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TECHNOLOGY TRANSFER

Improving the Use of Cooperative R&D Agreements at DOE's Contractor-Operated Laboratories

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Resources, Community, and
Economic Development Division

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April 15, 1994

The Honorable Marilyn Lloyd
Chairman
The Honorable Harris W. Fawell
Ranking Minority Member
Subcommittee on Energy
Committee on Science, Space,
and Technology
House of Representatives

The Honorable Tim Valentine
Chairman
The Honorable Tom Lewis
Ranking Minority Member
Subcommittee on Technology,
Environment, and Aviation
Committee on Science, Space,
and Technology
House of Representatives

Technology transfer between federal laboratories and industry is increasingly viewed as a major factor contributing to the economic strength and competitiveness of the United States. In 1986, the Congress sought to enhance the effectiveness of this transfer by authorizing cooperative research and development agreements (cooperative R&D agreements) as another form of technology transfer. We presented our preliminary analysis of the processes federal agencies use to implement these agreements when we testified in June 1993 before the Subcommittee on Energy, House Committee on Science, Space, and Technology. (See Technology Transfer: Implementation of CRADAs at NIST, Army, and DOE, GAO/T-RCED-93-53, June 10, 1993.)

Before we testified, you asked us to compare the Department of Energy's (DOE) process for implementing cooperative R&D agreements to the approaches used by the Army and the Department of Commerce's National Institute of Standards and Technology to determine why some federal laboratories had entered into more agreements than DOE's laboratories. As agreed with your offices, we compared the effect of different processes for implementing cooperative R&D agreements on the level of laboratory resources available for these agreements and on the time and resources used to implement or begin the collaboration. Most of the information in

this report reflects data collected in early 1993 from the National Institute of Standards and Technology, the Army, and DOE, as well as from four DOE laboratories—the Lawrence Livermore, Lawrence Berkeley, Sandia, and Los Alamos National Laboratories—and from two other laboratories, the National Institute of Standards and Technology laboratory in Maryland and the Army Research Laboratory in New Jersey. As we note throughout the report, we have added new information to reflect a number of substantial changes DOE has made to its process for implementing cooperative R&D agreements since we presented our testimony in June 1993.

Results in Brief

When DOE began implementing cooperative R&D agreements in 1991, it initially adopted a centralized process for implementing most of its cooperative R&D agreements that was very different from the decentralized process used by the National Institute of Standards and Technology and the Army. For example, the approval process DOE used to implement almost 80 percent of its agreements in 1991 and 1992 included a headquarters-controlled, competitive selection process supported with money specifically identified for cooperative R&D agreements. DOE headquarters officials also used strict selection criteria that directed most agreements to predetermined research objectives. In contrast, National Institute of Standards and Technology and Army laboratory officials use what they call an "open door" selection approach, choosing which agreements they will implement on the basis of the expertise and resources available at their laboratories. Furthermore, the Institute and the Army support cooperative R&D agreements directly from budgeted research and development accounts—no separate funding or headquarters-controlled selection process is used.

DOE and its laboratory officials told us that a number of institutional factors led them to establish a centralized process, including a tradition of preventing outside access to the laboratories' secret weapons technologies and a concern about past criticism of their oversight of laboratory contractors by our office and others. These factors contributed to DOE's initial view that cooperative R&D agreements must be tightly controlled. DOE officials also told us that they wanted a centralized process that would draw attention to the technology transfer activities of DOE's laboratories, in part to help justify continued funding for cooperative research and development.

DOE's headquarters-controlled cooperative R&D agreement approval process has allowed the Department to pursue large multilaboratory and multiparty agreements directed at achieving high-profile national research and development goals. However, DOE's centralized process has some drawbacks. For example, the dollar ceiling established by designating a specific amount of funds for cooperative R&D agreements may have limited the number of agreements that DOE implemented, even though resources may have existed at the laboratories to support additional cooperative research. In contrast, in 1991 and 1992 the Institute and the Army used a much higher proportion of their research and development budgets to support cooperative R&D agreements. Furthermore, because DOE's process was centralized, it was less flexible, used more personnel, and created more paperwork than the Institute's or the Army's process. As a result, DOE generally took about three to five times longer on average to implement an agreement than the other two agencies. Some of this delay can be attributed to the legislative requirement that DOE review two separate documents before approving an agreement at a contractor-operated laboratory.

