United States General Accounting Office

GAO

Report to the Chairman, Committee on Science, Space, and Technology, House of Representatives

May 1991

# DIFFUSING INNOVATIONS

# Implementing the Technology Transfer Act of 1986

144004

RELEASED

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GAO

**United States**
**General Accounting Office**
**Washington, D.C. 20548**

**Program Evaluation and**
**Methodology Division**

B-243863

May 29, 1991

The Honorable George E. Brown, Jr.
Chairman, Committee on Science, Space,
and Technology
House of Representatives

Dear Mr. Chairman:

On September 16, 1988, the Committee asked us to develop a plan for assessing the results of the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480), as amended by the Technology Transfer Act of 1986 (P.L. 99-502), and Executive Order No. 12591: "Facilitating Access to Science and Technology." In response, we developed criteria, based upon an analysis of the relevant legislation and executive order, and designed a questionnaire for measuring the extent of implementation, which we pretested.[1] The Committee then requested that we administer the questionnaire and transmit our results, thus documenting the extent to which federal departments and laboratories have, to date, implemented the provisions of the technology transfer legislation and executive order. This report responds to that request.[2] The findings reported here are based on data collected for fiscal year 1989 from 297 federal laboratories representing 10 federal departments.[3]

The five criteria we used to measure implementation are based, in part, on the provisions of the legislation. They are:

- receipt of implementation guidance from headquarters;
- establishment and staffing of Offices of Research and Technology Applications (ORTAS);
- delegation of authority to laboratory directors to enter into cooperative research and development agreements (CRDAS);
- creation of royalty-sharing programs; and

[1]See appendix I for a reproduction of the laboratory-level questionnaire. Also, see appendix II for selected provisions of the legislation.

[2]We presented preliminary results to the Committee on May 3, 1990. See Implementation of the Technology Transfer Act: A Preliminary Assessment (GAO/T-PEMD-90-4, May 3, 1990).

[3]In this report, cabinet-level departments (for example, the Departments of Defense (DOD) and Commerce) and the two independent agencies (National Aeronautics and Space Administration (NASA) and the Environmental Protection Agency (EPA)) are referred to as "departments." The term "agency" refers to, for example, the Agricultural Research Service of the Department of Agriculture (USDA) or the Food and Drug Administration of the Department of Health and Human Services (HHS). See appendix III for a list of departments and agencies in the study population.

- establishment of personnel exchange programs.

Based on the results of our questionnaire, we believe these criteria have, in fact, enabled us to arrive at a reasonably accurate determination of the degree to which the acts' provisions had been satisfied at that time.

Although we were not asked to measure impact, and did not do so, we did collect information about transfer activity indicators such as patents, licenses, royalty income, and the exchange of scientific and engineering personnel for fiscal year 1989. We also solicited opinions from federal laboratory personnel about the effectiveness of the technology transfer legislation and potential barriers to implementation. Additionally, we requested examples, from their viewpoint, of successful and unsuccessful attempts to transfer technology.[4]

In the past, when technology transfer has been successful, the experience has usually been that new and different products or processes have become available to meet (or generate) market demands. Examples of such transfers include many of the computer advances that were originally made as a part of Department of Defense research and development (R&D) activities; the further refinements of those advances that then occurred in the commercial aviation industry; and the development of freeze-dried foods resulting from work performed by the National Aeronautics and Space Administration.

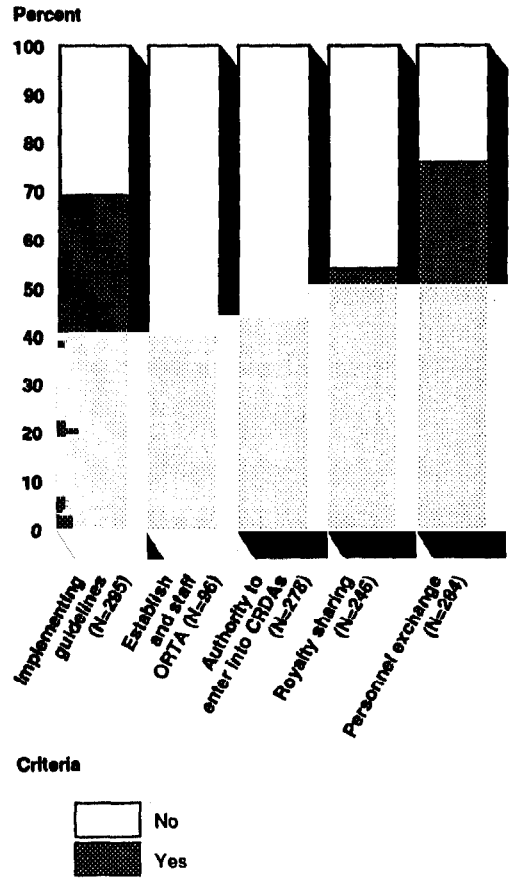
## Results in Brief

We found that almost all 297 laboratories, located in each of the 10 departments, had implemented some of the legislation. The level of implementation for all laboratories in the study, as measured by our criteria, is summarized in figure 1: (1) 69 percent had received written guidelines for implementing the legislation; (2) approximately 41 percent of the large laboratories had established and staffed the ORTAs at the laboratory level; (3) 44 percent of the laboratory directors were authorized to negotiate CRDAs; (4) about half of the laboratories had royalty-sharing programs; and (5) 217 of the laboratories had personnel exchange programs.[5]

[4]See appendix IV for examples of successful and unsuccessful transfers of technology reported by our respondents as occurring in federal laboratories for the period fiscal year 1986 through fiscal year 1989.

[5]All references to the year 1989 in our results pertain to the fiscal year.

**Figure 1: Scope of Implementation—All Departments**




None of the 10 departments had completely satisfied all the criteria, but some criteria were completely implemented in some departments. For instance, all HHS laboratories had received written instructions and all EPA laboratories had established personnel exchange programs. But in a few departments, some criteria had not been implemented at all. In sum, there was great variation, by department, in the extent to which the provisions of the act and executive order had been implemented, and we believe it would take at least another year before an impact evaluation could be meaningful.

In terms of federal laboratory transfer activities reported for 1989: (1) 160 reported having received no patents, (2) 106 had 2,233 patents pending, (3) 121 revealed 2,528 patent disclosures, (4) 167 licenses had

been granted (both exclusive and nonexclusive), and (5) 239 of the laboratories reported zero royalty income for 1989. Perhaps the single most important point to be made about these technology transfer activities is that, across all departments, 250 instances of transfers of technology were reported—68 percent (169) of them reported as successful.

## Scope and Methodology

We selected laboratories, representing 10 departments, for inclusion in the study population that: (1) had a significant R&D budget, (2) had technology transfer potential, and (3) were subject either to the provisions of the Federal Technology Transfer Act of 1986 or to a technology transfer mission legislatively mandated before the 1986 act.[6] There were 330 laboratories in our study population, and we obtained responses from 297 (90 percent) of those laboratories.[7]

The design of this study required the collection and analysis of both qualitative and quantitative data. In addition to administering and analyzing the data from the questionnaire, we conducted a comprehensive review of the available technology transfer literature, especially previous empirical studies, and analyzed the major technology transfer legislation to develop our criteria. Further, we conducted structured interviews with department officials at different points in the study to clarify and confirm the questionnaire data and the documentary evidence. We performed our review in accordance with generally accepted government auditing standards.

## Principal Findings

### Receipt of Departmental Guidance

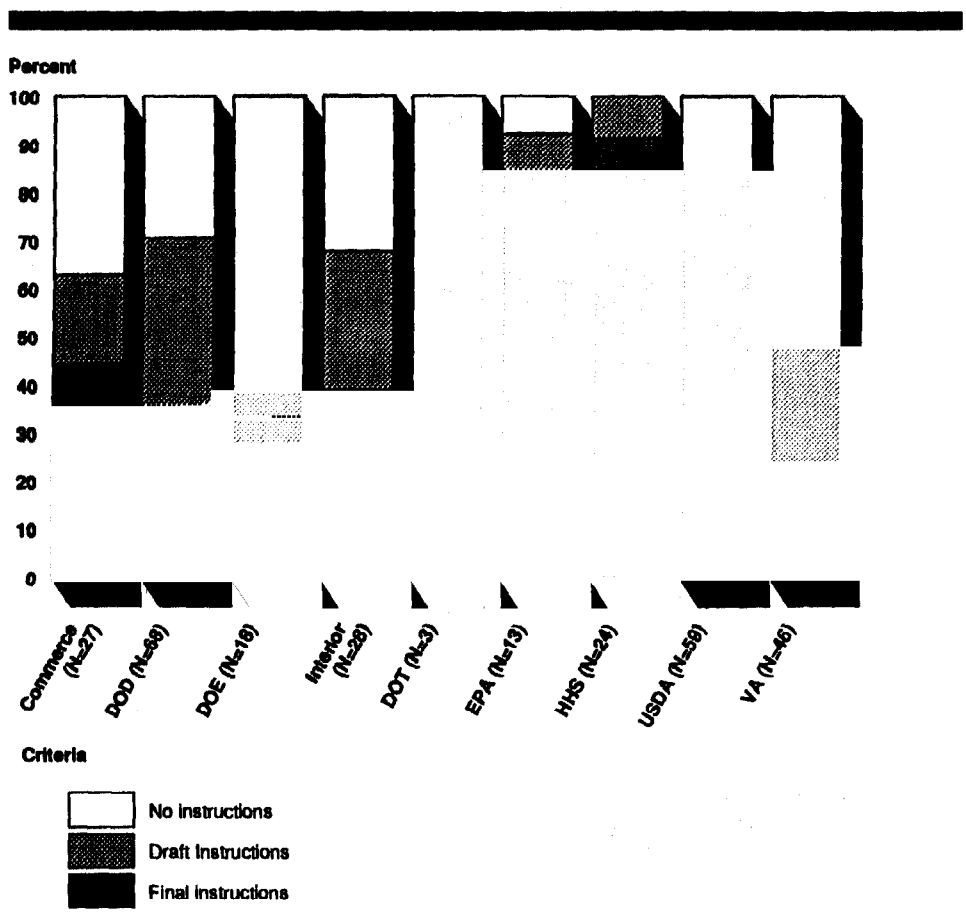
The majority of laboratories (69 percent) had received written guidance from their parent departments for implementing the act; however, this still leaves 31 percent of the laboratories without guidance 4 years after the passage of the Technology Transfer Act of 1986 and 10 years after

[6]Our initial list of departments was that used by the House Science, Space, and Technology Committee for its request for information from departments and federal laboratories in April 1988. This list was then expanded through consultation with officials from the Office of Management and Budget and an examination of OMB Circular A-11, Information on Research and Development—1988 submissions.

[7]A review of the empirical literature shows that there are different definitions of what constitutes a laboratory. The number of federal laboratories ranges from 400 to 700. For the purposes of this review, as defined by the departments and the Committee, the population consists of 330 laboratories. Our findings apply only to this population.

Stevenson-Wydler. Further, we found wide variations among the departments. (See figure 2.)

**Figure 2: Receipt of Departmental Guidance**




Specifically, at one end of the continuum, we found that all HHS laboratories had received instructions, and EPA and USDA had provided either final or draft guidelines to more than 80 percent of their constituent laboratories. At the other end, less than 50 percent of the laboratories under the Departments of Energy (DOE) and Veterans Affairs (VA) had received any type of written guidance for implementing any or all of the provisions of the Technology Transfer Act.

## Establishment and Staffing of ORTAs

Large laboratories (those having 200 or more scientific, engineering, and technical full-time-equivalent (FTE) staff) are required to assign at least one FTE to staff the Office of Research and Technology Applications.[8] There are 96 such laboratories in the study reported here; 64 percent of them have ORTAs located at laboratories. Thirty-one percent are located at agency headquarters, and 5 percent are at other locations. The departments with large laboratories and agency-located ORTAs are Commerce (5), Interior (5), EPA (2), HHS (12), USDA (5), and VA (1).

We asked the respondents for laboratories with on-site ORTAs to tell us how many FTEs are assigned to staff the office. Although one HHS and one VA large laboratory had reported a laboratory ORTA, they gave no response to the assignment of FTEs. However, four departments reported having implemented the establishment and staffing provision: DOD (22), DOE (11), DOT (1), and NASA (5).

In those cases where the ORTA was located in the laboratory, these staff positions were often (48 percent) assigned as a collateral duty. Generally, the directors of the laboratory ORTAs were experienced professionals; nearly three-fourths of those reporting level of education had advanced degrees and the average number of years of work experience in their specialization was 21.[9]

We found that all of the laboratory ORTAs carried out, to some degree, the activities that were prescribed for the ORTA in the legislation. They were especially active in the dissemination of information on laboratory activities to state and local governments and private industry (87 percent). Significant efforts were also devoted to coordinating with other federal ORTAs (85 percent), evaluating the potential of the laboratory innovations (80 percent), and providing assistance to the National Technical Information Service and the Federal Laboratory Consortium (77 percent).[10]

[8]We requested that laboratories indicate the number of full-time-equivalent staff positions filled at the laboratory during fiscal year 1989 for scientists, including visiting scientists and contract researchers. We distinguish between laboratories with less than 200 and those with 200 or more FTEs based upon the sum of FTEs across those categories. Using these data, there are 96 laboratories with 200 or more scientific, engineering, and technical FTEs. (See table VI.1 in appendix VI.)

