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FEDERAL RESEARCH

Superconducting Super Collider Cost and Schedule

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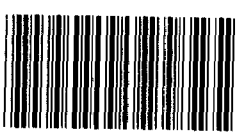

GAO/T-RCED-93-47

Mr. Chairman and Members of the Committee:

We are pleased to be here today to discuss the Department of Energy's (DOE) Superconducting Super Collider (SSC). Our testimony will be drawn primarily from our February 1993 report on the SSC project's cost and schedule,[1] as updated in our recent report to Senator John W. Warner.[2]

DOE has continued to make progress on the SSC project during the past year. Much conventional construction has been completed and tunneling has begun. The development of technical systems, such as the superconducting magnets, is advancing. To date, the Congress has provided about $1.6 billion toward the SSC's construction and will soon be considering the President's fiscal year 1994 budget request for additional funds. My testimony today points out a number of issues associated with the project's cost and schedule.

In summary we found that:

-- Management problems continue to hinder the construction of the SSC. The prime contractor still has not implemented a fully functioning Cost and Schedule Control System for managing the project. However, DOE's analyses of major subcontractors' work in progress as of August 1992 showed that the SSC project was over budget and behind schedule. To counter cost increases, DOE plans to follow a build-to-cost strategy that is intended to hold construction costs to baseline cost estimates by eliminating, reducing, or deferring some components, such as the detectors.

-- Because of these management problems, affordability issues have arisen. In estimating the project's cost at $8.25 billion, DOE omitted about $1.2 billion in costs to be funded from other sources. In addition, the administration has proposed to stretch out the project's completion schedule and reduce the project's planned annual funding. The total estimated cost is not yet known, but the project's total cost will exceed $11 billion. Furthermore, the federal share of the project's cost may rise if funding sought from foreign sources does not materialize. Although DOE set a goal of $1.7 billion in foreign contributions to the SSC, it is confident of obtaining only about $400 million.

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[1]Federal Research: Super Collider Is Over Budget and Behind Schedule (GAO/RCED-93-87, Feb. 12, 1993)

[2]Federal Research: Super Collider--National Security Benefits, Similar Projects, and Cost (GAO/RCED-93-158, May 14, 1993).

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 provided the Congress with an estimated total SSC project cost of $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 the federal government and one-third by nonfederal sources (primarily Texas and foreign countries). Until recently, DOE has maintained that the cost and schedule estimated in January 1991 would be met.

The SSC is being constructed about 30 miles south of Dallas, Texas. The accelerator complex, called the SSC Laboratory, is to consist of a series of five accelerators. The principal components of the accelerators are magnets that will steer and focus beams of protons, moving in opposite directions, until they collide, at nearly the speed of light. As proposed, the SSC will also include two large general-purpose detectors that will record the collisions for analysis by physicists.

The SSC project's prime contractor is Universities Research Association, Inc. (URA), a nonprofit corporation, which is to design, construct, and manage the SSC Laboratory. In managing the project, URA is contractually required to implement a Cost and Schedule Control System. When fully implemented, such a system shows tasks that are ahead of or behind schedule and/or under or over budget. Trends can be extrapolated from the data to produce a range of cost and schedule estimates for the project at completion or for major project 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, construction, assembly, and installation of the two large detectors.

MANAGEMENT PROBLEMS HINDER SSC'S CONSTRUCTION

The construction of the SSC is being hindered by management problems. Without a fully functioning Cost and Schedule Control System for managing the project, the project's costs cannot be reliably projected from URA's records. However, DOE's analyses of major subcontractors' work in progress as of August 1992 showed that the SSC project was over budget and behind schedule. To

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

counter cost increases, DOE plans to follow a build-to-cost strategy that may eliminate, reduce, or defer some components.

Cost and Schedule Control System Has Not Yet Been Implemented

URA still has not implemented a fully functioning Cost and Schedule Control System for managing the project. Although contractually required to implement such a system, URA initially gave low priority to implementing this system. In May 1992, URA began training its managers in the importance of the Cost and Schedule Control System, and URA has since made progress in implementation.

However, problems with URA's accounting system must be corrected for the Cost and Schedule Control System to work effectively. URA's accounting system has misallocated expenses among its accounts--overstating management costs and understating direct program costs. Without an accurate accounting system, 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. It may take several months to refine the system's operations to ensure reliable reporting. A fully functioning system--with trend analysis showing the estimated cost and schedule for completing the project--will not be available until the system generates accurate reports.