DOE officials have recognized the need to improve their processes for implementing cooperative R&D agreements and have taken steps to make these procedures more efficient. For example, in early 1994 DOE began using a simplified model cooperative R&D agreement that it expects will speed up its approval process and initiated a "block funding" pilot program that will allow more cooperative R&D agreement selections to be made at the laboratory and regional office level.

Background

In 1986, the Congress enacted the Federal Technology Transfer Act (P.L. 99-502), in part to establish cooperative research and development agreements (CRADA) as a distinct way of transferring technology between government-operated laboratories and nonfederal organizations, and to distinguish these agreements from standard federal procurement, grant, and cooperative agreement programs. In 1989, as part of the National Competitiveness Technology Transfer Act (P.L. 101-189), the Congress expanded authority for these collaborations to federal laboratories operated by contractors. Under the legislation as amended, CRADAs are agreements between laboratories and their nonfederal counterparts through which both parties provide resources to conduct specified research and development efforts that are consistent with the missions of the laboratory.

The CRADA provisions give federal agencies considerable flexibility in determining how to implement CRADAs. However, in addition to requiring that the collaborative work done under any CRADA be consistent with the laboratory's mission, the legislation establishes certain funding restrictions. While it allows collaborators to provide cash to conduct the CRADA R&D, it limits the government's contributions to noncash resources, such as personnel, services, facilities, and equipment. The legislation also states that agencies that operate their own laboratories, like the National Institute of Standards and Technology (NIST) and the Army,[1] are to be given the opportunity to disapprove or modify the CRADA within 30 days of the contract's submission by the laboratory director. However, agencies that have contractor-operated laboratories, like DOE,[2] must review two separate documents, each with its own deadline. Generally, the first document, the joint work statement—which describes the purpose, scope, rights, and responsibilities of the R&D work—must be approved or disapproved by the agency within 90 days of being submitted by the laboratory director. The second document, the CRADA itself, must be approved or disapproved within 30 days.

After P.L. 101-189 was passed in late 1989, DOE had to modify the contracts governing its contractor-operated laboratories. DOE officials told us that most of these contracts were modified to permit CRADAs during 1991. As a result, no CRADAs were implemented at DOE contractor-operated laboratories until April 1991. However, the NIST and Army government-owned and government-operated laboratories began implementing CRADAs in fiscal year 1987. DOE implemented a total of 209 CRADAs in fiscal years 1991 and 1992. During the same period, the NIST and Army laboratories implemented a total of 142 and 164 CRADAs, respectively. However DOE's laboratories are much larger than NIST's or the Army's. For example, for fiscal years 1991 and 1992, the four DOE laboratories we visited reported that they had obligated an average of about $3.5 billion each year for R&D activities, while the NIST and Army laboratories we visited had obligated an average of $226 million and $34 million each year, respectively.

[1]Generally when an agency operates its own laboratory, as NIST and the Army do, the laboratory's scientists and engineers are government employees.

[2]Most DOE laboratories are operated by contractors. The scientists and engineers who perform and manage these laboratories are employed by the contractors and are not federal employees. DOE does, however, own and operate several small laboratories, including the West Virginia and Pennsylvania Energy Technology Centers.

DOE, NIST, and the Army Developed Contrasting Funding and Selection Processes for CRADAs

DOE initially developed a centralized funding and selection process for most of its CRADAs, while NIST and the Army make CRADA decisions at the laboratory level. DOE's process allowed DOE to tightly control most of its CRADAs and to pursue large-scale research objectives. However, our analysis indicates that DOE's process may have limited the number of CRADAs DOE implemented.

