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Report to Congressional Requesters

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TECHNOLOGY TRANSFER

Implementation Status of the Federal Technology Transfer Act of 1986

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Resources, Community, and
Economic Development Division

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May 30, 1989

The Honorable Robert A. Roe
Chairman, Committee on Science, Space,
and Technology
House of Representatives

The Honorable Robert S. Walker
Ranking Minority Member,
Committee on Science, Space,
and Technology
House of Representatives

In your letter of June 17, 1988, you requested us to examine the implementation of the Federal Technology Transfer Act of 1986 (P.L. 99-502). Technology transfer is the movement of federally owned or originated technology from one organization, area, or purpose to another. The act promotes technology transfer from federal laboratories primarily by (1) permitting federal agencies to delegate authority to government-operated laboratories to enter into cooperative research and development agreements with entities in both the public and private sector and (2) providing federal employees incentives to promote technology transfer.

As requested by your letter and subsequently agreed to with your office, we obtained information on the implementation of several key aspects of the act at 12 federal agencies and 25 of their laboratories. Key aspects of the act that we examined included agencies' delegation of authority to laboratories to enter into cooperative research and development agreements, the number of such agreements entered into, incentives provided to government employees to promote technology transfer, and the status of reports mandated by the act.

Results in Brief

Federal agencies have taken numerous actions to implement the Federal Technology Transfer Act of 1986. Ten of the agencies we contacted had delegated authority to their laboratories to enter into cooperative research and development agreements. As of February 1989, the agencies contacted had entered into a total of 172 agreements under the specific authority of the 1986 act, in addition to agreements some agencies continued to enter into under their respective authorizing acts. As required by the act, each of the agencies either had distributed or planned to distribute to federal inventors at least 15 percent of royalties collected; and one agency had established a new cash awards program

focused solely on technology transfer. The Department of Commerce has drafted its first biennial report on the extent to which federal agencies have implemented the 1986 act. The agencies have submitted all other reports required by the act to date.

We believe it is too early to determine the impact the act has had on technology transfer. Further, although agencies reported undertaking numerous technology transfer activities, the activities are defined differently and, consequently, uniform statistical information has not been available to make a comprehensive evaluation. To resolve this problem and facilitate evaluating the impact of the act on technology transfer, we are conducting a separate review to develop criteria for reporting technology transfer activities.[1]

Background

The Federal Technology Transfer Act of 1986 provided agencies with considerable flexibility in how they could implement the act. It permitted but did not require, agencies to delegate to their laboratories authority to enter into cooperative research and development agreements.[2] The Congress expected that the act would make entering into these agreements as easy as possible, while protecting the government's interests. As incentives for technology transfer, the act established royalty sharing for federal inventions and directed agencies to provide cash awards. The act also mandated that the Department of Commerce report biennially and each agency with government-operated laboratories report annually to the Congress on technology transfer activities conducted under the act.

[1]This review is being performed by our Program Evaluation and Methodology Division.

[2]Although the 1986 act made agency delegation of authority to laboratory directors permissive, Executive Order 12591, April 10, 1987, as amended, states that agencies shall, within overall funding allocations and as permissible by law, delegate authority to their laboratories to enter into cooperative research and development agreements.

Delegation of Authority to Enter Into Cooperative Research and Development Agreements

Of the 12 agencies we contacted, 10 had delegated authority to their laboratories to enter into cooperative research and development agreements. In making the delegations, some agencies defined laboratories to be headquarters offices, which are at higher organizational levels than field laboratories or research centers. For example, the Department of Agriculture considered its Agricultural Research Service a laboratory—not the Service's approximately 120 research laboratories and facilities. According to Agriculture officials, most of these entities are small and lack the expertise or resources needed to enter into the agreements.

The two agencies that did not delegate such authority to their laboratories were the National Aeronautics and Space Administration (NASA) and the Navy. NASA historically has worked with industry using collaborative agreements entered into under the Space Act of 1958 and was the only federal agency to have a technology transfer mission at the time of the 1986 act.[3] NASA opted to continue its technology transfer activities under its Space Act authority and therefore has taken little action under the authority of the 1986 act.[4] According to Navy officials, the Navy has not delegated any authority to enter into agreements because its laboratories do not have the expertise to address liability issues that might arise. These officials added that after the laboratories have more experience with cooperative research and development agreements, the Navy might delegate such authority to its laboratories.

Of the 25 laboratories included in our study, 15 had been delegated authority to enter into agreements. Of the 10 not delegated such authority, 5 were not considered to be laboratories by their respective agencies and the other 5 were either NASA or Navy laboratories. (See app. II.)

Cooperative Research and Development Agreements

The 12 federal agencies we contacted had reported to the Office of Management and Budget and the cognizant appropriations subcommittees that they had entered into a total of over 1,200 cooperative research and development agreements in each of fiscal years 1987 and 1988. However, the 1986 act provides agencies flexibility by broadly defining a cooperative research and development agreement, and we found that they were reporting different types of agreements. For example, some agencies included agreements entered into under the authority of their

[3]See Congressional Research Service Issue Brief IB85031, Technology Transfer: Utilization of Federally Funded Research and Development, April 14, 1988.

[4]The 1986 act's cooperative research and development agreement provision was not intended to limit or diminish existing authorities of any agency.

respective authorizing acts, while other agencies included only those agreements entered into under the specific authority of the 1986 act. As of February 1989, the agencies had entered into a total of 172 agreements specifically under the authority of the 1986 act. The Agricultural Research Service, which over the years has worked closely with the private sector, was the first to enter into an agreement under the 1986 act and, as of February 1989, had the most—59 agreements. Others with a large number of agreements were the National Institutes of Health (48) and the National Institute of Standards and Technology (37). (See app. III for a list of the numbers per agency.)

Agencies that had not entered into similar agreements prior to the act have begun entering into cooperative research and development agreements. For example, the Air Force signed its first agreement in September 1988 and, as of February 1989, had entered into eight agreements and was processing another nine. (See app. III.)

Incentives to Federal Employees

The agencies we contacted had taken some actions to implement the act's incentive provisions. The act, as amended, requires that agencies distribute at least 15 percent of royalties and other income, such as licensing fees, to federal inventors and others that assign rights to inventions or intellectual property to the federal government.[5] This provision applies to all royalties or other income collected since the date of the act, October 20, 1986.

From October 1986 through September 1988, nine of the agencies collected a total of about $4.6 million in royalties.[6] These agencies had distributed or planned to distribute to the federal inventor at least 15 percent of the royalties they collected. The three agencies that had not yet collected any royalties each planned to distribute at least 15 percent to federal inventors.

The National Institutes of Health collected the most royalties, about $3.9 million, which were for agreements made prior to the 1986 act and were primarily for the National Cancer Institute's acquired immune deficiency syndrome-related inventions. A National Institutes of Health official explained that no royalties had been collected to date for inventions

[5]Agencies can establish an alternative royalty sharing program that, among other things, provides at least 15 percent of total agency royalties in any fiscal year to all such inventors.

[6]Royalties collected include licensing fees and are not necessarily for agreements made under the authority of the 1986 act.

made as part of cooperative research and development agreements because it generally takes at least 2 to 3 years for inventions to be made and to reach the marketplace.

The Agricultural Research Service has established a new cash awards program focused on technology transfer. The Service established the program in September 1988 and plans to make its initial awards in June 1989. Other agencies relied on their existing cash awards program to reward their employees for promoting technology transfer. These programs, as well as the possibility of royalties, are publicized to employees through various formal and informal mechanisms. (See app. IV.)

Mandated Reporting

Agencies have submitted to the Congress most of the reports mandated by the 1986 act. In April 1988, the Federal Laboratory Consortium for Technology Transfer[7] issued to the Congress, and to the federal agencies that contributed funds to the consortium, a report entitled Activities of the Federal Laboratory Consortium for Technology Transfer. In May 1988, the Secretary of Commerce issued to the President and the Congress its report: Barriers to the Commercialization of Federal Computer Software and Feasibility and Cost of Compiling an Inventory of Federally Funded Training Software. As of May 1989, Commerce, with input from the various federal agencies, had under final review a draft of its first biennial report[8] to the President and the Congress on the implementation of the act. These reports cite numerous examples of technology transfer activities and portray the implementation of the 1986 act in a positive light.

The act also requires each federal agency that operates or directs one or more federal laboratories to include in its annual budget submission to the Congress a report on the activities performed in carrying out the act's technology transfer provisions. For fiscal year 1989, the agencies included their reports in budget materials submitted to the Office of Management and Budget and the cognizant appropriations subcommittees. The agencies' reports provided information on their respective technology transfer activities. However, as we mentioned with respect to cooperative research and development agreements, the agencies used

[7]The Federal Laboratory Consortium for Technology Transfer is a networking organization to promote technology transfer. More than 300 federal laboratories and research centers, representing 14 federal agencies, are members.

[8]Commerce's draft report is entitled The Federal Technology Transfer Act: The First Two Years.

different definitions; consequently the reports do not provide uniform statistical information.

