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FEDERAL RESEARCH

Superconducting Super Collider's Total Estimated Cost Will Exceed \$11 Billion

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Division



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Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today to discuss the Department of Energy's (DOE) Superconducting Super Collider (SSC). My testimony will focus on the current estimated cost of constructing the SSC and on indications that this estimated cost will further increase. The testimony is drawn from our two recent reports that discuss the cost and schedule status of the SSC,¹ updated to address your concerns about the prime contractor's management and control of the project's baseline cost estimate.

In summary, we found that management problems continue to hinder accurate and timely reporting of the SSC project's cost and status. While the project's total cost cannot be reliably estimated, we feel certain that it will exceed \$11 billion. The SSC project's prime contractor, Universities Research Association Inc. (URA), and DOE have been slow to disclose project costs and anticipated cost increases. As a result, the Congress has not received timely and complete information on the project's status and expected cost.

We have previously reported that SSC project costs will exceed \$11 billion because some costs were omitted from the baseline cost estimate and because the project's construction schedule is being stretched out an additional 3 years. In January 1991, DOE estimated the project's cost at \$8.25 billion, but the agency omitted \$1.2 billion in costs to be funded from other sources--\$600 million from other federal sources and the rest from nonfederal sources. In addition, the administration has proposed to stretch out the project's completion schedule and reduce the project's planned annual funding. Stretching out the schedule 3 years would cost at least \$1.6 billion.

We have since found indications that the project's total cost could increase beyond the \$11 billion we previously reported. URA has provided us documents identifying potential cost increases of \$2 billion, of which URA and DOE officials said at least \$600 million are likely. Such an increase could deplete the balance of the project's \$843-million budgeted contingency.² If the identified potential cost increases materialize and deplete the contingency balance, additional cost increases will either need to be offset by savings from work on other project elements or they will increase the total cost of the project. URA still needs to complete over 80 percent of the project, including elements URA considers to be of high risk, such as the high energy booster accelerator and the production of the superconducting magnets. In addition to potential increases to the project's total cost, the

¹Federal Research: Super Collider Is Over Budget and Behind Schedule (GAO/RCED-93-87, Feb. 12, 1993) and Federal Research: Super Collider--National Security Benefits, Similar Projects, and Cost (GAO/RCED-93-158, May 14, 1993).

²According to DOE, cost increases that result from scope increases or other project enhancements may be funded from DOE's contingency fund. A contingency fund of \$843 million is included in DOE's January 1991 baseline cost estimate of \$8.25 billion.

federal share of the project's cost may increase due to a \$1.3 billion shortfall in foreign funding.

BACKGROUND

The SSC is intended to be the world's largest particle accelerator--a basic research tool for seeking fundamental knowledge about matter and energy. In 1987, DOE reported to the Congress that the total cost of the SSC project would be an estimated \$5.3 billion (in current year dollars), assuming that the project would be completed in 1996.³ In January 1991, DOE estimated that the SSC would be completed in 1999 at a total cost of \$8.25 billion (in current year dollars). About two-thirds of the estimated cost is to be funded by federal sources--\$5.6 billion--and one-third by nonfederal sources (primarily the state of Texas and foreign countries). Until recently, DOE had maintained that the cost and schedule estimates reported in January 1991 would be met. By the end of fiscal year 1993, about \$1.6 billion will have been invested in the project.

The SSC is being constructed in Ellis County, Texas, about 30 miles south of Dallas. The SSC is composed of three general segments: the injector, collider, and detector. The injector is essentially four interlinked accelerators, each used to increase the energy of the proton beam. The final accelerator in this injection process will be the High Energy Booster, which will be twice as large as any existing particle accelerator. The protons will be injected into the collider, where they will be accelerated in opposite directions into two 54-mile rings. These two beams of protons will be directed to interaction areas, where they will be made to collide at an energy of 40 trillion electron volts (TeV). The principal components of the accelerators are magnets that steer and focus the beams of protons around the rings. As proposed, the SSC will include two large general-purpose detectors that will record the collisions for analysis by physicists.

