

GAO

Report to the Subcommittee on
Investigations and Oversight, Committee
on Science, Space, and Technology,
House of Representatives

December 1992

FEDERAL RESEARCH

Foreign Contributions
to the Superconducting
Super Collider



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**Resources, Community, and
Economic Development Division**

B-227295

December 30, 1992

The Honorable Howard Wolpe
Chairman
The Honorable Sherwood L. Boehlert
Ranking Minority Member
Subcommittee on Investigations and Oversight
Committee on Science, Space, and Technology
House of Representatives

Your May 4, 1992, letter requested that we provide information on foreign contributions to the Department of Energy's (DOE) Superconducting Super Collider (SSC). In January 1991, DOE set a goal of obtaining \$1.7 billion from foreign countries toward the SSC's estimated total project cost of \$8.25 billion and of completing the SSC by 1999. This letter focuses on your specific request that we determine the nature and extent of foreign contributions.

You also asked us to examine the procedures DOE and the SSC Laboratory have followed in entering into agreements with foreign laboratories and the criteria used in considering cost savings under international agreements as foreign contributions. Universities Research Association, Inc. (URA), the DOE management and operating contractor for the SSC Laboratory, is authorized by its contract to enter into these agreements.¹

Results in Brief

DOE may have difficulty obtaining the foreign contributions needed to meet its \$1.7 billion goal for the SSC. As of the end of fiscal year 1992, DOE had received about \$15 million in foreign contributions. These have consisted of pledges and contributions of labor and materials from India, Russia, and China. Because of lower labor costs in Russia and China, DOE pays laboratories in these countries about half as much as it would pay for the same work done in the United States. DOE considers as foreign contributions the difference between the amount it is actually paying for the work and the value of the work cited in its baseline cost estimate.

The \$15 million obtained thus far is close to the \$20 million DOE estimated it would receive by the end of fiscal year 1992. However, the SSC funding profile calls for DOE to obtain an additional \$1.1 billion in foreign contributions through fiscal year 1996. Although most of these funds will need to come from Japan, Japanese officials told us that they are still

¹URA is a nonprofit institution formed by 79 major universities in the United States and Canada.

studying the merits of the project and have not yet decided whether to contribute. If the foreign contributions do not materialize, the U.S. taxpayers' share of the SSC's estimated cost will increase regardless of whether the Congress decides to make up for the funding shortfall or let the project's schedule slip. According to DOE, a 1-year slippage in the project's overall completion schedule would increase the project's costs by about \$400 million, or roughly \$1 million a day.

We found that the procedures DOE and the SSC Laboratory followed when entering into agreements with foreign laboratories and the criteria DOE used for considering cost savings under international agreements as foreign contributions were appropriate. See appendix I for a further discussion of these issues.

Background

The SSC—which is being constructed in Ellis County, Texas, about 30 miles south of Dallas—will be the world's largest high-energy particle accelerator. Physicists use a particle accelerator as a research tool to seek fundamental knowledge about energy and matter. The accelerator complex is to consist of a series of five accelerators, including a linear accelerator, a low-energy booster, a medium-energy booster, a high-energy booster, and the Collider itself. The principal components of the accelerators are magnets, which will steer and focus beams of protons, moving in opposite directions, until they collide at near the speed of light. The first three accelerators will use conventional magnets, which operate at room temperature; the high-energy booster and the Collider will use superconducting magnets, which operate near absolute zero (−452 degrees Fahrenheit). The collisions occur at interaction regions, where detectors record the collisions for analysis by physicists.