[9]Fifty-eight percent of the laboratories with on-site ORTAs (N=92) reported the level of education for the director of the ORTA and 58 percent provided information about the years of experience.

[10]Percentages reported for the functions to be performed by the ORTA do not total 100 because these are not mutually exclusive categories.

## Delegation of Authority to Enter Into CRDAs

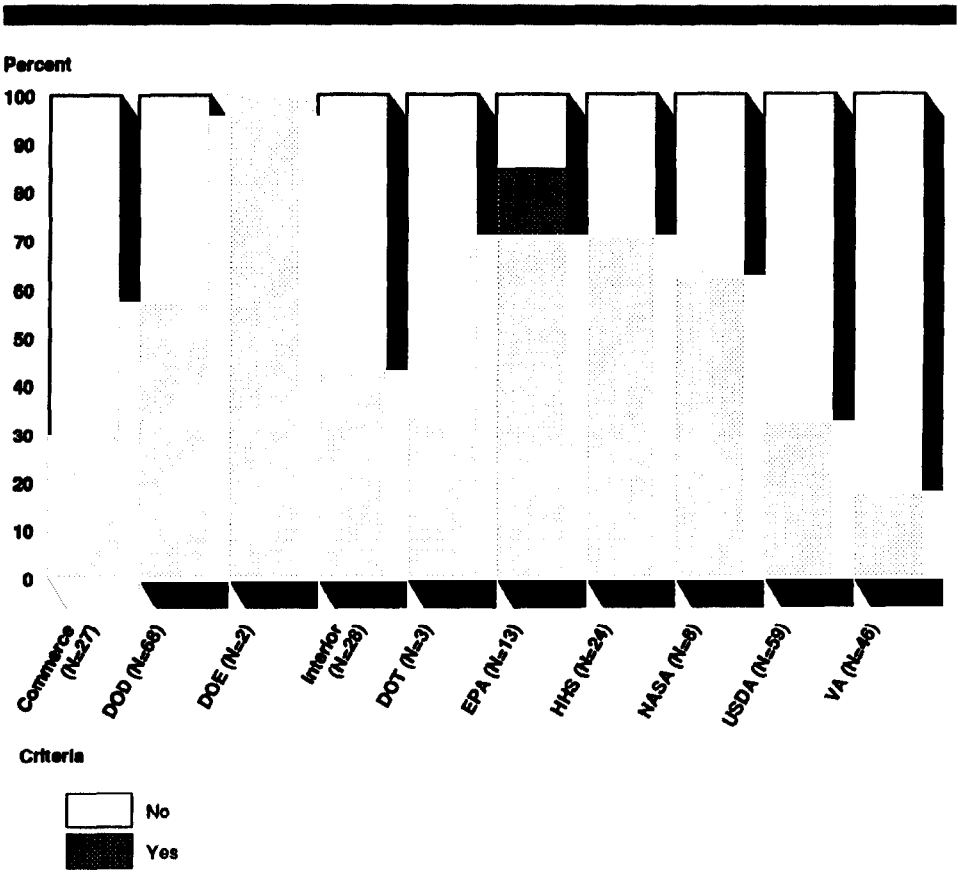
One hundred fifty-six of the laboratory directors had not been delegated authority to enter into CRDAs.[11] Among the departments, EPA had authorized 85 percent of its laboratories, followed by HHS (71 percent), NASA (63 percent), DOD (57 percent), and Interior (43 percent).[12] No other department had delegated authority to more than 34 percent of its laboratories. (See figure 3.)

About 80 percent of the laboratories falling under this provision had either finalized or were in the process of negotiating cooperative agreements in fiscal year 1989. Only the Department of Transportation (DOT) laboratories had none. HHS and DOD accounted for the highest percentage of the total CRDAs. The 685 agreements, either draft or final, that departments reported represented a wide variety of disciplines (e.g., biological sciences and computer science) and types of industrial partners (e.g., agricultural and medical instruments and supplies).

[11] A CRDA is a new contractual form created for the express purpose of fostering technology transfer from the federal domain to the private sector. CRDAs are further distinguished by the specifications laid out in the Federal Technology Transfer Act. For example: federal laboratories may accept, retain, and use funds, personnel, services, and property from collaborating parties; grant or agree to grant in advance, to a collaborating party, patent licenses or assignments in any invention made by a federal employee under the agreement; and permit employees or former employees of the laboratory to participate in efforts to commercialize inventions made while an employee. Further, special consideration is to be given to small business firms and consortia involving small business firms when considering potential CRDA partners. For further details, see the 1986 act, section 2, which adds a new Section 12: Cooperative Research and Development Agreements, to the original act.

[12] At the time of our survey, government-owned, contractor-operated (GOCO) laboratories did not fall under the CRDA provision of the 1986 act. Although the majority of DOE laboratories are GOCOs, 2 of the 18 in this study are not. (The National Competitiveness Technology Transfer Act of 1989 extended the CRDA provision to GOCOs.)

**Figure 3: Delegation of Authority to Enter Into CRDAs**




Both draft and final CRDAs tended to focus on applied research and testing and evaluation, with the least emphasis being given to clinical research. (See table VI.2 in appendix VI.) The projected lifetime of most CRDAs was more than one year, but less than three. The federal laboratory staff are expected to be responsible for 25 percent of the research in over two-thirds of the CRDAs. (See table VI.3.) The majority of CRDA partners were U.S. businesses (85 percent of CRDAs being drafted; 63 percent of those that have been finalized).[13]

In addition to CRDAs, there are at least five other formal arrangements whereby federal laboratories cooperate with nonfederal partners in research and development. They are: contracts, memorandums of understanding, work-for-other agreements, grants, and procurements to do

[13]Percentages reported for subcategories of CRDAs do not total 100 because each agreement could be classified in more than one category.

research and development. One hundred ninety-nine laboratories reported participation in such formal "non-CRDAs."[14] Twenty-four percent of the 22,421 agreements reported for 1989 were ones in which the federal partner provided some or all of the funds, and 22 percent were agreements in which all the work was contracted out to the nonfederal partner. (Under CRDAs, federal laboratories may not enter into sole-source procurements.) Both CRDAs and non-CRDAs aim to assist in the development of products with potential use to the partners or industry at large. In contrast, however, CRDAs are designed specifically to foster the commercialization of federal laboratory inventions and innovations.

## Establishment of Royalty-Sharing and Personnel Exchange Programs

The Technology Transfer Act, underscored by the executive order, called for the establishment of programs that would provide laboratory scientists, engineers, and technical staff with incentives to engage in technology transfer. Such programs were to provide broader scientific exchange as well as a share in the royalties received on inventions.

### Royalty-Sharing Programs

One hundred thirty-two of the laboratories reported that they give a percentage of royalties received to their inventors. In 1989, $777,183 in royalties were distributed to 313 laboratory inventors. While Commerce, DOT, and EPA made no payments to inventors, 79 percent of the monies went to HHS inventors.

### Personnel Exchange Programs

Personnel exchange programs have been instituted in 217 of the laboratories. Laboratories reported that in fiscal year 1989, 14,261 scientists and engineers participated. Eighty-eight percent of the 1989 participants were scientists visiting U.S. federal laboratories. Of these, fifty-four percent represented U.S. academic institutions, 22 percent were from foreign countries or organizations, and 15 percent were on temporary assignment from U.S. industries.

[14]Some overlap does exist between CRDA and non-CRDA agreements; specifically, both the federal partner and nonfederal entity may provide personnel, services, facilities, or funds. However, no funds may be provided by the federal laboratory in CRDAs.

## Technology Transfer Output—Patents, Licenses, Royalties

In fiscal year 1989, there were 676 patents issued to 87 federal laboratories.[15] Together, DOD, DOE, and NASA accounted for 88 percent of the patents. (See table VI.4.) In addition, the laboratories reported a total of 1,547 patent applications and 2,233 patents pending; the same three departments also accounted for 81 percent of both the exclusive and nonexclusive licenses issued. DOD, DOE, Interior, HHS, NASA, and USDA laboratories, collectively, accounted for the $6 million in royalty income reported for 1989.

The findings reported here are not indicators of the Technology Transfer Act's outcome, but rather of the federal R&D output at one point in time. Thus, these results alone should not be taken as an indication that there has been very little return to the federal government for its investment in federal R&D.

## Views of Laboratory Staff

Although the majority of the laboratories reported that the technology transfer legislation has been more effective than not, they also cited barriers and constraints to implementation. These opinions were similar to those expressed in our earlier reviews.[16] In particular, the problems most frequently mentioned by our respondents were:

- federal computer software cannot be copyrighted;
- companies need greater protection for proprietary information;
- private industry finds required government procedures burdensome and time-consuming; and
- conflicts of interest persist.[17]

Nonetheless, some were able to overcome such constraints. With respect to accounts of technology transfer attempts, laboratory respondents reported 169 examples of successful efforts as well as 81 examples of failed transfers.

[15]Some differences exist between the output statistics reported by the laboratories and their headquarters. We did not change our statistics for two reasons. First, our study's requester specifically asked that we obtain the laboratories' perspective on the implementation of the act. Second, the differences may reflect unequal access to the available statistics between the laboratories and their headquarters at the time of our survey.

[16]See Technology Transfer: Constraints Perceived by Federal Laboratory and Agency Officials (GAO/RCED-88-116BR, Mar. 4, 1988), Technology Transfer: Implementation Status of the Federal Technology Transfer Act of 1986 (GAO/RCED-89-154, May 30, 1989), and Technology Transfer: Copyright Law Constrains Commercialization of Some Federal Software (GAO/RCED-90-145, June 1, 1990).

[17]Greater protection for proprietary information has been provided by the National Competitiveness Technology Transfer Act of 1989.

## Conclusions

We conclude, based on these findings, that the major provisions of the Federal Technology Transfer Act of 1986 still have not been fully implemented. However, there are important differences among departments with respect to the extent of implementation. (In appendix V, we present a summary analysis of implementation by each of the 10 departments.) Some departments have, in fact, made considerable progress in implementing the act's provisions and others may also be proceeding along this line. Indeed, it is reasonable to expect that in a year or so, many more departments may well have achieved a greater degree and scope of implementation of the Technology Transfer Act of 1986.

As requested by your office, we did not obtain agency comments. Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from its date of issue. At that time, we will send copies to the Office of Management and Budget, the National Science Foundation, and the departments in our study population. We will also make copies available to interested organizations, as appropriate, and to others upon request.

If you have any questions or would like additional information, please call me on (202) 275-1854 or Kwai-Cheung Chan, Director of Program Evaluation in Physical System Areas at (202) 275-3092. Other major contributors to this report are listed in appendix VII.

Sincerely yours,

Eleanor Chelimsky
Assistant Comptroller General

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## Abbreviations

| | |
|---|---|
| CRDA | cooperative research and development agreement |
| DOD | Department of Defense |
| DOE | Department of Energy |
| DOT | Department of Transportation |
| EPA | Environmental Protection Agency |
| FTE | full-time-equivalent |
| GAO | General Accounting Office |
| GOCO | government-owned, contractor-operated |
| HHS | Department of Health and Human Services |
| NASA | National Aeronautics and Space Administration |
| ORTA | Office of Research and Technology Applications |
| R&D | research and development |
| USDA | U.S. Department of Agriculture |
| VA | Department of Veterans Affairs |

# GAO Laboratory-Level Questionnaire

United States General Accounting Office

## LABORATORY-LEVEL TECHNOLOGY TRANSFER QUESTIONNAIRE

NOVEMBER, 1989

**SECTION 1: INFORMATION ON LABORATORY RESEARCH AND TECHNOLOGY TRANSFER ACTIVITIES**

**NOTE:** In section 1, questions 5, 26, 27 & 28 were somewhat modified and questions 36, 37, & 38 were added after mail-out in August of the advance copy questionnaire.

**Please indicate the name, title, unit or office, and telephone number of the person(s) completing this section:**

| | |
|---|---|
| Name(s) | Name(s) |
| Title(s) | Title(s) |
| Unit(s) or office(s) address | Unit(s) or office(s) address |
| Telephone number(s) | Telephone number(s) |

## PURPOSE

For the present purposes, your research organization has been placed under a broadly defined category labeled "laboratory," and we have determined that yours is an appropriate organization to receive this questionnaire. Our immediate objective is to gather information about the implementation and impact at federal laboratories of the Stevenson-Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Act of 1986. However, it should be noted that in the interest of gaining a better understanding of the process of technology transfer we include in the questionnaire population some laboratories that are not covered explicitly under any or all of the provisions of the Acts referred to above.

We primarily are gathering FY 1989 data during the first year of implementation. In each of the next several years, your organization should expect to receive a similar questionnaire to update the account of its technological transfer activities.