Conclusions

Federal agencies have taken numerous actions to implement the 1986 act, but we believe that it is too early to determine what impact the act has had on technology transfer. In this regard, its effect on commercial products has not yet occurred because it takes at least 2 to 3 years for inventions to be made and to reach the marketplace. Even though the agencies had entered into 172 agreements specifically under the authority of the 1986 act, royalties have not yet resulted from them. Further, for purposes of entering into cooperative research and development agreements, the act defines laboratories and such agreements broadly, thereby allowing agencies considerable flexibility in implementing the act. Because agencies have made different interpretations, the technology transfer activities reported by agencies and laboratories represent different activities and uniform statistical information has not been available to make a comprehensive evaluation. To resolve this problem and facilitate evaluating the impact of the act on technology transfer, we are conducting a separate review to develop criteria for reporting technology transfer activities. (See app. IX.)

In preparing this report, we interviewed headquarters officials at 12 federal agencies that have government-owned and -operated laboratories and technology transfer officials at 25 of their laboratories, including some at both large and small laboratories. Background information on the 1986 act; our objectives, scope, and methodology; and a list of the agencies and laboratories contacted in our study are presented in appendix I.

You asked us to provide, in addition to the information on key aspects of the act discussed above, a brief description of the agencies' Offices of Research and Technology Applications and agencies' and laboratories' views on barriers to the act's implementation, the Federal Laboratory Consortium for Technology Transfer, and incentives for seeking foreign patents. These issues are discussed in appendixes V through VIII.

We discussed the information included in this report with agency officials, who agreed with the accuracy of the facts presented. However, as requested by your office, we did not obtain official agency comments on this report. We did not fully verify the statistical information the agencies provided. Our review was performed in accordance with generally

accepted government auditing standards between June 1988 and March 1989.

Major contributors to this report are listed in appendix X. If we can be of further assistance, please contact me at (202) 275-5525.

John M. Ols, Jr.
Director, Housing and
Community Development Issues

Contents

Abbreviations

CRDA	cooperative research and development agreement
EPA	Environmental Protection Agency
FLC	Federal Laboratory Consortium for Technology Transfer
GAO	General Accounting Office
NASA	National Aeronautics and Space Administration
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
ORTA	Office of Research and Technology Applications
R&D	research and development
USGS	U.S. Geological Survey

Background and Objectives, Scope, and Methodology

Background

In carrying out their respective missions, federal agencies annually spend billions of dollars for research and development (R&D). In fiscal year 1988, the federal government spent about $63 billion on R&D, of which about $16 billion was for R&D at federal laboratories. These laboratories are a potential source of technology, technical expertise, and techniques that may have commercial application. The commercialization of these technologies is the responsibility of private industry, however, not the federal government. The movement of federally owned or originated technology from federal laboratories to industry and/or state and local governments is achieved through technology transfer—a process by which technology developed in one organization, in one area, or for one purpose is applied and used in another organization, in another area, or for another purpose.[1]

Stevenson-Wydler Act of 1980

As concerns grew about U.S. competitiveness during the 1970s, the Congress began questioning whether the federal government was receiving an adequate return from its R&D expenditures. The Congress passed the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3701 et seq.), making technology transfer part of the mission of all federal agencies carrying out R&D.[2] This act also required federal agencies to establish at laboratories[3] an Office of Research and Technology Applications (ORTA) that would identify technologies and ideas with potential applications in other settings.

[1]For a more detailed definition of technology transfer, see Technology Transfer: Utilization of Federally Funded Research and Development, Issue Brief IB85031, Congressional Research Service, April 14, 1988.

[2]At the time this act was passed, according to the Congressional Research Service, the National Aeronautics and Space Administration (NASA) was the only federal agency that had technology transfer as part of its mission.

[3]The act originally required that an ORTA be established at each laboratory with an annual budget of $20 million or more. The 1986 act amended this, requiring laboratories with 200 or more full-time-equivalent scientific, engineering, and related technical positions to provide one or more full-time-equivalent positions as staff for their ORTAs.

Key Aspects of the Federal Technology Transfer Act of 1986

The Federal Technology Transfer Act of 1986 (P.L. 99-502) amended the Stevenson-Wydler Act to permit federal agencies to delegate authority to government-operated laboratories to collaborate with other agencies, private industry, state and local governments, and nonprofit organizations through cooperative R&D agreements (CRDA).[4] The definition of a CRDA is broad. Under a CRDA, one or more federal agencies, through its laboratories, may provide personnel, services, facilities, equipment, or other resources (but not funds), with or without reimbursement, to one or more nonfederal parties who, in turn, may provide funds, personnel, services, facilities, equipment, or other resources toward the conduct of specified R&D efforts that are consistent with the laboratories' missions. The act sought to make entering into such CRDAs as easy as possible, while protecting the legitimate concerns of the government. The act's legislative history indicates that CRDAs were not expected to disseminate restricted information or to transfer classified technologies. Although the act states that a CRDA is not a procurement contract, agencies may adopt as many provisions of the Federal Acquisition Regulations as they deem appropriate.

The act allows some flexibility in how agencies may implement a CRDA. Under a CRDA, a government-operated laboratory may (1) accept, retain, and use funds, personnel, services, and properties from collaborating parties and provide the same to the collaborating parties (except no funds may be provided to nonfederal parties); (2) grant, or agree to grant in advance, to a collaborating party patent licenses or assignments of licenses for any invention made in whole or in part by a federal employee (but the government must retain nonexclusive rights to use the inventions); (3) waive, in whole or in part, any right by the federal government to an invention, except for the nonexclusive right to use the invention; (4) determine the rights to other intellectual property developed under a CRDA; and (5) consistent with agency requirements and standards of conduct, permit laboratory employees or former employees to commercialize inventions they made while in the service of the United States. Moreover, memoranda of agreement which preexisted the 1986 act may meet the definition of a CRDA as long as the agreement does not transfer federal funds to participants and is for specified R&D directed toward a laboratory mission.

[4]Although the 1986 act made agency delegation of authority to laboratory directors permissive, Executive Order 12591, April 10, 1987, as amended, states that agencies shall, within overall funding allocations and as permissible by law, delegate authority to their laboratories to enter into CRDAs.

To provide incentives for federal employees to promote technology transfer, the act established royalty sharing for federal inventions and directed agencies to have a cash awards program focused on technology transfer. The act directs agencies to either (1) pay an employee inventor[5] at least 15 percent of any royalties or other income received—up to $100,000 per year for an invention—or (2) establish an alternative royalty sharing program. Any agency that expends more than $50 million per fiscal year for R&D at its government-operated laboratories is required to have a cash awards program to reward its scientific, engineering, and technical personnel for inventions, innovations, other outstanding scientific or technological contributions, or exemplary activities that promote technology transfer.

The 1986 act also formally established the Federal Laboratory Consortium for Technology Transfer (FLC), which evolved from a consortium created by the Department of Defense in 1971. The FLC is a networking organization of federal laboratories and their technology transfer offices. Its purpose is to help federal laboratories transfer technologies. The 1986 act requires the FLC to annually report its activities and expenditures to the Congress.

The act contains a number of other reporting requirements. The Secretary of Commerce must submit a one-time report to the President and the Congress on copyright provisions and other legal barriers that limit the transfer of federally funded computer software and on the feasibility and cost of compiling and maintaining a current and comprehensive inventory of all federally funded training software. The Secretary of Commerce is also required to report biennially on agencies' use of Stevenson-Wydler Act authorities. Also, each agency must include in its annual budget submission to the Congress a report on its technology transfer activities and the amounts of royalties and other income received and expenditures made, including inventor awards.

Objectives, Scope, and Methodology

In a letter dated June 17, 1988, the Chairman and Ranking Minority Member, House Committee on Science, Space, and Technology, asked us to examine the implementation of the Federal Technology Transfer Act of 1986 (P.L. 99-502). As requested by that letter and subsequently

[5]The National Institute of Standards and Technology Authorization Act for Fiscal Year 1989 (P.L. 100-519) amended this provision to include any inventor that assigned his or her rights in an invention to the United States.

agreed to with your office, we obtained (1) information on agencies' delegating authority to their laboratories to enter into CRDAs, (2) the number of CRDAs entered into, (3) data on the agencies' implementation of provisions for royalties and cash awards to federal employees and on how agencies publicized their incentives programs, (4) the status of the reports mandated by the act, (5) a brief description of laboratories' ORTAs, (6) agencies' and laboratories' views on barriers to CRDAs, (7) agencies' and laboratories' views on the FLC, and (8) agencies' views on whether domestic users of federal inventions and intellectual property have sufficient authority and incentive to seek foreign patent protection.

To accomplish our objectives, we interviewed technology transfer officials at agency headquarters in Washington, D.C., and used a data collection instrument for obtaining information from officials at 25 selected laboratories.[6] Agency headquarters visited in the Washington, D.C., metropolitan area included those of the U.S. Department of Agriculture's Agricultural Research Service; the Department of Commerce and its National Institute of Standards and Technology (NIST) and National Oceanic and Atmospheric Administration (NOAA); the Department of Defense[7] and the Air Force, Army, and Navy; the Department of Energy's Office of Fossil Energy; the Department of the Interior and its Bureau of Mines and U.S. Geological Survey (USGS); the Environmental Protection Agency (EPA); the National Aeronautics and Space Administration (NASA); and the National Institutes of Health (NIH). As agreed with the requesters' offices, we selected laboratories in the Washington, D.C., metropolitan area and laboratories in other regions of the country, including large and small laboratories of interest to the requesters' offices. Laboratories included in our review are both headquarters offices designated by their respective agencies to be laboratories for the purposes of the 1986 act and relatively small field research centers not considered to be laboratories. Because the laboratories were not randomly selected, information obtained does not necessarily represent the status of implementation at other laboratories. The 12 agencies and 25 laboratories and research facilities we contacted are listed in table I.1.

