DEPARTMENT OF ENERGY
FY 1994 CONGRESSIONAL BUDGET REQUEST
GENERAL SCIENCE AND RESEARCH

OVERVIEW

SUPERCONDUCTING SUPER COLLIDER (SSC)

Research in high energy physics is directed at understanding the nature of matter and energy at the most fundamental level and the basic forces which govern all processes in nature. Experimental research in high energy physics most often requires the use of large particle accelerators, colliding beam devices, and large particle detectors. The ability to carry out forefront exploratory research on the physics frontier is critically dependent on the experimental capabilities of the accelerators, colliding beam and detector facilities. The Stanford Linear Collider (SLC) and the Fermilab Tevatron, together with the other high energy physics facilities, will keep the U.S. program highly competitive and at the cutting edge for the next several years.

Although the present model for understanding the subnuclear world has been very successful, we know that it is not complete and cannot provide answers to a number of very fundamental questions. After extensive studies and careful review it has been determined that exploration of the TeV mass region is essential to advance understanding of the fundamental nature of matter and energy and to enable the U.S. High Energy Physics program to remain at the research frontier in the late 1990's and beyond. To explore this region a new, more powerful particle accelerator is required. The SSC is a proton-proton collider having an energy of up to 20 TeV per beam that will permit exploration of this new domain of physics research in which major breakthroughs in understanding are anticipated and which cannot be reached by any other facility either in existence or planned. While the primary purpose of the SSC is to provide new fundamental knowledge and insights, history has clearly demonstrated that major advances in fundamental understanding lead subsequently to developments in technology and practical products which profoundly affect the quality of life for all Americans and enhance the economic competitiveness of our nation.

The SSC is a critical initiative to strengthen the position of the nation as a world leader in science and technology. It will be both a symbol of the nation's commitment to scientific leadership in this century and the next, and an instrument by which U.S. leadership can be maintained. The SSC holds the potential for new breakthroughs in science, technology, and education that could profoundly touch every American. The design of the SSC is based firmly on principles and engineering concepts used in previous accelerators. It is backed by an R&D program specifically related to the SSC which has been in progress since FY 1984, by prior efforts in the High Energy Physics program to develop accelerator-quality superconducting magnets and by the experience gained in the successful operation of the Tevatron. In January 1989, the Department selected the site for the SSC and awarded a contract to Universities Research Association, Inc., to serve as the Management and Operating Contractor for the SSC. A revised conceptual design has been prepared to reflect the characteristics of the Texas site and R&D achievements. This forms the basis for the technical, cost and schedule baseline for the SSC published by the Department in January 1991, which indicated a Total Project Cost (TPC) is $8.249 billion (as-spent), with completion projected by the end of FY 1999. Currently the Department is re-estimating the project completion and TPC as a result of the most recent FY 1994 Presidential Budget guidance which calls for a stretch-out of the SSC program to reduce planned outlays in FY 1994-FY 1998. Due to the magnitude of the changes in the funding profile, a detailed re-evaluation of the project schedule, the approach to accomplishing major tasks, and the laboratory staffing plan will be required. The revised project plan developed by the laboratory will be subject to a detailed cost and schedule review by the Department. The re-estimate will be formalized with a baseline change by the end of FY 1993. The impact of the reduced outlays is currently estimated as a 3 year delay in schedule and $2 billion increase in as-spent project cost. This estimate of the change is believed accurate within 20 percent at this time. The program changes will be discussed with current and planned non-Federal contributors and the impact in this area will be reflected in the baseline change.

There has been substantial progress on the Superconducting Super Collider (SSC) in 1991 and 1992. Main accomplishments include: (1) award of the contract for SSC architect engineer/construction management services to the team of Parsons - Brinkerhoff/Morrison - Knudsen, which will perform the design and construction of all on-site conventional facilities such as tunnels, surface buildings, utilities, and roads; (2) completion of the Supplemental Environmental Impact Statement and Record of Decision for construction and operation of the SSC; (3) completion of a Memorandum of Understanding with the State of Texas that outlines the principles that will govern the interaction between the Department and the State of Texas regarding its participation in, and $1 billion contribution to, the SSC; (4) transfer of land parcels to the Federal Government by the State of Texas as part of the land acquisition program by the State which is running well ahead of schedule; (5) completion of

construction of the Magnet Development Laboratory and the Accelerator Systems String Test facility and the first magnet delivery shaft; (6) award of contracts to General Dynamics and Westinghouse, respectively, as leader-follower contractors for the engineering development, prototype production, and production of a limited number of the collider dipole magnets; (7) award of a contract to Babcock & Wilcox as the contractor for the engineering development, prototype production and production of a limited number of collider quadrupole magnets; (8) award of a contract to Westinghouse for development of the High Energy Booster superconducting dipoles; (9) in the detector area, the design report for the large general purpose detector proposed by the Solenoidal Detector Collaboration, which includes major foreign participation has been submitted and been subjected to technical, cost, and schedule review by the Laboratory and the Department; (10) a new international collaboration for a second large detector (GEM) for the initial SSC physics program has been approved for further design and proposal development; (11) establishment of a strong laboratory and DOE presence in the Waxahachie area in the SSC Central Facility recently acquired for project use by the State of Texas; and (12) successful testing of the full length 50-millimeter design magnets which demonstrated performance significantly above the required operating currents; (13) successful completion of a string of five of the full length 40 mm magnets was tested at Fermilab late in FY 1991; (14) tests of a string of full length superconducting magnets along with supporting accelerator systems at the ASST have been completed successfully, ahead of schedule for this major project milestone; and (15) five tunnel contracts, covering about 55 percent of the collider tunnel, have been awarded and the first contractor has nearly completed shaft digging.

The SSC Project has progressed on the cost and schedule that was established in the Department's "Report On The Superconducting Super Collider Cost and Schedule Baseline," which was implemented in January 1991. A recent event was the completion of a Level I Milestone. The Accelerator Systems String Test was completed 6 weeks ahead of schedule. The test demonstrated that a string of superconducting magnets can be successfully manufactured by industry and installed and tested in a collider configuration. Another area of accomplishment is the tunneling for the 54 miles of the collider ring. Over 55% of the collider tunneling has been bid and awarded at a cost well within the baseline cost estimate. The cost and schedule report identified $843 million for contingency. To date, only a small portion of this contingency has been allocated which further supports our baseline cost estimate.