## INSTRUCTIONS

The questionnaire has been divided into five sections. They are:

Section 1: Information on Research and Technology Transfer Activities

Section 2: Information on Office of Research and Technology Applications (ORTA) Characteristics and Activities

Section 3: Information on Patents, Licenses and Royalties

Section 4: Information on Federal Laboratory Consortium Activities

Section 5: Information on Laboratory Staff, Personnel Exchanges and Training

We ask that each section be completed by the staff member with the greatest pertinent knowledge. In some instances, it may be necessary to involve more than one person or office in answering questions. For your convenience each section of the questionnaire can be separated from the package.

To increase the reliability of the responses to each of the five sections, key terms have been defined either in the "definitions segment" or, in some cases, within the questionnaire. These definitions should be followed when answering questions.

Many questions can be answered with hard data. However, some answers will be based necessarily on rough estimates. You should not be overly concerned about generating such estimates. Please use your best professional judgment in extrapolating from existing data. For some questions, we ask for both FY 1986 and FY 1989 data in order to make a before-and-after comparison of changes since the Federal Technology Transfer Act of 1986.

When all sections are completed, the laboratory director, or designated staff member should assemble them as a single package. Return the package in the postpaid envelope before December 5, 1989 to Francine E. Jefferson, GAO. If you have any questions, please call Dr. Jefferson at (202) 275-8822 (FTS 275-8822).

Thank you for your cooperation.

**DEFINITIONS**

**AGENCY:** The following cabinet-level departments, independent agencies, or dependent agencies within cabinet departments are considered "agencies" for this questionnaire:

--Department of the Air Force

--Department of the Army

--Department of the Navy

--Within Department of the Agriculture
Agriculture Research Service, Forest Service

--Within Department of Commerce
NIST, NOAA, NTIA

--Within Department of Energy
Fossile Energy, Energy Research, Defense Programs, Conservation and Renewable Energy

--Within Department of Interior
Geological Survey, Bureau of Mines, Fish and Wild Life Service, Bureau of Land Management, Bureau Reclamation

--Within Department of Transportation
FAA, Federal Highway Administration, Coast Guard

--EPA

--NASA

--Veteran's Affairs

--Public Health Service's
NIH, CDC, FDA, ADAMHA

**FEDERAL TECHNOLOGY TRANSFER ACT OF 1986 (P.L. 99-502):** A congressional amendment to the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480). Major facets of P.L. 99-502 include directing heads of all federal agencies to authorize their *government-owned and government-operated* laboratories to enter into cooperative R&D agreements with universities and the private sector; formally chartering the Federal Laboratory Consortium for Technology Transfer as a national mechanism to promote and strengthen technology transfer; mandating that agencies pay at least 15% of the royalties from inventions made at laboratories to the inventor(s); allowing agencies to assign title to inventions (with restrictions) to current or former government-employee inventors; and allowing agencies to grant, in advance, to collaborating parties patent licenses or assignments on inventions made under cooperative R&D agreements (CRDAs).

**LABORATORY:** The term "laboratory" means 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 employees of the Federal Government. For the purposes of this questionnaire, the determination of which research organizations count as laboratories was settled on an agency-by-agency basis. The units designated as laboratories here are:

-- Institutes or similar level organizations within NIH, ADAMHA, CDC and FDA

-- ARS research locations with more than 40 staff years and Forest Service locations designated by the Forest Service

-- Army, Navy and Air Force laboratories and research centers designated by the responsible service agency

-- Selected Energy laboratories, both GOGO and GOCO, designated by the agency

-- All 9 NASA centers or laboratories

(DEFINITIONS CONTINUED)

LABORATORY CONTINUED

-- Veteran's Affairs hospitals with more than $1 million in funding for medical research

-- EPA laboratories, centers, or offices designated by the EPA Office of Research and Development

-- Geological Survey units within the Mapping, Water Resources and Geological Divisions

-- The Research and Laboratory Services Division within the Bureau of Reclamation

-- The Denver Service Center within the Bureau of Land Management

-- All 9 Bureau of Mines Research Centers

-- Fish and Wildlife Service reserach centers designated by the agency

-- The FAA Technology Center, Turner-Fairbank Research Center, and Coast Guard Research Development Center

-- The Institute for Telecommunication Sciences

-- All laboratories or institutes within NIST designated by NIST

-- NOAA laboratories with 50 or more full-time equivalent (FTE) staff and the National Weather Service Laboratories

**ORTA:** Offices of Research and Technology Applications (ORTAs) are organizational units created under P.L. 96-480. The primary function of these offices is to disseminate information on federally owned or originated products, processes, and services having potential for transfer, and to assist in linking the research and development resources of the Federal laboratories, and the Federal Government as a whole, to State and local government and to the private sector.

**STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980 (P.L. 96-480):** The goals of the Stevenson-Wydler Technology Innovation Act of 1980 were : (1) to promote increased and improved domestic technology development; (2) to stimulate improved utilization of federally funded technology developments by State and local governments and the private sector; and (3) to provide recognition for outstanding contributions in technology. Also, it formally mandated the establishment of Offices of Research and Technology Applications (ORTAs) within major Federal Laboratories. The act was amended by the Federal Technology Transfer Act of 1986 (P.L. 99-502).

(DEFINITIONS CONTINUED)

**TECHNOLOGY TRANSFER:** The Federal Technology Transfer Act of 1986 (P.L. 99-502) amended the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480) in order to ensure the full use of the results of the Federal investment in research and development. The Act promotes technological transfer by authorizing government-operated laboratories to enter into cooperative research agreements and by establishing a Federal Laboratory Consortium for Technology Transfer. "Technology Transfer" is defined here as the process whereby new knowledge and new technologies generated at Federal laboratories are further developed and commercially exploited by the domestic private sector, as well as being applied where appropriate by State and local governments.

Some of the essential transfer mechanisms are:

**Technical/Cooperative Interactions:**

--Direct technical assistance to private-sector users and producers of laboratory-developed inventions

--Personnel exchanges

--Resource sharing with industry, state and local governments, or other users and manufacturers of technology

--Cooperative research and development agreements (CRDAs) as defined under the Federal Technology Transfer Act of 1986

**Technology Utilization Activities:**

--Patenting and licensing of inventions

--Assessing potential commercial applications of inventions and identifying markets and users

--Meetings with potential users and manufacturers to help set the laboratory research agenda

**Information Exchange:**

--Disseminating technical information through papers, articles, seminars, etc.

--Linking technology users or manufacturers with technology producers

--Increasing public and industry awareness of laboratory facilities and resources

## QUESTIONS

1. Laboratory name: (6-7)

_____

_____

2. Name of federal agency under which the laboratory operates: (8-9)

_____

3. Please indicate the total number and names of any other laboratories or subunits (either co-located with your lab or located elsewhere) which are being included in your responses to this questionnaire.

_____ Total number of other labs or subunits being included

_____

_____

_____

_____

4. What was the approximate dollar amount of your total FY 1989 laboratory intramural (in agency laboratories and centers) and extramural (through grants and contracts) research and development budget? *Include appropriated and nonappropriated funds in your response.* (10-29)

$_____ Total FY 1989 intramural research and development budget

$_____ Total FY 1989 extramural research and development budget

5. In which of the following areas is your laboratory's mission-related work concentrated? (Limit your response to no more than 5 areas). (30-74)

1. ☐ Aeronautical/astronautical engineering
2. ☐ Agricultural, forestry, and food sciences
3. ☐ Atmospheric and space sciences
4. ☐ Behavioral and social sciences
5. ☐ Biological sciences
6. ☐ Business, economics and administration
7. ☐ Ceramic engineering
8. ☐ Chemical engineering
9. ☐ Chemical sciences
10. ☐ Civil engineering
11. ☐ Communication sciences
12. ☐ Computer sciences
13. ☐ Earth sciences
14. ☐ Education and training fields
15. ☐ Electronic/electrical engineering
16. ☐ Energy sciences
17. ☐ Environmental sciences
18. ☐ Health and medical sciences
19. ☐ Human factors
20. ☐ Mathematical sciences
21. ☐ Mechanical engineering
22. ☐ Oceanographic and marine sciences
23. ☐ Physical sciences
24. ☐ Public administration
25. ☐ Regional sciences and planning
26. ☐ Veterinary and animal husbandry sciences
27. ☐ Other (*please specify*) (75)

_____

_____

6. Please characterize your laboratory's work in terms of the relative percentage of activity devoted to the following types of research. In the first column, estimate the percentage of activity as derived from the *percentage of funding* expended for, or allocated to, each activity, including grants, contracts and on-site work. Also, if available, in the second column estimate the percentage of activity as derived *from staff-years devoted to the various types of research.*

Relative Percentage of Activity as derived from: 2(6-46)

| Funding | Staff Years | |
|---|---|---|
| _____% | _____% | **Basic Research** (i.e., research consisting of investigations whose primary purpose is to advance knowledge without regard to specific applications) |
| _____% | _____% | **Applied Research** (i.e., nonclinical research consisting of investigations aimed at advancing scientific knowledge with the ultimate aim of meeting a recognized need, such as producing a new product or process.) |
| _____% | _____% | **Clinical Research** (i.e., research on the etiology, medical diagnosis, or medical treatment of physical or mental disease in human beings or animals.) |
| _____% | _____% | **Development** (i.e., the systematic use of knowledge or information gained from research aimed at the production of materials, products, systems or methods) |
| _____% | _____% | **Testing and Evaluation** (i.e., developmental and/or operational test and evaluation of prototype hardware or processes, including assisting in the engineering design and development, verifying attainment of technical performance specifications, field testing an item or component of equipment for the purpose of determining the effectiveness for use by typical users, and the evaluation of the results of such tests.) |
| | | **Other** (*please specify*) |
| _____% | _____% | _____ |
| _____% | _____% | _____ |
| 100% | 100% | |

7. Consider the overall focus of your program to transfer knowledge or innovations to the types of organizations listed below. Rank each type of organization with respect to the relative emphasis placed upon transfer of knowledge/innovations to them. Rank in descending order with "1" indicating the greatest emphasis. (47-54)

| Rank (1=greatest emphasis) | Type of Organization |
|---|---|
| _____ | Other federal laboratories or agencies (including agencies within your own department), or scientists at federal facilities |
| _____ | State and local governments |
| _____ | Domestic private industry |
| _____ | Foreign industry or government |
| _____ | University scientists |
| _____ | University researchers |
| _____ | Other (*please specify*) _____ _____ |

8. Has your laboratory received final written instructions from your agency for implementing any or all parts of the Federal Technology Transfer Act of 1986? (55-61)

1. ☐ Yes. Final instructions were received on:_____ (Date)
2. ☐ No. However, draft instructions were received on: _____ (Date)
3. ☐ No instructions have been received

9. Does your laboratory give an award (separate and distinct from any such awards given by your agency) to reward scientific, engineering and technical personnel for activities leading to the filing of patent applications or the award of patents? (62-64)

1. ☐ Yes
2. ☐ No, but plan to begin giving such awards in FY ____ (*Skip to question 12*)
3. ☐ No, and do not plan to (*Skip to question 12*)

10. Are such awards given in response to the Federal Technology Transfer Act? (*Check one*) (65)

1. ☐ Yes
2. ☐ No

11. Please indicate the number of personnel receiving awards in the following categories, using FY 1989 data. If your facility is a GOCO laboratory, also complete the column for Contractor Personnel. 3(5-28)

| Government Personnel | GOCO Lab Contractor Personnel | |
|---|---|---|
| _____ | _____ | Total number of awardees given cash awards for patent applications filed (i.e., a document submitted to the U.S. Patent and Trademark Office requesting that Office to issue a patent to an applicant) |
| _____ | _____ | Total number of awardees given nonmonetary awards for patent applications filed |
| _____ | _____ | Total number of awardees given cash awards (excluding royalty income) for patents issued. (A patent is a contract between the Government and the inventor whereby, in exchange for the inventor's complete disclosure of the invention, the Government gives the inventor the right to exclude others from making, using or selling the invention for a fixed period of time.) |
| _____ | _____ | Total number of awardees given nonmonetary awards for patents issued |

12. Does your laboratory give awards (distinct from any such awards given by your agency) to reward staff, other than inventors, for activities contributing to licensing or patenting efforts? (29-31)

1. ☐ Yes
2. ☐ No, but plan to give awards in FY ____ (*Skip to question 14*)
3. ☐ No, and do not plan to (*Skip to question 14*)

13. Please indicate, for FY 1989, the number of personnel receiving awards under this program indicated in question 12. If your facility is a GOCO laboratory, also complete the column for Contractor Personnel. (32-43)

| Government Personnel | GOCO Lab Contractor Personnel | |
|---|---|---|
| _____ | _____ | Total number of awardees given cash awards (excluding royalty income) for activities contributing to licensing or patenting efforts |
| _____ | _____ | Total number of awardees given nonmonetary awards for activities contributing to licensing or patenting efforts |

14. Does your laboratory have awards (distinct from any such awards given by your agency) to reward staff, for technology transfer activities other than patenting or licensing efforts? Such activities may include *"but need not be limited to"* identifying markets or users for inventions, arranging for cooperative agreements, developing or conducting training courses in technology transfer, and serving or assisting the FLC? (44-46)