Work in Progress Was Over Budget and Behind Schedule

Analyses of the major subcontractors' work in progress showed that the SSC project was over budget and behind schedule. However, because DOE does not have a fully functioning Cost and Schedule Control System, it is not clear how much these increases will change the project's total cost and schedule.

Each of the major subcontractors reported being over budget and behind schedule as of August 1992. For example, reports prepared by the subcontractor for architectural and engineering services and for conventional construction, showed that, as of August 1992, work performed under its subcontract was $47 million, or 51 percent, over budget and 19 percent behind schedule. Reports by other major subcontractors, including those developing magnets, also identified both cost overruns and schedule delays.

At our request, DOE analyzed the major subcontractors' reports and projected cost trends to completion. DOE's projection of the trend to completion for the conventional construction subcontractor showed that the subcontractor would be about $630 million over the $1.25 billion baseline estimate. Trend analyses also predicted that the two major magnet subcontractors would have cost overruns on their development contracts. Cost overruns of $53 million, or

25 percent, for the dipole magnet development contractor, and of $25 million, or 37 percent, for the quadrupole magnet development contractor were projected.

In providing the trend projections, DOE asserted that it was too early to produce quality trend analyses. We noted that, as of August 1992--the date of the data analyzed--each subcontract had incurred 11, 16, and 21 percent of its total subcontract costs, respectively. While we agree that the subcontracts are in relatively early phases, we believe that the large projected cost increases indicated are of concern. Although it examined Department of Defense (DOD) contracts, a 1990 DOD study indicated that contractor cost performance does not improve after 15 percent of total contract costs are incurred.[4] This study, which was based on the DOD's experience since 1977 in more than 400 programs, found that without exception the cumulative cost performance does not improve, but tends to decline, between 15 percent and 85 percent of contract performance.

SSC Laboratory officials advised us that, following DOE's projection of the major contractor's costs, they revised the scope and value of the conventional construction subcontract. At the request of the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, we are currently examining the effect of the SSC Laboratory's actions on the project's cost and schedule.

DOE Is Following a Build-to-Cost Strategy

To counter cost increases, DOE plans to follow a build-to-cost strategy. This strategy is intended to hold construction costs to baseline cost estimates by eliminating, reducing, or deferring some components, such as the detectors. Such actions would reduce the SSC's experimental capabilities and could adversely affect the experimental research. Furthermore, if such components were added later, the overall cost to the government might increase.

To illustrate, DOE and the SSC Laboratory have been using the build-to-cost strategy for constructing the two large detectors, which are being designed to cost a total of about $1.1 billion. The project's baseline cost estimate allows about $596 million for the two large detectors--leaving about $500 million to be funded from other sources. Although most of this additional funding has been expected to come from foreign countries, such funding has been slow to materialize. If the funding from other sources is not received, DOE is considering deleting or deferring the installation of some detector components.

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[4]A-12 Navy Aircraft: System Review and Recommendations, Twenty-First Report by the Committee on Government Operations, H.R. Rep. No. 102-853, 2nd Sess., Aug. 27, 1992, pp. 31-69.

The absence of such components will reduce the experimental capabilities of the detector(s) and may adversely affect the experimental research. Although the physicists believe that both of the two large detectors are needed, some consideration is even being given to deferring the construction of one of them so that DOE can keep the project within its baseline cost estimate. Installing these components after the SSC's construction has been completed could increase the SSC's costs and require DOE to shut down the SSC for as long as 2 years.

SSC'S TOTAL COST WILL EXCEED $11 BILLION

While the total estimated cost for constructing the SSC is not yet known, it is expected to exceed $11 billion (current dollars). As we reported in February 1993, DOE does not yet have in place a system for managing the project that will provide a reliable projection of the SSC's total cost and schedule. However, it is known that the project has exceeded its budget and is behind schedule. We also reported that DOE's January 1991 estimated total project cost of $8.25 billion did not include about $1.2 billion in costs expected to be funded from other sources. Since we issued our February report, the administration has proposed to stretch out the project's completion and reduce the project's planned annual funding. Although the precise impact of this proposal has not been fully analyzed, stretching out the project would further increase the total cost of constructing the SSC by at least another $1.6 billion. Therefore, the project's total estimated cost would exceed $11 billion.