DOE Developed a Centralized CRADA Funding Process

NIST and Army laboratory directors generally have the flexibility to implement a CRADA as soon as one is proposed, as long as the R&D resources are available, the collaboration supports the laboratory's mission, and the CRADA is not modified or disapproved by the designated headquarters official. In addition, NIST's and the Army's laboratories support the government's contribution, or resources for CRADA work, directly from each agency's R&D programs.

DOE initially developed a very different process for implementing most of its CRADAs. For example, before DOE's contractor-operated laboratories could implement a CRADA in an area supported by DOE's two largest program offices, support in the form of funding had to be secured from a headquarters program office. In particular, DOE's Offices of Defense Programs and Energy Research initially identified a specific amount of program funds for CRADAs. By the end of December 1992, these two offices had provided $63.7 million, or 65 percent of all DOE's funds for CRADAs; furthermore, these two program offices had supported about 77 percent of all the CRADAs conducted at DOE's contractor-operated laboratories—217 out of 282. The remaining 23 percent of the CRADAs conducted at DOE's contractor-operated laboratories were funded by four other major programs—Fossil Energy, Energy Efficiency and Renewable Energy (formerly Conservation and Renewable Energy), Environmental Restoration and Waste Management, and Nuclear Energy. These programs do not identify a specific amount of funds for CRADAs, but rather draw the resources they devote to CRADAs directly from their R&D programs.

DOE's Selection Process Differs From NIST's and the Army's

Officials at NIST's and the Army's laboratories select CRADAs on the basis of criteria that assess the laboratory's and collaborator's technical compatibility and available resources.[3] Furthermore, these officials take a relatively broad view, or what they call an "open-door" approach, to

[3]Officials at federal laboratories generally use the term "core competencies" to describe the scientific knowledge, skills, and abilities and the resources available to do research at the laboratory.

potential CRADA collaborations. For example, a suitable CRADA can embrace R&D work that is both consistent with the laboratory's R&D mission and has a dual use.[4] NIST and Army officials said they determine that a CRADA is consistent with the laboratory's mission when the R&D needed for the CRADA can be used to support or advance the laboratory's R&D objectives. In summary, a potential NIST or Army CRADA is evaluated on whether (1) the proposed collaboration will expand the knowledge that already resides in the laboratory, (2) the collaborator is committed to doing a substantial share of the work, (3) the laboratory has the resources and facilities to do the required work, and (4) the technical expertise and skills are present among the scientists and engineers at the laboratory.

At DOE, the selection of most CRADAs was controlled by headquarters program officials who determined whether a proposal (1) focused on predefined technology objectives chosen by headquarters program managers, (2) was directed to the stage of a technology's development that precedes commercialization (which DOE refers to as a "spin-off"), or (3) was directed at specific energy-related industries that generally have been part of the program's mission research in the past. Also, DOE officials told us that they sometimes use a CRADA to help maintain technical expertise in an area in which budget cutbacks have been made. In addition, DOE generally expects a collaborator to contribute an amount of cash or noncash resources that match dollar for dollar the value of the resources DOE expects to contribute. NIST and Army have no similar expectation, although officials said that if a CRADA called for expenses above those normally used to conduct the laboratory's mission, the collaborator would be expected to pay the additional cost.

DOE's Funding and Selection Process May Have Limited Opportunities for CRADA Collaborations

DOE's initial practice of designating a specific amount of funds to support most of its CRADAs affected the number of CRADAs that DOE implemented. In effect, this practice set a "ceiling" on the funding available for CRADAs. For example, the large demand for cooperative projects and the limits created by the funding ceiling allowed DOE's Office of Defense Programs to support only about one out of nine proposals that it received from the laboratories, even though DOE laboratory officials said that resources—scientists, engineers, and facilities—were generally available for collaborative work. Since 1992 and 1993, respectively, the appropriations for Defense Programs and Energy Research activities have authorized specific amounts for technology transfer activities, including CRADAs.