[6]The 25 laboratories were selected from research facilities listed in the Directory on Federal Laboratory and Technology Resources, 1988-1989, Center for the Utilization of Federal Technology, National Technical Information Service, Department of Commerce.

[7]For purposes of the 1986 act, the Air Force, Army, and Navy are defined as agencies. Accordingly, the services have direct statutory authority and no action to implement the act for the services was required by the Department of Defense.

Table I.1: Agencies and Laboratories Included in This Study

Agency/laboratory	Location
Agricultural Research Service	
Agricultural Research Service[a]	Beltsville, MD
Western Regional Research Center[b]	Berkeley, CA
NIST	
Office of Research and Technology Assistance, NIST[a]	Gaithersburg, MD
NOAA	
Satellite Applications Laboratory[b]	Camp Springs, MD
EPA	
Air and Energy Engineering Research Laboratory	Triangle Park, NC
Health Effects Research Laboratory	Triangle Park, NC
Energy	
Morgantown Energy Technology Center	Morgantown, WV
Pittsburgh Energy Technology Center	Pittsburgh, PA
NIH	
National Cancer Institute	Bethesda, MD
National Institute for Aging	Bethesda, MD
Air Force	
Air Force Wright Aeronautical Laboratories	Dayton, OH
Army	
Harry Diamond Laboratories	Adelphi, MD
Army Engineer Topographic Laboratories	Ft. Belvoir, VA
Army Ballistic Research Laboratory	Aberdeen, MD
Letterman Army Institute of Research	San Francisco, CA
Navy	
Naval Research Laboratory	Washington, DC
Naval Ocean Systems Center	San Diego, CA
Naval Air Test Center[b]	Patuxent River, MD
Naval Surface Weapons Center	Silver Spring, MD
Naval Underwater Systems Center	New London, CT
Bureau of Mines	
Bureau of Mines[a]	Washington, DC
Pittsburgh Research Center[b]	Pittsburgh, PA
USGS	
USGS National Center[a]	Reston, VA
USGS Western Region[b]	Menlo Park, CA
NASA	
Lewis Research Center	Cleveland, OH

[a]For purposes of the Federal Technology Transfer Act of 1986, these headquarters offices are considered by their respective agencies to be laboratories.

[b]For purposes of the act, agencies did not consider these research facilities to be laboratories.

To obtain an overview of the status of the implementation of the 1986 act, we attended the FLC's November 1988 conference on the implementation of the Federal Technology Transfer Act. To gain a perspective on the act and the problems or barriers being encountered, we examined past reports on the subject and the act's legislative history.

To ascertain the status and problems encountered in delegating to laboratories the authority for entering into CRDAs, we spoke with officials from each agency and one or more of its laboratories. We verified that delegations had been made by obtaining copies of relevant documents.

We obtained information on the number of CRDAs entered into from the agencies and laboratories, focusing on CRDAs entered into under the authority of the 1986 act. At the time we initially interviewed agency and laboratory officials, we obtained copies and listings of CRDAs to validate that CRDAs had been entered into. However, those interviews took place at various times, and to provide more recent and consistent time frames, we obtained updates from responsible officials without further verification.

To ascertain the extent to which agencies and laboratories have implemented the royalty and cash award incentives for federal inventors, as well as publicized their incentives programs, for the period October 1986 through September 1988, we interviewed laboratory and agency officials and reviewed documents they provided.[8] However, because extensive time would be required to examine the relatively large number of accounting systems involved, we did not independently verify the accuracy of the information provided.

To ascertain the status of the reports mandated by the act, we obtained copies of the reports issued by the various agencies and discussed them with agency officials.

We obtained a brief description of laboratories' ORTAs from each agency and discussed their organization and function with each of the laboratories included in our review.

We obtained agencies' and laboratories' views on barriers to CRDAs through interviews with agency and laboratory officials. We followed

[8]On October 24, 1988, the National Institute of Standards and Technology Authorization Act for Fiscal Year 1989 (P.L. 100-519) amended the royalty provision to include any inventor that assigns his or her rights to an invention to the United States. Although this provision was made retroactively effective to October 20, 1986, royalties discussed in this report are those for federal inventors.

up on problems or barriers mentioned in our March 1988 report.[9] To gain additional perspective, we reviewed past reports on this issue by the Congressional Research Service, Commerce, the FLC, and others.

We interviewed agency and laboratory officials for their views on the FLC. To understand the FLC's objectives and scope of activities, we also spoke with the FLC's Washington, D.C., representative and reviewed documents provided.

We also obtained views on incentives for seeking foreign patent protection through interviews with agency officials. Because many of the agencies included in our review rely on Commerce's National Technical Information Service for obtaining patents, we interviewed patent officials at that Service and at Commerce's Patent and Trademark Office, as agreed with the requesters' offices.

We discussed the information included in this report with agency officials, who agreed with the accuracy of the facts presented. However, as instructed by the requesters' offices, we did not obtain official agency comments on this report. As noted above, we did not fully verify the information the agencies provided. Our review was performed in accordance with generally accepted government auditing standards between June 1988 and March 1989.

[9]Technology Transfer: Constraints Perceived by Federal Laboratory and Agency Officials (GAO/RCED-88-116BR, Mar. 4, 1988).

Agencies' Delegation of Authority to Laboratories

As of February 1989, 10 of the 12 agencies we visited had delegated authority to their laboratories to enter into CRDAs under the Federal Technology Transfer Act of 1986. Of the 25 laboratories in our study, 15 had been delegated authority to enter into CRDAs, 5 were not considered laboratories by their agencies, and 5 laboratories belonged to agencies that had not delegated CRDA authority to the laboratory level. Some of the agencies that had made delegations defined laboratories to be headquarters offices, which are at higher organizational levels than field laboratories or research centers.[1] For example, the U.S. Department of Agriculture considered its Agricultural Research Service to be a laboratory. According to Agriculture officials, the Service's approximately 120 research laboratories and facilities lack the expertise or resources needed to enter into CRDAs.

Two agencies, NASA and the Navy, have not delegated authority to their laboratories to enter into CRDAs. NASA, which had a technology transfer mission before the 1986 act was passed, historically has worked with industry using collaborative agreements entered into under its Space Act authority. NASA opted to continue its technology transfer activities under this authority rather than to delegate any authority under the 1986 act. According to Navy officials, the Navy has not delegated authority to its laboratories because, in their view, the laboratories do not have the expertise to address potential liability issues that might arise.

A more detailed discussion of the delegation of authority by the agencies in our study follows.

Agriculture

On May 11, 1987, the Secretary of Agriculture delegated, through the respective Assistant Secretaries (Science and Education and Natural Resources and Environment), authority to enter into CRDAs to the Administrator of the Agricultural Research Service and the Chief of the Forest Service. For purposes of the Federal Technology Transfer Act of 1986, the U.S. Department of Agriculture decided that the Agricultural Research Service and the Forest Service met the definition of "laboratory." Agriculture does not believe the act intended small field activities to be entering into CRDAs and has not delegated such authority to the Agricultural Research Service's approximately 120 field locations.

[1]For provisions of the act pertaining to CRDAs, the 1986 act defines "laboratory" as a facility or group of facilities owned, leased, or otherwise used by a federal agency, a substantial purpose of which is the performance of research, development, or engineering by federal employees.

According to an Agriculture Research Service official, the Service's large research facility at Beltsville, Maryland, also has not been delegated authority to enter into CRDAs. This official explained that because the facility lacks the needed expertise and is located at the Service's headquarters office, Agriculture decided not to duplicate capabilities at Beltsville.

Commerce

National Institute of Standards and Technology

The Secretary of Commerce delegated all of the Department of Commerce's authorities under the 1986 act to the Under Secretary for Economic Affairs.[2] On January 26, 1988, the Under Secretary for Economic Affairs, delegated authority to enter into CRDAs to the Director of the National Bureau of Standards (now NIST). On March 16, 1988, the Director further delegated this authority to NIST's four major organizational units: the National Measurement Laboratory, the National Engineering Laboratory, the Institute for Materials Science and Engineering, and the National Computer Systems Laboratory.

National Oceanic and Atmospheric Administration

On March 18, 1988, the Under Secretary for Economic Affairs delegated implementation authorities of the 1986 act to the Under Secretary for Oceans and Atmosphere, who, in turn, delegated these authorities to the Chief Scientist. Subsequent delegations were issued to NOAA's Assistant Administrators for the Office of Oceanic and Atmospheric Research; the National Marine Fisheries Service; the National Ocean Service; the National Weather Service; and the National Environmental Satellite, Data, and Information Service. The Assistant Administrator for the Office of Oceanic and Atmospheric Research delegated the authority to enter into CRDAs to the only large laboratory within NOAA, the Environmental Research Laboratories, Boulder, Colorado, which has about 200 to 250 researchers. The Assistant Administrator for the National Marine Fisheries Service delegated the authority to the National Marine Fisheries Service's four regional fisheries centers. According to a NOAA official, NOAA has delegated the authority to enter into CRDAs down to the lowest

[2]The National Institute of Standards and Technology Authorization Act for Fiscal Year 1989 (P.L. 100-519) created the position of an Under Secretary of Commerce for Technology within the Department of Commerce. Technology transfer activities, formerly the responsibility of the Under Secretary for Economic Affairs, were transferred to the Under Secretary for Technology.

practical level that has sufficient legal, administrative, and management support.

