

DEPARTMENT OF ENERGY
FY 1992 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. The SSC holds the potential for new breakthroughs in science, technology and education. 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 part of the Administration's 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. It will produce discoveries, innovations and spin-offs 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. A preliminary design and cost estimate developed in the 1986 Conceptual Design Report and supporting documentation have served as a baseline for the project. 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 since 1986. This forms the basis for the technical, cost and schedule baseline for the SSC developed by the Department in September of 1990. The baseline TPC is \$8.249 billion (as-spent), with completion projected by the end of FY 1999.

There has been substantial progress on the Superconducting Super Collider (SSC) in 1990. The management of the SSC Laboratory has recently been substantially strengthened, and we now have a very strong management team with a combination of major construction and technical project experience. The Department has established an On-Site Project Office, with sufficient resources and the appropriate delegation of authority and responsibilities to the Project Director to ensure that the SSC is built to the cost and schedule baseline. A major step forward in the collider superconducting dipole magnet program was taken recently with the selection of the leader and follower contractors for the engineering development and demonstration of manufacturability phase of this program. The architect-engineer/construction management firm for the project has been selected and is under contract. Additionally, even in the current climate of budget and economic restraint, we have obtained a commitment from the State of Texas for a total contribution of \$149 million for FY 1991. The support from Texas is key to maintaining the project's momentum in FY 1991 and is in concert with a Memorandum of Understanding signed with the Texas National Research Laboratory Commission, outlining principles of agreement between the Department and the State of Texas.

The request for Federal funds in FY 1992 includes \$103,593,000 in operating funds for continued R&D on superconducting magnets, R&D on other accelerator technical systems, R&D on detector subsystems, and DOE program direction costs; \$56,340,000 in capital equipment funds for detector subsystem prototypes, accelerator component 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, \$373,767,000 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. In addition to the Federally-funded activities described above, construction of on-site facilities and work on technical systems is expected with funds contributed by the State of Texas. 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. Exact funding contributions for each

fiscal year will be agreed upon annually. Some international contributions to accelerator construction and detectors may become available in FY 1992 in the form of design work on subsystems and components. Advanced teams and delegations led by the Deputy Secretary have visited Japan, Korea, Western Europe and Canada. Negotiations with India have begun and discussions with the Soviets are beginning.

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 (dollars in thousands)
 LEAD TABLE
 Superconducting Super Collider (SSC)

Activity	FY 1990 Actual	FY 1991 Estimate	FY 1992 Base	FY 1992 Request	Program Change Request vs Base	
					Dollar	Percent
Operating Expenses.....	\$69,587 a/b/	\$116,000	\$116,620	\$103,593	\$- 13,027	- 11%
Capital Equipment.....	20,706	33,000	33,000	56,340	+ 23,340	+ 71%
Construction.....	126,592	93,866	93,866	373,767	+279,901	+ 298%
Total.....	\$216,885 c/	\$242,866 c/	\$243,486	\$533,700 c/	+\$290,214	+ 119%
Operating Expenses.....	(\$69,587)	(\$116,000)	(\$116,620)	(\$103,593)	- 13,027	+ 11%
Capital Equipment.....	(20,706)	(33,000)	(33,000)	(56,340)	+ 23,340	+ 71%
Construction.....	(126,592)	(93,866)	(93,866)	(373,767)	+ 279,901	+ 298%
Total Program.....	(\$216,885)	(\$242,866)	(\$243,486)	(\$533,700)	+\$290,214	+ 119%
Staffing (FTEs).....	15	58	70	89		

Authorization: Section 209, P.L. 95-91.

- a/ Includes \$2,400,000 reprogrammed from SSC Construction for 18 additional FTEs. Does not include \$838,000 in in FY 1990 General Science Program Direction support.
- b/ Total has been reduced by \$847,000 reprogrammed to Energy Supply for SBIR.
- c/ 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.