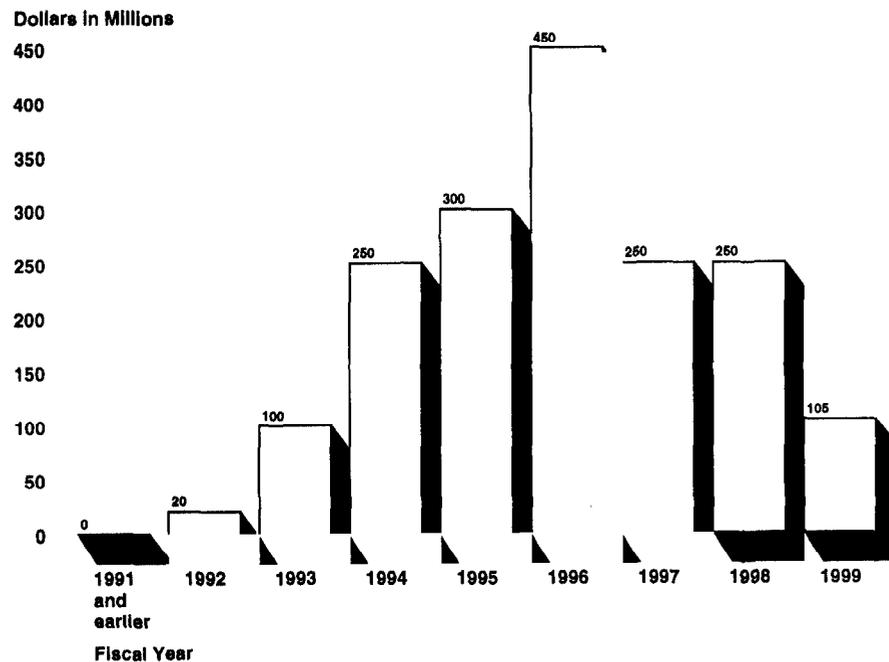
As of the end of fiscal year 1993, the SSC will have received about \$1.6 billion in federal funding. DOE estimates that it will need over \$700 million in federal funding in fiscal year 1994 to keep the project on schedule.

DOE has been seeking international participation in the SSC to share the benefits of and responsibility for the SSC program equitably with other nations, commensurate with their scientific and technological strengths and resources. Cost-sharing in a scientific research program of this size is considered desirable because other nations, as well as the United States, will have access to and benefit from the facility.

DOE Is Seeking \$1.7 Billion From Foreign Sources Over 8 Years

In January 1991, DOE estimated that the cost of the SSC would be \$8.25 billion. In its estimate, DOE set as an objective that one-third, or about \$2.6 billion, would be obtained from nonfederal sources. Texas agreed to provide \$875 million for the project, leaving about \$1.7 billion to be obtained in foreign contributions for the SSC's construction through fiscal year 1999.² From its baseline cost estimate for the SSC, DOE developed a funding profile, including foreign contributions, through the projected completion year of 1999. DOE's funding profile for foreign contributions is shown in figure 1.

Figure 1: Projected Funding Profile for Foreign Contributions



Note: Totals represent years in which agreements are reached. Actual contributions would likely be received in later years.

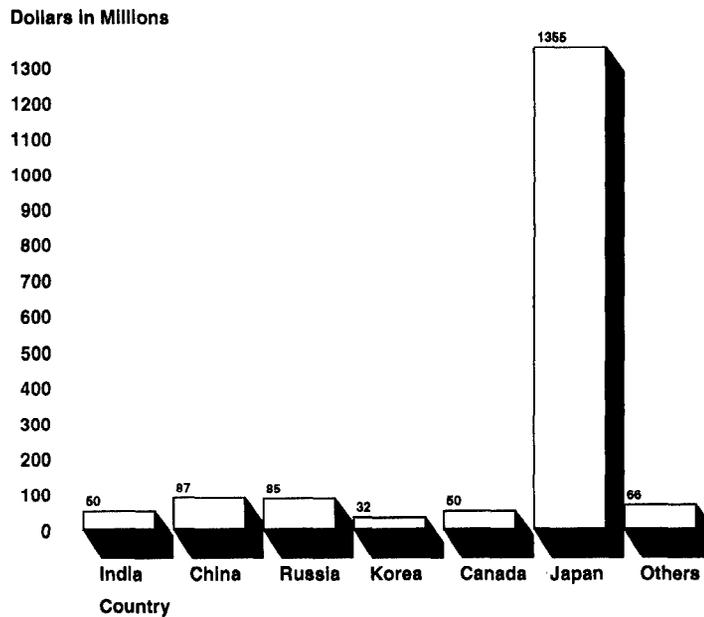
Source: SSC Site Project Office, DOE.

²The \$1.7 billion does not include the up to \$500 million sought for construction of the SSC's detectors.

As the figure shows, only \$20 million was expected through fiscal year 1992, but the amount needed increases to \$100 million this fiscal year and to \$250 million in fiscal year 1994, peaking at \$450 million in fiscal year 1996.