1. ☐ Yes
2. ☐ No, but plan to give such awards in FY ____ (*Skip to question 16*)
3. ☐ No, and do not plan to (*Skip to question 16*)

15. Please indicate, for FY 1989, the number of personnel receiving awards. If your facility is a GOCO laboratory, also complete the column for Contractor Personnel. (47-56)

| Government Personnel | GOCO Lab Contractor Personnel | |
|---|---|---|
| _____ | _____ | Total number of awardees given cash awards (excluding royalty income) for technology transfer activities other than patenting and licensing |
| _____ | _____ | Total number of awardees given nonmonetary awards for technology transfer activities other than patenting and licensing |

16. Does your laboratory participate in formal cooperative agreements, EXCLUDING THOSE CRDAs SPECIFIED UNDER THE PROVISIONS OF THE FEDERAL TECHNOLOGY TRANSFER ACT OF 1986, for example, agreements made under your agency's implementing legislation? Other examples include contracts, memorandums-of-understanding, work-for-others-agreements, grants, and procurements to do research and development. We are referring here only to those agreements whereby both your laboratory and the domestic nonfederal entity may provide any one, or more of the following: personnel, services, facilities, or funds. Such agreements aim to further the knowledge base or assist in the development of products with potential use to the partners or industry at large. *(Check one)* (59)

1. ☐ Yes
2. ☐ No *(Skip to question 19)*

17. If yes, please indicate the following information for FY 1986 and FY 1989 agreements. (If yours is a government-owned, government-operated (GOGO) laboratory, your responses should EXCLUDE any cooperative research and development agreements (CRDAs) entered into under the provisions of the Federal Technology Transfer Act of 1986.) (60-65)

_____ Number of agreements in effect during FY 1986 (including agreements entered into prior to FY 1986)

_____ Number of agreements in effect during FY 1989 (including agreements entered into prior to FY 1989)

18. **Consider the formal contracts and agreements in effect during FY 1989 indicated in question 17. How many were in the following categories?** *(Please note that not all categories are mutually exclusive in that one agreement might fall into more than one category.)* 4(5-34)

_____ Number of agreements (including contracts) where your laboratory provides any or all funds for the work

_____ Number of agreements where all research and development work is being contracted out to the external entity or partner to the agreement

_____ Number of formal agreements for sharing *only* your laboratory's physical resources

_____ Number of formal agreements for sharing *only* nonfederal partner's physical resources

_____ Number of formal agreements for *sharing each others physical resources* (i.e., your laboratory and nonfederal partner both share resources)

_____ Number of formal work-for-others agreements

_____ Number of formal agreements where nonfederal partner's staff work at your laboratory along with your staff, or vice versa

Other (*please specify*)

_____ _____

_____ _____

_____ _____

**Questions 19 - 29 pertain only to cooperative research and development agreements (CRDAs) authorized under the Federal Technology Transfer Act of 1986, NOT AGREEMENTS MADE UNDER ANY OTHER AUTHORITY OR LEGISLATION.**

**CRDA:** The following definition of a CRDA should be used when answering these questions: As specified in the Federal Technology Transfer Act of 1986, CRDAs include agreements between one or more federal laboratories and one or more **nonfederal parties** under which the laboratory provides personnel, services, facilities, equipment or other resources **(but not funds)** with or without reimbursement and the nonfederal parties provide funds, personnel, services, facilities, equipment or other resources toward the conduct of specified research or development efforts which are consistent with the missions of the laboratory. The term **does not include** procurements, grants or other types of cooperative agreements made under the authority of any other legislation, regardless of whether your laboratory provided funds for the work.

19. Has your laboratory received authorization from your agency for approving CRDAs? *(Check one)* (35)

1. ☐ Yes
2. ☐ No (*Skip to question 21*)

20. If yes to question 19, which of the following staff have the authority to approve CRDAs? *(Check all that apply)* (36-37)

1. ☐ Laboratory director or comparable level individual
2. ☐ Other staff at agency or laboratory (specify titles)

_____

21. Is this laboratory a government-owned contractor-operated (GOCO) laboratory? *(Check one)* (38)

1. ☐ Yes
2. ☐ No (*Skip to question 24*)

22. Please indicate which, if any, of the following benefits might be gained by your laboratory if it had the authority to approve or enter into CRDAs under the Federal Technology Transfer Act. *(Check all that apply)* (39-46)

1. ☐ No benefits
2. ☐ More flexible and productive negotiations for agreements or research plans
3. ☐ Better focused and scoped R&D efforts
4. ☐ Better cooperation and coordination between parties to the agreement
5. ☐ Lower costs and better utilization of resources
6. ☐ Improved quality of R&D products
7. ☐ Better transfer and utilization of technology
8. ☐ Other (*please specify*)

_____

_____

23. Consider your contractual arrangement with your parent company. Please indicate how technology transfer activities are handled in the contract. Specifically, are they: (47-52)

| | Yes | No |
|---|---|---|
| 1. Addressed | ____ | ____ |
| 2. Permitted | ____ | ____ |
| 3. Encouraged | ____ | ____ |
| 4. Obligatory | ____ | ____ |
| 5. Evaluated | ____ | ____ |
| 6. Rewarded | ____ | ____ |

**Questions 24-30 pertain only to government-owned, government-operated (GOGO) laboratories. GOCO laboratories should skip to question 31.**

24. Please indicate, for FY 1989, the following: (53-58)

_____ Number of cooperative research and development agreements (CRDAs) where a written agreement has been drafted, but not yet finalized

_____ Number of cooperative research and development agreements (CRDAs) in effect during FY 1989, including those entered into prior to FY 1989

25. Did you have at least one CRDA where a written agreement had been drafted, but not yet finalized or at least one CRDA in effect during FY 1989? *(Check one)* (59)

1. ☐ Yes (*Continue to question 26*)
2. ☐ No (*Skip to question 29*)

26. Consider the total number of CRDAs in effect and/or being negotiated during FY 1989. Please indicate the number of CRDAs in the following classifications. (*Estimates are sufficient, and please note that not all categories are mutually exclusive in that one agreement may fall into more than one category.*) 6(0-66)

| In effect | In Progress | |
|---|---|---|
| _____ | _____ | Number in which your laboratory is to provide only equipment or use of facilities |
| _____ | _____ | Number in which your laboratory staff are expected to have responsibility for at least 25% of the total amount of research, development, testing or evaluation work |
| _____ | _____ | Number that focus on basic research activities (i.e., research consisting of investigations whose primary purpose is to advance knowledge without regard to specific commercial applications, although it may help to form the base for future commercial innovations.) |
| _____ | _____ | Number that focus on applied research activities (i.e., research consisting of investigations aimed at advancing scientific knowledge with the ultimate aim of producing a new product or process.) |
| _____ | _____ | Number that focus on clinical research (i.e., research on the etiology, medical diagnosis, or medical treatment of physical or mental disease in human beings or animals) |
| _____ | _____ | Number that focus on development activities (i.e., the systematic use of knowledge of information gained from research aimed at the production of materials, products, systems or methods) |
| _____ | _____ | Number that focus on testing and evaluation activities (i.e., developmental and/or operational test and evaluation of prototype hardware or processes including assisting in the engineering design and development, verifying attainment of technical performance specifications, field testing an item or component of equipment for the purpose of determining the effectiveness for use by typical users, and the evaluation of the results of such tests) |
| _____ | _____ | Number in which the nonfederal partner's scientist(s) works at your laboratory or your scientist(s) at their laboratory to conduct specific research related to the CRDA |
| _____ | _____ | Number that have an expected duration of 1 year or less |

(Question 26 continued on next page)

26. (Continued)

| In effect | In Progress | |
|---|---|---|
| _____ | _____ | Number that have an expected duration of more than 1 but less than 3 years |
| _____ | _____ | Number that have an expected duration of more than 3 years but less than 5 years |
| _____ | _____ | Number that have an expected duration of 5 years or more |
| _____ | _____ | Number in which at least one partner is a small business entity. A small business entity 1) has no more than 500 employees, 2) is independently owned and not dominant in its field of operation, 3) has its principal place of business located in the U.S., and 4) is organized for profit. |
| _____ | _____ | Number in which at least one partner is a U.S. business entity. A U.S. business entity is owned or controlled directly or indirectly (e.g., 50% or more of the stock is held) by U.S. citizens or nationals, and/or is organized under the laws of the United States. |
| _____ | _____ | Number in which at least one partner is a Canadian business entity. A Canadian business entity is owned or controlled directly or indirectly (e.g., 50% or more of the stock is held) by citizens or nationals of Canada, and/or is organized under the laws of the Canadian government. |
| _____ | _____ | Number in which at least one partner is a foreign business entity (excluding Canada). A foreign business entity is owned or controlled directly or indirectly (e.g., 50% or more of the stock is held by foreign citizens or nationals, and/or is organized under foreign government laws, *excluding Canada*). |

27. Consider all CRDAs in effect or being negotiated by this laboratory during FY 1989. Which of the following disciplines were covered by these agreements? (Limit your responses to no more than five (5) areas.) *(Check all that apply)*

(5-49)

1. ☐ Aeronautical/astronautical engineering
2. ☐ Agricultural, forestry, and food sciences
3. ☐ Atmospheric and space sciences
4. ☐ Behavioral and social sciences
5. ☐ Biological sciences
6. ☐ Business, economics and administration
7. ☐ Ceramic engineering
8. ☐ Chemical engineering
9. ☐ Chemical sciences
10. ☐ Civil engineering
11. ☐ Communication sciences
12. ☐ Computer sciences
13. ☐ Earth sciences
14. ☐ Education and training fields
15. ☐ Electronic/electrical engineering
16. ☐ Energy sciences
17. ☐ Environmental sciences
18. ☐ Health and medical sciences
19. ☐ Human factors
20. ☐ Mathematical sciences
21. ☐ Mechanical engineering
22. ☐ Oceanographic and marine sciences
23. ☐ Physical sciences
24. ☐ Public administration
25. ☐ Regional sciences and planning
26. ☐ Veterinary and animal husbandry sciences
27. ☐ Other (*please specify*) (50)

_____

_____

28. Again, consider all CRDAs in effect or being negotiated by this laboratory during FY 1989. Which of the following **industries** were included as partners in these agreements? The list given below follows mainly, but not exclusively the 1987 **Standard Industrial Classification Manual** and the 1988 **Guide to the High Technology Industries**. *(Include both the number of agreements in effect and the number being negotiated in your aggregate response.)*

7(5-83)

Total number in effect
and being negotiated

_____ Agriculture & horticulture

_____ Forestry

_____ Mining and extraction

_____ Heavy construction (other than building)

_____ Food and kindred products

_____ Textiles

_____ Lumber and wood products

_____ Chemical and allied products

_____ Rubber and plastics (including high-strength plastics)

_____ Stone, clay and glass products

_____ Primary metals

_____ Fabricated metal products (except machinery and transportation equipment)

_____ Industrial and commerical machinery

_____ Office and computing machinery

_____ Electric and electronic equipment and components (except computer equipment, but including integrated circuits)

_____ Aerospace technology (including guided missiles and space vehicles)

_____ Engineering and scientific instruments

_____ Measuring, analyzing, and controlling instruments

(QUESTION CONTINUED ON NEXT PAGE)

28. Continued)

Total number in effect and being negotiated

_____ Optical instruments and lenses (including semiconductor lasers, fiber optics, and integrated optics)

_____ Medical instruments and supplies

_____ Optical instruments and lenses (including semiconductor lasers, fiber optics, and integrated optics)

_____ Medical instruments and supplies

_____ Transportation services and equipment (including railroad, passenger transit, aircraft trucking, water, air, pipelines)

_____ Public utilities

_____ Finance, insurance, and real estate

_____ Computer and data processing services

_____ Computer software

_____ Educational and training services

_____ Telecommunications

_____ Information/communication technologies and software (including mobile-radio systems)

_____ Public administration

_____ Social services

_____ Health services

_____ National security

_____ Printing and publishing

_____ Electronic components and accessories (including semiconductors, HDTV, CRT, and integrated circuits)

_____ Ceramics

(QUESTION CONTINUED ON NEXT PAGE)

28. Continued)

Total number in effect
and being negotiated

_____ Biotechnologies

_____ Fishing

_____ Genetic engineering

_____ Robotics

_____ Artificial intelligence

_____ Automated factory assembly

_____ Other: *(please specify)*_____

(64)

_____ _____

_____ _____

29. During FY 1989, which, if any, of the following factors negatively affected the successful negotiation of CRDAs? *(Check all that apply)*

(65-72)

1. ☐ National security concerns
2. ☐ The home nation of proposed partners to the agreement did not permit U.S. participation on a comparable basis
3. ☐ Proposed foreign partner's home nation did not have policies to protect the U.S. intellectual property rights
4. ☐ Proposed partner's concerns over disclosure of research results or proprietary information (e.g., through Freedom of Information Act)
5. ☐ Disagreements over resource or cost-sharing arrangements (e.g. inability of laboratory to provide funds as specified under the legislation)
6. ☐ Conflict between the potential CRDA and agency procurement policies (e.g., partner interested in CRDA was also interested in bidding on a laboratory project)
7. ☐ Proposed partner's objection to certain patent rights being retained by the federal government on inventions made by the partner under the CRDA
8. ☐ Other (*please specify*)