Defense

Air Force

On October 31, 1988, the Air Force delegated authority to enter into CRDAs to the Commander, Air Force Systems Command, which is responsible for the Air Force's 14 laboratories. On February 4, 1989, the Command formally delegated this authority to its laboratories. The Air Force Systems Command has retained the right to disallow or modify a CRDA within 30 days after it is received.

Army

On November 4, 1987, the Secretary of the Army delegated to the Assistant Secretary of the Army (Research, Development, and Acquisition) authority to enter into CRDAs and to license, assign, or waive rights to intellectual property developed at the laboratories. The Assistant Secretary then delegated this authority to five Army Commands on December 4, 1987.

On March 31, 1988, the Army Material Command, with 22 of the 36 Army's laboratories, became the first of the Army commands to delegate CRDA authority to its laboratories. By mid-November 1988, three other Army commands—the U.S. Army Surgeon General, the U.S. Corps of Engineers, and the U.S. Army Deputy Chief of Staff for Personnel—also had delegated this authority to their respective laboratories. According to the Army, the fifth command, the U.S. Army Strategic Defense Command, does not have a laboratory.

Navy

The Navy domestic technology transfer program has been in effect over 16 years, but the early emphasis was on wide dissemination of Navy technology to all users rather than on exclusive marketing licenses to commercial organizations. According to Navy officials, the Navy has not delegated to its laboratories authority to enter into CRDAs primarily because liability issues might arise that the laboratories do not have the expertise to address; without established procedures, the laboratories lack legal capabilities to ensure that the government's interests are protected. These officials told us that after the laboratories have more experience with CRDAs (one had been entered into as of February 1989),

the Navy may delegate authority to its laboratories. Pending issuance of the authority, laboratory personnel have been encouraged to pursue possible CRDAs and advised to submit any such agreement that is negotiated to the Secretary of the Navy for signature.[3]

Energy

The Department of Energy's two major government-owned, government-operated laboratories are the Morgantown and Pittsburgh Energy Technology Centers. These laboratories, which report to Energy's Office of Fossil Energy, have been involved over the years in many cooperative cofunded R&D projects in technologies such as synthetic fuels and clean coal. Energy indicated in its June 20, 1988, letter to the Subcommittee on Science, Research, and Technology, House Committee on Science, Space, and Technology, that delegation of authority to the laboratories was not needed because the laboratory directors had authority to enter into CRDAs under Energy's authorizing legislation. However, on October 13, 1988, the Assistant Secretary for Fossil Energy delegated authority to the directors of the Energy Technology Centers to enter into CRDAs. The Assistant Secretary noted that the purpose of the delegation of authority was to (1) reemphasize the high priority placed on making available the results of publicly financed R&D to the private sector and (2) clarify any confusion that may have existed about the directors' authority to carry out the provisions of the Federal Technology Transfer Act.

EPA

On December 15, 1988, EPA delegated to its laboratory directors the authority to enter into CRDAs. While the delegation of authority was being developed, EPA's Administrator informed the laboratory directors that they may develop CRDAs; several CRDAs were in process at the time the delegation was made.

Interior

Bureau of Mines

On May 24, 1988, the U.S. Department of the Interior delegated authority to enter into CRDAs to the Director, Bureau of Mines. For the CRDA

[3]About 9 months after the laboratory had submitted a proposed CRDA to Navy headquarters for review and approval, the Navy delegated authority on a one-time basis to the Director, Naval Research Laboratory, to sign the specific CRDA; the laboratory director was not delegated authority to sign other CRDAs.

provisions of the 1986 act, Interior considered the Bureau of Mines to be a "laboratory," and authority has not been delegated to lower-level entities.

U.S. Geological Survey

On May 24, 1988, Interior also delegated authority to enter into CRDAs to the Director, USGS. Interior also considered USGS to be a "laboratory." USGS has not made any further delegations.

NASA

NASA has not delegated authority to enter into CRDAs under the Federal Technology Transfer Act of 1986. Instead, NASA uses its Space Act authority (42 U.S.C. 2473 (c) (5) and (6)) to enter into cooperative agreements similar to those under the Federal Technology Transfer Act of 1986. Under the Space Act agreements, NASA and a U.S. individual or entity may agree to contribute to or participate in a space- or aeronautics-related project of mutual benefit. These agreements usually involve the use of each other's services, equipment, information, and/or facilities.

NASA has formally delegated authority to enter into Space Act agreements to officials in charge of NASA headquarters offices. These offices include the Associate Administrators for Aeronautics and Space Technology, External Relations, Space Flight, Space Science and Applications, Space Tracking and Data Systems, Space Station, and Commercial Programs. This delegation for agreements not involving reimbursement was last revised on January 28, 1985. The delegation authority sets forth limits such as the following: (1) each agreement will be reviewed by the NASA Comptroller, General Counsel, and Associate Administrator for External Relations; (2) NASA's investment in each agreement will not exceed $25 million; and (3) consideration for NASA's involvement requires taking into account NASA's statutory objectives and obligations and Presidential and NASA policies on U.S. efforts in space. According to NASA, a further delegation of authority to field installations was not made because of a need for accountability over available resources.

NASA made a separate delegation for Space Act agreements involving reimbursements on July 12, 1984. Under these types of agreements, participants reimburse NASA for work or services NASA performs for them. This delegation also sets forth various limitations, including a $10 million limit. The NASA laboratory we visited, the Lewis Research Center, had been delegated authority to enter into reimbursable agreements under the Space Act.

NIH

NIH established a Patent Policy Board to oversee the invention development program and to implement the 1986 act. The Patent Policy Board has established subcommittees for areas such as CRDAs, royalty distribution, data systems, and NIH-industry collaboration. On June 23, 1987, the Secretary of Health and Human Services delegated authority to carry out the activities necessary to implement the 1986 act to the Assistant Secretary for Health, who is responsible for the Public Health Service. All of the Department of Health and Human Services' research laboratories are under the Public Health Service. On February 4, 1988, the Assistant Secretary, in turn, delegated the authority to the Public Health Service agency heads, including the Director, NIH.

The Director, NIH, on March 15, 1988, delegated authority to sign CRDAs to the Director of each of NIH's 12 institutes. The Patent Policy Board's CRDAs subcommittee, acting for the Director, NIH, reviews each agreement within 30 days after it is received.

Number of Cooperative Research and Development Agreements

The 12 federal agencies we contacted reported entering into a total of 172 CRDAs specifically under the authority of the Federal Technology Transfer Act of 1986 as of February 1989. In their 1989 budget submissions to the Office of Management and Budget and their cognizant appropriations subcommittees, the agencies reported that they had entered into a total of 1,217 CRDAs in fiscal year 1987 and another 1,285 in fiscal year 1988. In reporting these amounts, some agencies included various cooperative agreements entered into under the authority of their respective authorizing acts, while others reported only those entered into under the authority of the 1986 act. Further, some agencies included estimates of the number expected to be entered into, while others reported only agreements already entered into. For this report, we focused on CRDAs entered into under the specific authority of the 1986 act.

The agencies with the most CRDAs were Agriculture, NIH, and NIST. These agencies had entered into similar agreements with private industry prior to the 1986 act. Other agencies, such as the Air Force and the Army, which had not entered into similar agreements prior to the act, have begun entering into CRDAs. NASA has continued to enter into cooperative agreements under the Space Act.

The first agency to enter into a CRDA under the 1986 act was the Agriculture Research Service, which had already been working extensively to transfer technology to the private sector. In 1983, an Agriculture Research Service survey showed that its scientists had made over 61,000 industry and public contacts that fiscal year. Between 1980 and 1986, 28 inventions were patented for which exclusive licenses were granted to private sector entities. The Agriculture Research Service entered into its first CRDA under the authority of the 1986 act in July 1987 and had entered into 59 CRDAs as of February 1989.

Similarly, NIH and NIST had entered into a large number of CRDAs. NIH had been collaborating with companies prior to the act and had entered into 48 CRDAs under the authority of the 1986 act as of February 1989. Commerce's NIST and its predecessor, the National Bureau of Standards, have worked cooperatively with industry for about 60 years. NIST usually has about 1,100 cooperative agreements at any one time, but most of these agreements have not been made under the authority of the 1986 act and NIST does not consider them to be CRDAs. NIST defines CRDAs to be cooperative agreements that include preassigning titles or exclusive licensing rights to the collaborator. As of February 1989, NIST had entered into 37 CRDAs under the authority of the 1986 act.

Several agencies with no prior experience with collaborative agreements have also started to enter into CRDAs. For example, the Air Force entered into its first CRDA in September 1988. By February 1989, the Air Force had entered into eight CRDAs and was processing another nine. Similarly, the Army had entered into 12 CRDAs, and the Navy and EPA had entered into 1 each by February 1989. Table III.1 shows the number of all agencies' CRDAs as of February 1989.