DOE has estimated the potential foreign contributions, totaling over \$1.7 billion, as shown in figure 2.

Figure 2: Estimated Potential Foreign Contributions



Note: "Others" represents potential contributions from other countries, such as Mexico, or increases in contributions from identified countries.

Source: SSC Site Project Office, DOE.

Contributions Made to Date

Foreign countries have contributed about \$15 million, compared with the \$20 million sought for fiscal year 1992. Contributions received to date have been in-kind contributions consisting of labor, equipment, and/or materials. Table 1 shows, by country, the value of the in-kind contributions as of September 1992, the amounts DOE has agreed to pay, and the net contribution as recorded in the SSC Laboratory's financial records.

Table 1: Status of Foreign Contributions to the SSC, as of September 30, 1992

| Dollars in millions | | | |
|---------------------|--|-------------------|--------------------------|
| Country | DOE valuation of items being contributed | Amount DOE to pay | Net foreign contribution |
| India ^a | \$1.0 | \$0 | \$1.0 |
| China | \$7.7 | \$3.2 | \$4.5 |
| Russia | \$14.8 | \$5.6 | \$9.3 |
| Total ^b | \$23.5 | \$8.8 | \$14.8 |

^aAn agreement with India for \$6.3 million is under negotiation but had not been signed as of November 1992.

^bTotals may not add because of rounding.

Source: SSC Laboratory.

Of the \$14.8 million net foreign contributions under agreement, the SSC Laboratory has estimated that about \$3.6 million of the work agreed to had been completed as September 30, 1992.

Status of Agreements With India, China, and Russia

The first foreign country that agreed to contribute to the SSC was India, which pledged to donate \$50 million in in-kind contributions for accelerator components. Two Indian laboratories and the SSC Laboratory have been negotiating to determine the specific work to be contributed. According to a DOE official, one Indian laboratory has signed an agreement with the SSC Laboratory, valued at about \$1 million, to make magnets for the linear accelerator. An SSC Laboratory official told us that in October 1992 the SSC Laboratory was negotiating a separate agreement with a second Indian laboratory, valued at about \$6.3 million, to make additional components. According to the SSC Laboratory official, because the agreement has not been signed with the second Indian laboratory, the SSC Laboratory does not yet consider any work being done as a contribution. Had the \$6.3 million been recognized as a contribution, DOE would have met its goal through fiscal year 1992.

The SSC Laboratory has entered into agreements with Chinese and Russian laboratories under which the laboratories are paid for their contributions. These laboratory-to-laboratory agreements identify the potential items to be contributed; the foreign laboratories are to be paid up to 50 percent of the items' value as stated in DOE's baseline cost estimate. The difference between the amount the laboratories are paid for the item and the value of the item in the baseline cost estimate is considered by DOE to be a

contribution to the construction of the SSC. According to DOE, the foreign laboratories selected for this kind of arrangement have considerable expertise in the construction of accelerators and accelerator systems and have unique capabilities that would otherwise not have been available to the SSC Laboratory.

The agreements with the Russian and Chinese laboratories, however, do not commit the laboratories to any specific contribution. Instead, according to SSC Laboratory officials, the laboratories are to further negotiate the specific work to be contributed and any payment to be made. The results of these negotiations are then set forth in attachments to the agreements; the attachments contain a schedule of activities that the foreign laboratories are to undertake and milestones for these activities, a compensation schedule, a statement of work, and technical specifications.

China's Institute of High Energy Physics and the SSC Laboratory have signed an interlaboratory collaborative agreement. DOE estimates that under the agreement the Chinese laboratory can be paid up to \$34.5 million for work on several items. The SSC Laboratory's baseline cost estimate for these items, based on U.S. material and labor rates, is \$70.9 million. After payment of the \$34.5 million, DOE would consider the \$36.4 million offset to the total project cost as a contribution from China.