The request for Federal funds for FY 1994 includes $109,402,000 in operating funds for continued R&D on superconducting magnets, R&D on other accelerator technical systems, R&D on detector subsystems, general laboratory operating costs, support of SSC Laboratory operations not directly related to the project, and DOE program direction costs; $50,000,000 in capital equipment funds for detector subsystems, accelerator components and system prototypes, apparatus in support of on-site accelerator system and magnet tests, laboratory computing equipment, and a variety of general laboratory equipment and instrumentation essential to establishing a new research laboratory; and, $480,598,000 in Federal construction funds for detailed design of technical systems and conventional facilities, the magnet industrialization program, fabrication of injector and collider technical systems and components, on-site construction of conventional facilities and project management and administration. This budget includes $26,000,000 in FY 1993 and $20,000,000 in FY 1994 in support of Advanced Manufacturing FCCSET activities. In addition to the Federally-funded activities described above, construction of on-site facilities and work on technical systems is expected with an estimated contribution of $190,000,000 by non-Federal sources. The contribution of Texas funds will be in accordance with the Memorandum of Understanding between the Department and the State of Texas which outlines principles of agreements for contributions to the SSC and support of the project. Discussions are underway with potential foreign partners to develop specific proposals for participation and to begin negotiating agreements on the magnitude and type of contributions. International contributions to accelerator construction are expected in FY 1994 in the form of technical subsystems and components. Four Government Joint Working Groups have been established with the former USSR (July 1991), Korea (September 1991), the People's Republic of China (October 1991), and Japan (January 1992). The Joint Working Groups with the PRC and the former USSR have agreed to government-to-government agreements that will oversee SSC participation. The agreements have been forwarded to the respective governments for approval. The U.S. has also extended an invitation to Canada to join in the SSC; a Memorandum of Understanding has been signed by DOE with the Canadian Commercial Corporation to facilitate potential Canadian participation. Collaborative work is underway at the SSC Laboratory, in the former Soviet Union, PRC and India where scientists and engineers are designing and producing prototypes of selected magnets and components for accelerator systems.

DEPARTMENT OF ENERGY
FY 1994 CONGRESSIONAL BUDGET REQUEST
GENERAL SCIENCE AND RESEARCH
(Tabular dollars in thousands narrative in whole dollars)

LEAD TABLE

Superconducting Super Collider (SSC)

Activity	FY 1992 Adjusted	FY 1993 Appropriation	FY 1993 Adjustment	FY 1994 Request
SSC Project				
Operating Expenses	$102,449	$116,828	$0	$104,402
Capital Equipment	56,340	63,000	-25,000	50,000
Construction	323,767	370,172	-10,500	480,598
Subtotal SSC Project	$482,556	$550,000	-$35,500	$635,000
Adjustment	0	-33,000 c/	33,000 c/	0
SSC Laboratory Operations				
Operating Expenses	0	0	0	5,000
Subtotal SSC Laboratory Operations	0	0	0	5,000
Total SSC	482,556	517,000	-2,500 d/	640,000
Summary				
Operating Expenses	$102,449 a/	$116,828	$0	$109,402
Capital Equipment	56,340	40,500	-2,500 d/	50,000
Construction	323,767	359,672	0	480,598
Total Program	$482,556 b/	$517,000 b/	-$2,500 d/	$640,000
Staffing (FTEs)	72	91	91	96

Authorizations:
P.L. 95-91, "Department of Energy Organization Act" (1977)

a/ Total has been reduced by $1,144,000 reprogrammed to Energy Supply for SBIR.

b/ Includes funding provided through appropriation process only. Non-federal contributions will permit additional activities. The size and scope of these contributions will be known after firm agreements with the State of Texas and foreign partners are completed.

c/ Reflects program specific general reduction.

d/ Reflects general reduction for prior year balances.

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(dollars in thousands)

SUMMARY OF CHANGES

Superconducting Super Collider (SSC)

FY 1993 Appropriation	$ 550,000
- Adjustment - Program specific general reduction	- 33,000
- Adjustment - General reduction for use of prior balances	- 2,500
FY 1994 Base	$ 514,500
SSC R&D and Operations	
- R&D on design of superconducting magnets and development of designs for the injectors, other collider technical systems and detectors	- 12,426
- Funding for SSCL laboratory operating costs not directly related to the project such as the library, calibration laboratory, long lead spares, education programs, and facilities for visiting scientists doing physics research	+ 5,000
Capital Equipment	
- Equipment in support of SSC detector fabrication, accelerator and detector R&D programs and for general laboratory equipment	+ 12,000
Construction	
- Increased level of SSC construction on both technical components and conventional facilities	+120,926
FY 1994 Congressional Budget Request	$ 640,000

DEPARTMENT OF ENERGY
FY 1994 CONGRESSIONAL BUDGET REQUEST
GENERAL SCIENCE AND RESEARCH
(dollars in thousands)

KEY ACTIVITY SUMMARY

SUPERCONDUCTING SUPER COLLIDER (SSC)

I. Preface: SSC Research, Development and Operations

The SSC R&D program provides support for the studies that develop the conceptual design and technological foundation for the SSC and its technical systems. The program currently has a strong focus on superconducting magnet development but also includes R&D on detectors and other accelerator systems which are also critical elements of the SSC. Also provides support for SSC Laboratory operating costs not directly related to the project.

This subprogram also provides the Federal staffing resources and associated funding required to oversee and administer a highly complex program to plan, design, construct, and operate the multibillion dollar SSC. The magnitude and complexity of the project resulted in formation of the Office of Superconducting Super Collider (OSSC) which reports directly to the Director of Energy Research. Responsibility for SSC project management and oversight of scientific and technical activities is carried out in Texas. The OSSC substructure provides for an SSC Project Office and an Administration Office in Texas and a Washington Support Office at DOE Headquarters.