[4]As a result of legislation authorizing defense R&D activities, support for "dual use" technology—technology that can be used for military as well as commercial applications—became an accepted objective for many CRADAs.

In contrast, the number of CRADAs that a NIST or Army laboratory can implement does not depend on a specific amount of funds designated for CRADAs within an R&D account but rather on the laboratory manager's determination of available resources—scientists and R&D facilities. Consequently, several NIST and Army laboratory managers told us that they have no set objective for the number of CRADAs they will approve but rather seek a "balance" between CRADAs and all other laboratory R&D. NIST officials believe that collaborative efforts currently represent between 5 percent and 10 percent of all laboratory work. An Army official said that the level of the Army's effort is difficult to estimate because it requires sorting out the time spent on collaborative efforts with industry from the time spent on other mission R&D; however, he also said that several Army laboratories estimate their collaborative efforts at between 4 percent and 25 percent of all their R&D work.

Our analysis of available laboratory estimates of the resources contributed directly to CRADAs in fiscal years 1991 and 1992 shows that DOE devoted less than 1 percent of its R&D funds to CRADAs, while the NIST and Army laboratories devoted almost 4 percent and 2 percent of their R&D resources to CRADAs, respectively. Furthermore, we found that for every 100 scientists and engineers at each laboratory we surveyed, NIST implemented about 9 CRADAs, the Army implemented 7 CRADAs, and DOE implemented 0.4 CRADAs, although the data supporting our analysis did not allow us to determine the average number of personnel associated with each CRADA at any of the agencies. DOE officials estimate that their CRADAs may be twice as large as NIST's and the Army's. However, even if we assumed that DOE's CRADAs were four or five times "larger" than NIST's or the Army's, DOE would still appear to have devoted relatively fewer resources to CRADAs during fiscal years 1991 and 1992 than NIST or the Army.

DOE officials told us in December 1993 that a number of institutional factors (discussed in detail in the following section of this letter) are responsible for these findings during the first 2 years of DOE's CRADA program. They also pointed out that it took some time for the Department to incorporate CRADAs as part of its overall technology transfer program and that CRADAs are considered to be only one of several tools they can use to accomplish technology transfer goals. Even so, DOE technology transfer officials report that the number of CRADAs has increased dramatically since the end of 1992, the last year included in our analysis. Recent reports show that DOE implemented over 300 CRADAs during 1993, the third year of DOE's CRADA program. DOE also recently announced that it plans to support some of its CRADAs at selected laboratories on a trial basis with "block funding."

Under this pilot arrangement, Defense Programs and Energy Research would transfer a portion of the funds designated for CRADAs to the laboratories and allow the laboratories to select and fund CRADAs without having to go through a competitive review at headquarters.

Institutional Factors Led DOE to Centralize Its Process for Implementing CRADAs

DOE officials told us that a number of institutional factors led DOE to initially establish a headquarters-controlled CRADA process that, among other things, allows the Department to pursue a strategy of implementing multilaboratory and/or multipartner CRADAs directed at achieving specific national R&D goals. However, DOE's CRADA implementation process takes longer and uses more resources than NIST's or the Army's, even when only one collaborator at one laboratory is involved. In addition, DOE, like NIST and the Army, initially did little to evaluate the impact of its CRADAs. Recently, however, DOE has taken some initial steps to develop measures to evaluate its CRADAs.

Institutional Factors Determine DOE's Approach to CRADAs

One important institutional factor affecting the development of DOE's centralized CRADA implementation process was DOE's long-standing tradition of securing and preventing the transfer of secret technology from the Department's weapons laboratories. In addition, DOE officials were (and are) concerned because our office and others have criticized the Department for its inability to oversee the contractors that manage its laboratories. DOE's policy to initially centralize decision-making and to designate specific funds for CRADAs also resulted from DOE officials' desire to publicize reports of large CRADA contributions to demonstrate the success of DOE's technology transfer efforts to the Congress and the public. Consequently, DOE officials decided to pursue large multicollaborator, multilaboratory CRADAs directed at achieving specific R&D objectives in hopes that these large efforts would help demonstrate a continuing need for the Department's laboratories. Finally, a DOE official pointed out that the number of DOE R&D facilities almost requires that headquarters exercise tight, centralized controls to prevent more than one laboratory from pursuing similar or the same cooperative research.