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 cost does not include (1) about $500 million for the detectors, for which the SSC project is seeking primarily nonfederal funding; (2) about $400 million for laboratory pre-operations costs not associated with commissioning the four injector accelerators or the collider, which costs are to be funded by DOE's High Energy Physics Program; (3) about $118 million through fiscal year 1999 for DOE program direction costs; and (4) about $60 million in land costs and $125 million in infrastructure and general support costs, which the state of Texas is contributing. Therefore, DOE excluded a total of over $1.2 billion in costs from its January 1991 estimate.

In commenting on this issue, DOE officials told us that their agency has historically omitted such costs from the estimated cost of its accelerator projects. Therefore, the omission of such costs from the SSC's cost estimate is consistent with DOE's historical

practice. We have reported on this practice in the past, pointing out that this practice makes it difficult for the Congress to assess the affordability of such projects; consequently, we have recommended that DOE furnish complete costs of projects to the Congress.[5] DOE officials noted that although the costs totalling about $1.2 billion have not been included in the project's cost estimate, they have been disclosed to the Congress.

Reduced Federal Funding Will Stretch Out the Schedule and Increase Costs

DOE's January 1991 cost estimate of $8.25 billion assumes that the project will be completed in 1999 and that DOE will receive funding on a timely construction schedule. As we noted in our February report, the DOE Project Director stated that reduced fiscal year 1993 funding had already increased the total cost by $50 million to $200 million, depending on whether past funding shortfalls are restored in fiscal year 1994.

Our report also cautioned that as the project's peak funding period approaches, DOE's funding profile would need 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, according to which, 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 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.

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 there would not be a change in the approach for building the SSC. He explained that if it were known that less funding would be available, management could restructure the work to fit the available funding.

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 will

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

further increase the project's cost because it will lengthen the time required to complete the project and increase the amounts consumed by inflation and overhead costs. As disclosed in the President's budget request, DOE estimated that the impact of receiving funding below planning assumptions for fiscal years 1994 through 1998 would increase the SSC's total cost by about $2 billion in current 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 he 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 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.

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

In addition to the total project costs' increasing, the federal share of the costs 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 goal it established in January 1991. In December 1992, we reported that only about $15 million in foreign contributions had been received.[7] We pointed out that the Congress faced a critical decision point for its funding of the SSC. By the end of fiscal year 1993, about $1.6 billion will have been invested in the project. Starting in fiscal year 1994, the project's peak funding period begins.

For fiscal year 1994, the SSC project's funding profile showed that about $250 million in foreign contributions was needed. Without a major contribution from Japan in fiscal year 1994, we reported that 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

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[6]According to a DOE official, the SSC Laboratory is to assume completion at the end of calendar year 2002 (the end of the first quarter of fiscal year 2003).

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

slip further. A 1-year slip in the project's schedule could increase the SSC's cost by about $400 million in current 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 the Japanese 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 it with the most complete, accurate, and up-to-date information available on the status of DOE's efforts to obtain contributions for the SSC from Japan and other foreign countries.

By 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.

CONCLUSIONS

Since the SSC was first proposed to the Congress in 1987, costs have more than doubled, from $5.3 billion to more than $11 billion. However, the total cost to construct the SSC is still not known. Depending on the assumptions made, this cost could increase significantly. For example, if the projected increases in subcontractors' costs that have been identified are not mitigated, the project's total cost may increase.

Furthermore, to preclude the SSC's cost from significantly increasing beyond the $11 billion identified in this report, 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 1998. 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 the consumption by inflation and overhead costs of all available funding, thereby impacting 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. Starting in fiscal year 1994, the peak funding period for the project begins. Currently, the SSC is over budget and behind schedule, and costs

are expected to increase further as a result of funding constraints. Moreover, the federal share of the project's cost may increase. In December 1992, we reported that only about $15 million in foreign contributions had been received. In January 1993, DOE advised the Congress that it was confident of obtaining only about $400 million of the $1.7 billion that it was seeking from foreign contributions by 1999--leaving a shortfall of $1.3 billion. As a result, the Congress is now faced with the prospect of having to increase the federal share of funding substantially to complete the project.

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

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