_____

_____

_____

30. The following factors have been identified by various laboratory officials as possible constraints on technology transfer. Please review this list. **For any factor that has no impact on limiting your laboratory's progress toward fulfilling your technology transfer program goals or objectives, place a zero (0) on the line.** Then, for all remaining factors, please rank them in order of their impact, where "1" is greatest. 8(6-28)

| Rank (Where 1= greatest) | Factor |
|---|---|
| _____ | Department or agency regulations (e.g., inadequate reward system, regulations unclear or overly binding, etc.) |
| _____ | Freedom of Information Act regulations |
| _____ | Conflict of interest concerns |
| _____ | Resource constraints |
| _____ | Policies or procedures of target recipients (e.g., industry regulations or attitudes) |
| _____ | Laboratory environment (e.g., technology transfer not yet accepted by staff as a meaningful responsibility) |
| _____ | Laboratory primary mission emphasis doesn't allow for or encourage technology transfer activities (e.g., primary mission is national security or weapons production) |
| _____ | Contractual arrangement with parent company prohibits certain technology transfer activities (e.g., only parent company may obtain an exclusive license to laboratory developed innovations) |
| _____ | Contractual arrangement with parent company discourages technology transfer (e.g., no reward system for this, consulting not allowed, etc.) |
| _____ | Other (*please specify*) _____ |
| _____ | _____ |
| _____ | _____ |

31. In your opinion, how effective or ineffective have the Stevenson-Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Act of 1986 been in enhancing your laboratory's technology transfer activities or program? *(Check one)* (29)

1. ☐ Very effective
2. ☐ More effective than ineffective
3. ☐ As effective as ineffective
4. ☐ More ineffective than effective
5. ☐ Very ineffective

32. Which, if any, of the following situations have actually occurred at your laboratory since the implementation of the legislation named in question 31 above? *(Check all that apply)* (30-36)

1. ☐ Scientists and/or technical staff have begun to communicate less with each other and/or exhibit increasing competition
2. ☐ Focus of laboratory research is more on innovations with commercial applications and away from discovery of scientific principles or innovations without commercial application
3. ☐ Resources are being channelled away from research, development, testing, or evaluation into technology transfer activities
4. ☐ Defense mission infringement
5. ☐ Legal conflicts of interest have increased
6. ☐ Other (*please specify*)

_____

7. ☐ None of these situations has occurred

33. Please comment on any concerns you have about the recent legislation, or areas where you see a need for new legislation. These comments may be both general in nature or specific to your laboratory experience. (37)

_____

_____

_____

34. Please attach a copy of your laboratory's complete mission statement, and technology transfer mission statement (if separate and applicable) to the end of the questionnaire. (38)

35. During the research and development process, does your research staff have access to advisors who could help them determine the potential future commercial applications of research products? (Such advisors may include, but need not be limited to, patent attorneys or marketing specialists.) *(Check one)* (39)

1. ☐ Yes
2. ☐ No

36. What suggestions do you have for increasing U.S. industry interest in and involvement with your laboratory in the research and development or technology transfer process? (40)

_____

_____

_____

_____

_____

_____

_____

_____

37. What role, if any, do you feel brokers can play in the technology transfer process? (41)

_____

_____

_____

_____

38. Do you think the laboratory should pay for a portion of the technology transfer broker's fees? *(Check one)* (42)

1. ☐ Yes
2. ☐ No

Please explain your response.

_____
_____
_____
_____

39. Please describe one or two examples of your most successful technology transfer efforts using any type of transfer mechanism. Include a description of the innovation transferred, to whom it was transferred, methods of transfer, and your opinion as to the reasons for the *success of the transfer effort.* (If you already have something written, please attach the written summary in lieu of responding in the space provided.) (43)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

40. Please describe one or two examples of your least successful technology transfer efforts using any type of transfer mechanism. Include a description of the innovation transferred, to whom it was transferred, methods of transfer, and your opinion as to the reasons for the *lack of success of the transfer effort.* (If you already have something written, please attach the written summary in lieu of responding in the space provided.) (44)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

41. Please indicate which, if any, of the questions in this section required you to get answers from some office outside your laboratory (e.g., your agency budget office, agency technology transfer office, etc.). (45-54)

| Question # | Source of Data (Name and location of Office) |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

42. If you have any comments that would further explain, better illustrate, or qualify *any of your answers in this section* please write them in the space below. Also if you have any suggestions about other questions you feel we should have asked, please note them here. (56)

_____

_____

_____

_____

United States General Accounting Office

# LABORATORY-LEVEL TECHNOLOGY TRANSFER QUESTIONNAIRE

NOVEMBER, 1989

**SECTION 2: INFORMATION ON ORTA CHARACTERISTICS AND ACTIVITIES**

**NOTE:** In section 2, question 58 was added after mail-out in August of the advance copy questionnaire.

**Please indicate the name, title, unit or office, and telephone number of the person(s) completing this section:**

| | |
|---|---|
| Name(s) | Name(s) |
| Title(s) | Title(s) |
| Unit(s) or office(s) address | Unit(s) or office(s) address |
| Telephone number(s) | Telephone number(s) |

## PURPOSE

For the present purposes, your research organization has been placed under a broadly defined category labeled "laboratory," and we have determined that yours is an appropriate organization to receive this questionnaire. Our immediate objective is to gather information about the implementation and impact at federal laboratories of the Stevenson-Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Act of 1986. However, it should be noted that in the interest of gaining a better understanding of the process of technology transfer we include in the questionnaire population some laboratories that are not covered explicitly under any or all of the provisions of the Acts referred to above.

We primarily are gathering FY 1989 data during the first year of implementation. In each of the next several years, your organization should expect to receive a similar questionnaire to update the account of its technological transfer activities.

## INSTRUCTIONS

Section 1: Information on Research and Technology Transfer Activities

Section 2: Information on Office of Research and Technology Applications (ORTA) Characteristics and Activities

Section 3: Information on Patents, Licenses and Royalties

Section 4: Information on Federal Laboratory Consortium Activities

Section 5: Information on Laboratory Staff, Personnel Exchanges and Training

We ask that each section be completed by the staff member with the greatest pertinent knowledge. In some instances, it may be necessary to involve more than one person or office in answering questions. For your convenience each section of the questionnaire can be separated from the package.

To increase the reliability of the responses to each of the five sections, key terms have been defined either in the "definitions segment" or, in some cases, within the questionnaire. These definitions should be followed when answering questions.

Many questions can be answered with hard data. However, some answers will be based necessarily on rough estimates. You should not be overly concerned about generating such estimates. Please use your best professional judgment in extrapolating from existing data. For some questions, we ask for both FY 1986 and FY 1989 data in order to make a before-and-after comparison of changes since the Federal Technology Transfer Act of 1986.

When all sections are completed, the laboratory director, or designated staff member should assemble them as a single package. Return the package in the postpaid envelope before December 5, 1989 to Francine E. Jefferson, GAO. If you have any questions, please call Dr. Jefferson at (202) 275-8822 (FTS 275-8822).

Thank you for your cooperation.

**DEFINITIONS**

**AGENCY:** The following cabinet-level departments, independent agencies, or dependent agencies within cabinet departments are considered "agencies" for this questionnaire:

--Department of the Air Force

--Department of the Army

--Department of the Navy

--Within Department of the Agriculture
Agriculture Research Service, Forest Service

--Within Department of Commerce
NIST, NOAA, NTIA

--Within Department of Energy
Fossile Energy, Energy Research, Defense Programs, Conservation and Renewable Energy

--Within Department of Interior
Geological Survey, Bureau of Mines, Fish and Wild Life Service, Bureau of Land Management, Bureau Reclamation

--Within Department of Transportation
FAA, Federal Highway Administration, Coast Guard

--EPA

--NASA

--Veteran's Affairs

--Public Health Service's
NIH, CDC, FDA, ADAMHA

**FEDERAL TECHNOLOGY TRANSFER ACT OF 1986 (P.L. 99-502):** A congressional amendment to the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480). Major facets of P.L. 99-502 include directing heads of all federal agencies to authorize their *government-owned and government-operated* laboratories to enter into cooperative R&D agreements with universities and the private sector; formally chartering the Federal Laboratory Consortium for Technology Transfer as a national mechanism to promote and strengthen technology transfer; mandating that agencies pay at least 15% of the royalties from inventions made at laboratories to the inventor(s); allowing agencies to assign title to inventions (with restrictions) to current or former government-employee inventors; and allowing agencies to grant, in advance, to collaborating parties patent licenses or assignments on inventions made under cooperative R&D agreements (CRDAs).

**LABORATORY:** The term "laboratory" means 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 employees of the Federal Government. For the purposes of this questionnaire, the determination of which research organizations count as laboratories was settled on an agency-by-agency basis. The units designated as laboratories here are:

-- Institutes or similar level organizations within NIH, ADAMHA, CDC and FDA

-- ARS research locations with more than 40 staff years and Forest Service locations designated by the Forest Service

-- Army, Navy and Air Force laboratories and research centers designated by the responsible service agency

(DEFINITIONS CONTINUED)

LABORATORY CONTINUED

- Selected Energy laboratories, both GOGO and GOCO, designated by the agency
- All 9 NASA centers or laboratories
- Veteran's Affairs hospitals with more than $1 million in funding for medical research
- EPA laboratories, centers, or offices designated by the EPA Office of Research and Development
- Geological Survey units within the Mapping, Water Resources and Geological Divisions
- The Research and Laboratory Services Division within the Bureau of Reclamation
- The Denver Service Center within the Bureau of Land Management
- All 9 Bureau of Mines Research Centers
- Fish and Wildlife Service reserach centers designated by the agency
- The FAA Technology Center, Turner-Fairbank Research Center, and Coast Guard Research Development Center
- The Institute for Telecommunication Sciences
- All laboratories or institutes within NIST designated by NIST
- NOAA laboratories with 50 or more full-time equivalent (FTE) staff and the National Weather Service Laboratories

ORTA: Offices of Research and Technology Applications (ORTAs) are organizational units created under P.L. 96-480. The primary function of these offices is to disseminate information on federally owned or originated products, process, and services having potential for transfer and to assist in linking the research and development resources of the Federal laboratories and the Federal Government as a whole to State and local government and to the private sector.

STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980 (P.L. 96-480): The goals of the Stevenson-Wydler Technology Innovation Act of 1980 were : (1) to promote increased and improved domestic technology development; (2) to stimulate improved utilization of federally funded technology developments by State and local governments and the private sector; and (3) to provide recognition for outstanding contributions in technology. Also, it formally mandated the establishment of Offices of Research and Technology Applications (ORTA) within major Federal Laboratories. The act was amended by the Federal Technology Transfer Act of 1986 (P.L. 99-502).

(DEFINITIONS CONTINUED)

TECHNOLOGY TRANSFER: The Federal Technology Transfer Act of 1986 (P.L. 99-502) amended the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480) in order to ensure the full use of the results of the Federal investment in research and development. The Act promotes technological transfer by authorizing government-operated laboratories to enter into cooperative research agreements and by establishing a Federal Laboratory Consortium for Technology Transfer. "Technology Transfer" is defined here as the process whereby new knowledge and new technologies generated at Federal laboratories are further developed and commercially exploited by the domestic private sector, as well as being applied where appropriate by State and local governments.

Some of the essential transfer mechanisms are:

**Technical/Cooperative Interactions:**

--Direct technical assistance to private sector users and producers of laboratory-developed inventions

--Personnel exchanges

--Resource sharing with industry, state and local governments, or other users and manufacturers of technology

--Cooperative research and development agreements (CRDAs) as defined under the Federal Technology Transfer Act of 1986

**Technology Utilization Activities:**

--Patenting and licensing of inventions

--Assessing potential commercial applications of inventions and identifying markets and users

--Meetings with potential users and manufacturers to help set the laboratory research agenda

**Information Exchange:**

--Disseminating technical information through papers, articles, seminars, etc.