These and other factors led DOE to initially centralize its process for implementing most of its CRADAs. For example, the Offices of Defense Programs and Energy Research periodically conducted CRADA funding competitions similar to the year-long competitions for federal grants that fund R&D for many nonfederal organizations. These competitions among the contractor-operated laboratories were generally scheduled annually,

although laboratory officials said that in 1992 Defense Programs conducted two full competitions and selected several additional CRADAs after some additional Defense Programs funds were made available for technology transfer activities. In 1993, Defense Programs and Energy Research each conducted one competition.

DOE program officials said they must conduct these competitions to give all of their laboratories and potential collaborators fair access to the funds designated for CRADAs. However, these competitions may have had a negative impact outside the CRADA program. Many of the laboratory directors and technology transfer officials whom we spoke with described how the competitions increase their anxiety about the future of DOE's weapons laboratories and, in turn, affect the cooperative relationship among scientists from different DOE laboratories. Technology transfer officials said that to preserve their laboratory's standing in the competition, they quietly caution potential CRADA researchers to limit the information they share with their counterparts at DOE's other laboratories.

DOE's Processes Lengthen Time for Implementing CRADAs

Analysis of available data on CRADAs from the two NIST and Army laboratories we surveyed showed that it took these agencies about 1.5 and 3 months, respectively, to implement a CRADA with one collaborator during fiscal years 1991 and 1992. Similarly, officials at two government-owned and government-operated DOE laboratories estimate that the CRADAs they implement that are supported by program offices other than Defense Programs and Energy Research take between 2 and 4 months to approve. In contrast, our analysis of data provided by technology transfer officials at four DOE contractor-operated laboratories showed that, on average, it took them about 7.5 months to implement a one-collaborator, one-laboratory CRADA. In addition, a DOE laboratory official told us that some of the CRADA proposals that Energy Research funded in 1993 had been waiting for funding since 1991.

At least several months of the difference in implementation time can be attributed to the many levels of review in DOE's competition for CRADA funding. For each CRADA chosen to compete for Defense Programs or Energy Research funds, laboratory officials first prepared and submitted a proposal that was, in turn, reviewed and ranked by panels and boards of scientists and technology transfer officials from other laboratories, or from other program areas at DOE headquarters. This process sometimes took several months to complete. Then, after a proposal was accepted, the final joint work statement and CRADA document had to be reviewed and

approved by a government contracting officer and a budget analyst. In summary, DOE's CRADA implementation process involved many laboratory, regional operations, and headquarters officials.

Some of the difference in implementation time can also be attributed to high-level negotiations that DOE conducted with representatives of groups of potential CRADA collaborators, such as the American Textile Partnership. DOE conducted these negotiations to develop broad-based agreements that it hopes will lead to large multilaboratory, multicollaborator CRADAs. These agreements—which DOE sometimes calls "umbrella" CRADAs—do not immediately lead to R&D collaborations. Rather, they set out the general provisions under which each laboratory can begin to negotiate individual CRADAs.

NIST and the Army can make CRADA decisions more quickly than DOE because (1) no additional time is required to compete for funds designated for CRADAs and (2) far fewer individuals are involved in the decision-making process. NIST and Army officials told us that involving a limited number of personnel in CRADA decision-making was crucial to a timely CRADA implementation process.

Consolidating Paperwork Could Streamline DOE's CRADA Decision-Making

We found that DOE'S CRADA processing documents—the proposal that is used to select a CRADA, the statutorily required joint work statement that describes the plans for the CRADA's R&D, and the required CRADA—contain much of the same information in different formats. As described above, in many cases all three of these documents are reviewed and approved, at different times and locations, by different DOE officials. DOE officials said that the joint work statement and the CRADA require separate preparation, review, and approval because the 1989 technology transfer legislation required the preparation of separate documents and established 90-day and 30-day deadlines for approving the joint work statement and the CRADA, respectively.