As the SSC project's prime contractor, URA is to design, construct, and manage the SSC Laboratory. As a nonprofit organization of research universities, URA has had access to the technical talent necessary for designing and building the SSC, but it did not have corporate procedures and support systems for managing such a large project. The project's organization, management, procedures, accounting systems, etc., had to be developed as the program was executed. URA is contractually required to implement a Cost and Schedule Control System and related support systems. The Cost and Schedule Control System, using the baseline cost estimate and other accounting data, periodically reports the status of the cost and schedule of the project, and the project's estimated cost at completion, for management attention. When fully implemented, such a system would show tasks that are ahead of or behind schedule and/or under or over budget. A controlled baseline cost estimate is one of

³Cost estimates in current year dollars are estimates of total costs as spent in the year of expenditure.

the key elements used in the required Cost and Schedule Control System. A project's baseline cost estimate should include all tasks needed to complete the project, and any change to the baseline estimate should be accounted for by Configuration Control Board established for that purpose. Trends can be extrapolated from the data to produce a range of cost and schedule estimates for the project's completion or for the project's major segments.

URA has awarded subcontracts for conventional construction and for the production and design of project equipment, such as superconducting magnets. Two groups of scientists have been selected to collaborate on the design, assembly, and installation of the two large detectors.

GAO REPORTED THAT THE SSC'S TOTAL COST WILL EXCEED \$11 BILLION

In May 1993, I testified that the total estimated cost for constructing the SSC will exceed \$11 billion (in current year dollars).⁴ DOE's January 1991 estimate of \$8.25 billion for the total project cost did not include about \$1.2 billion in costs that were expected to be funded by other federal and nonfederal (Texas and foreign countries) sources. In addition, the administration had proposed stretching out the project's completion schedule and reducing the project's planned annual funding. Although the precise impact of this proposal had not been fully analyzed, we noted that stretching out the schedule would increase the cost of the project by at least \$1.6 billion. In mid-June 1993, URA was still analyzing the effect of stretching out the schedule and was expected to report its preliminary results to DOE in July 1993.

Some Known Costs Were Excluded From DOE's Estimate

Our February 1993 report pointed out that DOE's January 1991 cost estimate of \$8.25 billion excluded some costs that were expected to be funded from sources other than the DOE appropriation for construction. The baseline \$8.25 million estimate does not include a total of over \$1.2 billion in costs DOE excluded from its January 1991 estimate. This \$1.2 billion includes

-- about \$543 million for the detectors, for which the SSC project is seeking primarily nonfederal funding (\$80 million from other federal sources, \$35 million from Texas, \$329 million from foreign countries, and \$99 million from undetermined nonfederal sources);

⁴Federal Research: Superconducting Super Collider Cost and Schedule (GAO/T-RCED-93-47, May 26, 1993).

- about \$400 million to be funded by DOE's High Energy Physics Program for laboratory preoperations costs for operating the four injector accelerators prior to commissioning the collider;
- about \$118 million through fiscal year 1999 for DOE program direction costs to operate the SSC project office; and
- about \$60 million in land costs and \$125 million in infrastructure and general support costs, which the state of Texas is contributing.

In commenting on this issue, DOE officials told us that their agency has historically omitted such costs from the estimated cost of its previous accelerator projects; therefore, DOE believes that the omission of such costs from the SSC's cost estimate is consistent with the agency's historical practices. We have reported on this practice of omitting such costs in the past, pointing out that such omissions make it difficult for the Congress to assess the affordability of such projects; consequently, we have recommended that DOE furnish the complete costs of projects to the Congress.⁵ DOE officials noted that although some costs were not included in the estimated total project cost, examples of the types of costs excluded were disclosed in DOE's January 1991 cost and schedule baseline report.