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SUMMARY OF CHANGES

Superconducting Super Collider (SSC)

FY 1991 Appropriation.....	\$ 242,866
Adjustments - Increased personnel costs.....	<u>+ 620</u>
FY 1992 Base.....	\$ 243,486
 <u>SSC R&D and Operations</u>	
- R&D to concentrate on design of superconducting magnets and development of designs for the injectors, other collider technical systems and detectors.....	- 16,307
- Additional personnel and support costs.....	+ 3,280
 <u>Capital Equipment</u>	
- Equipment in support of SSC accelerator and detector R&D programs and for general purpose equipment essential to set up a new laboratory.....	+ 23,340
 <u>Construction</u>	
- Enhanced level of SSC construction for major efforts on both technical components and conventional facilities.....	<u>+279,901</u>
FY 1992 Congressional Budget Request.....	\$ 533,700

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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.

This subprogram also provides the Federal staffing resources and associated funding required to plan, direct, 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 approval of the Office of Superconducting Super Collider (OSSC) which reports directly to the Director of Energy Research. An SSC On-Site Project Office (SSCPO) at the SSC site in Texas has also been established which reports directly to OSSC.

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

Program Activity	FY 1990 Enacted	FY 1991 Enacted	FY 1992 Request	% Change
SSC R&D.....	\$ 67,187	\$ 108,900	\$ 92,593	- 15
SSC Program Direction.....	2,400	7,100	11,000	+ 55
Total, SSC Research, Development and Operations	\$ 69,587	\$ 116,000	\$ 103,593	- 11

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

Program Activity	FY 1990	FY 1991	FY 1992
SSC Research, Development and Operations			
SSC R&D	<p>The three major emphases of the FY 1990 R&D program were superconducting dipole magnet R&D, the development of the site-specific conceptual design and cost estimate, and detector R&D. The superconducting magnet R&D program under the guidance of the SSC Laboratory continues to be pursued largely at Fermilab, BNL, and LBL pending establishment of on-site facilities in Texas. The program of fabrication and testing of full-length 4cm magnets has been highly successful. The development of the new 5cm aperture design is now underway. Accelerator R&D includes developing design specifications and technical systems requirements for injector and collider technical systems, integration of technical systems, establishing primary beam parameters, beam dynamics and particle tracking studies, and the fabrication and testing of prototypes of accelerator components and systems. The detector R&D program includes continuation of the generic detector R&D program and the initiation of a program of detector subsystems R&D.</p>	<p>In FY 1991 the superconducting magnet R&D program will continue fabricating and testing 40mm magnets, further refine and develop the design of the 50mm magnets and test that design with short model magnets, fabricate and prepare for testing the first full-length 50mm magnets, continue R&D on superconductor, work with the industrial vendors to prepare for producing the first dozen test magnets, and begin preparations for the magnet string test scheduled for late in FY 1992. A significant portion of the work is conducted at other laboratories. Accelerator R&D will include refinement of the design of the injector accelerators & collider technical systems, the fabrication and testing of prototypes of components, the development of specifications for long lead procurements, and preparation of the accelerator systems required for the magnet string tests. The detector R&D will focus on an enhanced program of detector subsystem R&D and the development of detailed proposals for specific detectors.</p>	<p>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 (\$31,800). 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 (\$30,100). Detector subsystem R&D will continue at a reduced level and the emphasis will progressively shift toward specific approved detectors after first stage approval of experiments early in FY 1992 (\$4,600). The remainder of the request is needed to support general laboratory operations such as laboratory management and administration, and the laboratory's, technical and experimental support groups (\$26,093).</p>
	\$ 67,187	\$ 108,900	\$ 92,593