II. A. Summary Table: SSC Research, Development and Operations

Program Activity	FY 1992 Enacted	FY 1993 Enacted	FY 1994 Request	% Change
SSC R&D	$ 91,449	$ 105,828	$ 92,002	- 13
SSC Program Direction	11,000	11,000	12,400	+ 13
SSC Laboratory Operations	0	0	5,000	>999
Total, SSC Research, Development and Operations	$ 102,449	$ 116,828	$ 109,402	- 6

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1992	FY 1993	FY 1994
SSC Research, Development and Operations			
SSC R&D	A major feature of the FY 1992 R&D program will be final preparation for and implementation of the magnet string test to take place late in the fiscal year. Superconducting magnet R&D will continue to further refine the superconducting dipole design and to pursue development of the superconducting quadrupole and high energy booster superconducting dipole magnets. Accelerator R&D will focus on testing and evaluation of prototypes of components and systems, refinements of the design of the injectors and collider, and the development of final specifications for procurement of these systems. Detector subsystem R&D will continue at a reduced level and the emphasis will progressively shift toward engineering design of specific approved detectors. The remainder of the request is needed for general laboratory operations such as laboratory management and administration, and the laboratory's, technical and experimental support groups.	The FY 1993 R&D program will include the continuation of superconducting magnet R&D, accelerator R&D and detector R&D. The program will include R&D to further refine the design of the superconducting magnets for the collider and high energy booster ($30,000); accelerator R&D to complete design of various accelerator systems and components and to fabricate and test prototypes of components ($10,800); detector and experimental systems R&D and operation of computing capability ($28,828); general laboratory operations such as laboratory management and administration and the laboratory's technical and experimental support groups ($36,200).	In FY 1994, the R&D program will continue at a reduced level of activity as is normal at this stage of a project when numerous systems are under construction and in final design. The program will include injector preoperation ($7,500); collider R&D ($16,500); detector, experimental systems and test beam R&D ($31,602); and laboratory general and administrative expenses ($36,400).
	$ 91,449	$ 105,828	$ 92,002
SSC Program Direction	Provided funds for salaries, benefits, and travel for 66 full-time equivalents (FTEs) for the Office of Superconducting Super Collider (OSSC) and 6 FTEs for Energy Research support personnel. ($5,287)	Provide funds for salaries, benefits, and travel for 85 FTEs for the Office of SSC and 6 FTEs for Energy Research support personnel. ($8,400)	Provide funds for salaries, benefits, and travel for 90 FTEs for the Office of SSC and 6 FTEs for Energy Research support personnel. ($8,972)

III. SSC Research, Development and Operations (Cont'd):

Program Activity	FY 1992	FY 1993	FY 1994
SSC Program Direction (Cont'd)	Continued to staff the Texas offices to carry out policy and program direction and effective day-to-day DOE oversight and management of this large, complex project, which is one of the Department's and Administration's major science initiatives. Provided independent assessments of progress, issues and recommendations to the Secretary of Energy. Provided project oversight and management of construction activities at the site to ensure cost and schedule baselines are met. Provided oversight of the many design and development efforts for technical systems, and oversight of the laboratory's procurement and business activities. Administered the M&O contract, and provided administrative support at the site. Supported an ES&H program that ensures compliance with all regulations and directives. Served as focal point for daily interactions with M&O contractor staff, State of Texas representatives, Washington Support Office at HQ, and others as required.	Continue to provide effective policy and program direction and day-to-day DOE oversight and management of this large, complex project. Continue to provide oversight of construction activities at the site, oversight of the many design and development efforts for technical systems, and the laboratory's procurement and business activities. Administer the M&O contract, ensure compliance with ES&H regulations and directives, and provide administrative support at the site. Continue to serve as the focal point for daily interactions with M&O contractor staff, State of Texas representatives, Washington Support Office, and others as required.	Complete the staffing plan for the SSC Texas office to continue to provide effective policy and program direction and day-to-day DOE oversight and management of this large, complex project. Continue to provide oversight of construction activities at the site and the many design and research and development efforts for technical systems. Oversee the laboratory's procurement and business activities, administer the M&O contract, ensure compliance with ES&H regulations and directives, and provide administrative support at the site. Continue to serve as the focal point for daily interactions with M&O contractor staff, State of Texas representatives, Washington Support Office, and others as required.
	Staffed the Washington Support Office to manage HQ activities related to the DOE SSC program and additional non-Federal contributions. Provided oversight for negotiation and implementation of detailed cost-sharing arrangements with foreign countries. Participated in oversight of accelerator and detector R&D programs. Developed policy for and coordinated SSC program activities with the high energy physics program. Integrated SSC program planning with Departmental strategic planning activities. Provided support for project control and civil construction at the HQ level. Provided ES&H support to ensure safe	Continue to manage HQ activities related to the DOE SSC program and additional non-Federal contributions. Continue to oversee negotiation and implementation of detailed cost-sharing arrangements with foreign countries. Continue to participate in oversight of accelerator and detector R&D programs. Continue to coordinate SSC program activities with the high energy physics program and integrate SSC program planning with Departmental strategic planning activities. Continue to provide support for project control, and civil construction at the HQ level. Meet demands for project reviews, briefings, information requests, and	Continue to manage HQ activities related to the DOE SSC program and additional non-Federal contributions, including negotiation and implementation of detailed cost-sharing arrangements with foreign countries. Participate in oversight of accelerator and detector R&D programs. Continue to coordinate SSC program activities with the high energy physics program and integrate SSC program planning with Departmental strategic planning activities. Provide support for project control and civil construction at the HQ level; and meet demands for project reviews, briefings, information requests, and other program support

III. SSC Research, Development and Operations (Cont'd):

Program Activity	FY 1992	FY 1993	FY 1994
SSC Program Direction (Cont'd)	and efficient project implementation. Met demands for project reviews, briefings, information requests, and other program support requirements of the SSC project.	other program support requirements of the SSC project.	requirements of the SSC project.
	Provided ER HQ program and management support to the SSC in the areas of budget and finance, personnel administration, acquisition and assistance, policy review, information resources management, and construction management support.	Continue to provide for ER HQ program and management support to the SSC at the level included in the FY 1992 budget.	Continue to provide for ER HQ program and management support to the SSC at the level included in the FY 1993 budget.
	Provided a variety of program support at HQ and at the Project Office such as rents, printing and binding, and contractual support such as relocation services and Automated Office Support Systems workstations. ($5,713)	Continue a variety of program support as in FY 1992. ($2,600)	Continue a variety of program support as in FY 1992 and FY 1993. ($3,428)
	$ 11,000	$ 11,000	$ 12,400
SSC Laboratory Operations			Provides funding for laboratory operating costs not directly related to the project which are outside of the Total Project Cost. Covers activities such as the library, calibration laboratory, long lead spares, and facilities for visiting scientists doing physics research.
	Funding in the amount of $1,144,000 has been transferred to the SBIR program.	Funding in the amount of $1,587,000 has been budgeted for the SBIR program.	Funding in the amount of $1,380,000 has been budgeted for the SBIR program.
	$ 0	$ 0	$ 5,000
SSC Research, Development and Operations	$ 102,449	$ 116,828	$ 109,402

DEPARTMENT OF ENERGY
FY 1994 CONGRESSIONAL BUDGET REQUEST
GENERAL SCIENCE AND RESEARCH
(dollars in thousands)

KEY ACTIVITY SUMMARY

SUPERCONDUCTING SUPER COLLIDER (SSC)

I. Preface: Capital Equipment

The SSC has significant capital equipment requirements for procurements in support of R&D efforts on the many accelerator technical system and components, and for engineering design and procurement of detector components and systems. Also included are the equipment needs for establishing a major new research laboratory, including in-house computing capability, acquisition of general purpose scientific instrumentation and general laboratory support equipment.