Table III.1: Number of CRDAs, by Agency, as of February 1989

Agency	Number of CRDAs
Agricultural Research Service	59
NIST	37
NOAA	0[a]
Air Force	8
Army	12
Navy	1
Energy	0[b]
EPA	1
Bureau of Mines	1[c]
USGS	5[d]
NASA	0[e]
NIH	48
Total for selected agencies	**172**

[a]According to a NOAA official, NOAA is proceeding cautiously because it had not entered cooperative agreements with the private sector prior to the 1986 act. As of April 1989, NOAA was developing procedures for pursuing CRDAs and had one potential CRDA in process.

[b]Since 1986 the Department of Energy's energy technology centers have entered into 12 cooperative agreements, but these were not negotiated under the authority of the Federal Technology Transfer Act.

[c]The Bureau of Mines entered into about 180 other cooperative agreements under its authorizing legislation.

[d]USGS entered into about 900 other cooperative agreements under its authorizing legislation.

[e]From October 1986 to February 1989, NASA entered into about 108 agreements under the Space Act.

Source: Prepared by GAO from data provided by the agencies.

Incentives to Federal Employees

The Federal Technology Transfer Act of 1986 requires that agencies either distribute at least 15 percent of royalties and other income to federal inventors and others that assign rights to inventions to the federal government or establish an alternative royalty sharing program. The act also generally requires agencies to develop and implement cash award programs for technology transfer activities. Each of the 12 agencies we contacted either had distributed or planned to distribute to federal inventors at least 15 percent of the royalties collected. One agency had established a new cash awards program focused solely on technology transfer. Other agencies relied on their existing cash awards programs to reward their employees for promoting technology transfer. According to officials at the agencies and laboratories, agencies publicized their respective royalties and cash awards programs to their employees through various formal and informal mechanisms.

Royalties Collected and Distributed

As required by the 1986 act, each of the agencies we contacted had distributed or planned to distribute at least 15 percent of the royalties collected to the federal inventors. From the passage of the act in October 1986 through September 1988, the agencies we examined collected about $4.6 million in royalties.[1] Table IV.1 shows the amount of royalties collected from October 1986 through September 1988 by the agencies contacted.

[1] Royalties collected include licensing fees and are not necessarily for agreements made under the authority of the 1986 act.

Table IV.1: Royalties Collected by Agencies, October 1986 to September 1988

Agency	Amount collected
Agricultural Research Service	$213,416
NIST	104,312
NOAA	11,492
Air Force	57,244
Army	28,535
Navy	20,048
Energy/Fossil Energy[a]	0
EPA	0
Bureau of Mines[b]	54,000
USGS	0
NASA[c]	181,760
NIH[d]	3,946,263
Total	**$4,617,070**

[a]The zero is for the Department of Energy's Office of Fossil Energy, which is responsible for the government-operated energy technology centers. Other entities within the Department of Energy collected royalties totaling about $881,000 for this period, but this amount was not subject to distribution under the 1986 act because the inventions were made by contractors.

[b]Bureau of Mines estimate.

[c]The amount shown for NASA is for the period October 1986 through December 1988.

[d]All of NIH's royalties were for agreements made prior to the 1986 act and were primarily for the National Cancer Institute's acquired immune deficiency syndrome-related inventions.

Source: Prepared by GAO from data provided by the agencies.

Table IV.2 shows the royalties distributed by percent from October 1986 through September 1988 by the agencies we contacted.

Table IV.2: Distribution of Royalties, October 1986 to September 1988

Agency	Percent distributed			
	Inventors	Offset expenses	Laboratories	Treasury
Agricultural Research Service	15	85	0	0
NIST	15	52	33	0
NOAA	15	85	0	0
Air Force[a]	0	0	0	0
Army[a]	0	0	0	0
Navy[b]	48	0	52	0
Energy/Fossil Energy[c]	0	0	0	0
EPA[d]	0	0	0	0
Bureau of Mines	15	35	50	0
USGS[e]	0	0	0	0
NASA[f]	65	0	24	11
NIH[g]	17	29	54	0

[a]The Air Force and the Army had not distributed any royalties collected as of February 1989. Each of these military services held the funds in an escrow account and planned to distribute to inventors the greater of the first $1,000 or 20 percent of the royalties collected annually for each invention.

[b]The Navy distributes to each inventor the greater of the first $1,000 or 20 percent of the royalties collected annually for each invention.

[c]The Department of Energy's Office of Fossil Energy had not collected any royalties during the period, but it planned to distribute to the inventors 15 percent of any future royalties collected.

[d]EPA had not collected any royalties during the period, but it had established a royalty program providing for inventors to receive about 35 percent of any future royalties collected.

[e]USGS had not collected any royalties during the period, but it planned to distribute to the inventors 15 percent of any future royalties collected.

[f]Percentages shown for NASA are for calendar years 1987-88. NASA provides its inventors the first $2,000 of royalties collected and 20 percent of the royalties in excess of the first $2,000. Remaining royalties are generally distributed to the field installations where the invention was made. However, if the amount to the field installation exceeds 5 percent of its budget, 25 percent of the excess is distributed to the field installations and 75 percent of the excess is paid to the Treasury.

[g]Fiscal year 1988 royalty data provided by NIH showed amounts distributed to inventors, but did not show other distributions. Percentages shown are for fiscal year 1987 distributions.

Source: Prepared by GAO from data provided by the agencies.

Rewards for Technology Transfer

The Agriculture Research Service established a new cash awards program focused on technology transfer in September 1988 and plans to make the first cash awards in June 1989. Officials from other agencies pointed out that cash awards are given to inventors, as well as others, as part of their respective agencies' existing awards programs. Several agencies make cash awards to inventors when a patent is applied for and when it is granted. For example, inventors at NIH, the Air Force, and

the Agricultural Research Service are awarded $100 when a patent is applied for and $300 when it is issued. Similarly, the Navy awards inventors $200 when a patent is applied for and $500 when it is issued.

Publicizing Incentive Programs

According to agency and laboratory officials, agencies publicize their respective royalties and cash awards programs to their employees through various formal and informal mechanisms. Royalty programs are publicized through written directives or memorandums, seminars, meetings, brochures, scientific meetings, agency or laboratory newspapers and newsletters, and informal discussions between supervisors and employees. The Agricultural Research Service has publicized its cash awards program in its Administrator's newsletter and a brochure.

Description of Offices of Research and Technology Applications

Under the Stevenson-Wydler Act, as amended, each federal laboratory must establish an ORTA.[1] To implement this requirement, the act requires each agency to determine, in consultation with its laboratories, (1) how the ORTAs should be staffed and funded and (2) whether to combine ORTA functions with any existing laboratory units that perform similar functions. If an agency has an established organizational structure outside its laboratories that has the principal purpose of technology transfer, the agency may elect to perform its ORTA functions in that organizational structure. Although this provision allows considerable flexibility, the act, as amended, requires that each laboratory having 200 or more full-time-equivalent scientific, engineering, and related technical positions staff its ORTA with one or more full-time-equivalent positions.

In general, the ORTAs' technology transfer functions are to (1) assess R&D projects with potential for successful application in the public or private sector; (2) provide and disseminate information on federally owned or originated products, processes, and services having potential applications; (3) provide technical assistance to state and local governments; (4) cooperate with organizations that link federal laboratories to potential users; and (5) participate in regional, state, and local programs designed to facilitate or stimulate technology transfer.

A description of the ORTAs is presented below by federal agency.

Agriculture

Agricultural Research Service's implementation of the Federal Technology Transfer Act of 1986 is coordinated by its Office of Cooperative Interactions, headed by an Assistant Administrator. This office is staffed with 11 technical and 12 clerical personnel at various locations, including an ORTA in Beltsville, Maryland. This ORTA, staffed by a professional with marketing and extension service experience and a secretary, services the Beltsville Agricultural Research Center and the approximately 120 Agricultural Research Service field research facilities.

Commerce

[1]The general definition of a laboratory in the Stevenson-Wydler Act, as amended, is "any laboratory, any federally funded research and development center, or any [cooperative research center or National Science Foundation cooperative research center] that is owned, leased, or otherwise used by a federal agency and funded by the federal government, whether operated by the government or by a contractor."

National Institute of Standards and Technology

In NIST, the ORTA is part of the Director's office and is staffed by five professionals. The ORTA manages the agency's Research Associate Program, Small Business Innovation Research Program, and Inventions and Patent Committee. It also carries out the agency's assigned responsibilities to administratively support the FLC. The ORTA provides policy guidance, advice, and marketing support to managers and staff in identifying and acting upon cooperative research opportunities with industry and with state and local governments. It also represents NIST in the FLC.

National Oceanic and Atmospheric Administration

NOAA established an ORTA in its Office of the Chief Scientist, which has two full-time professionals and one secretary, and a part-time "ORTA contact" at each of its five major line organizations, who are responsible for ORTA functions in their respective laboratories. The ORTA and a representative from each major line organization make up the NOAA Technology Transfer Working Group, which coordinates the technology transfer activities.

NOAA ORTA officials have been active in the FLC, participating as members and serving on committees. Their activities include assessing transferable technologies, disseminating technical briefs (NOAA uses the National Technical Information Service to disseminate the information further), cooperating with other agencies, and providing direct contacts for queries from individuals and companies.

Defense

Air Force

The Air Force responded that in establishing its ORTAs, as provided by the act it considered two major points: (1) its already existing technology transfer offices, called Science and Technical Information Program Management offices, substantially achieve the objective of transferring technology, and (2) its classified and national defense-oriented research and engineering efforts must be protected and are therefore inappropriate for transfer to the civil sector.