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

Program Activity	FY 1990	FY 1991	FY 1992
SSC Program Direction	<p>Provided funds for salaries, benefits, and travel for 15 full-time equivalents (FTEs) in the Office of Superconducting Super Collider (OSSC) and at the on-site Chicago Support Office. (\$1,423)</p> <p>The OSSC-HQ provided program direction and management oversight of the DOE SSC program totaling \$217 million as well as the non-Federal funding contributions. R&D focused on magnet industrialization, detectors, engineering and fabrication of injectors, accelerator R&D, physics, and theoretical analyses. External relations increased, particularly with Texas regarding land acquisition and funding contributions. State and international agreements for cost-sharing arrangements were being negotiated. Workload related to project management plans, briefings, reviews, and documentation continued to be heavy. OSSC-HQ staff has primary responsibility for project control activities as well as policy and technical direction to the on-site SSC Project Office (SSCPO).</p>	<p>Provide funds for salaries, benefits, and travel for 58 FTEs for OSSC, including 6 additional FTEs above the FY 1991 budget. (\$5,910)</p> <p>Provide 22 FTEs to staff the OSSC-HQ to manage an SSC program with a total FY 1991 budget of \$392 million which includes non-Federal contributions. Significant staff time will be expended on negotiation and implementation of cost-sharing arrangements with Texas and foreign partners. Continue to manage the expanded scientific R&D program and provide guidance and oversight from HQ on detailed design and civil construction activities. Manage the project baseline at the HQ level and meet the heavy demand for project reviews, briefings and information requests from the Congress, public and media. Provide ES&H support to ensure safe and efficient project implementation, including completion of the Supplemental Environmental Impact Statement and the associated Record of Decision.</p>	<p>Provide funds for salaries, benefits, and travel for 83 FTEs for the Office of SSC and 6 FTEs for Energy Research support personnel, including 5 FTEs transferred from other Energy Research programs. Provide for 31 additional FTEs above the revised FY 1991 level and for normal increased personnel costs resulting, for example, from general pay raises and within-grade and merit increases. (\$8,950)</p> <p>Provide 28 FTEs to continue to staff the OSSC-HQ to manage the DOE SSC program and additional non-Federal contributions. Continue negotiation and implementation of detailed cost-sharing arrangements with Texas and foreign countries. Continue accelerator R&D programs to finalize conceptual designs of superconducting magnets, injector accelerators and other technical systems, and fabricate and test models of components. Manage increased workload related to detailed detector design and prototyping activities. Continue to manage project control at the HQ level and meet demands for project reviews, briefings, information requests, ES&H, and other program support requirements of the SSC project.</p>

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

Program Activity	FY 1990	FY 1991	FY 1992
SSC Program Direction (Cont'd)	<p>Began to staff the SSCPO to provide technical guidance and support activities at the site, with the State of Texas, and with the M&O contractor; provide guidance and oversight on the scientific program and monitor technical progress; provide engineering and construction support; maintain project control at the field level; and ensure ES&H and quality assurance control and compliance. Provided on-site contract administration, industrial relations, personnel, and administrative services. Provided OSSC-HQ assistance as required.</p>	<p>Provide 36 FTEs to staff the SSCPO, including the addition of 6 FTEs above the FY 1991 budget base to ensure that the appropriate oversight and management are available at the on-site office to ensure that cost and schedule baselines are met and to implement recent delegations of personnel and procurement authority. Provide project oversight and guidance and manage on-site systems engineering and civil construction activities including site preparation, campus buildings, and injector facilities. Oversee development of technical systems such as the collider dipole magnets. Interact daily with M&O contractor staff and State of Texas representatives. Assist OSSC-HQ as required.</p>	<p>Provide 55 FTEs to continue to staff the SSCPO to provide 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. Continue to provide project oversight of construction activities at the site, monitor the many design and development efforts for technical systems, oversee the laboratory's procurement and business activities, administer the M&O contract, and provide administrative support at the site. Serve as focal point for daily interactions with M&O contractor staff, State of Texas representatives, and OSSC-HQ and others as required.</p>
	<p>Provided a variety of program support to the OSSC-HQ and SSCPO such as printing and binding, supplies and materials, and contractual support such as relocation services, telecommunications and rents. (\$977)</p>	<p>Provide for a variety of program support as in FY 1990 at an increased level to support the additional staff. Provide for rents at the site, employee relocations, and other services at the SSCPO. (\$1,190)</p>	<p>TRANSFER: Provide six FTEs for ER program and management support to the SSC in the areas of budget and finance, personnel administration, acquisition and assistance, policy review and coordination, and construction management support. Five FTEs were transferred from other ER programs. The additional FTE is required for increased support to the complex SSC project.</p>
	\$ 2,400	\$ 7,100	\$ 11,000