II. A. Summary Table: Capital Equipment

Program Activity	FY 1992 Enacted	FY 1993 Enacted	FY 1994 Request	% Change
SSC Capital Equipment.....	$ 56,340	$ 38,000	$ 50,000	+ 32
Total Capital Equipment	$ 56,340	$ 38,000	$ 50,000	+ 32

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1992	FY 1993	FY 1994
Capital Equipment			
SSC Capital Equipment	Provides for fabrication of detector subsystems and components; equipment in support of the accelerator R&D effort and equipment for on-site testing; equipment in support of the magnet R&D effort, a variety of items of general laboratory technical support equipment that are essential when establishing a new research laboratory.	Provides a major increase for the design and fabrication of SSC detector systems following selection of the two large general purpose detectors ($27,000). Also provides continued support for fabrication of accelerator systems and components prototypes ($5,000); general laboratory equipment ($3,000); and computing equipment ($3,000).	Provides a major increase for design and fabrication of SSC detector systems following establishment of technical and cost beamlines for each of the two major detectors ($40,100); other experimental systems and computing ($3,500); equipment in support of R&D programs ($1,400); and, general laboratory equipment ($5,000).
	$ 56,340	$ 38,000	$ 50,000
Capital Equipment	$ 56,340	$ 38,000	$ 50,000

DEPARTMENT OF ENERGY
FY 1994 CONGRESSIONAL BUDGET REQUEST
GENERAL SCIENCE AND RESEARCH
(dollars in thousands)

KEY ACTIVITY SUMMARY

SUPERCONDUCTING SUPER COLLIDER (SSC)

I. Preface: Construction

II. A. Summary Table: Construction

Program Activity	FY 1992 Enacted	FY 1993 Enacted	FY 1994 Request	% Change
Construction	$ 323,767	$ 359,672	$ 480,598	+ 34
Total, Construction	$ 323,767	$ 359,672	$ 480,598	+ 34

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1992	FY 1993	FY 1994
Construction	Provides $129,900 for the magnet program, including the Collider Dipole Magnet Industrialization Program which includes the development and acquisition of tooling, and the procurement of materials and components for the 70 preproduction magnets to be manufactured in FY 1993. The remainder of the magnet program includes the collider quadrupole contracts, the high energy booster dipole and quadrupole contract, procurement of equipment and tooling for the on-site magnet facilities, and advance procurement of superconducting wire and cable. Also provides $36,100 for design of conventional facilities (collider tunnel, injector enclosures, experimental areas, campus buildings, and other surface facilities); $43,300 for collider system technical components other than the superconducting magnets; and $45,000 for injector technical systems for the linac, Low Energy Booster (LEB) and Medium Energy Booster (MEB); Conventional facilities construction includes; completion of the ASST facility, the award of the first shafts and first collider tunnel sector contracts, commencement of Linac, LEB and MEB construction, and initiation of underground tunnel construction in the fourth quarter of FY 1992 ($70,200); onsite utilities and roads for the west campuses, and the administration building at the west interaction region ($51,900). Also provides $39,942 for project management and administration and $39,300 for contingency.	Required for the project to proceed in accordance with Department's cost and schedule baseline. Provides $197,062 for the superconducting magnet program, including $178,377 for the collider dipole and quadrupole contracts with industry and $18,685 for the high energy booster magnet contracts. The FY 1993 dipole program will include fabrication of the 70 preproduction magnets and acquisition of materials and components for the 500 low-rate production magnets to be fabricated in FY 1994. Also provides: $50,028 for fabrication of elements of the linac, low energy booster, medium energy booster, and high energy booster; $62,838 for fabrication of other collider technical systems; $205,552 for design and construction of enclosures for the low energy booster, medium energy booster, high energy booster, and collider, including tunnels and surface structures; and for other conventional construction including initiation of one experimental hall, test beams, campus buildings utilities and infrastructure; $27,190 for project management and administration; and $35,002 for contingency.	Required for the project to proceed in accordance with the President's stretch-out plan for the SSC. Provides $206,300 for the superconducting magnet program, including $194,500 for the collider dipole and quadruples and $11,800 for HEB magnets. The FY 1994 program will include continuation of the preproduction magnets. The budget request also provides: $78,000 for technical components of the injector accelerators and beam transfer lines; $83,000 for other collider technical systems; $105,462 for construction of accelerator enclosures for the MEB, HEB and collider; $63,300 for construction of experimental halls and the test beam facility; $32,900 for campus buildings, infrastructure and utilities; $66,500 for project management and administration; and $35,136 for contingency.

III. Construction (Cont'd):

Program Activity	FY 1992	FY 1993	FY 1994
Construction (Cont'd)	Of the total construction requirement of $455,642 described above it is expected that approximately $131,875 will be met with anticipated non-Federal contributions, primarily from the State of Texas. The Federal construction funding requirement is therefore estimated to be $323,767.	Of the total construction requirement of $577,672 described above it is expected that $218,000 will be met with anticipated non-Federal contributions, with $118,000 coming from the State of Texas and $100,000 from foreign sources. The Federal construction funding requirement is therefore estimated to be $359,672.	The Federal construction requirement is estimated to be $480,598.
	$ 323,767	$ 359,672	$ 480,598
Construction	$ 323,767	$ 359,672	$ 480,598

DEPARTMENT OF ENERGY
FY 1994 CONGRESSIONAL BUDGET REQUEST
(Changes from FY 1993 Congressional Budget Request are denoted with a vertical line in left margin.)

OFFICE OF ENERGY RESEARCH
GENERAL SCIENCE AND RESEARCH
Superconducting Super Collider
(Tabular dollars in thousands. Narrative material in whole dollars.)