Reduced Federal Funding Will Stretch Out the Schedule and Increase Costs

DOE's January 1991 cost estimate assumes that the project will be completed in 1999 and that DOE will receive funding according to a timely construction schedule. Our February report cautioned that as the project's peak funding period approaches, DOE's funding profile would have to be met or closely approximated if the project is to be completed within the estimated cost and schedule. To illustrate, we referred to an SSC Laboratory study that stated that at an annual federal funding level of \$650 million, the SSC project would require an additional 18 months and an additional \$570 million (in current year dollars) to complete. In preparing this projection, the SSC Laboratory assumed that all constraints, other than the level of federal funding received, would remain the same as those used in preparing the January 1991 baseline estimate.

At our request, the SSC Laboratory also prepared a profile using a \$550 million funding cap. The SSC Laboratory's analysis showed that the project could not be completed at a \$550 million federal funding level because overhead costs and reductions in buying power would consume most of the available funds after fiscal year 2000. A DOE official pointed out that this analysis, as well as the analysis for a \$650 million funding cap, assumed that the approach for building the SSC would not change. He explained that if it were known

⁵Nuclear Science: Information on DOE Accelerators Should Be Better Disclosed in the Budget (GAO/RCED-86-79, Apr. 9, 1986).

that less funding would be available, management could, within limits, restructure the work to fit the available funding. The DOE Project Director added that restructuring the work can deal with funding caps up to a point; at some level, funding would be too low to complete the project.

In April 1993, the President included \$640 million for the SSC in his fiscal year 1994 budget request. The federal funding projected for fiscal year 1995 was \$551 million, rising slightly each year to \$591 million in fiscal year 1997 and increasing to \$812 million in fiscal year 1998. The reduction in funding after fiscal year 1994 will increase the project's cost because it will lengthen the time required to complete the project and increase the amount of funding consumed by inflation and overhead costs. As disclosed in the President's budget request, DOE estimated that funding amounts that are below the planning assumptions for fiscal years 1994 through 1998 would increase the SSC's total cost by about \$2 billion in current year dollars, plus or minus 20 percent (\$1.6 billion to \$2.4 billion), and would delay the project's completion by 3 years.

The DOE Project Director requested the SSC Laboratory to prepare a revised baseline budget and schedule by July 1, 1993. As we noted in our May 1993 report, a key assumption in the guidance the Director provided was for the laboratory to assume that funding beyond fiscal year 1998 would be received as necessary to complete the SSC in fiscal year 2003.⁶ This assumption will ensure that the SSC Laboratory's analyses will show that the project can be completed with the federal funding levels included in the President's fiscal year 1994 budget request. If, however, annual funding continues to be constrained after fiscal year 1997 at the same level projected in the President's budget request for fiscal years 1995 through 1997, costs may increase indefinitely and the project may never be completed.

As of late June 1993, URA had not completed its revised baseline budget and schedule. According to URA officials, their analysis of the effect of the President's proposed stretch out was slightly behind the original schedule, but the preliminary results of this analysis will be reported to DOE in July 1993.

PROJECT COSTS MAY FURTHER INCREASE

URA's Cost and Schedule Control System for managing the project is now operating, but the data incorporated into the system are still being refined and are not accurate. Until the data are accurate, the system cannot reliably report the project's cost and schedule, nor can it be used to reliably project the total cost. However, we found indications that the project's total cost may increase beyond the \$11 billion we reported in May 1993. For example, URA and DOE have been slow to disclose known cost increases, the project's contingency fund balance is overstated, and URA and DOE have identified potential cost

⁶According to a DOE official, the SSC Laboratory is to assume the project will be completed at the end of calendar year 2002 (the end of the first quarter of fiscal year 2003).

increases that could deplete most, if not all, of the remaining contingency fund balance. With over 80 percent of the project to be completed, little or no contingency funds are available to offset additional costs. Furthermore, the lack of accurate information on the project's total estimated cost hinders the Congress in carrying out its oversight responsibilities and making informed decisions.