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

Program Activity	FY 1990	FY 1991	FY 1992
SSC Research, Development and Operations	\$ 69,587	\$ 116,000	\$ 103,593

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KEY ACTIVITY SUMMARY

SUPERCONDUCTING SUPER COLLIDER (SSC)

I. Preface: SSC 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 initial 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: SSC Capital Equipment

Program Activity	FY 1990 Enacted	FY 1991 Enacted	FY 1992 Request	% Change
SSC Capital Equipment.....	\$ 20,706	\$ 33,000	\$ 56,340	+ 71
Total, SSC Capital Equipment	\$ 20,706	\$ 33,000	\$ 56,340	+ 71

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

Program Activity	FY 1990	FY 1991	FY 1992
SSC Capital Equipment	<p>Provides capital equipment in support of the SSC R&D programs and for establishing an effective research laboratory. The FY 1990 equipment acquisitions include prototypes of detector subsystems and accelerator technical components and systems for the four injectors and the collider; computing equipment; equipment needed to establish on-site magnet testing and development capabilities, and a variety of power supplies, electronics, test instrumentation, and other equipment needed when establishing a major new research laboratory.</p>	<p>In FY 1991 there will be an enhancement in the level of prototypes of detector subsystems and components, an increase in accelerator component and systems prototyping and an enhanced level of equipment required to establish a new laboratory.</p>	<p>Provides for fabrication of prototypes for detector subsystems and components (\$29,540); prototypes of accelerator components and systems for the four injector accelerators and the collider and equipment for on-site testing (\$14,900); equipment in support of the magnet R&D effort (\$5,300), a variety of items of general laboratory technical support equipment that are essential when establishing a new research laboratory (\$6,600).</p>
	\$ 20,706	\$ 33,000	\$ 56,340
SSC Capital Equipment	\$ 20,706	\$ 33,000	\$ 56,340

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

Program Activity	FY 1990	FY 1991	FY 1992
SSC Research, Development and Operations			
SSC R&D	<p>The three major emphases of the FY 1990 R&D program were superconducting dipole magnet R&D, the development of the site-specific conceptual design and cost estimate, and detector R&D. The superconducting magnet R&D program under the guidance of the SSC Laboratory continues to be pursued largely at Fermilab, BNL, and LBL pending establishment of on-site facilities in Texas. The program of fabrication and testing of full-length 4cm magnets has been highly successful. The development of the new 5cm aperture design is now underway. Accelerator R&D includes developing design specifications and technical systems requirements for injector and collider technical systems, integration of technical systems, establishing primary beam parameters, beam dynamics and particle tracking studies, and the fabrication and testing of prototypes of accelerator components and systems. The detector R&D program includes continuation of the generic detector R&D program and the initiation of a program of detector subsystems R&D.</p>	<p>In FY 1991 the superconducting magnet R&D program will continue fabricating and testing 40mm magnets, further refine and develop the design of the 50mm magnets and test that design with short model magnets, fabricate and prepare for testing the first full-length 50mm magnets, continue R&D on superconductor, work with the industrial vendors to prepare for producing the first dozen test magnets, and begin preparations for the magnet string test scheduled for late in FY 1992. A significant portion of the work is conducted at other laboratories. Accelerator R&D will include refinement of the design of the injector accelerators & collider technical systems, the fabrication and testing of prototypes of components, the development of specifications for long lead procurements, and preparation of the accelerator systems required for the magnet string tests. The detector R&D will focus on an enhanced program of detector subsystem R&D and the development of detailed proposals for specific detectors.</p>	<p>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 (\$31,800). 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 (\$30,100). Detector subsystem R&D will continue at a reduced level and the emphasis will progressively shift toward specific approved detectors after first stage approval of experiments early in FY 1992 (\$4,600). The remainder of the request is needed to support general laboratory operations such as laboratory management and administration, and the laboratory's, technical and experimental support groups (\$26,093).</p>
	\$ 67,187	\$ 108,900	\$ 92,593