--Linking technology users or manufacturers with technology producers

--Increasing public and industry awareness of laboratory facilities and resources

## QUESTIONS

43. What is the location of the ORTA, or office that functions as an ORTA, that your laboratory manages or controls? *(Check one)* 1(5)

1. ☐ Within your laboratory (*Skip to question 47*)
2. ☐ At agency headquarters *
3. ☐ Other (*please specify*)

_____

_____

***IF THE MANAGEMENT OF THE ORTA FOR YOUR LABORATORY IS DONE AT AGENCY HEADQUARTERS PLEASE ANSWER ONLY QUESTIONS 44 THROUGH 47 AND 62.**

44. Are there one or more persons at your laboratory who assist the main ORTA in carrying out its activities? *(Check one)* (6)

1. ☐ Yes
2. ☐ No (*Skip to question 62*)

45. If yes, approximately how many "full-time equivalent" staff positions at this laboratory are used to assist the main ORTA? (*One FTE equals 2080 hours.*) (7)

_____ FTEs used to assist main ORTA

46. What ORTA related activities are performed by your laboratory staff who assist the ORTA? (8)

_____

_____

_____

_____

_____

_____

_____

47. **Please attach an organizational chart indicating the location of the ORTA and the office to which it reports.**

48. How many "full-time equivalent" (FTE) staff positions are budgeted and filled for the ORTA? (One FTE equals 2080 hours.) Of the FTEs filled, how many are filled by consultants? (9-17)

_____ (FTEs) budgeted

_____ (FTEs) filled by laboratory staff

_____ (FTEs) filled by consultants

49. For the FTE's filled at this time, how many actual persons (including laboratory staff and consultants) make up this total? (18-26)

_____ Actual number of individuals comprising filled FTEs

50. For the director/manager of the ORTA, please indicate the following: (27-36)

A. _____ GS grade level or equivalent

B. _____ Highest educational degree and area of educational specialization

_____

C. Area of work experience specialization (e.g., area of science or engineering, marketing, public relations, law, etc.):

_____

_____

D. _____ Years of experience in area of work specialization

E. Position held prior to moving to the ORTA:

_____

_____

51. Are ORTA positions assigned as primary or collateral duties *(Check one)* (37)

1. ☐ Primary duty
2. ☐ Collateral duty
3. ☐ Some are primary and some are collateral

52. Are ORTA staff positions temporary or permanent? *(Check all that apply)* (38-42)

1. ☐ Rotating/temporary assignments
2. ☐ Permanent assignments
3. ☐ Both rotating and permanent assignments
4. ☐ Not yet decided whether rotating or permanent
5. ☐ Other *(please specify)*

_____

_____

53. If ORTA positions are rotating, what is the average duration of the rotation? (43-44)

_____ Duration of rotation, in months

54. Throughout the entire existence of the ORTA, have any ORTA staff members moved out of the ORTA to other positions, either within the laboratory or elsewhere? *(Check one)* (45)

1. ☐ Yes
2. ☐ No

If yes, please indicate the positions and offices to which these staff went: (46)

_____

_____

55. Did the requests for information received by the ORTA from all sources outside the laboratory (e.g., industry, academia, etc.) during FY 1989 increase, decrease or remain about the same when compared to FY 1986? If you can, please estimate the number of requests in FY 1986 and FY 1989. If you do not have actual data, what is your best judgment about increase or decrease? (67-68)

_____ Estimated number of requests in FY 1986

_____ Estimated number of requests in FY 1989

_____ Increased by _____% between FY 1986 and FY 1989

_____ Decreased by _____% between FY 1986 and FY 1989

_____ Remained about the same

_____ Cannot estimate change because ORTA was not in existence in FY 1986

56. Please indicate whether your ORTA performs the following activities. *(Check all that apply)* (67-74)

1. ☐ Disseminates information on laboratory activities, services or innovations having potential application to state and local governments and to private industry
2. ☐ Assists NTIS and/or the FLC in linking laboratory resources to potential users in state and local governments and in private industry
3. ☐ Provides direct technical assistance to state and local governments (i.e., advice, guidance, references, and general technical assistance, including the conduct of tests and evaluating experimental devices)
4. ☐ Participates in regional, state and/or local programs designed to facilitate or stimulate technology transfer for the benefit of the region, state or locality in which your facility is located
5. ☐ Communicates and/or coordinates efforts with ORTAs of other laboratories or departments
6. ☐ Communicates and/or coordinates efforts with regional, state and/or local technology transfer organizations
7. ☐ Conducts assessments of laboratory developed innovations to determine if they have potential application to and should be made available for transfer to industry or other users
8. ☐ Other (*please specify*)

_____

_____

57. Please indicate which, if any, of the following activities the ORTA interacts with or uses consultants for: *(Check all that apply)* (76-80)

1. ☐ Legal advice or services
2. ☐ Marketing advice or services
3. ☐ Public relations
4. ☐ Brokering activities
5. ☐ Administrative activities
6. ☐ Other *(please specify)*

_____

_____

_____

58. If the ORTA does not use or interact with consultants, please indicate the reasons. *(Check all that apply)* 2(5-7)

1. ☐ Do not have funds for this
2. ☐ Do not have authority to do this
3. ☐ Other *(please specify)*

_____

_____

_____

59. Please indicate the number of *formally planned* meetings held with industry in FY 1989 as part of setting your laboratory's research priorities. **Do not include informal, day-to-day meetings or interactions with industry in your responses.** (8-13)

_____# Number of meetings *held to inquire about the problems which the companies consider most important for your facility to research*

_____# Number of meetings held to *brief industry on your research progress in order to solicit their reactions and suggestions for further work*

60. Please describe the role played by the ORTA in these meetings. If the ORTA had no role, indicate "NONE". (14)

_____

_____

_____

_____

_____

_____

61. Please indicate which, if any, of the questions in this section required you to get answers from some office outside your laboratory (e.g., your agency budget office, agency technology transfer office, etc.). (18-24)

| Question # | Source of Data (Name and location of Office) |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

62. If you have any comments that would further explain, better illustrate, or qualify *any of your answers in this section* please write them in the space below. Also if you have any suggestions about other questions you feel we should have asked, please note them here. (25)

_____

_____

_____

_____

United States General Accounting Office

# LABORATORY-LEVEL TECHNOLOGY TRANSFER QUESTIONNAIRE

NOVEMBER, 1989

## SECTION 3: INFORMATION ON PATENTS, LICENSES AND ROYALTIES

**Please indicate the name, title, unit or office, and telephone number of the person(s) completing this section:**

| | |
|---|---|
| Name(s) | Name(s) |
| Title(s) | Title(s) |
| Unit(s) or office(s) address | Unit(s) or office(s) address |
| Telephone number(s) | Telephone number(s) |

## PURPOSE

For the present purposes, your research organization has been placed under a broadly defined category labeled "laboratory," and we have determined that yours is an appropriate organization to receive this questionnaire. Our immediate objective is to gather information about the implementation and impact at federal laboratories of the Stevenson-Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Act of 1986. However, it should be noted that in the interest of gaining a better understanding of the process of technology transfer we include in the questionnaire population some laboratories that are not covered explicitly under any or all of the provisions of the Acts referred to above.

We primarily are gathering FY 1989 data during the first year of implementation. In each of the next several years, your organization should expect to receive a similar questionnaire to update the account of its technological transfer activities.

## INSTRUCTIONS

The questionnaire has been divided into five sections. They are:

Section 1: Information on Research and Technology Transfer Activities

Section 2: Information on Office of Research and Technology Applications (ORTA) Characteristics and Activities

Section 3: Information on Patents, Licenses and Royalties

Section 4: Information on Federal Laboratory Consortium Activities

Section 5: Information on Laboratory Staff, Personnel Exchanges and Training

We ask that each section be completed by the staff member with the greatest pertinent knowledge. In some instances, it may be necessary to involve more than one person or office in answering questions. For your convenience each section of the questionnaire can be separated from the package.

To increase the reliability of the responses to each of the five sections, key terms have been defined either in the "definitions segment" or, in some cases, within the questionnaire. These definitions should be followed when answering questions.

Many questions can be answered with hard data. However, some answers will be based necessarily on rough estimates. You should not be overly concerned about generating such estimates. Please use your best professional judgment in extrapolating from existing data. For some questions, we ask for both FY 1986 and FY 1989 data in order to make a before-and-after comparison of changes since the Federal Technology Transfer Act of 1986.

When all sections are completed, the laboratory director, or designated staff member should assemble them as a single package. Return the package in the postpaid envelope before December 5, 1989 to Francine E. Jefferson, GAO. If you have any questions, please call Dr. Jefferson at (202) 275-8822 (FTS 275-8822).

Thank you for your cooperation.

DEFINITIONS

AGENCY: The following cabinet-level departments, independent agencies, or dependent agencies within cabinet departments are considered "agencies" for this questionnaire:

--Department of the Air Force

--Department of the Army

--Department of the Navy

--Within Department of the Agriculture
Agriculture Research Service, Forest Service

--Within Department of Commerce
NIST, NOAA, NTIA

--Within Department of Energy
Fossile Energy, Energy Research, Defense Programs, Conservation and Renewable Energy

--Within Department of Interior
Geological Survey, Bureau of Mines, Fish and Wild Life Service, Bureau of Land Management, Bureau Reclamation

--Within Department of Transportation
FAA, Federal Highway Administration, Coast Guard

--EPA

--NASA

--Veteran's Affairs

--Public Health Service's
NIH, CDC, FDA, ADAMHA

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT (CRDA): As specified in the Federal Technology Transfer Act of 1986, CRDAs include agreements between one or more federal laboratories and one or more nonfederal parties under which the laboratory provides personnel, services, facilities, equipment or other resources (but not funds), with or without reimbursement, and the nonfederal parties provide funds, personnel, services, facilities, equipment or other resources toward the conduct of specified research or development efforts which are consistent with the missions of the laboratory. The term does not include procurements, grants or other types of cooperative agreements made under the authority of any other legislation, regardless of whether your laboratory provided funds for the work.

FEDERAL TECHNOLOGY TRANSFER ACT OF 1986 (P.L. 99-502): A congressional amendment to the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480). Major facets of P.L. 99-502 include directing heads of all federal agencies to authorize their *government-owned and government-operated* laboratories to enter into cooperative R&D agreements with universities and the private sector; formally chartering the Federal Laboratory Consortium for Technology Transfer as a national mechanism to promote and strengthen technology transfer; mandating that agencies pay at least 15% of the royalties from inventions made at laboratories to the inventor(s); allowing agencies to assign title to inventions (with restrictions) to current or former government employee inventors; and allowing agencies to grant, in advance, to collaborating parties patent licenses or assignments on inventions made under cooperative R&D agreements (CRDAs).

INVENTION DISCLOSURE: An invention disclosure is a description including possibly a sketch of the proposed invention.

(DEFINITIONS CONTINUED)

LABORATORY: The term "laboratory" means 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 employees of the Federal Government. For the purposes of this questionnaire, the determination of which research organizations count as laboratories was settled on an agency-by-agency basis. The units designated as laboratories here are:

- Institutes or similar level organizations within NIH, ADAMHA, CDC and FDA
- ARS research locations with more than 40 staff years and Forest Service locations designated by the Forest Service
- Army, Navy and Air Force laboratories and research centers designated by the responsible service agency
- Selected Energy laboratories, both GOGO and GOCO, designated by the agency
- All 9 NASA centers or laboratories
- Veteran's Affairs hospitals with more than $1 million in funding for medical research
- EPA laboratories, centers, or offices designated by the EPA Office of Research and Development
- Geological Survey units within the Mapping, Water Resources and Geological Divisions
- The Research and Laboratory Services Division within the Bureau of Reclamation
- The Denver Service Center within the Bureau of Land Management
- All 9 Bureau of Mines Research Centers
- Fish and Wildlife Service reserach centers designated by the agency

(DEFINITIONS CONTINUED)

LABORATORY CONTINUED:

- The FAA Technology Center, Turner-Fairbank Research Center, and Coast Guard Research Development Center
- The Institute for Telecommunication Sciences
- All laboratories or institutes within NIST designated by NIST
- NOAA laboratories with 50 or more full-time equivalent (FTE) staff and the National Weather Service Laboratories

LICENSE: A license is a contract that gives permission to make, use or sell a patented product or process.

NTIS: National Technical Information Service. An agency of the Department of Commerce that is authorized to carry out technology-transfer-related activities on behalf of the U.S.Government. NTIS oversees domestic and foreign licensing; advertises for patent licenses; negotiates terms with prospective licensees; and collects royalty income and licensing fees to disburse to agencies.

PATENT: A patent is an agreement between the Government and the inventor whereby, in exchange for the inventor's complete disclosure of the invention, the Government gives the inventor the right to exclude others from making, using or selling the invention for a certain period of time.

PATENT APPLICATION: A patent application is a document submitted to the U.S. Patent and Trademark Office requesting that Office to issue a patent to an applicant.

(DEFINITIONS CONTINUED)

**STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980 (P.L. 96-480):** The goals of the Stevenson-Wydler Technology Innovation Act of 1980 were : (1) to promote increased and improved domestic technology development; (2) to stimulate improved utilization of federally funded technology developments by State and local governments and the private sector; and (3) to provide recognition for outstanding contributions in technology. Also, it formally mandated the establishment of Offices of Research and Technology Applications (ORTAs) with major Federal Laboratories. The act was amended by the Federal Technology Transfer Act of 1986 (P.L. 99-502).