At the time the Stevenson-Wydler Act of 1980 was enacted, requiring ORTAs to be established, the Air Force already had Science and Technical Information Program Management offices in place. These offices are

responsible for ensuring that scientific and technical information resulting from R&D are appropriately disseminated to potential contractors or users. The Air Force has such offices at all major commands, including the Air Force Systems Command. Within the Air Force Systems Command, the offices have been established at all divisions, centers, and laboratories.

In implementing the Stevenson-Wydler Act of 1980, according to the Air Force, it established ORTAs within this existing structure. At the laboratory we visited, Wright Aeronautical Laboratories, the ORTA is in the laboratory Director's program office, where ORTA-type functions are carried out by a full-time technical information specialist.

Army

At the time of passage of the 1986 act, the Army already had a regulation establishing a domestic technology transfer program (Army Regulation 70-57). This regulation, which was originally issued in 1976, was revised to implement the provisions of the original Stevenson-Wydler Act. The revised regulation provided for identifying laboratories that must have an ORTA, specified that the Army Material Command was responsible for coordinating laboratory programs Army-wide, and stated that all identified laboratories should participate in the FLC.

According to the Army, each of the 22 Army Material Command laboratories, including the two we visited, has an ORTA. The ORTA is often located organizationally within the technology planning, industrial liaison, or program management staff of the laboratory commander or director. In other cases, a group of related laboratories has less active points of contact coordinated by a more active manager at the subordinate command level. According to an Army official, no single organizational structure is suited to all laboratories. Almost half of the Army Material Command laboratories have active outreach programs in their region, state, and local areas.

The Corps of Engineers' Army Engineer Topographic Laboratories and the Army Medical Research and Development Command's Letterman Army Institute of Research, the two other Army laboratories we visited, had ORTAs performing various ORTA activities.

Navy

According to a Navy headquarters official, the Navy has full-time-equivalent ORTAs at each of its 14 laboratories with 200 or more scientific,

engineering, and related technical positions. Four of the five Navy laboratories we visited told us they had ORTAs performing various ORTA activities. Officials at the fifth laboratory, the Navy Air Test Center, told us that the center does not have a designated ORTA, but has personnel who are responsible for technology transfer activities and spend a total of more than one full-time-equivalent position on such activities.

Energy

The Department of Energy's Office of Fossil Energy has ORTAs at its Morgantown Energy Technology Center, Pittsburgh Energy Technology Center, and Bartlesville Project Office. The ORTAs provide a central laboratory coordination point for technology transfer, help foster an environment that encourages researchers to consider potential technical applications, identify potential commercial applications, and make information available to stimulate technology transfer.

EPA

EPA's ORTA is in its Office of Research and Development, which has 14 laboratories that range in size from less than 50 persons to one laboratory with over 200 persons. Because of the relatively small size of EPA's laboratories, the Office of Research and Development combined them under one person at headquarters. This person is a member of the FLC and acts as the office's spokesman. To provide communication with the laboratories, a Technology Transfer Advisory Group was formed, comprising representatives of each laboratory and headquarters office.

According to EPA officials, the laboratory with over 200 persons, the Health Effects Research Laboratory, has a technology transfer coordinator with two staff. The coordinator reports to the laboratory director on technology transfer and other matters and, with the staff, expends more than a full-time-equivalent position on ORTA-type functions.

Interior

Bureau of Mines

The Bureau of Mines' Office of Technology Transfer serves as the Bureau's ORTA. This office has a chief with a staff of seven, plus a technology transfer representative at each of the Bureau's nine research centers. Additionally, the Bureau has a special-emphasis Technology Transfer Office in Alaska, composed of three persons who report to the

headquarters office. The Alaska office deals with specific minerals-related technology transfer within cold climates.

U.S. Geological Survey

USGS has an ORTA at its National Center in Reston, Virginia. In addition to conducting research at the National Center, the ORTA is responsible for regional centers located in Denver, Colorado, and Menlo Park, California, and for research and data gathering conducted at other USGS field offices located throughout the 50 states, Puerto Rico, and the Trust Territories of the Pacific. According to a USGS official, the regional centers are not laboratories but are responsible for the field offices in their respective regions. The regions do not have designated ORTAs, but according to the USGS official, they each expend far more than one full-time-equivalent position on technology transfer activities, such as conducting technical forums and seminars for industry and state and local government representatives. The Western region, located in Menlo Park, has a representative, reporting to the USGS Director, who performs many of the ORTA-type functions for the region. This representative is responsible for about 20 field offices, many of which have only one or two persons.

NASA

Because it conducts technology transfer activities as a coordinated program, NASA considers its entire system, headed by the Director, Technology Utilization Division, as its ORTA. The Director is located at headquarters and reports to the Assistant Administrator for Commercial Programs. Each NASA laboratory has a Technology Utilization Office, which is responsible for technology transfer activities at that laboratory. The organizational location of the Technology Utilization Offices varies among the laboratories at the discretion of the laboratory directors. The Technology Utilization Office at the NASA laboratory we visited, NASA Lewis Research Center, reports to the laboratory's Director, Office of Interagency and Industry Programs. This office conducts all of the activities typically performed by an ORTA, such as responding to inquiries from the private sector, other federal facilities, and state and local governments; promoting technology transfer to small businesses; and representing the laboratory on the FLC.

NIH

With the passage of the 1986 act, the ORTA and patent functions previously in NIH's Office of Medical Applications of Research were transferred to a new Office of Invention Development, which has four full-time positions. Additionally, each institute has a liaison who acts as a

focal point for patenting and licensing activities. The Office of Invention Development provides staff support for the Patent Policy Board, attends FLC meetings, and conducts the NIH-industry forums that bring together NIH scientists and company or other outside representatives. The first forum was held in October 1988, with about 250 federal government scientists and 250 industry representatives attending. According to an NIH official, the initial forum was a success and forums will be held at least annually.

Agencies' and Laboratories' Views on Barriers to the Act's Implementation

The barriers to the Federal Technology Transfer Act's implementation most frequently mentioned by the agencies and laboratories we contacted were: (1) federal computer software cannot be copyrighted, (2) companies need greater protection for proprietary information, (3) private industry finds required government procedures burdensome and time-consuming, and (4) conflicts of interest exist with agency missions and for government employees.[1]

Copyright of Computer Software

While recent changes in the law allow federal laboratories to patent and exclusively license inventions, federal computer software cannot be copyrighted (17 U.S.C. 105). Without copyright protection, federal computer software is publicly available. Therefore, individual software companies have little incentive to develop the software further for commercial applications. For example, a software company may need to (1) debug and simplify the software to ensure that it works properly, (2) enhance it for different commercial applications, and (3) develop manuals and provide assistance to users. Some agency officials said that federal computer software should be treated as federal inventions, which can be patented and licensed.

Of the 25 laboratories in our study, 11 laboratories from 8 agencies responded that the absence of copyrights for federal computer software hindered their efforts to enter into CRDAs.

Protection of Proprietary Information

Because federal laboratories generally cannot conduct proprietary research, industry is less inclined to collaborate with them. The results of unclassified and nonsensitive R&D at federal laboratories normally are published in the scientific literature and/or result in a patent application. Even if the results are not published, interested parties can, with certain exceptions, generally get information about federally funded research through a request under the Freedom of Information Act. That act requires federal agencies to make records promptly available to any person upon a request that reasonably describes such records and is made in accordance with published rules.

[1]The first three of these barriers are discussed in our report, Technology Transfer: Constraints Perceived by Federal Laboratory and Agency Officials (GAO/RCED-88-116BR, Mar. 4, 1988). Our report also discussed concerns about technology transfer constraints faced by the Department of Energy's contractor-operated laboratories. We do not address these concerns here because contractor-operated laboratories are not covered under the CRDA provisions of the Federal Technology Transfer Act.

Officials from several laboratories and agencies advised us that the limited authority to conduct proprietary research was a constraint to technology transfer. Of the 25 laboratories in our study, 7 laboratories from 6 agencies responded that the status or clarity of rules and regulations protecting the confidentiality of data or processes developed through cooperative R&D had hurt their ability to enter into CRDAs; 8 laboratories from 7 agencies responded that public access to data via the Freedom of Information Act had hurt them.

Burdensome and Time-Consuming Procedures

Federal laboratories, in their efforts to be fair in providing companies opportunities to collaborate on research, may institute burdensome and time-consuming procedures that inhibit industry participation. Officials at two agencies noted that because they had little interaction with private industry before the Federal Technology Transfer Act was enacted, the laboratories do not have procedures in place for determining the extent to which they will notify companies about potential collaborative research opportunities. These officials were concerned that after a CRDA had been entered into with a company, a competitor could claim, either legitimately or for the purpose of tying up the collaboration, that he was not offered a similar opportunity to collaborate.

Of the 25 laboratories in our study, 5 laboratories from 4 agencies responded that the rules and regulations on how cooperative R&D opportunities should be announced had hurt their efforts to enter into CRDAs.

Conflicts of Interest

Some agencies mentioned concerns over two types of conflicts of interest: (1) collaborative work under CRDAs can create a conflict of interest with an agency's primary mission, and (2) financial interests in a collaborating company can cause a federal employee to have a conflict of interest. The U.S. Office of Government Ethics decided that royalty sharing, in itself, does not create a conflict of interest.

