deuterium - tritium experiments on TFTR. Extend experiments on modifying the twist of magnetic field lines in TFTR and DIII-D to higher temperatures to determine the stability of enhanced confinement.

- Study particle, heat and radiation transport processes in DIII-D to support design of a system to exhaust waste heat from ITER without damaging the surrounding walls or protective surfaces.

- Begin the phase-in of new tokamak improvement and alternate toroidal confinement concept experiments selected as a result of the 1995 competition.

- Make new calculational capabilities available to ITER design personnel to allow more accurate analysis of the behavior of plasmas in the edge of the ITER device.

- Continue to use the Numerical Tokamak Project, the fusion energy "Grand Challenge" initiative, to simulate plasma physics behavior. Work will continue on three dimensional simulations for comparison with experimental data.

- Funding in the amount of $3,070,000 and $230,000 has been provided for SBIR and STTR, respectively.

FY 1997 Planned Accomplishments:

- Take the lead within DOE and work with other Federal agencies to increase both the level of plasma science research and promote its recognition as an important research endeavor.

III. Performance Summary: FUSION AND PLASMA SCIENCES (Cont'd)

- Extend the enhanced confinement, or low energy loss, region at the core of TFTR plasmas in size and time duration to increase the self-heating of the plasma using deuterium-tritium (D-T) fuel and make detailed measurements of where in the plasma the self-heating occurs for the use of ITER and other future experiments. This enhanced confinement region is referred to as "reversed shear" because the twist of the magnetic field lines changes. Evaluate feasibility of completing experiments in plasma self-heating and (alpha channelling) in FY 1997.

- Conduct initial experiments using a new high power microwave heating system on DIII-D to locally create and modify barriers to energy loss, enhancing confinement within the tokamak plasma.

- Evaluate results from small-scale innovative confinement experiments to assess their future impact on fusion science and decide on next steps.

- Conduct joint experiments on the TORE SUPRA superconducting experiment in France on the sustained fueling of plasmas for longer pulses.

- Carry out calculations and computer modeling by coordinated, inter-laboratory teams along with international collaborations.

- Funding in the amount of $3,800,000 has been budgeted for SBIR requirements.

Explanation of Funding Changes FY 1996 to FY 1997:

- An additional $8,084,000 for tokamak physics is provided to increase research on the TFTR (+$2,915,000), DIII-D (+$4,405,000), and Alcator C-Mod (+$3,055,000). This will allow investigation of recently discovered enhanced confinement regions and support of key physics design issues for ITER. Minor decreases (-$2,291,000) are allocated over the balance of the program element.

- In response to FEAC recommendations, an increase of $5,603,000 has been provided to substantially increase the support of alternative confinement concepts. A combination of new funds and those from existing experiments will form the basis for a new competitive initiative which will be used to select promising alternative approaches. Enhanced operating schedules for existing small, world class facilities will provide more rapid development of alternative concept physics understanding.

  This initiative will be led by the DOE Fusion Energy Sciences Program and will be coordinated with other DOE programs and other government agencies.

III. Performance Summary: FUSION AND PLASMA SCIENCES (Cont'd)

- An additional $3,780,000 in FY 1997 is provided for a FEAC recommended initiative supporting research for university-scale experiments in basic plasma science.

- An additional $1,366,000 is provided for increased support of theory directed toward alternative confinement concepts and the development of increased computational capability.

Fusion Technologies
(Tabular dollars in thousands, Narrative in whole dollars)

I. Mission Supporting Goals and Objectives:

The Fusion Technologies subprogram provides the technological foundation for current day fusion science as well as the research and engineering that are required in key technology areas to advance fusion science in the future. Research will be performed in the areas of superconducting magnets, plasma heating and fueling, safety, plasma control, fuel processing and breeding, high current particle beams, heat removal and high performance materials. Research and engineering design in support of the International Thermonuclear Experimental Reactor (ITER) Engineering Design Activities (EDA) is included in this program element. This category includes work on heavy ion beam drivers for use in inertial fusion energy systems. Also included are assessments of critical aspects of integrated fusion systems.

Research on low-activation materials will be focused on high performance fusion system materials capable of withstanding long-term exposure to energetic particles and electromagnetic radiation from fusion plasma reactions.