QUESTIONS

63. In FY 1986 and 1989, what amount of royalty income did your laboratory receive 1) from your agency and 2) directly from licensees for laboratory developed innovations? (Royalty income is income returned to the owner of a patented invention by the licensee company(ies) that is based on use, such as percentage of sales). (15-29)

$_____ FY 1986 total royalty income received from agency (in thousands)

$_____ FY 1986 total royalty income received directly from licensees (in thousands)

$_____ FY 1989 total royalty income received from agency (in thousands)

$_____ FY 1989 total royalty income received directly from licensees (in thousands)

64. Of the total royalty income received by your laboratory from any source during FY 1989, what amount was attributable to licenses from inventions developed under cooperative research and development agreements (CRDAs) as defined under the Federal Technology Transfer Act of 1986? (30-34)

$_____ Royalty income attributable to CRDAs (in thousands)

65. Does your laboratory give a percentage of royalties from licenses to inventors who were employed by the laboratory at the time the invention was made? *(Check one)* (35)

1. ☐ Yes
2. ☐ No *(Skip to question 68)*

66. What percentage of royalties are paid to your laboratory inventors under the following policies? *(If not applicable, write N/A.)* (36-44)

_____% Percentage given in accordance with agency policy

_____% Percentage given in accordance with contractor policy

_____% Percentage given in accordance with laboratory policy

67. Please indicate the following information about royalties paid to individual inventors at your laboratory in FY 1989: (45-54)

$_____ Total dollar amount of royalties paid during FY 1989 to laboratory inventors

_____ Total number of inventors at laboratory receiving royalties

68. During FY 1989, please indicate the following: 2(5-36)

_____ Number of invention disclosures prepared by laboratory employees

_____ Number of patent applications *filed by your laboratory* (i.e., not by the agency) on inventions arising from your laboratory research

_____ Number of patent applications *filed by your agency* on inventions arising from laboratory's research

_____ Number of patents issued from your laboratory for inventions arising from your laboratory research or development work

_____ Number of patents pending for innovations arising form your laboratory research or development work

_____ Number of foreign patent applications filed by your agency

_____ Number of foreign patent applications filed by your laboratory

69. During FY 1986, how many patents were issued for inventions arising from your laboratory research or development work? (37-39)

_____ Number of patents issued from your laboratory during FY 1986

70. How many licenses were granted during FY 1986 and FY 1989 for laboratory produced inventions, including licenses transferred to NTIS? (40-61)

_____ Number of *exclusive licenses* granted in FY 1986 (An exclusive license limits the use of a product or process to a single entity, or to a single field of use, except for rights reserved by the federal government to use the invention)

_____ Number of *exclusive licenses* granted in FY 1989

_____ Number of *nonexclusive licenses* granted in FY 1986 (A non exclusive license does not limit the use of a licensed product or process to a single entity, or to a single field or use)

_____ Number of *nonexclusive licenses* granted in FY 1989

71. During FY 1989, how many titles were assigned to laboratory inventors (rather than the government) for inventions developed at your laboratory? (62-64)

_____ Number of titles vested in laboratory inventors in FY 1989

72. Have you experienced any difficulties related to licensing or patenting inventions made at your laboratory? *(Check one)* (65)

1. ☐ Yes
2. ☐ No

If yes, please explain: (66)

_____

_____

_____

_____

73. Please indicate which, if any, of the questions in this section required you to get answers from some office outside your laboratory (e.g., your agency budget office, agency technology transfer office, etc.). (67-68)

| Question # | Source of Data (Name and location of Office) |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

74. If you have any comments that would further explain, better illustrate, or qualify *any of your answers in this section* please write them in the space below. Also if you have any suggestions about other questions you feel we should have asked, please note them here. (67)

_____

_____

_____

_____

United States General Accounting Office

# LABORATORY-LEVEL TECHNOLOGY TRANSFER QUESTIONNAIRE

NOVEMBER, 1989

## SECTION 4: INFORMATION ON FEDERAL LABORATORY CONSORTIUM ACTIVITIES

**NOTE:** In section 4, questions 77, 83 and 84 were added after mail-out in August of the advanced copy questionnaire.

**Please indicate the name, title, unit or office, and telephone number of the person(s) completing this section:**

| | |
|---|---|
| Name(s) | Name(s) |
| Title(s) | Title(s) |
| Unit(s) or office(s) address | Unit(s) or office(s) address |
| Telephone number(s) | Telephone number(s) |

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--Department of the Navy

--Within Department of the Agriculture
Agriculture Research Service, Forest Service

--Within Department of Commerce
NIST, NOAA, NTIA

--Within Department of Energy
Fossile Energy, Energy Research, Defense Programs, Conservation and Renewable Energy

--Within Department of Interior
Geological Survey, Bureau of Mines, Fish and Wild Life Service, Bureau of Land Management, Bureau Reclamation

--Within Department of Transportation
FAA, Federal Highway Administration, Coast Guard

--EPA

--NASA

--Veteran's Affairs

--Public Health Service's
NIH, CDC, FDA, ADAMHA

**FEDERAL TECHNOLOGY TRANSFER ACT OF 1986 (P.L. 99-502):** A congressional amendment to the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480). Major facets of P.L. 99-502 include directing heads of all federal agencies to authorize their *government-owned and government-operated* laboratories to enter into cooperative R&D agreements with universities and the private sector; formally chartering the Federal Laboratory Consortium for Technology Transfer as a national mechanism to promote and strengthen technology transfer; mandating that agencies pay at least 15% of the royalties from inventions made at laboratories to the inventor(s); allowing agencies to assign title to inventions (with restrictions) to current or former government employee inventors; and allowing agencies to grant, in advance, to collaborating parties patent licenses or assignments on inventions made under cooperative R&D agreements (CRDAs).

**FLC:** Federal Laboratory Consortium. An organization organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986. Members include all major federal laboratories and centers, and their parent agencies. The mission of the FLC is to promote the rapid movement of federal facility research results and technologies into the mainstream of the U.S. economy.

**FLC CLEARINGHOUSE:** A database containing information on facility work in progress, technical staff skills and facility capabilities that operates on keyword identifiers to enable the inquirer to identify possible responses or solutions to private sector inquirers about federal facility research or capabilities related to particular problems.

**FLC ELECTRONIC MAIL SYSTEM:** A computerized communication system available to FLC representatives in which requests for information from the private sector are entered and made available to other FLC representatives.

**(DEFINITIONS CONTINUED)**

**LABORATORY:** The term "laboratory" means 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 employees of the Federal Government. For the purposes of this questionnaire, the determination of which research organizations count as laboratories was settled on an agency-by-agency basis. The units designated as laboratories here are:

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- Army, Navy and Air Force laboratories and research centers designated by the responsible service agency
- Selected Energy laboratories, both GOGO and GOCO, designated by the agency
- All 9 NASA centers or laboratories
- Veteran's Affairs hospitals with more than $1 million in funding for medical research
- EPA laboratories, centers, or offices designated by the EPA Office of Research and Development
- Geological Survey units within the Mapping, Water Resources and Geological Divisions
- The Research and Laboratory Services Division within the Bureau of Reclamation
- The Denver Service Center within the Bureau of Land Management
- All 9 Bureau of Mines Research Centers

(DEFINITIONS CONTINUED)

LABORATORY CONTINUED:

- Fish and Wildlife Service reserach centers designated by the agency
- The FAA Technology Center, Turner-Fairbank Research Center, and Coast Guard Research Development Center
- The Institute for Telecommunication Sciences
- All laboratories or institutes within NIST designated by NIST
- NOAA laboratories with 50 or more full-time equivalent (FTE) staff and the National Weather Service Laboratories

**STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980 (P.L. 96-480):** The goals of the Stevenson-Wydler Technology Innovation Act of 1980 were : (1) to promote increased and improved domestic technology development; (2) to stimulate improved utilization of federally funded technology developments by State and local governments and the private sector; and (3) to provide recognition for outstanding contributions in technology. Also, it formally mandated the establishment of Offices of Research and Technology Applications (ORTAs) with major Federal Laboratories. The act was amended by the Federal Technology Transfer Act of 1986 (P.L. 99-502).

(DEFINITIONS CONTINUED)

**TECHNOLOGY TRANSFER:** The Federal Technology Transfer Act of 1986 (P.L. 99-502) amended the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480) in order to ensure the full use of the results of the Federal investment in research and development. The Act promotes technological transfer by authorizing government-operated laboratories to enter into cooperative research agreements and by establishing a Federal Laboratory Consortium for Technology Transfer. "Technology Transfer" is defined here as the process whereby new knowledge and new technologies generated at Federal laboratories are further developed and commercially exploited by the domestic private sector, as well as being applied where appropriate by State and local governments.

Some of the essential transfer mechanisms are:

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--Personnel exchanges

--Resource sharing with industry, state and local governments, or other users and manufacturers of technology

--Cooperative research and development agreements (CRDAs) as defined under the Federal Technology Transfer Act of 1986

**Technology Utilization Activities:**

--Patenting and licensing of inventions

--Assessing potential commercial applications of inventions and identifying markets and users

--Meetings with potential users and manufacturers to help set the laboratory research agenda

**Information Exchange:**

--Disseminating technical information through papers, articles, seminars, etc.

--Linking technology users or manufacturers with technology producers

--Increasing public and industry awareness of laboratory facilities and resources

## QUESTIONS

75. Does your laboratory have a representative to the Federal Laboratory Consortium (FLC)? *(Check one)* (6)

1. ☐ Yes *(Continue)*
2. ☐ No *(Skip to question 83)*

76. What percentage of his/her official work time is spent on FLC business or activities? (7-8)

_____ Percentage of time spent on FLC activities

77. Has the FLC representative been involved in developing or conducting any technology transfer training classes either for this laboratory or other laboratories? *(Check one)* (9)

1. ☐ Yes
2. ☐ No

78. Are data on your laboratory's: (1) work-in-progress, (2) technical staff skills, and (3) laboratory facilities fed into the FLC Clearinghouse database? *(Check one)* (10)

1. ☐ Yes
2. ☐ No *(Skip to question 80)*

79. Approximately how many times were the data on your laboratory that are listed in the FLC Clearinghouse database updated in FY 1989? (11-13)

_____ Estimated number of times data were updated

80. Does your laboratory use the FLC electronic mail system? *(Check one)* (14)

1. ☐ Yes
2. ☐ No *(Skip to question 82)*

81. Approximately how many times did your laboratory use the electronic mail system in FY 1989? *(This may be estimated.)* (15-17)

_____ Estimated number of times used FLC electronic mail system

82. In your opinion, what are the FLC's most and least effective features or services?

Most Effective (18)

_____
_____
_____
_____

Least Effective (19)

_____
_____
_____
_____

83. In your opinion, what activities should the FLC be performing *that it is not performing at this time?* (20)

_____
_____
_____
_____

84. Are you the FLC representative? *(Check one)* (21)

1. ☐ Yes
2. ☐ No *(Skip to question 86)*

85. Please comment on any concerns you have regarding your experience as FLC representative. (22)

_____

_____

_____

_____

86. Please indicate which, if any, of the questions in this section required you to get answers from some office outside your laboratory (e.g., your agency budget office, agency technology transfer office, etc.). (23-32)

| Question # | Source of Data (Name and location of Office) |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

87. If you have any comments that would further explain, better illustrate, or qualify *any of your answers in this section* please write them in the space below. Also if you have any suggestions about other questions you feel we should have asked, please note them here. (33)

_____

_____

_____

_____

United States General Accounting Office

# LABORATORY-LEVEL TECHNOLOGY TRANSFER QUESTIONNAIRE

NOVEMBER, 1989

**SECTION 5: INFORMATION ON LABORATORY STAFF, PERSONNEL EXCHANGES AND TRAINING**

**NOTE:** In section 5, question 103 was added after mail-out in August of the advanced copy questionnaire.

**Please indicate the name, title, unit or office, and telephone number of the person(s) completing this section:**

| | |
|---|---|
| Name(s) | Name(s) |
| Title(s) | Title(s) |
| Unit(s) or office(s) address | Unit(s) or office(s) address |
| Telephone number(s) | Telephone number(s) |

## PURPOSE

For the present purposes, your research organization has been placed under a broadly defined category labeled "laboratory," and we have determined that yours is an appropriate organization to receive this questionnaire. Our immediate objective is to gather information about the implementation and impact at federal laboratories of the Stevenson-Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Act of 1986. However, it should be noted that in the interest of gaining a better understanding of the process of technology transfer we include in the questionnaire population some laboratories that are not covered explicitly under any or all of the provisions of the Acts referred to above.

We primarily are gathering FY 1989 data during the first year of implementation. In each of the next several years, your organization should expect to receive a similar questionnaire to update the account of its technological transfer activities.

## INSTRUCTIONS

The questionnaire has been divided into five sections. They are:

Section 1: Information on Research and Technology Transfer Activities

Section 2: Information on Office of Research and Technology Applications (ORTA) Characteristics and Activities

Section 3: Information on Patents, Licenses and Royalties

Section 4: Information on Federal Laboratory Consortium Activities

Section 5: Information on Laboratory Staff, Personnel Exchanges and Training

We ask that each section be completed by the staff member with the greatest pertinent knowledge. In some instances, it may be necessary to involve more than one person or office in answering questions. For your convenience each section of the questionnaire can be separated from the package.

To increase the reliability of the responses to each of the five sections, key terms have been defined either in the "definitions segment" or, in some cases, within the questionnaire. These definitions should be followed when answering questions.