The Chinese have started work on the coupled cavity linac that will be incorporated into the linear accelerator.³ China will be paid \$3.2 million for this item—about 42 percent of the \$7.7 million cost estimated by SSC. Chinese officials told us that they feel they are contributing to part of the cost of the coupled cavity linac because they believe that the SSC estimate is low. They said that the \$3.2 million is one-third of the cost to produce the coupled cavity linac in the United States and that their work is worth more than they are being paid, although they could not identify exactly how much more. The SSC Laboratory and the Chinese are continuing to negotiate work on other items—for example, medium-energy booster corrector magnets, which have a baseline cost estimate of between \$4 million and \$5 million. According to an SSC Laboratory official, the manufacture of corrector magnets, which are made up of many smaller magnets, is labor intensive and therefore well suited for China, which has lower labor costs. Also, according to a DOE official, in negotiations with the Chinese, DOE and the SSC Laboratory eliminated two items valued at \$41.6 million and \$28.1 million, respectively, because DOE considered them

³The linear accelerator for the SSC contains an ion source and four stages through which the ions are focused, aligned, and accelerated. The fourth stage is the coupled cavity linac.

to be inappropriate for acquisition under interlaboratory agreements. According to a DOE official, the items did not require scientific input and China is not the only country capable of producing the items.

Six Russian institutes and the SSC Laboratory have signed interlaboratory collaborative agreements for potential work on, among other things, the low-energy booster magnets. The SSC Laboratory's baseline cost estimate for these items, based on U.S. material and labor rates, is \$122.5 million. If all of this work is agreed to, the SSC Laboratory would pay the Russian institutes \$59.4 million. The \$63.2 million offset would be considered a contribution from Russia. DOE officials told us that the Russians are able to do this work for less primarily because of their lower labor costs.

Agreement With Koreans Under Negotiation

Although the SSC Laboratory is negotiating with Korean scientific and government officials for a contribution, as of November 1992 the Koreans and the SSC Laboratory had not agreed on the nature and extent of any Korean contribution to the SSC. The Koreans have proposed a contribution of 240 man-years of scientific and technical support, which DOE has valued at \$30 million. The Koreans told us that, for them, the benefit of this contribution would be the training for their scientists and engineers. However, DOE officials told us that the SSC should not be just a training ground for Korean scientists and engineers and that any contribution of scientific and technical support must be tied to specific hardware, such as the medium-energy booster magnets, which are valued at about \$40 million to \$50 million. DOE officials proposed that the Koreans donate all these magnets, including a prototype of the magnet, valued at \$400,000. Korean officials told us that funding for the prototype medium-energy booster magnet was not included in Korea's 1993 budget. According to Korean industry officials, they may be willing to contribute the prototype magnet if they are paid for the production magnets or if they are guaranteed the opportunity to bid on a contract for the production of medium-energy booster magnets. However, DOE officials have repeatedly told the Koreans that DOE will not pay them to produce the medium-energy booster magnets. A DOE official told us that DOE would not guarantee the Koreans an opportunity to bid on the magnets. DOE may decide to build them at DOE's Fermi National Accelerator Laboratory in Illinois. Therefore, as of November 1992, negotiations were at an impasse.

Large Contribution From Japan Needed to Reach Goal

For the SSC to be constructed on schedule, DOE's funding profile depends on foreign contributions to materialize. Obtaining the contributions according to the funding profile is important because funding delays could cause the completion schedule to slip. According to DOE, a large Japanese contribution will be needed if the \$1.7 billion goal is to be met. DOE and SSC Laboratory officials estimated that a maximum of \$300 million to \$500 million can be obtained from countries other than Japan. The officials noted that the in-kind contributions from countries such as China and Korea would be primarily limited to components for the linear accelerator, the low-energy booster, and the medium-energy booster. They stated that most components for the high-energy booster and the Collider would be too sophisticated, considering that these countries do not have superconducting high-energy physics facilities. Furthermore, they noted, few, if any, contributions are expected to be obtained from Western European countries. These countries have committed most of their physics funds to the European Organization for Nuclear Research, commonly known as CERN,⁴ which is considering building a new accelerator called the Large Hadron Collider. Also, although Canada had considered contributing to the SSC, as of November 1992 DOE had not initiated negotiations.

As a result, DOE pointed out, a significant contribution of over \$1 billion will be needed from Japan. In January 1992, the United States and Japan agreed to establish a Joint Working Group on the SSC. The Japanese told us that they are studying (1) the academic merits of the SSC; (2) the plans for the project, including its technical feasibility and cost and schedule estimates; and (3) the possibility of making the SSC an international project rather than a U.S. domestic project.