In our June 1993 testimony, we suggested that one option for speeding up DOE'S CRADA approval process would be to change the existing legislation to permit the consolidation of the joint work statement and CRADA into one document and to reduce the time DOE is allowed to review it. Since then, the Senate has passed legislation that would eliminate the requirement for DOE to process a separate joint work statement and would require DOE to approve or disapprove a CRADA within 30 days. The House is considering similar legislation.

In addition to encountering delays caused by multiple reviews, DOE's negotiations typically took longer than NIST's or the Army's, in part, because the CRADA document that DOE initially developed for negotiating CRADAs with collaborators was less flexible than the document used by NIST and the Army. NIST and Army officials use a CRADA model that the laboratory technology transfer official and attorney can tailor to each collaboration by mixing and adapting, as necessary, contractual terms and conditions selected from an approved core group. In contrast, DOE headquarters officials began negotiations with a CRADA that DOE called a "redline" model. DOE officials said they advised collaborators that additional implementation time would be needed if the collaborator wanted to make changes to the "redlined," or underlined, words in the contract.

In December 1993, DOE headquarters technology transfer officials told us that they were planning a number of steps to speed up the CRADA process and make it more flexible. Later that month, DOE announced that it had sent two simplified CRADA formats—a modular CRADA and a CRADA for small businesses—to the laboratories for immediate use. Designed to make the process more flexible, the new formats should cut the time needed to implement the agreements.

Agencies Have Not Evaluated CRADAs

Neither NIST and the Army nor DOE routinely evaluates the effectiveness of its CRADAs. In 1992, however, 6 years after the Federal Technology Transfer Act gave federal agencies the authority to conduct CRADAs, NIST hosted a "visiting" committee to evaluate its CRADA experience. This committee, which consisted of industrial, academic, and government officials, examined how well NIST's CRADAs were working and how they could work better. On the basis of its findings, the committee suggested several strategies and procedures for improving NIST's CRADA partnerships.

The committee noted that, although much of the evidence is anecdotal, CRADAs appear to promote technical collaborations. The committee also suggested that an objective study was needed to evaluate the effect of CRADAs on transferring technology and to identify ways of improving CRADAs. To date, none of the three agencies has initiated such a review, although an Army technology transfer official said his agency had considered evaluating its CRADAs. In addition, DOE has begun to collect data from ongoing CRADAs and is working to develop performance measurements to allow it to evaluate the effectiveness of CRADAs. In so doing, DOE has also held a series of meetings across the country to obtain

feedback from the laboratories and industry on its evolving CRADA process. DOE officials also note that, to date, no uniform standards exist on which to evaluate the effect or impact of CRADAs implemented by any government agency.

Conclusions

A number of institutional and other factors, such as a concern about past criticism of inadequate controls over laboratory contractors and a desire to draw attention to technology transfer efforts, led DOE officials to initially develop a highly centralized, headquarters-controlled cooperative R&D agreement approval process to fund most of the Department's collaborative efforts. In contrast, the directors of the National Institute of Standards and Technology and the Army laboratories select which agreements to support at the local level on the basis of available expertise and resources. No centralized funding mechanism or selection process is used.

Because most of DOE's cooperative R&D agreements were started within the last 2 years, it is too soon to say whether DOE's centralized approval process is more or less effective than the National Institute of Standards and Technology and the Army's decentralized approach in improving or enhancing the competitiveness of U.S. industry. On the one hand, DOE's process brought many laboratories and partners together to pursue major research and development objectives. It also allowed DOE headquarters officials to focus the cooperative efforts of different facilities and reduce the chances of efforts being duplicated at different laboratories. On the other hand, DOE's centralized process may have limited the number of cooperative R&D agreements that the Department's laboratories can implement. Furthermore, because the process involves many levels of review, it generally took DOE about three to five times longer than the National Institute of Standards and Technology or the Army to approve an agreement—time that could prove critical in today's fast-paced, high-technology world markets. Some of this delay can be attributed to the legislative requirement that DOE separately review and approve a joint work statement and a cooperative R&D agreement.