IV. A. Construction Funded Project Summary

Project No.	Project Title	Previous Obligations	FY 1993 Appropriated	FY 1994 Request	Unappropriated Balance *	TEC *
90-R-106	Superconducting Super Collider, SSCL	$ 802,614	$ 577,672	$ 670,598	TBD	TBD
	Less Estimated Non-Federal Contributions	(258,390)	(218,000)	(190,000)	TBD	TBD
Total, Federal Superconducting Super Collider Construction		$ 544,224	$ 359,672	$ 480,598	TBD	TBD

* Currently the Department is re-estimating the project completion and TPC as a result of the most recent FY 1994 Presidential Budget guidance which calls for a stretch-out of the SSC program to reduce planned outlays in FY 1994-FY 1998. Due to the magnitude of the changes in the funding profile, a detailed re-evaluation of the project schedule, the approach to accomplishing major tasks, and the laboratory staffing will be required. The revised project plan developed by the laboratory will be subject to a detailed cost and schedule review by the Department. The re-estimate will be formalized with a baseline change by the end of FY 1993. The impact of the reduced outlays is currently estimated as a 3 year delay in schedule and $2 billion increase in as-spent project cost. This estimate of the change is believed accurate within 20 percent at this time. The program changes will be discussed with current and planned non-Flederal contributors and the impact in this area will be reflected in the baseline change.

IV. 8. Construction Funded Project Descriptive Summary

1. Project Title and Location: Project 90-R-106, Superconducting Super Collider, Ellis County, Texas — TEC: TBD a/ b/; TPC: TBD a/ b/

Start Date: 1st Qtr. FY 1990 — Completion Date: TBD a/

2. Financial Schedule: c/

Fiscal Year	Appropriation a/	Adjustments	Obligations	Costs
1990	$ 135,000	$- 8,408 d/	$ 102,704	$ 84,995
1991	218,495 e/	- 1 f/	242,382	191,189
1992	457,528 g/		457,528	334,663
1993	577,672 h/		577,672	574,598
1994	670,598 i/		670,598	637,998
Outyears	TBD		TBD	TBD

a/ Currently the Department is re-estimating the project completion and TPC as a result of the most recent FY 1994 Presidential Budget guidance which calls for a stretch-out of the SSC program to reduce planned outlays in FY 1994-FY 1998. Due to the magnitude of the changes in the funding profile, a detailed re-evaluation of the project schedule, the approach to accomplishing major tasks, and the laboratory staffing will be required. The revised project plan developed by the laboratory will be subject to a detailed cost and schedule review by the Department. The re-estimate will be formalized with a baseline change by the end of FY 1993. The impact of the reduced outlays is currently estimated as a 3 year delay in schedule and $2 billion increase in as-spent project cost. This estimate of the change is believed accurate within 20 percent at this time. The program changes will be discussed with current and planned non-Federal contributors and the impact in this area will be reflected in the baseline change.

b/ Total construction project funding indicated. Funding required through appropriation process will be less as a result of anticipated non-federal contributions. The Department is seeking non-Federal participation in the SSC to share the benefit and the responsibility of the construction and operational phases of the SSC program. Identification of the details of the non-Federal contributions will depend upon completion of negotiation of agreements with foreign partners and on cost-sharing agreements with Texas.

c/ For consistency with Departmental accounting system, the Appropriations, Obligations, and Costs for fiscal years prior to 1993 have been changed from amounts on the last data sheet.

d/ Reflects reduction of funds resulting from FY 1990 sequester and general reduction, and reprogramming of funds from the construction project to operating expenses for SSC program direction.

e/ Includes $93,866,000 of Federal funds and $124,629,000 of the Texas contribution in FY 1991.

f/ Reflects reduction of funds resulting from FY 1991 sequester.

g/ Includes $323,767,000 of Federal funds and $133,761,000 in non-Federal contributions.

h/ Includes $359,672,000 of Federal funds and an estimated $218,000,000 in non-Federal contributions.

i/ Includes $480,598,000 of Federal funds and an estimated $190,000,000 in non-Federal contributions.

3. Narrative: The Superconducting Super Collider is a high luminosity proton-proton collider with beam energy of up to 20 trillion electron volts (TeV). The collider itself consists of two rings of superconducting magnets and associated systems in a common tunnel, about 54 miles in circumference. Up to four interaction regions will be outfitted with collision halls and support areas for experiments. The project includes a series of injector accelerators which provide the input beam for acceleration and circulation in the collider rings. The associated office and laboratory facilities (buildings, structures, and utilities) required to support the technical systems are also included.

The SSC will ensure forefront experimental capability for continued progress in advancing the frontier of knowledge of matter and energy at its most fundamental level, with resulting impacts on the Nation's science and technology base. The collider will cause oppositely directed bunches of protons to collide, basically head-on, making available a total of up to 40 TeV of energy within an extremely small volume. These energies are expected to produce new types of matter and new forms of energy. Internal structure, and even more basic building blocks of matter, may be revealed. Large detectors will be used in the interaction regions to detect and record interactions of interest. The SSC, through its investigation of fundamental physical processes, will provide new insights into questions of great significance to other sciences as well as high energy physics, and to our knowledge and understanding of the world in which we live. It will be a powerful and unique tool for extending those investigations of matter and energy that have led us to an understanding of the atom, the nucleus, and on to their smallest components.

Construction activities will proceed at a significantly enhanced pace in FY 1994. The request for appropriated funds includes: $202 million for conventional facility construction, $78 million for injector technical systems fabrication, $206 million for superconducting magnet program, $83 million for collider technical system fabrication (other than the superconducting magnets), and $67 million for project management, and administration; and $35 million for contingency. Of the $671 million requirement for construction, it is estimated that $190 million will be provided from non-Federal funds, resulting in a requirement for $481 million of Federal funds.

Total BA funding for the project including construction, detectors and R&D and preoperational costs in escalated dollars are:

(Dollars in Millions)

	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	Remaining Years b/	Total b/
Total Project Funding	$ 33.0	$ 97.6	$ 214.5	$ 383.4	$ 621.6	$ 721.5	$ 812.6	TBD	TBD	TBD	TBD	TBD	TBD
Estimated Non-Federal Contributions	0	0	0	149.0	150.0	218.0	190.0	TBD	TBD	TBD	TBD	TBD	TBD
Federal Share[a/]	$ 33.0	$ 97.6	$ 214.5	$ 234.4	$ 471.6	$ 503.5	$ 622.6	$ 538.0c/	$ 556.3c/	$ 576.5c/	$ 796.7c/	TBD	TBD

a/ Excludes direct Federal management and on-site administrative costs and SSC Laboratory Operations shown below. (BA in Thousands)

b/ Currently the Department is re-estimating the project completion and TPC as a result of the most recent FY 1994 Presidential Budget guidance which calls for a stretch-out of the SSC program to reduce planned outlays in FY 1994-FY 1998. The re-estimate will be formalized with a baseline change by the end of FY 1993.

c/ SSC Laboratory Operations will be determined from the total SSC appropriations after the rebaselining is completed.