To date, the Japanese have not decided whether they will contribute to the SSC. Japanese officials indicated to us that the decision would be based on political considerations, such as the extent of U.S. support for the project. They told us that a prerequisite for a Japanese contribution was strong support for the SSC project from both the administration and the U.S. Congress. According to DOE officials, Japan will not decide on the nature and extent of any Japanese contribution until the position of the new administration on the SSC is known. As of December 1992, negotiations were under way and it was unclear when they would be concluded.

⁴CERN, located near Geneva, Switzerland, is one of the world's leading centers for particle physics research.

According to a DOE official, if the Japanese decide not to contribute to the SSC, DOE will have a shortfall in needed funding starting with fiscal year 1994. While DOE had not fully assessed the impact of such a shortfall, the official said that in the absence of increased federal funding, the completion schedule would slip. According to DOE, a 1-year slippage in the project's overall completion schedule would increase the project's costs by about \$400 million, or roughly \$1 million a day.

Conclusions

In our view, the Congress faces a critical decision point on funding for the SSC for fiscal year 1994. By the end of fiscal year 1993, about \$1.6 billion will have been invested in the project. However, only about \$15 million of this amount represents foreign contributions. DOE still needs nearly all of the \$1.7 billion in foreign contributions it has been seeking if it is to meet its January 1991 goal.

In order to reach its goal, DOE will need a major contribution from Japan. However, the Japanese have not yet decided whether to contribute, largely because they are concerned about whether the administration and the Congress will continue to support the project. Negotiations between DOE and Japan are still under way, and it is unclear when they will be concluded.

If DOE does not receive a Japanese contribution, DOE is likely to have difficulty obtaining funds from other foreign sources. Although DOE has received contributions and pledges of contributions from three countries, these have been relatively small in-kind contributions. The three countries do not have the potential to make a large enough contribution to reach the goal: According to DOE, the maximum potential contribution is \$300 million to \$500 million. Furthermore, Western European countries are unlikely to contribute because they are committed to their own high energy facility at CERN.

In fiscal year 1994, the SSC will need almost \$1 billion more (about \$700 million in federal funds and about \$250 million in foreign contributions) to meet its funding profile. If by then the Japanese have not yet decided to make a large contribution, in all likelihood the Congress will be faced with deciding whether to increase U.S. funding to make up for the shortfall in foreign contributions or whether to let the project's schedule slip. A slip in the project's schedule could increase the SSC's cost by as much as \$400 million a year. Furthermore, the Congress will 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 decide not to contribute to the project.

Matters for Consideration by the Congress

With \$1.6 billion invested in the SSC, the Congress faces a critical decision point on funding, especially in light of the uncertainty of foreign contributions. As part of its fiscal year 1994 funding decision for the SSC, the Congress 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.

Agency Comments

We discussed the information contained in this report with agency officials, including the Project Director and Deputy Director of DOE's SSC Project Office. They generally agreed with the facts as presented. As requested, we did not obtain written agency comments on a draft of this report.

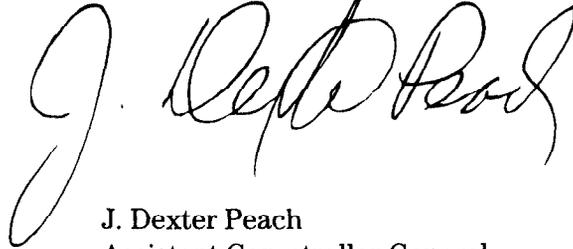
Scope and Methodology

To ascertain the nature and extent of the foreign contributions, we obtained from DOE and the SSC Laboratory pertinent planning documents and interlaboratory agreements. To test DOE's valuation of foreign contributions, we compared the data in a representative agreement with the data in the baseline cost estimate. We interviewed DOE officials and SSC Laboratory officials, as well as an official from India working at the SSC Laboratory. We also visited facilities in China, Korea, and Japan and interviewed cognizant government, laboratory, and industry officials in those countries concerning their proposed and/or actual participation in the SSC.

We performed our review between June and November 1992 in accordance with generally accepted government auditing standards.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies to the Secretaries of Energy and State. We will make copies available to others on request.