With respect to a conflict with an agency mission, a USGS official told us that the traditional USGS role of providing accurate and impartial information to the public could be compromised, or appear to be compromised, if USGS worked too closely with a particular industry. To illustrate, this official said that the Electric Power Research Institute proposed to collaborate on experiments on Eastern earthquakes. The results of the experiments might be used in siting decisions for a future nuclear power plant. If the Nuclear Regulatory Commission needed information on the likelihood of earthquakes at the nuclear power plant

site, USGS' opinion might be perceived to have been compromised. Accordingly, USGS decided not to enter the proposed agreement.

Conflicts of interest also have been a concern at NIH, where some companies have been attempting to deal directly with federal inventors. In some instances, companies have contacted NIH inventors to negotiate special arrangements, such as foreign patent rights.[2] According to NIH officials, they are concerned that such contacts are being made while the government has the rights to file for foreign patents. NIH currently requires all scientists to report contacts with companies. This enables the National Technical Information Service, which handles NIH's licensing, to contact the companies and determine whether they are interested in a license and to recommend to NIH whether a foreign patent should be sought. NIH, in turn, can make a more informed decision on whether to file for foreign patents. NIH also is concerned because many of its scientists consult for private companies. Since August 1985, NIH has permitted its scientists to consult for companies on the basis of their general scientific knowledge and expertise. To protect against a conflict of interest, NIH staff are subject to various restrictions and safeguards, including a prohibition against receiving any payment from a company with which he or she has any official relationship, such as collaborating under a CRDA.

In September 1988, the U.S. Office of Government Ethics advised the Commerce Department that royalty sharing under the Federal Technology Transfer Act does not give an employee a personal financial interest to which the conflict-of-interest laws are applicable. This decision resolves concerns that may have existed that royalty sharing by federal inventors in itself created a conflict of interest. However, it does not preclude conflicts of interest from occurring in situations such as those cited by USGS and NIH.

[2]After 6 months of the filing for a U.S. patent or of the invention's disclosure, whichever is later, the right to file for foreign patents goes to the inventor.

The Federal Laboratory Consortium for Technology Transfer

FLC Objectives and Activities

The FLC evolved from a Department of Defense Laboratory Consortium established in 1971. Defense had created the consortium to improve interlaboratory communication and to find greater civilian uses for technical knowledge developed originally for military purposes. In 1974 the consortium adopted its current name and invited all federal agencies to participate. The Stevenson-Wydler Act of 1980 increased emphasis on technology transfer and stimulated the further growth of the FLC. The Technology Transfer Act of 1986 formally established the FLC and defined its roles and responsibilities, including

- providing training assistance, advice, and assistance for individual transfer programs;
- providing a clearinghouse for technology user requests;
- facilitating interagency and laboratory communication and coordination;
- assisting individual laboratories in developing technical transfer mechanisms; and
- facilitating communication and cooperation with public and private technology transfer organizations and user groups.

More than 300 federal laboratories and research centers, representing 14 federal agencies, are presently members of the FLC. Each of the agencies we examined participate in the FLC's activities.

Views on the FLC

Most of the agency and laboratory officials responded that their laboratories benefited from the FLC's activities. For example, NOAA officials commented that the FLC is a "super" group and has done an exceptional job and that the FLC's current emphasis on clearinghouse and outreach efforts to match interested companies with researchers in federal laboratories is appropriate. The activity cited most frequently as being beneficial to the laboratories was the FLC's workshops and seminars. The only concern mentioned by those supporting the FLC was that different interpretations of what an agency is required to contribute have resulted in some agencies not paying their full share. Suggestions by laboratory officials for improving the FLC related primarily to increasing its funding or the number of employees.

Officials from two agencies thought the FLC to be of general value, but did not believe the clearinghouse and outreach efforts provided benefits to their laboratories. According to an NIH official, the FLC is of general value in matching companies with agencies and laboratories. However, this official explained that the FLC would need a massive organization to match companies with specific researchers and this function is better

left in the agencies, which can design specific systems to meet their individual needs. The official pointed out that NIH developed its industrial collaboration forum to meet this need. Similarly, an Agriculture official told us that, in his view, the FLC's attempts to match companies with laboratory researchers can be done better closer to the researchers.

According to an Air Force headquarters official, the Air Force receives little benefit from the FLC. On the other hand, an official at the Air Force Wright Aeronautical Laboratories, who has actively participated in the FLC, believed the FLC provided benefits to the laboratory.

FLC Funding

To fund the FLC's activities, the 1986 act required agencies to transfer 0.005 percent of their federal laboratories' R&D budgets to the FLC.[1] This percentage was increased to 0.008 percent by the Omnibus Trade and Competitiveness Act of 1988 (P.L. 100-418). According to NIST, which collects the funds for the FLC, agencies meeting the $10,000 threshold have contributed funds for the FLC as shown in table VII.1.

Table VII.1: Agency Contributions to the FLC, Fiscal Years 1987 and 1988

Dollars in Thousands

	FY 1987	FY 1988
Agriculture	$25.0[a]	$25.5
Commerce	12.1	13.1
Army	94.5	126.1
Navy	157.0	166.3
Air Force	13.6	14.3
Energy	218.0[a]	227.0
NIH	33.0[a]	35.2
Interior	0[a]	16.6
NASA	80.0	77.5
Total	**$633.2**	**$701.6**

[a]Fiscal year 1987 was the first funding for the FLC under the act, and the former National Bureau of Standards billed only selected agencies. The agencies indicated were not billed, but some provided funds.

Source: NIST.

According to a NIST official, agencies have been very responsive in making their FLC contributions, with the exception of the Air Force. In fiscal years 1987 and 1988, the Air Force paid significantly less than what

[1]The Federal Technology Transfer Act of 1986 required agencies to transfer funds to the FLC in fiscal years 1987 through 1991. However, the act further stipulated that an agency need not transfer funds to the FLC if the amounts to be transferred totaled $10,000 or less.

NIST billed. NIST bills agencies by applying the percent set forth in the law to each agency's intramural budget as reported by the National Science Foundation.[2] Table VII.2 shows the amounts NIST billed and the amounts the Air Force paid for fiscal years 1987-88.

Table VII.2: Air Force FLC Contributions

Dollars in Thousands

Fiscal year	Amount billed	Amount received	Percent of amount billed
1987	$174.6	$13.6	7.8
1988	186.5	14.3	7.7

Source: NIST.

For fiscal year 1989, the Congress reworded the provision governing the FLC funding transfers with an amendment in the Omnibus Trade and Competitiveness Act of 1988. The provision (section 11(e)(7)(A) of the Stevenson-Wydler act, as amended) states, in part, the following:

"... An amount equal to 0.008 percent of the budget of each Federal agency from any Federal source, including related overhead, that is to be utilized by or on behalf of the laboratories of such agency for a fiscal year ... shall be transferred ... for the purpose of carrying out activities of the Consortium ...."

The Air Force initially disagreed with the amount NIST computed as the Air Force's share for fiscal year 1989 and computed a smaller amount based on the in-house portion of its laboratories' R&D budgets. After we pointed out to Air Force officials that the amount for the FLC should be based on the Air Force laboratories' total R&D budget, the Air Force recomputed the amount it will transfer for fiscal year 1989. In April 1989, NIST and the Air Force agreed on the amount the Air Force will pay for fiscal year 1989—$123,900.

[2]As part of its report Federal Funds for Research and Development, the National Science Foundation reports each federal agency's intramural budget. The foundation defines intramural work as that carried out directly by federal agency personnel.

Incentives for Seeking Foreign Patent Protection

According to National Technical Information Service (NTIS) and Patent and Trademark Office officials,[1] the incentive to domestic users for seeking foreign patent protection is the expected profits. Domestic users of federal inventions may file for foreign patent protection if they have title to the invention. If title to the invention is retained by the government, the decision on whether to file is the government's or, in some cases, the federal inventor's. If exclusive licensing is preassigned through a CRDA, the government retains the patent filing rights but consults with the participating company in deciding whether to file for foreign patent protection.

Authority to File

The government usually owns a federal invention and the right to file for foreign patents. However, if the government does not file for a foreign patent within 6 months of the filing for a U.S. patent, the declassification of a previously classified invention, or the invention's disclosure, whichever is later, the right to file for foreign patents goes to the inventor.[2] In such cases, where practical, the government would retain a nonexclusive, irrevocable royalty-free license in any foreign patent issued. The inventor may file for the foreign patent(s), sell the right to file to the private sector, or assign the right back to the government. In most foreign countries, filing must be done within 1 year of the U.S. patent application filing date.

Under the Federal Technology Transfer Act of 1986, agencies and/or laboratories may preassign to companies participating in CRDAs the title or exclusive licensing rights to federal inventions. When title is preassigned to a company, the government retains a royalty-free nonexclusive license to use the invention, but the invention resulting from the cooperative research is owned by the company. In such cases, the company may seek foreign patent protection as it deems appropriate. When an exclusive license is preassigned, the government retains ownership of federal inventions, and the participating company has the right of first refusal to an exclusive license. In these cases, the government has the right to file for foreign patents, but agencies usually consult with the prospective licensees and pass on the patent filing costs to the eventual licensees.

[1]NTIS files for foreign patents on behalf of most of the agencies we studied. The Patent and Trademark Office is involved in receiving and processing applications for foreign patents.

[2]The 6-month period is established by 37 C.F.R. 101.