4. Total Project Funding (BA in Thousands): (Federal Share - excludes Program Direction and SSC Laboratory Operations shown below)

	Prior Years	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
Construction	$ 0	$126,592	$ 93,865	$323,767	$359,672	$480,598	TBD d/	TBD d/	TBD d/	TBD d/
Operating Expenses & Capital Equipment	130,585	87,893	140,537	147,789	143,828	142,002	TBD d/	TBD d/	TBD d/	TBD d/
Totals	$130,585	$214,485	$234,402	$471,556	$503,500	$622,600	$538,000	$556,300	$576,500	$796,700

	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
5. Program Direction	$ 2,400	$ 7,100	$11,000	$11,000	$12,400	$13,000	$13,700	$14,500	$15,300
FTE's	15	58	72	91	96	96	96	96	96

	Prior Years	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
6. SSC Laboratory Operations	$ 0	$ 0	$ 0	$ 0	$ 0	$ 5,000	TBD e/	TBD e/	TBD e/	TBD e/

DEPARTMENT OF ENERGY
FY 1994 CONGRESSIONAL BUDGET REQUEST
(Changes from FY 1993 Congressional Budget Request are denoted with a vertical line in left margin.)

GENERAL SCIENCE AND RESEARCH - PLANT AND CAPITAL EQUIPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

SUPERCONDUCTING SUPER COLLIDER (SSC)

1. Title and location of project: Superconducting Super Collider (SSC)
Ellis County, Texas

2a. Project No.: 90-R-106
2b. Construction Funded

3a. Date A-E Work Initiated: 3rd Qtr. FY 1989

3b. A-E Work Duration: 66 months

5. Previous Cost Estimate:
Total Estimated Cost (TEC) - $6,346,802 a/
Total Project Cost (TPC) - $8,249,062 a/

4a. Date Physical Construction Starts: 1st Qtr, FY 1990

4b. Date Construction Ends: TBD b/

6. Current cost estimate:
TEC -- TBD b/
TPC -- TBD b/

7. Financial Schedule: c/

Fiscal Year	Appropriations	Adjustments	Obligations	Costs
1990	$ 135,000	$- 8,408 d/	$ 102,704	$ 84,995
1991	218,495 e/	- 1 f/	242,382	191,189
1992	457,528 g/		457,528	334,663
1993	577,672 h/		577,672	574,598
1994	670,598 i/		670,598	637,998
Outyears	TBD		TBD	TBD

1. Title and location of project:	Superconducting Super Collider (SSC) Ellis County, Texas	2a. Project No.: 90-R-106 2b. Construction Funded

7. Financial Schedule: (Continued)

a/ Total construction project funding indicated. Funding required through appropriation process will be less as a result of anticipated non-federal contributions. The Department is seeking non-Federal participation in the SSC to share the benefit and the responsibility of the construction and operational phases of the SSC program. Identification of the details of the non-Federal contributions will depend upon completion of negotiation of agreements with foreign partners and on cost-sharing agreements with Texas.

b/ Currently the Department is re-estimating the project completion and TPC as a result of the most recent FY 1994 Presidential Budget guidance which calls for a stretch-out of the SSC program to reduce planned outlays in FY 1994-FY 1998. Due to the magnitude of the changes in the funding profile, a detailed re-evaluation of the project schedule, the approach to accomplishing major tasks, and the laboratory staffing will be required. The revised project plan developed by the laboratory will be subject to a detailed cost and schedule review by the Department. The re-estimate will be formalized with a baseline change by the end of FY 1993. The impact of the reduced outlays is currently estimated as a 3 year delay in schedule and $2 billion increase in as-spent project cost. This estimate of the change is believed accurate within 20 percent at this time. The program changes will be discussed with current and planned non-Federal contributors and the impact in this area will be reflected in the baseline change.

c/ For consistency with Departmental accounting system, the Appropriations, Obligations, and Costs for fiscal years prior to 1993 have been changed from amounts on the last data sheet.

d/ Reflects reduction of funds resulting from FY 1990 sequester and general reduction, and reprogramming of funds from the construction project to operating expenses for SSC program direction.

e/ Includes $93,866,000 of Federal funds and $124,629,000 of the Texas contribution in FY 1991.

f/ Reflects reduction of funds resulting from FY 1991 sequester.

g/ Includes $323,767,000 of Federal funds and $133,761,000 in non-Federal contributions.

h/ Includes $359,672,000 of Federal funds and an estimated $218,000,000 in non-Federal contributions.

i/ Includes $480,598,000 of Federal funds and an estimated $190,000,000 in non-Federal contributions.

1. Title and location of project:	Superconducting Super Collider (SSC) Ellis County, Texas	2a. Project No.: 90-R-106 2b. Construction Funded

8. Brief Physical Description of Project

The Superconducting Super Collider (SSC) consists of a superconducting storage ring system in which beams of protons traveling in opposite directions in two rings of superconducting magnets are made to collide at certain interaction points, producing ultra-high energy reactions for physics studies. The project includes a series of injector accelerators which provide the input beam for acceleration and circulation in the collider rings. The associated laboratory facilities (buildings, structures, and utilities) required to support the technical systems are included.

Proposed SSC Design Objectives

Proton beam energy up to 20 TeV

Luminosity $10^{33}cm^{-2}s^{-1}$

Number of interaction regions 4 (plus 4 potential)

In the collider, oppositely directed bunches of protons, each with an energy of up to 20 TeV (20 trillion electron volts), are caused to collide with each other, almost head-on, making available a total of 40 TeV of energy in each proton-proton collision. Since the probability of interaction per proton is comparatively low, the beams can be recirculated to collide repetitively for many hours without significant attenuation. Thus the SSC is constructed as a pair of storage rings capable of holding tightly confined, counter-rotating proton beams. The rings are made to cross at locations where the collision reactions take place and where detectors that observe and measure the reaction products for physics study can be located. Four interaction regions are to be provided in the base project. The design can accommodate future upgrades such as beam bypass tunnels where an additional four interaction regions could be added for future expansion of experimental capabilities.