This work was performed under the direction of Victor S. Rezendes, Director, Energy and Science Issues, who may be reached at (202) 275-1441 if you or your staff have any questions. Major contributors to this report are listed appendix II.



J. Dexter Peach
Assistant Comptroller General

Procedures for Entering Foreign Agreements and Criteria for Considering Cost Savings

The Department of Energy (DOE) has entered into foreign agreements in accordance with established procedures and appropriately accounted for the contributions received. In entering into laboratory agreements, Universities Research Association (URA) has followed established DOE and State Department procedures. URA has also accounted for foreign contributions as prescribed by accounting principles for nonprofit organizations established by the American Institute of Certified Public Accountants (AICPA).

Procedures for Entering Into Agreements

Collaborative work with foreign countries is being negotiated on two levels—in country-to-country agreements negotiated between DOE and the foreign country's government and in laboratory-to-laboratory agreements negotiated between the SSC Laboratory and the foreign laboratory. DOE is following prescribed procedures for agreements with foreign countries, and the SSC Laboratory is exercising its contractual authority to enter into laboratory-to-laboratory agreements.

The State Department approves country-to-country agreements between the United States and foreign governments. In accord with State Department Circular 175, DOE officials briefed congressional committees on their plans to negotiate with foreign countries for contributions to the SSC. According to State Department officials, DOE has met State's requirements, and approval has been given for DOE to negotiate the country-to-country agreements with Russia, China, and Korea. DOE also needs State Department approval to conclude negotiations. According to State Department and DOE officials, DOE requested State Department approval to conclude the negotiations with Korea and China, but this approval was put on hold when the House of Representatives voted in June 1992 to eliminate funding for the SSC for fiscal year 1993. According to a DOE official, when the Congress voted to fund the SSC for fiscal year 1993, the State Department started to process the approvals. A DOE official told us that in October 1992 the State Department gave approval to conclude negotiations with Russia and China, and on November 3, 1992, an agreement was signed with China.

According to State Department and DOE officials, laboratory-to-laboratory agreements come under the country-to-country agreements but are negotiated separately and can be signed before the country-to-country agreements are signed. Laboratory-to-laboratory agreements do not need State Department approval. DOE has authority to contract or collaborate with international firms and governments for the purpose of securing

international participation. Under section 103 of the Energy Reorganization Act of 1974 (42 U.S.C. 5801 et seq.), the Secretary is authorized to, among other things, participate in and support cooperative research and development projects that may involve contributions, by public or private persons or agencies, of financial or other resources in performance of work and to encourage and participate in international cooperation with respect to energy research and development. The SSC Laboratory is authorized to exercise these responsibilities under the URA operating contract with DOE. The SSC Laboratory entered into agreements with six laboratories in Russia, one laboratory in China, and one laboratory in India.

The laboratory-to-laboratory agreements identify potential items to be contributed but do not commit the laboratories to any specific contribution. Instead, according to SSC Laboratory officials, the laboratories further negotiate specific work to be contributed and any payment to be made. The results of these negotiations are set forth in attachments to the agreements that contain a schedule of activities and milestones, a compensation schedule, a statement of work, and technical specifications. Once the attachments are signed, the laboratories are contractually obligated to carry out the provisions.

Criteria for Considering Cost Savings as Foreign Contributions

In treating cost savings as contributions, URA is determining the contribution by subtracting the amount paid for the item contributed from the estimated value of the item in the SSC baseline cost estimate. URA—which was hired by DOE to design, construct, manage, operate, and maintain the SSC laboratory—is a nonprofit institution formed by 79 major universities in the United States and Canada. Accounting principles for contributions to nonprofit institutions, such as URA, are contained in the AICPA Statement of Position 78-10, dated December 31, 1978. The principles state, in part, that it is difficult to place a monetary value on services and that donated material and facilities should be recorded at their fair value, provided the organization has a clearly measurable and objective basis for determining the value. The SSC Laboratory used the January 1991 baseline cost estimate to determine the value of the items contributed. Therefore, URA appears to be following appropriate accounting principles in its valuation of foreign contributions to the SSC.

Methodology

To examine DOE's procedures for entering into agreements with foreign laboratories, we examined pertinent agency guidance and legislative

**Appendix I
Procedures for Entering Foreign
Agreements and Criteria for Considering
Cost Savings**

authority. We also interviewed DOE and State Department officials and examined documents provided by the State Department on its procedures for entering into international agreements.