Problems With the Baseline Cost Estimates and Accounting Records Hinder Implementation

As prime contractor, URA is required to maintain the integrity of the baseline by properly recording project changes against the project baseline estimate and incorporating those changes in its Cost and Schedule Control System. Although URA is contractually required to implement such a system, it initially gave low priority to implementing the system. In May 1992, URA began training its managers in the importance of the Cost and Schedule Control System. In December 1992, URA produced its first monthly cost performance report from the system. The monthly reports are not yet producing accurate information primarily because of problems with the project's baseline costs and the allocation of costs among tasks.

As of late June 1993, URA was still trying to reconcile its approved baseline changes with those reported in its Cost and Schedule Control System. URA plans to change the way it has allocated costs so that they can be better compared with the appropriate tasks in the baseline estimate. Without corrections made to the baseline and cost allocations, the reports generated by the Cost and Schedule Control System are also inaccurate and cannot be relied on for monitoring the project's status or progress. A reliable system--with trend analysis showing the estimated cost and schedule for completing the project--will not be available until the system has accurate data to generate accurate reports.

Cost Increases Not Disclosed in a Timely Manner

URA and DOE have been slow to formally record cost increases as they become known. We found the DOE contingency fund is overstated and potential future costs could outstrip available contingency. Some cost increases were known, but have not been recorded for over two years. DOE and URA managers need complete and timely records in order to effectively manage the project, and the Congress needs full disclosure of costs for carrying out its oversight responsibilities.

Of the \$843 million in the baseline for contingencies, DOE had approved the use of about \$48 million, or about 6 percent, as of June 1993; however, this does not reflect the total additional known costs that the project is experiencing. In May 1993, URA acknowledged that a number of approved and pending project changes that require additional funding had not been posted. In accounting for unposted changes, URA acknowledged that

the SSC project had a negative balance of \$53 million in its management reserve account.⁷ Furthermore, we found that URA had an additional \$22 million in approved project changes and errors in recording that were to be charged against management reserve. In effect, this management reserve of negative \$75 million is an undisclosed claim against DOE's contingency.

Other cost increases were identified by URA, but were not recorded in the baseline cost estimate. For example, the January 1991 baseline did not reflect some of the costs associated with having a leader-follower approach for contracting for the superconducting dipole magnets to be used for steering the proton beams around the collider rings. In July 1991, URA awarded two superconducting magnet development contracts for which the award amounts totaled about \$117 million over the magnet baseline cost estimate. URA did not adjust the baseline estimate to reflect this increase. According to URA officials, this was because the increase will be offset by anticipated savings resulting from increased competition for the subcontracts for the magnets to be built during the full-rate production phase. More recent URA studies indicate that these savings may not be realized. We believe that URA should have recognized the increase in its estimates as soon as it was known and, if appropriate, separately recognized any anticipated savings in its estimate. In April 1993, URA began formally recognizing these costs.

Indications are that other cost increases are likely. About 2 weeks ago, URA provided us documents that identified potential cost increases totaling about \$2 billion. In discussing this issue, URA and DOE officials advised us that the documents were of a very preliminary nature and that much of the increased costs included in the \$2 billion had since been revised downward. URA and DOE officials estimated that the more realistic potential cost increase, aside from increases due to the stretch out, is about \$600 million. Many of the cost increases identified are a result of underestimates in the baseline cost estimate. For example, the baseline cost estimate for the URA's labor costs was underestimated by about \$200 million, according to the DOE Project Director. He advised us that the administrative costs for managing the SSC Laboratory are much higher than originally estimated.

These officials further advised us that some of the increases may be offset by savings totaling up to \$200 million. Such savings would result from increased contractor competition and from tunneling contracts being awarded under baseline. We have not yet verified the potential amounts of the increases or savings.

If the identified potential cost increases materialize, they would consume most, if not all, of the total funds available in the project's contingency. Without a contingency fund balance, any additional increase in cost would increase the project's total cost, unless

⁷According to DOE, cost increases from overruns are funded from URA's management reserve fund. Funds for the reserve are not provided for in DOE's January 1991 baseline cost estimate of \$8.25 billion, but are intended to be generated from project savings.

additional savings can be found to offset that increase. Future cost increases can be expected because over 80 percent of the project remains to be built, and many of the high technical and cost risk items such as High Energy Booster accelerator, the superconducting magnet production, and the collider installation remain to be completed.