1. Title and location of project: Superconducting Super Collider (SSC) Ellis County, Texas	2a. Project No.: 90-R-106 2b. Construction Funded

8. Brief Physical Description of Project (Continued)

The two collider rings confining the proton beams are housed one above the other in a common underground tunnel. The beams are guided around the desired path through an evacuated tube by a system of superconducting electromagnets. This magnetic confinement system consists of a periodic array of bending and focusing magnets. The circumference of the rings is approximately 87 km (54 miles), a size governed by the maximum magnetic field and the maximum energy. The operating cycle of the SSC begins with the collider magnets maintained at low field for about seventy minutes while the proton beams are loaded into both collider rings. With injection complete, the acceleration system is activated. The increase in the beam energy is accompanied by a corresponding increase in the confining magnet strength thus keeping fixed the position of the beam orbit. This synchronous acceleration is complete in about twenty five minutes when the beams reach their collision energy of up to 20 TeV, about ten times the injection energy. Then the beams are steered into collision at the interaction points. The resulting reactions can take place for about a day before the beams are depleted sufficiently so that the refill and acceleration cycle must be repeated. The design luminosity, a measure of the effectiveness of a collider in producing useful collisions, is 10^{33} cm $^{-2}s^{-1}$.

The injector system consists of a source and a linear accelerator (which accelerates the protons to 600MeV), a Low Energy Booster (LEB) (11GeV), a Medium Energy Booster (MEB) (200GeV) and a High Energy Booster (HEB) (2TeV). The MEB also provides test beams for use in testing detector components and systems.

By far the largest and most costly of the SSC technical systems are the main ring magnets -- some 8500 dipoles and nearly 2000 quadrupoles. An extensive cryogenic system is required to maintain the magnets at the operating temperature.

The SSC conventional facilities structures can be classified into four major categories -- the Collider Tunnel, the Collision Halls, the Campus-Injector Complex, and Cryogenic and Surface Support Facilities. The underground Collider Tunnel is approximately 54 miles in circumference. The tunnel is composed of arc sections of uniform periodicity, interrupted by two special sections called clusters. Within these clustered areas are the utility sections needed for specialized accelerator functions (such as injection, radio frequency acceleration, and the beam extraction facilities) and the collision halls containing the detectors. Four collision halls are to be constructed. For future flexibility, space has been left for four more collision halls.

1. Title and location of project: Superconducting Super Collider (SSC) Ellis County, Texas	2a. Project No.: 90-R-106 2b. Construction Funded

8. Brief Physical Description of Project (Continued)

The Campus-Injector (West) Complex has a very different character. In this location, and at the East Complex on the other side of the ring, there are groups of laboratory, shop and office buildings with associated grounds, roads, parking lots, utilities yards, etc. There is also the Central Facility located approximately in the center of the main ring, which houses a significant portion of the laboratory staff and facilities. The utilities and services for the entire SSC, as well as all of the operating staff, largely are concentrated in these areas. The campus complex will consist of buildings arranged in four major groups -- laboratory, industrial, warehouses, and support buildings.

At the surface and distributed at a number of points around the ring are service areas which house refrigerator facilities with large helium compressors, power supplies and other support functions for the collider tunnel. These areas also have vertical shafts which provide tunnel access and egress for personnel and equipment. At two or more locations around the large ring are located major electrical sub-stations connecting the accelerator complex to the power grid. The entire facility requires a reliable and stable source of electric power with peak demands up to about 200 MW and a domestic water supply averaging 234,000 gallons per day.

The laboratory staff during regular operation will consist of about ~~2,700~~ 2,900 people, of whom ~~2,200~~ 2,400 are resident staff and workers and 500 are visiting scientists on short-term stays of days to months. During construction, the population will fluctuate. In addition to the basic buildings, roads and parking areas, appropriate environmental and support systems are needed for this population, including items such as heating and ventilation of buildings and work areas, provision for sewage and solid waste disposal, provision of police and fire protection, emergency medical aid and other standard considerations.

Construction activities will proceed at a significantly enhanced pace in FY 1994. The request for appropriated funds includes: $202 million for conventional facility construction, $78 million for injector technical systems fabrication, $206 million for superconducting magnet program, $83 million for collider technical system fabrication (other than the superconducting magnets); and $67 million for project management and administration; and $35 million for contingency. Of the $671 million requirement for construction, it is estimated that $190 million will be provided from non-federal funds, resulting in a request for $481 million of federal construction funds.

1. Title and location of project:	Superconducting Super Collider (SSC) Ellis County, Texas	2a. Project No.: 90-R-106 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of Project

The purpose of the SSC is to ensure forefront experimental capability for continued progress in advancing the frontier of knowledge of matter and energy at the most fundamental level, with resulting impacts on the Nation's science and technology base. The scientific work of the laboratory will be focused on the study of reactions among the elementary constituents of matter at the highest energies.

The SSC will build on the experience of earlier hadron-hadron colliders, especially the Fermilab Tevatron Collider, which has been in operation for a number of years with its superconducting magnets. The SSC represents an enormous step in both energy and luminosity over existing machines. In the energy regime of interest only a proton-proton machine is today capable of the high luminosity necessary to gather information on the rarest and likely most interesting phenomena. The very high energy of the SSC will take it to a completely unexplored domain, providing answers to some of the most fundamental questions concerning the nature of matter and the forces acting on it, as well as uncovering new, unanticipated phenomena.

The recent progress of particle physics has brought astounding results. A distinct level of matter below the proton has been identified. Three generations of that matter have been found, and basic forces between these particles have been identified. The present understanding of matter and forces is extensive and extraordinarily successful, but is not complete. Many crucial questions need to be answered. Are there more quarks and leptons? Are there additional levels of matter beneath the quarks and leptons? What is the origin of mass? Are there new, undiscovered forces in nature? New energy sources? These are some of the challenges in particle physics for which the SSC will play a major role.

Facilities in operation, or soon to be, will explore the near frontier but will be unable to extend the energy frontier to the extent necessary to address many important questions. The only currently feasible way to reach the energies of interest is by a high-luminosity, multi-TeV proton collider. The SSC will have impressive potential for discovery in the following areas:

New quarks and leptons

The SSC will search for new quarks and leptons up to masses of a few TeV, a factor of 40 beyond the present limit.

9. Purpose, Justification of Need For, and Scope of Project (Continued)

New force particles

The SSC will search for new force particles, like the W and Z of the weak force, up to masses of 7 TeV, a factor of 20 beyond the present 0.3 TeV.

New hypothetical particles

The SSC will search for hypothetical new "supersymmetric" particles up to masses of 1.5 TeV, a factor of about 20 beyond today's limit.

Mass generation

The SSC will explore the mass-generating phenomenon at energies more than an order of magnitude beyond today's limits.

Internal structure

The SSC will search for internal structure (even more basic building blocks) in quarks and leptons to distances 40 times smaller than the present limits.

These examples serve only to illustrate the power of the SSC relative to other high energy facilities. Nature is usually more subtle and intricate than the projection of the human mind. Surprises will surely occur and a rich and diverse research and discovery program will develop, including in directions not now even contemplated. The basic strength of the SSC is its long reach up in energy and its high luminosity.