To ascertain the criteria used for determining the cost savings under international agreements as foreign contributions, we examined the American Institute of Certified Public Accountants' accounting principles for nonprofit organizations. We interviewed DOE and SSC Laboratory officials and obtained copies of applicable laboratory procedures.

Major Contributors to This Report

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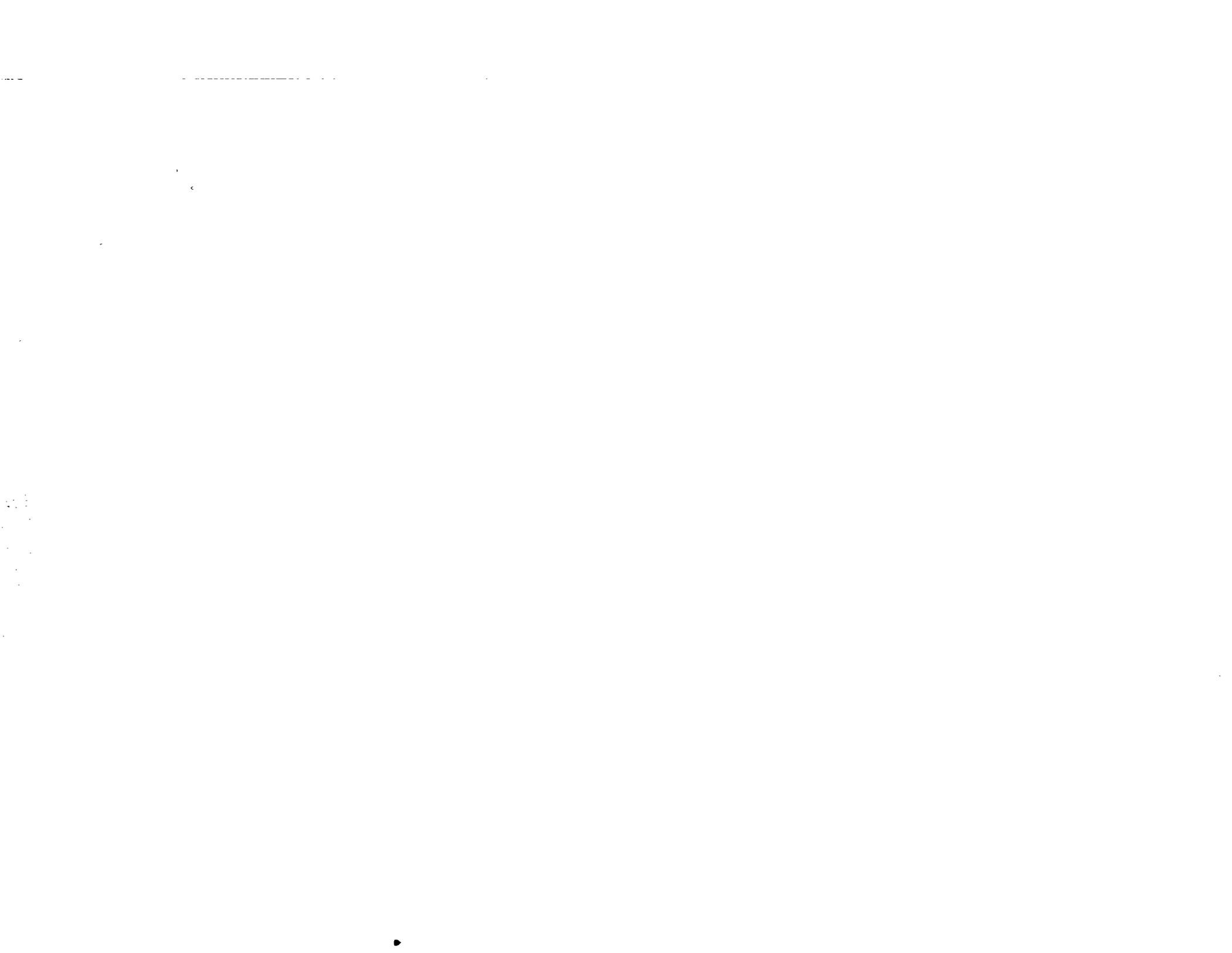
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