II. Funding Schedule:

Program Activity	FY 1995	FY 1996	FY 1997	$ Change	% Change
Fusion Engineering Research	$128,564	$75,417	$75,280	$ - 137	+ 0.2%
Materials Research	9,087	7,560	8,700	+1,140	+13.1%
Total, Fusion Technologies	$137,651	$82,977	$83,980	$+1,003	+ 1.2%

III. Performance Summary: FUSION TECHNOLOGIES

FY 1995 Accomplishments

o TPX engineering design progressed through major subsystem reviews and most R&D tasks were completed to verify the design. An orderly closeout of the project began leading to full termination of all contacts in FY 1996.

III. Performance Summary: FUSION TECHNOLOGIES (Cont'd)

- Completed the ITER Central Solenoid Model Magnet Design with the Japanese; delivered initial quantities of ITER superconducting magnet materials.

- With ITER partners, produced the ITER Interim Design Report with site requirements, estimated construction costs and a preliminary safety assessment.

- Demonstrated the feasibility of a high-velocity fusion fuel injector system capable of fueling plasmas for longer pulses, for potential use in future fusion experiments, including ITER.

- Initiated the testing in a tritium environment of components for a fusion fuel cleanup system.

- Completed and published the design of a fusion power plant based on the stellarator concept.

- Prepared a small-scale experiment to test the physics of how energetic ions can be merged into a beam for inertial fusion applications.

- Purchased and began radiation testing of production quantities of a vanadium alloy, one of the low-activation materials selected for potential use in advanced fusion devices.

- Funding in the amount of $3,424,000 and $171,000 has been transferred to SBIR and STTR, respectively.

FY 1996 Accomplishments (to date and planned):

- Complete the production of all superconducting materials required for fabricating the ITER model magnets and complete a manufacturing demonstration of all production steps for the ITER Central Solenoid Model Magnet.

- Continue to work with ITER partners on design and R&D necessary for completing the EDA.

- Complete testing of a vanadium alloy blanket section with high temperature lithium coolant in a magnetic field to demonstrate potential of the concept for breeding fusion fuel.

- Complete a power plant pre-conceptual engineering design using a team of university, national laboratory, and industrial design engineers and physicists.

III. Performance Summary: FUSION TECHNOLOGIES (Cont'd)

- Complete the initial characterization of selected vanadium alloy based on the tests of irradiated samples and the evaluation of manufacturing techniques.

- Funding in the amount of $1,581,000 and $111,000 has been provided for SBIR and STTR, respectively.

FY 1997 Planned Accomplishments

- Complete the U.S. fabrication of the ITER Central Solenoid Model Magnet and make it ready for installation in the Japanese test facility.

- Issue and review jointly with our partners the ITER Detailed Design Report, including a cost and safety assessment.

- Complete the comprehensive testing of high heat flux ITER divertor components to establish performance capabilities and demonstrate ITER maintenance and repair procedures for remote replacement of divertor components.

- Conduct non-neutral plasma experiments to study ion beam focus conditions required for inertial fusion applications.

- Continue scientific and engineering assessments of various fusion innovations such as reverse shear tokamak confinement and vanadium materials.

- Complete and review the IEA fusion materials neutron source conceptual design phase study and develop plans for the engineering design, prototype development and testing, and possible construction of a materials test facility as an international project.

- Funding in the amount of $1,800,000 has been budgeted for SBIR requirements.

III. Performance Summary: FUSION TECHNOLOGIES (Cont'd)

Explanation of Funding Changes FY 1996 to FY 1997:

- Additional funds of $1,140,000 for Materials Research will be used to strengthen university programs and continue critical low-activation materials experiments in fission test reactors.
- ITER-EDA activities continue at the FY 1996 level ($54,930,000).
- Systems Studies efforts will decrease by $475,000 to reflect the deletion of demonstration power plant studies. Remaining funds will be used for Concept Evaluation Studies.
- Inertial Fusion Energy research increases $100,000.

FUSION ENERGY SCIENCES

RELATED CAPITAL FUNDING
(Tabular dollars in thousands, Narrative in whole dollars)

I. Mission Supporting Goals and Objectives:

Related capital funding is comprised of Capital Equipment and General Plant Projects (GPP) funding. The former provides essential hardware for the fusion experimental research program. Much of this equipment is used to support the operation of fusion science experiments or to make measurements and gather technical data. Some of this equipment replaces existing obsolete equipment while the remainder is new equipment. The principal element involves the reconfiguration of existing equipment at Princeton Plasma Physics Laboratory into a modest size fusion device called the National Spherical Tokamak Experiment (NSTX), which will be used as a national facility for studying tokamak innovations. Another substantial effort is an upgrade to the DIII-D tokamak with an advanced heat removal system (radiative divertor). When this radiative divertor is installed, DIII-D will be able to test prototype power handling systems for ITER and study current drive techniques relevant to ITER and innovative confinement concepts.