According to an NTIS official, most agencies entering into CRDAs have chosen to retain title to federal inventions and grant exclusive licenses. This official said that agencies generally follow the licensees' decisions on whether to file for a foreign patent, but retaining ownership puts the agencies in a better position to influence the development of the technology. If a technology is not properly used, agencies can step in and exercise prerogatives to further develop the technology. Another factor in agencies' choosing to preassign exclusive licenses instead of titles is that greater recognition is given to the federal inventor and the agency when the patent is filed by the government.

Seeking Foreign Patent Protection

According to NTIS and Patent and Trademark Office officials, deciding whether to file for foreign patents is a "business decision" depending on the expected profitability of an invention in foreign markets. A Patent Office official explained that whether sufficient incentive exists to seek foreign patent protection is a function of the expected profitability. If a potential market appears profitable, a company will presumably seek to protect that market with a patent.

NTIS files for foreign patents and negotiates the licensing terms on behalf of most of the federal agencies we studied. According to NTIS officials, in deciding whether or not to file for foreign patents in the past, NTIS often considered the longer-range objective of protecting the government and the U.S. economy against foreign competitors. Although NTIS still considers this long-range objective, it now places greater emphasis on the shorter-term payoff. NTIS gets agreement with an agency before it files. These officials could not recall an agency's refusing to file for a foreign patent because of costs. In negotiating the terms of CRDAs, agencies usually include exclusive licensing clauses to the collaborating company. In these cases, the agencies consult with the licensees on whether to file for a foreign patent and usually follow the desire of the licensees. The clauses include a requirement for the licensee to pay fixed fees for initial filing and annual patent maintenance costs. Licensees must also agree to provide a royalty as a percentage of sales.

Although they did not believe additional incentives were needed, NTIS and Patent Office officials advised us of some barriers to foreign patent protection. According to NTIS officials, the biggest barrier to foreign patent protection has been the 6-month time frame in which the federal government must decide whether it wants to file for foreign patent protection. After 6 months, the inventor has the right to file on his or her own, or to sell that right to the private sector. Frequently, about 2

months have elapsed by the time NTIS receives the invention from the federal agency where the invention was made. Therefore, NTIS has only a 4-month window in which to decide. Sometimes the decision on whether to file must be made before a licensee is found. On occasion the inventor has given the right to file back to the government, and the time frame has been extended to the full year in which filing must be done. The 6-month filing period, established by Commerce's regulations in 1952, is currently under review by Commerce's Chief General Counsel.

According to a Patent Office official, cost is one constraint to domestic users (not just of federal inventions) seeking foreign patent protection. The cost of foreign patent protection in most Western industrial markets (Western Europe, Japan, Australia, and Canada) would amount to about $40,000, compared with the basic fee of $900 in the United States ($340 application fee and $560 issue fee).[3] In addition, since a patent attorney costs about $100 to $200 per hour, legal charges could amount to $2,000 or more. The United States charges maintenance fees after 3-1/2 years ($450), 7-1/2 years ($890), and 11-1/2 years ($1,340). The total maintenance charge over the 17-year life of a U.S. patent is $2,680. The fees charged to nonprofit organizations, small businesses, and universities are reduced by one-half. Since a patent is more expensive to maintain the longer it is in force, a Patent Office official pointed out that a company is more likely to let it lapse after some years. According to the Patent Office official, foreign countries have different maintenance charges; for example, the United Kingdom has annual taxes starting 3 years after the application is submitted, and France has an annual tax each year after the submissions. Some countries have flat taxes, and others have progressive taxes that increase each year.

According to a Patent Office official, U.S. companies may be making a decision "by default." That is, rather than spending money on patent attorneys, U.S. companies might be choosing not to seek foreign patents, which have various requirements that are different from those in the United States. For example, the United States and the Philippines are the only countries to grant patents on a first-to-invent basis. Elsewhere, patents are granted on a first-to-file basis. Commerce has an effort to "harmonize" the worldwide patent requirements through the World Intellectual Property Organization and trilateral cooperative meetings of

[3]The Patent and Trademark Office adjusted its patent fee amounts, increasing the basic filing fee to $370 and the issue fee to $620, effective April 17, 1989. Maintenance fees were increased to $490 at 3-1/2 years, $990 at 7-1/2 years, and $1,480 at 11-1/2 years.

the United States, Japanese, and European patent offices. Other countries, particularly Japan, would like to see the United States change to the first-to-file basis. This harmonization effort is still in progress. Consequently, the Patent and Trademark Office does not want to move prematurely or seek legislation at this point that might jeopardize the negotiations. When the time is appropriate, a Patent and Trademark Office official told us that the Patent Office will probably propose legislation through appropriate channels.

Officials interviewed from other agencies were generally unfamiliar with the details of foreign patents. A NIST official said that his agency leaves the decision about seeking a foreign patent up to the companies and NTIS. This official said that the decision is a business one and that companies are "pretty smart" about what to apply for. A patent attorney from NASA, which obtains its own patents and licenses, similarly told us that while the costs of foreign patents are high, the judgment about whether to obtain one is a business decision.

Development of Technology Transfer Reporting Criteria

In a September 1988 letter, the House Committee on Science, Space, and Technology asked us to develop criteria for reporting on technology transfer activities. The Committee made this separate request to help resolve reporting problems that we uncovered during the early phases of our review of the implementation of the Federal Technology Transfer Act of 1986. Currently, federal agencies that operate or direct one or more federal laboratories are required by the 1986 act to report on their activities implementing the act's technology transfer provisions. For the past 2 fiscal years, agencies have submitted these reports to the Office of Management and Budget.

Problems surfaced in the interpretation of the data contained in these reports largely for two reasons: (1) some officials responsible for responding to the Office of Management and Budget's request for information on technology transfer activities found that the terms used in the request are ambiguous, and (2) reporting instructions regarding exactly what data to include in agencies' calculations have not been made clear. For example, some officials responsible for preparing these reports were uncertain about what technology transfer activities to include when calculating funds devoted to technology transfer or estimating the value of CRDAs. An Office of Management and Budget official indicated that the agency did not expect good or complete data from the first year's reports and that it would take at least 2 years for the data to stabilize. However, reporting problems are not likely to disappear unless an effort is made to dispel ambiguities in the guidance for report preparation.

In April 1988, the Congress requested the agencies and selected laboratories to provide detailed information on the steps they had taken to implement the technology transfer legislation.[1] As with the reports to the Office of Management and Budget, the written responses of the agencies and laboratories proved, overall, to be difficult to interpret.

To respond to the Committee's request for criteria for laboratory reporting, it was necessary to develop comparable, valid, reliable, and reportable measures of the impact of recent legislation on laboratory technology transfer activities. Therefore, we reviewed technology transfer literature and analyzed the major technology transfer legislation

[1]This information was requested by the Chairman, Senate Committee on Commerce, Science, and Transportation and the Chairman, House Subcommittee on Science, Research, and Technology.

since 1980.[2] We also analyzed the responses prepared by departments and laboratories to the set of questions from the Congress, and fiscal year 1989 Office of Management and Budget reports. In addition, we conducted interviews with department or agency technology transfer officials.[3]

After analyzing the data collected in the activities discussed above and accounting as much as possible for differences across laboratories, we structured the criteria as a questionnaire for laboratory directors. The questionnaire was submitted for comment to approximately 70 reviewers outside GAO, including department, agency, and laboratory technology transfer officials and university technology transfer experts. It was then further modified on the basis of comments received from reviewers and pretested during April and May 1989 to develop additional information necessary to ready the questionnaire for implementation.[4]

The questionnaire we have developed has several characteristics. First, it includes precise definitions of terms that may affect the type of data reported. These definitions should allow department and laboratory officials to provide valid, reliable, and comparable data. Second, it is divided into two parts: a 5-section laboratory-level questionnaire, targeted to respondents in various laboratory units, and an agency-level questionnaire, to be answered by agencies or departments. In this way, we should obtain the information needed from the respondents best able to provide it. Third, it includes questions not asked by the Office of Management and Budget or Commerce for their reports, but that help develop a more complete picture of the impact of legislation on technology transfer activities. As such, it should produce more comprehensive information than has been available to date.

[2]Specifically, we analyzed the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480); the Federal Technology Transfer Act of 1986 (P.L. 99-502); Executive Order 12591, "Facilitating Access to Science and Technology"; the Omnibus Trade and Competitiveness Act of 1988 (P.L. 100-418); the Bayh-Dole Act (P.L. 96-517); and various conference reports associated with legislation.

[3]We interviewed officials at the following Departments: Agriculture (specifically the Agricultural Research Service), Defense, the Army, the Air Force, the Navy, Transportation, Interior (specifically the Bureau of Mines and USGS), Commerce, Energy, Veteran's Affairs, and Health and Human Services (specifically NIH); and at EPA and NASA. We also interviewed officials at the Office of Management and Budget, the National Science Foundation, and the FLC. We interviewed these officials to obtain their views and suggestions for developing criteria and to determine what information they need on technology transfer activities.

[4]As agreed to with the Committee, the questionnaire is expected to be implemented at the beginning of the next fiscal year to enable collection of complete fiscal year 1989 data.

The GAO-developed questionnaire is designed to provide comprehensive and uniform data to (1) aid congressional oversight of laboratory and department technology transfer activities and programs and (2) enhance the ability of departments and laboratories to manage and evaluate their technology transfer programs.

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