DOE officials have recognized the need to improve their cooperative R&D agreement implementation process and have taken some initial steps, such as developing a simplified agreement document, to speed up the approval time. They have also taken some steps to allow more cooperative R&D agreement implementation decisions to be made at the laboratories and regional operations offices. We believe that DOE should continue to look

for ways to enhance the technology transfer potential of these agreements at the DOE laboratories. For example, DOE should continue to look at new ways to build more flexibility into its system so that laboratory scientists can conduct cooperative R&D agreements when resources are available, without going through a competitive headquarters selection process. In addition, DOE should begin to evaluate the impact of ongoing agreements to determine what techniques are most productive. We also believe that DOE needs to discuss its cooperative R&D agreement strategy with officials from private industry and academia.

Recommendations to the Secretary of Energy

Recognizing that the Department of Energy is already taking steps to expedite and add flexibility to its existing cooperative R&D agreement processes, we recommend that the Secretary of Energy review the Department's cooperative R&D agreement strategy and policies. In conducting this review, the Department should consider establishing a visiting committee whose members include officials from industry, academia, and government agencies other than the Department. The committee should study and report to the Secretary on ways to improve the selection and funding of cooperative R&D agreements. We also recommend that the Secretary develop a systematic process for evaluating the impact of completed and ongoing cooperative R&D agreements.

Agency Comments

We discussed the information in this report with officials from DOE headquarters, laboratories, and regional operations offices; NIST; and the Army. Officials from NIST and the Army said we had accurately described the process they use to implement their CRADAs. DOE headquarters officials stressed the many institutional differences between DOE, NIST, and the Army, which, they said, are largely responsible for the differences in how each agency implements CRADAs. These officials also emphasized the recent improvements they have made in DOE's CRADA implementation processes. We have included these views in the report where appropriate. However, as requested, we did not obtain written comments on a draft of this report from DOE, NIST, or the Army.

Scope and Methodology

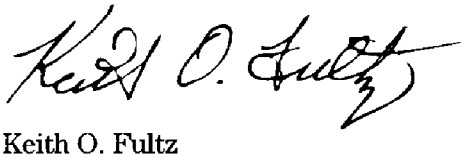
We conducted our review between October 1992 and December 1993 in accordance with generally accepted government auditing standards. To obtain our information, we interviewed senior officials at the NIST, Army, and DOE headquarters offices and at DOE's Albuquerque and San Francisco field offices. We also interviewed managers and researchers at six federal

laboratories—the Lawrence Berkeley, Lawrence Livermore, Los Alamos, and Sandia National Laboratories owned by DOE; the NIST Laboratory, part of the Department of Commerce in Gaithersburg, Maryland; and the Army Research Laboratory at Fort Monmouth, New Jersey. In addition, we spoke with several industry executives experienced in CRADA negotiations.

We obtained relevant information on CRADAs from NIST, the Army, and DOE for 3 years, from 1990 through 1992. This information included the availability of laboratory resources, the number of CRADAs requested and implemented, the contributions made by the government and the collaborator, the technology developed, and the time used to identify, negotiate, and approve CRADAs. To standardize terminology among all three agencies, we described a CRADA's implementation time as the time from when a company first expresses interest in a CRADA until all approvals have been granted and the collaborative work can begin at the laboratory.

As arranged with your offices, 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 appropriate congressional committees; the Secretary of Energy; the Secretary of Commerce; the Secretary of the Army; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

This report was prepared under the direction of Victor S. Rezendes, Director of Energy and Science Issues, who may be reached at (202) 512-3841 if you or your staff have any questions. Major contributors to the report are listed in appendix I.



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