DECISION ON WHETHER TO RELY ON FOREIGN CONTRIBUTIONS NEEDS TO BE MADE

In addition to the total cost of the project increasing, the federal share of the cost may increase. DOE still needs nearly all of the \$1.7 billion in foreign contributions it has been seeking if it is to meet the schedule and cost goals it established as part of its January 1991 estimate. In December 1992, we reported that only about \$15 million in foreign contributions had been received.⁸ We pointed out that the Congress faced a critical decision point for its funding of the SSC.

For fiscal year 1994, the SSC project's funding profile shows that about \$250 million in foreign contributions was needed. We reported in 1992 that without a major contribution from Japan in fiscal year 1994, the Congress would, in all likelihood, be faced with deciding whether to increase U.S. funding to make up for the shortfall in foreign contributions or to let the project's schedule slip further. A 1-year slip in the project's schedule could increase the SSC's cost by about \$400 million in current year dollars. Furthermore, we reported that the Congress would have to decide whether it would be willing to ask the U.S. taxpayer to bear a substantially larger portion of the SSC's cost in future years if Japan decided not to contribute to the project.

We advised the Congress that, as part of its consideration of fiscal year 1994 funding for the SSC, it should require DOE to provide the most complete, accurate, and up-to-date information available on the status of the agency's efforts to obtain contributions for the SSC from Japan and other foreign countries.

In a letter dated January 14, 1993, DOE provided the Congress with updated information on the funding status of the SSC project, including information on the extent of foreign contributions anticipated. DOE acknowledged that without a significant contribution from Japan, it was highly doubtful that the \$1.7 billion foreign funding goal could be met; DOE was confident that foreign commitments of only \$400 million could be obtained by fiscal year 1999.

⁸Federal Research: Foreign Contributions to the Superconducting Super Collider (GAO/RCED-93-75, Dec. 30, 1992).

CONCLUSIONS

Since the SSC was first proposed to the Congress in 1987, estimated costs have more than doubled--from \$5.3 billion to more than \$11 billion. We have since found indications that the cost could increase further. Potential cost increases that URA has identified could deplete the project's contingency fund with more than 80 percent of the project yet to be built. With much of the highly technical work still to be done, it seems unlikely that the project will be completed without incurring any additional cost increases, or that project savings will be sufficient to offset these increases. In addition, because URA and DOE have been slow to report cost increases, the Congress does not have timely and complete information for carrying out its oversight responsibilities and making informed decisions.

Furthermore, to preclude the SSC's cost from significantly increasing beyond the \$11 billion estimate, annual funding levels beyond fiscal year 1998 would need to be increased dramatically over those projected in the President's budget for fiscal years 1995 through 1997. Following DOE's guidance, the SSC Laboratory, in its current study of the impact of the President's proposed project funding, assumes that funding will increase in fiscal year 1998 and will not be constrained from fiscal year 1999 through the project's completion at the end of calendar year 2002. Unless the budget deficit is markedly reduced, such an assumption could prove unrealistic. Continued funding at the level projected for fiscal years 1995 through 1997 could lead to inflation and overhead costs consuming all available funding, thereby hindering the ability to complete construction.

The SSC project has reached a crossroads at which key funding decisions need to be made. At the end of fiscal year 1993, about \$1.6 billion will have been invested in the project. Currently, the SSC is over budget and behind schedule, and costs are expected to further increase as a result of funding constraints. Moreover, the congressional limit of \$5.6 billion for the federal share of the project's cost must increase. DOE currently expects to receive only \$1.4 billion from nonfederal sources--\$400 from foreign sources and \$1 billion from Texas. As a result, to complete the project the Congress will have to substantially increase the federal share of funding.

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Mr. Chairman, this concludes my prepared remarks. I would be pleased to respond to any questions from the Subcommittee at this time.

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