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

Program Activity	FY 1990	FY 1991	FY 1992
Construction	<p>Provides initial construction funding for the SSC. Permits a significant program of detailed design of technical components and conventional facilities, initiation of the magnet industrialization program, selected long lead procurements for the injectors, and build-up of the laboratory staff and support capabilities.</p>	<p>Provides for detailed design of technical systems and conventional facilities, including the AE/CM contractor. Technical systems construction includes procurement of linac components (RFQ and klystrons), cryogenics and control systems. The magnet program includes the dipole industrial contract, initiation of the quadrupole contract and procurement of components for the magnet development and test laboratories. Conventional construction includes the award of the first collider, three buildings in the magnet facility, the linac enclosure, the Accelerator System String Test (ASST), cryogenics and support facilities in the E-1 area, the accelerator shop and warehouse, and some utilities and infrastructure.</p>	<p>Provides \$194,000 for the magnet program, including the Collider Dipole Magnet Industrialization Program which includes the development and acquisition of tooling, the fabrication of 15 prototype magnets by industry 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 contract, 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 \$43,000 for detailed design of conventional facilities (collider tunnel, injector enclosures, campus buildings, and other surface facilities); \$44,000 for collider system technical components other than the superconducting magnets; and \$41,000 for injector technical systems for the linac, Low Energy Booster (LEB) and Medium Energy Booster (MEB); Conventional facilities construction includes the award of the first collider tunnel sector and initiation of construction in the fourth quarter of FY 1992 (\$59,000); onsite utilities and roads for the west east campuses, and the administration building at the west interaction region (\$106,000), and the LEB enclosure is constructed in total and construction of the MEB enclosure is initiated (\$20,000). Also provides \$17,000 for project management and administration.</p>

Of the total construction requirement of \$524,000 described above it is expected that approximately \$150,000 will be met with expected non-Federal

III. Construction (Cont'd):

Program Activity	FY 1990	FY 1991	FY 1992
Construction (Cont'd)	\$ 126,592	\$ 93,866	\$ 373,767
Construction	\$ 126,592	\$ 93,866	\$ 373,767

contributions, primarily from the state of Texas (\$130,000). It is expected that their funds would primarily be used for the conventional construction activities in the areas of collider facilities and injector facilities. The Federal construction funding requirement is therefore estimated to be \$373,767.

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KEY ACTIVITY SUMMARY

CONSTRUCTION PROJECTS

Superconducting Super Collider

IV. A. Construction Project Summary

<u>Project No.</u>	<u>Project Title</u>	<u>Total Prior Year Obligations</u>	<u>FY 1991 Request</u>	<u>FY 1992 Request</u>	<u>Unappropriated Balance</u>	<u>TEC</u>
90-R-106	Superconducting Super Collider	\$ 126,592	\$ 234,844	\$ 523,767	\$5,466,000	\$6,351,203
	Less Estimated Non-Federal Contributions	(0)	(140,978)	(150,000)	(2,301,000)	(2,591,978)*
<hr/>						
Total, Federal Superconducting Super Collider Construction		<u>\$ 126,592</u>	<u>\$ 93,866</u>	<u>\$ 373,767</u>	<u>\$3,165,000</u>	<u>\$3,759,225</u>

* Estimate based on DOE goal for non-Federal participation in SSC. Firm agreements are yet to be negotiated.