The SSC, through its investigation of fundamental physical processes, will provide new insights into questions of great significance to other sciences as well as particle physics, and to our general knowledge and understanding of the world in which we live. It will be a powerful tool for extending those investigations of matter and energy that have led us to an understanding of the atom, the nucleus, and on to their smallest components.

1. Title and location of project: Superconducting Super Collider (SSC) Ellis County, Texas

2a. Project No.: 90-R-106

2b. Construction Funded

10. Details of Cost Estimate a/

		Item Cost a/	Total Cost a/
a.	Engineering design and Inspection, and administration		TBD
b.	Construction costs		TBD
	1. Conventional systems	TBD	
	(a) Improvements to Land (site preparations, utilities, roads, fencing and landscaping)	TBD	
	(b) Campus Buildings	TBD	
	(c) Accelerator Facilities (structures & underground enclosures)	TBD	
	(d) Experimental Facilities (structures & underground enclosures)	TBD	
	2. Technical systems	TBD	
	(a) Injector Systems	TBD	
	(b) Collider Systems		
	(1) Superconducting Magnets	TBD	
	(2) Other Systems	TBD	
c.	Contingency at 19 percent of above costs (exclusive of a reduction for estimated contingency on the production of expected foreign in-kind contributions)		TBD
	Total line item cost		TBD a/

11. Method of Performance

Design, construction, and inspection of the facility is the responsibility of the Management and Operating Contractor. The design and construction of the conventional facilities have been subcontracted to architectural/engineering and construction/management firms. It is anticipated that the vast majority of the hardware and technical components will be procured from industry using fixed-price contracts awarded on the basis of competitive bidding. The private sector is being utilized to the maximum extent possible while meeting the SSC requirements in a cost effective manner. The SSC will involve the participation of the State of Texas and expected international partners.

a/ Currently the Department is re-estimating the project completion and TPC as a result of the most recent FY 1994 Presidential Budget guidance which calls for a stretch-out of the SSC program to reduce planned outlays in FY 1994-FY 1998. The re-estimate will be formalized with a baseline change by the end of FY 1993.

1. Title and location of project: Superconducting Super Collider (SSC) Ellis County, Texas

2a. Project No.: 90-R-106

2b. Construction Funded

12. Funding Schedule of Project Funding and Other Related Funding Requirements (dollars in millions)

	Prior[a/] Years	FY 1991	FY 1992	FY 1993	FY 1994	Outyears e/	Total e/
a. Total project funding							
1. Total facility costs							
(a) Construction line item.....	$ 85.0	$191.2	$334.7	$574.6	$638.0	TBD	TBD
2. Other project costs							
(a) R&D and Laboratory Support.....	170.5	119.4	103.1	73.7	59.3	TBD	TBD
(b) Pre-operations..	0	0	0	0	7.5	TBD	TBD
(c) Initial Complement of Detectors and Computers.....	37.0	40.0	35.9	74.9	75.2	TBD	TBD
Total other project costs...	207.5	159.4	139.0	148.6	142.0	TBD	TBD
Total project cost (TPC).....	$292.5	$350.6	$473.7	$723.2	$780.0	TBD	TBD
Estimated Non-Federal Contribution.....	$ 0	$104.2	$ 98.0	$174.0	$ 190.0	TBD	TBD
Estimated Federal Costs.	$292.5	$246.4	$375.7	$549.2	$ 590.0	TBD	TBD

a/ FY 1988 thru FY 1990.

b/ Assumes site provided at no cost to DOE. Total construction cost including anticipated international, state, and other non-Federal contributions.

c/ Includes detector fabrication, as well as detector R&D and computers.

d/ Total project cost including a preliminary estimate of non-Federal contributions to the SSC. The exact magnitude and timing of the non-Federal contributions will depend on which SSC systems are provided by others and how these systems fit into the project schedule. Improved firm estimates will be available after completion of definitive agreements with the State of Texas and foreign contributors. The Department's goal is to achieve non-Federal participation up to one-third of the TPC.

e/ Currently the Department is re-estimating the project completion and TPC as a result of the most recent FY 1994 Presidential Budget guidance which calls for a stretch-out of the SSC program to reduce planned outlays in FY 1994-FY 1998. The re-estimate will be formalized with a baseline change by the end of FY 1993.

1. Title and location of project:	Superconducting Super Collider (SSC) Ellis County, Texas	2a. Project No.: 90-R-106 2b. Construction Funded

12. Funding Schedule of Project Funding and Other Related Funding Requirements (dollars in millions) (Continued)

b. Related annual funding requirements after completion* (FY 1991 dollars)

1. Annual facility operating costs	$ 257.8
2. Capital equipment	44.4
3. General Plant Projects (GPP)	5.0
4. Accelerator Improvement Projects (AIP)	10.0
Total related annual funding	$ 317.2**

* Cost levels estimated for normal operation in the first full year of operation after completion of construction.

** Based on November 1992, SSCL Report: SSCL Operations Program Plan FY 2000 to FY 2005.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding

1. Total facility cost

Explained in items 8, 9, and 10

2. Other project costs

(a) R&D and Laboratory Support

This will provide further design and cost optimization of components. In addition to the Technical Accelerator systems, this program will also address the issues of Safety, Quality Assurance, Operations, Reliability, and Maintainability. Optimization of the facility for experimental High Energy Physics research potential will also be made. Also includes costs of laboratory technical support, administrator services and management costs.

1. Title and location of project:	Superconducting Super Collider (SSC) Ellis County, Texas	2a. Project No.: 90-R-106 2b. Construction Funded

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements (Continued)

2. Other Project Costs (continued)

(b) Pre-Operation Costs

Pre-Operations costs are projected for the operations of each injector accelerator system and collider sector until commissioning of that element is completed. The successive completion of the Linac, LEB, MEB, and HEB injectors is forecast beginning in FY 1994. The costs for pre-operations include manpower, materials, power, and utilities associated with the commissioning of each accelerator system. Operating costs of technical systems beyond the completion of commissioning are to be covered outside of the TPC, as are general laboratory operating costs not directly related to the construction project.

(c) Initial Complement of Detectors

The baseline provides an allowance of $910 million of US funds for the initial complement of detector systems for the SSC, for detector R&D and for computing requirements. Anticipated foreign participation will enhance the capability of the initial detectors.

b. Related Annual Funding

Total costs are estimated for the operation of the SSC laboratory facility in the first full year of operation after construction completion. The projected costs for laboratory operations, capital equipment, GPP, and accelerator improvements are included.