GPP funding represents an essential investment in maintaining the productivity and usefulness of Department-owned facilities and in meeting obligations for their safe and reliable operation. Since it is difficult to detail this type of project in advance, a continuing evaluation of requirements and priorities may result in additions, deletions, and changes in the currently planned projects. The total estimated cost of each project does not exceed $2,000,000.

II. Funding Schedule:

Program Activity	FY 1995	FY 1996	FY 1997	$ Change	% Change
Capital Equipment	$11,099	$1,917	$10,287	$ +8,370	+81.4%
General Plant Projects	2,000	1,000	1,000	0	+ 0.0%
Total, Related Capital Funds	$13,099	$2,917	$11,287	$+8,370	+74.2%

III. Performance Summary: RELATED CAPITAL FUNDING (Cont'd)

FY 1995 Accomplishments:

- Provided support for existing tokamak physics experiments at Alcator C-Mod, TFTR, and DIII-D.
- Continued maintenance and modest upgrades to data acquisition systems by replacing or upgrading diagnostics for Alcator C-Mod and DIII-D.
- Procured high power microwave plasma heating system prototypes for DIII-D.
- Performed engineering design of a radiative divertor for future installation on DIII-D.
- Purchased special and general purpose equipment to increase the efficiency and productivity of the research and development efforts and technology test facilities related to the ITER program.
- GPP was provided for minor new construction, other capital alterations and additions, and for buildings and utility systems at PPPL.

FY 1996 Accomplishments (to date and planned):

- Continuing to provide support for existing experiments at TFTR, Alcator C-Mod, and DIII-D.
- Continuing maintenance and modest upgrades to data acquisition systems by replacing or upgrading diagnostics for Alcator C-Mod and DIII-D.
- Completing installation of high power microwave plasma heating systems on DIII-D.
- Starting fabrication of the DIII-D radiative divertor, but at a significantly reduced level.
- Using GPP funds, continuing with buildings and utility systems at PPPL.

III. Performance Summary: RELATED CAPITAL FUNDING (Cont'd)

FY 1997 Planned Accomplishments:

- Initiate fabrication of a modest-scale spherical tokamak experiment (National Spherical Tokamak Experiment) to follow up on theoretical predictions of improved plasma confinement and stability using this alternative concept.
- Continue to provide support for existing experiments at TFTR, Alcator C-Mod, and DIII-D.
- Continue maintenance and modest upgrades to data acquisition systems by replacing or upgrading diagnostics for Alcator C-Mod and DIII-D.
- GPP is provided for minor new construction, other capital alterations and additions, and for buildings and utility systems at PPPL.

Explanation of Funding Changes FY 1996 to FY 1997:

- Overall capital equipment funding is increased by $8,370,000 which will benefit both tokamak physics and alternative concept physics, the former by continuing the radiative divertor upgrade of DIII-D (+$3,300,000), and the latter by completing the design and initiating fabrication of the National Spherical Tokamak Experiment (+$5,000,000). This increase is almost back to the FY 1995 level.

FUSION ENERGY SCIENCES CAPITAL OPERATING EXPENSES & CONSTRUCTION SUMMARY
(Tabular dollars in thousands, Narrative in whole dollars)

	FY 1995	FY 1996	FY 1997	$ Change	% Change
Capital Operating Expenses					
General Plant Projects (total)	$ 2,000	$ 1,000	$ 1,000	$ 0	0.0%
Capital Equipment (total)	11,099	1,917	10,287	+ 8,370	81.4%

Major Items of Equipment (CE $2 Million and Above)

	TEC	Previous Approp.	FY 1995 Approp.	FY 1996 Approp.	FY1997 Request	Acceptance Date
1. Doublet-III	$ 32,400	$ 9,600	$ 4,800	$ 700	$ 4,000	FY 1999
2. NSTX	18,500	0	0	0	5,000	FY 1999