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KEY ACTIVITY CONSTRUCTION PROJECT SUMMARY

Superconducting Super Collider (SSC)

IV. B. Plant Funded Construction Project

1. Project title and location: 90-R-106
 Superconducting Super Collider (SSC)
 Ellis County, Texas
- Project TEC: \$6,351,203^{a/}
- Start Date: 1st Qtr. FY 1990
 Completion
 Date: 4th Qtr. FY 1999^{a/}

2. Financial schedule:

<u>Fiscal Year</u>	<u>Appropriated^{a/}</u>	<u>Obligations</u>	<u>Costs</u>
1990	126,592	102,704	84,995
1991	234,844	258,732	185,900
1992 ^{b/}	523,767	523,767	390,300
1993	710,688	710,688	673,900
1994	972,757	972,757	938,400
1995	1,010,321	1,010,321	1,021,100
1996	1,092,829	1,092,829	1,114,100
1997	875,481	875,481	998,200
1998	686,510	686,510	801,900
1999	117,414	117,414	142,408

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.

^{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. The data presented are estimates based on obtaining one-third of the Total Project Cost from non-Federal contributions. 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/} Reflects savings of \$6.3 million BA and \$4.7 million BO due to proposed David Bacon Amendment.

- 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 1992. The request for appropriated funds includes: \$43 million for conventional facilities design, \$185 million for conventional facility construction, \$41 million for injector technical systems fabrication, \$194 million for superconducting magnet program, \$44 million for collider technical system fabrication (other than the superconducting magnets); and \$17 million for project management, support equipment, and rental space of the \$524 million requirement for construction, it is estimated that \$150 million will be provided from non-Federal funds, resulting in a requirement for \$374 million of Federal funds. No tunnel construction will occur before the 4th quarter of FY 1992.
- Total BA funding for the project including construction, detectors and R&D and preoperational costs in escalated dollars are:

	(Dollars in Millions)												
	<u>FY 1988</u>	<u>FY 1989</u>	<u>FY 1990</u>	<u>FY 1991</u>	<u>FY 1992</u>	<u>FY 1993</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY1999</u>	<u>Total</u>
Total Project Funding	\$ 33.0	\$ 97.6	\$ 214.5	\$ 384.8	\$ 672.7	\$871.1	\$1,137.6	\$1,194.1	\$1,302.7	\$1,101.7	\$915.9	\$323.4	\$8,249.1
Estimated Non-Federal Contributions	0	0	0	149.0	150.0	233.0	427.0	466.0	570.0	250.0	250.0	105.0	2,600.0
Federal Share ^{ε/}	\$ 33.0	\$ 97.6	\$ 214.5	\$ 235.8	\$ 522.7	\$638.1	\$ 710.6	\$ 728.1	\$ 732.7	\$ 851.7	\$665.9	\$218.4	\$5,649.1

ε/ Excludes direct Federal management and on-site administrative costs shown below. (BA in Thousands)

	<u>FY 1990</u>	<u>FY 1991</u>	<u>FY 1992</u>	<u>FY 1993</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>
Program Direction.....	\$ 2,400	\$ 7,100	\$11,000	\$11,900	\$12,400	\$13,000	\$13,700
FTE's.....	15	58	89	96	96	96	96

4. Total Project Funding (BA in Thousands): (Federal Share - excludes Program Direction)

	Prior <u>Years</u>	<u>FY 1990</u>	<u>FY 1991</u>	<u>FY 1992</u>	<u>FY 1993</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>
Construction.....	\$ 0	\$126,592	\$ 93,866	\$373,767	\$477,688	\$545,757	\$544,321	\$522,829
Operating Expenses & Capital Equipment.....	130,585	87,893	141,900	148,933	\$160,412	\$164,843	\$183,779	\$209,871