Many questions can be answered with hard data. However, some answers will be based necessarily on rough estimates. You should not be overly concerned about generating such estimates. Please use your best professional judgment in extrapolating from existing data. For some questions, we ask for both FY 1986 and FY 1989 data in order to make a before-and-after comparison of changes since the Federal Technology Transfer Act of 1986.

When all sections are completed, the laboratory director, or designated staff member should assemble them as a single package. Return the package in the postpaid envelope before December 5, 1989 to Francine E. Jefferson, GAO. If you have any questions, please call Dr. Jefferson at (202) 275-8822 (FTS 275-8822).

Thank you for your cooperation.

**DEFINITIONS**

**AGENCY:** The following cabinet-level departments, independent agencies, or dependent agencies within cabinet departments are considered "agencies" for this questionnaire:

--Department of the Air Force

--Department of the Army

--Department of the Navy

--Within Department of the Agriculture
Agriculture Research Service, Forest Service

--Within Department of Commerce
NIST, NOAA, NTIA

--Within Department of Energy
Fossile Energy, Energy Research, Defense Programs, Conservation and Renewable Energy

--Within Department of Interior
Geological Survey, Bureau of Mines, Fish and Wild Life Service, Bureau of Land Management, Bureau Reclamation

--Within Department of Transportation
FAA, Federal Highway Administration, Coast Guard

--EPA

--NASA

--Veteran's Affairs

--Public Health Service's
NIH, CDC, FDA, ADAMHA

**FEDERAL TECHNOLOGY TRANSFER ACT OF 1986 (P.L. 99-502):** A congressional amendment to the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480). Major facets of P.L. 99-502 include directing heads of all federal agencies to authorize their *government-owned and government-operated* laboratories to enter into cooperative R&D agreements with universities and the private sector; formally chartering the Federal Laboratory Consortium for Technology Transfer as a national mechanism to promote and strengthen technology transfer; mandating that agencies pay at least 15% of the royalties from inventions made at laboratories to the inventor(s); allowing agencies to assign title to inventions (with restrictions) to current or former government employee inventors; and allowing agencies to grant, in advance, to collaborating parties patent licenses or assignments on inventions made under cooperative R&D agreements (CRDAs).

**FLC:** Federal Laboratory Consortium. An organization organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986. Members include all major federal laboratories and centers, and their parent agencies. The mission of the FLC is to promote the rapid movement of federal facility research results and technologies into the mainstream of the U.S. economy.

**LABORATORY:** The term "laboratory" means 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 employees of the Federal Government. For the purposes of this questionnaire, the determination of which research organizations count as laboratories was settled on an agency-by-agency basis. The units designated as laboratories here are:

-- Institutes or similar level organizations within NIH, ADAMHA, CDC and FDA

-- ARS research locations with more than 40 staff years and Forest Service locations designated by the Forest Service

--Army, Navy and Air Force laboratories and research centers designated by the responsible service agency

(DEFINITIONS CONTINUED)

LABORATORY CONTINUED:

-- Selected Energy laboratories, both GOGO and GOCO, designated by the agency

-- All 9 NASA centers or laboratories

-- Veteran's Affairs hospitals with more than $1 million in funding for medical research

-- EPA laboratories, centers, or offices designated by the EPA Office of Research and Development

-- Geological Survey units within the Mapping, Water Resources and Geological Divisions

-- The Research and Laboratory Services Division within the Bureau of Reclamation

-- The Denver Service Center within the Bureau of Land Management

-- All 9 Bureau of Mines Research Centers

-- Fish and Wildlife Service reserach centers designated by the agency

-- The FAA Technology Center, Turner-Fairbank Research Center, and Coast Guard Research Development Center

-- The Institute for Telecommunication Sciences

-- All laboratories or institutes within NIST designated by NIST

-- NOAA laboratories with 50 or more full-time equivalent (FTE) staff and the National Weather Service Laboratories

STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980 (P.L. 96-480): The goals of the Stevenson-Wydler Technology Innovation Act of 1980 were : (1) to promote increased and improved domestic technology development; (2) to stimulate improved utilization of federally funded technology developments by State and local governments and the private sector; and (3) to provide recognition for outstanding contributions in technology. Also, it formally mandated the establishment of Offices of Research and Technology Applications (ORTAs) within major Federal Laboratories. The act was amended by the Federal Technology Transfer Act of 1986 (P.L. 99-502).

TECHNOLOGY TRANSFER: The Federal Technology Transfer Act of 1986 (P.L. 99-502) amended the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480) in order to ensure the full use of the results of the Federal investment in research and development. The Act promotes technological transfer by authorizing government-operated laboratories to enter into cooperative research agreements and by establishing a Federal Laboratory Consortium for Technology Transfer. "Technology Transfer" is defined here as the process whereby new knowledge and new technologies generated at Federal laboratories are further developed and commercially exploited by the domestic private sector, as well as being applied where appropriate by State and local governments.

(DEFINITIONS CONTINUED)

Some of the essential transfer mechanisms are:

**Technical/Cooperative Interactions:**

--Direct technical assistance to private-sector users and producers of laboratory-developed inventions

--Personnel exchanges

--Resource sharing with industry, state and local governments, or other users and manufacturers of technology

--Cooperative research and development agreements (CRDAs) as defined under the Federal Technology Transfer Act of 1986

**Technology Utilization Activities:**

--Patenting and licensing of inventions

--Assessing potential commercial applications of inventions and identifying markets and users

--Meetings with potential users and manufacturers to help set the laboratory research agenda

**Information Exchange:**

--Disseminating technical information through papers, articles, seminars, etc.

--Linking technology users or manufacturers with technology producers

--Increasing public and industry awareness of laboratory facilities and resources

## QUESTIONS

88. Using your laboratory or agency personnel classification scheme, please indicate the number of full-time equivalent (FTE) staff positions filled (i.e., not only authorized, but actually occupied) at the laboratory during FY 1989 in the following categories (one FTE equals 2080 hours): 1(6-32)

| FTE's as of Sept. 30, 1989 | Classification |
|---|---|
| _____ | 1. Scientists |
| _____ | 2. Engineers |
| _____ | 3. Technicians |
| _____ | 4. Technical/program management personnel |
| _____ | 5. Visiting scientists |
| _____ | 6. Visiting researchers |
| _____ | 7. Contract researchers |
| _____ | 8. Other (*please specify*) _____ _____ |

89. Please indicate whether any of your staff in the following classifications have technology transfer activities specifically listed in their official job descriptions or performance plans. (33-39)

| Yes* | No | Classification |
|---|---|---|
| ____ | ____ | 1. Scientists |
| ____ | ____ | 2. Engineers |
| ____ | ____ | 3. Technicians |
| ____ | ____ | 4. Technical/program management personnel |
| ____ | ____ | 5. Visiting scientists |
| ____ | ____ | 6. Visiting researchers |
| ____ | ____ | 7. Contract researchers |
| ____ | ____ | 8. Other (*please specify*) _____ _____ |

***If yes to any of the above, please attach sample copies of relevant job descriptions.**

90. Please indicate whether any of your staff in the following classifications were explicitly evaluated during FY 1989 on technology transfer duties as part of their annual job performance appraisal? (40-47)

| Yes | No | Classification |
|---|---|---|
| ____ | ____ | 1. Scientists |
| ____ | ____ | 2. Engineers |
| ____ | ____ | 3. Technicians |
| ____ | ____ | 4. Technical/program management personnel |
| ____ | ____ | 5. Visiting scientists |
| ____ | ____ | 6. Visiting researchers |
| ____ | ____ | 7. Contractor researchers |
| ____ | ____ | 8. Other (*please specify*) |

_____

_____

91. If yes to any part of question 90, please indicate one or two examples of the tangible results of the evaluations on technology transfer duties (e.g., staff member was promoted, staff member received an award, etc.) (48)

_____

_____

_____

92. Regarding promotions of your scientific, technical and management personnel, does your laboratory have any guidelines that specifically recognize technology transfer activities or accomplishments as one factor on which promotion decisions may depend? *(Check one)* (49)

1. ☐ Yes*
2. ☐ No (*Skip to question 94*)

***IF YES, PLEASE ATTACH A COPY OF THESE GUIDELINES THAT INDICATE TECHNOLOGY TRANSFER ACTIVITIES AS A PROMOTION DECISION CRITERION.**

93. If yes, approximately what weight is given to technology transfer activities or accomplishments relative to other duties when making promotion decision? (50-52)

_____ Relative weight given to technology transfer activities

94. Does your laboratory have a policy that allows staff to pursue (outside the laboratory) small-business and/or innovation development activities while at the same time retaining at least part-time employment status at your laboratory? Such activities might include commercialization efforts, additional research and/or development of innovations, manufacturing of innovations, etc. *(Check one)* (53)

1. ☐ Yes*
2. ☐ No (*Skip to question 96*)

***PLEASE ATTACH A COPY OF THE POLICY OR GUIDELINES THAT PERTAINS TO THE ABILITY OF EMPLOYEES TO RETAIN EMPLOYMENT STATUS WHILE PURSUING OUTSIDE BUSINESS VENTURES.**

95. If yes, during FY 1989, how many laboratory employees were pursuing business ventures outside the laboratory under this policy? (54-57)

_____ Number of staff pursuing outside business ventures

96. Does your laboratory have a personnel exchange and/or visiting scientists program, whereby scientists and engineers not employed by your laboratory take temporary assignments in your lab, and/or your scientists and engineers take temporary assignments elsewhere? This may include such exchanges under a cooperative research and development agreement as defined in the Federal Technology Transfer Act of 1986. *(Check one)*

(58)

1. ☐ Yes *(Skip to question 98)*
2. ☐ No *(Complete question 97* **and then skip to question 102)**

97. If no to question 96, is this type of activity discouraged or prohibited by: *(Check all that apply)*

(59-62)

1. ☐ Agency policy?
2. ☐ Laboratory policy?
3. ☐ Contractor policy?
4. ☐ Other *(please specify)*

_____

_____

98. If yes to question 96, using FY 1989 data, please indicate the number of scientists and engineers **exchanged from your laboratory to the following entities**, the typical length (in months) of the exchanges, and the range of length (shortest and longest exchange period).

| Entity | Number of Personnel | Typical Length (in months) | Range of Length (in months) | |
|---|---|---|---|---|
| 1. U.S. Academia | _____ | _____ | _____-_____ | (69-72) |
| 2. U.S. Industry | _____ | _____ | _____-_____ | 2(5-14) |
| 3. Your federal agency | _____ | _____ | _____-_____ | (15-24) |
| 4. Other U.S. federal agencies or laboratories | _____ | _____ | _____-_____ | (25-34) |
| 5. U.S. Non-profit organizations/ foundations | _____ | _____ | _____-_____ | (35-44) |
| 6. State/local governments or organizations | _____ | _____ | _____-_____ | (45-54) |
| 7. Foreign countries or organizations | _____ | _____ | _____-_____ | (55-64) |
| 8. Other *(please specify)* _____ | _____ | _____ | _____-_____ | (65-74) |
| 9. Other *(please specify)* _____ | _____ | _____ | _____-_____ | 3(5-14) |

99. What was the total number of your laboratory scientists and engineers who participated in the personnel exchange program in FY 1986 and FY 1989? (10-26)

_____ Number in FY 1986

_____ Number in FY 1989 (*Sum total from question 98*)

_____ Increased by _____% between FY 1986 and FY 1989

_____ Decreased by _____% between FY 1986 and FY 1989

_____ Remained about the same

100. Again, if yes to question 96, please indicate the number of scientists and engineers visiting from the following entities to your laboratory, the typical length of visit in months, and the range of length (shortest and longest visit period).

| Entity | Number of Personnel | Typical Length (in months) | Range of Length (in months) | |
|---|---|---|---|---|
| 1. U.S. Academia | _____ | _____ | _____-_____ | (27-36) |
| 2. U.S. Industry | _____ | _____ | _____-_____ | (37-46) |
| 3. Your federal agency | _____ | _____ | _____-_____ | (47-56) |
| 4. Other U.S. federal agencies or laboratories | _____ | _____ | _____-_____ | (57-66) |
| 5. U.S. Non-profit organizations/ foundations | _____ | _____ | _____-_____ | (67-76) |
| 6. State/local governments or organizations | _____ | _____ | _____-_____ | 4(5-14) |
| 7. Foreign countries or organizations | _____ | _____ | _____-_____ | (15-24) |
| 8. Other *(please specify)* _____ | _____ | _____ | _____-_____ | (25-34) |
| 9. Other *(please specify)* _____ | _____ | _____ | _____-_____ | (35-44) |

101. What was the total number of scientists and engineers **from other organizations** who participated in the visiting scientists program in FY 1986 and FY 1989? (45-61)

_____ Number in FY 1986

_____ Number in FY 1989 (*Sum total from question 100*)

_____ Increased by _____% between FY 1986 and FY 1989

_____ Decreased by _____% between FY 1986 and FY 1989

_____ Remained about the same

102. Regarding technology transfer training, which of the following training opportunities does your laboratory offer to scientific, engineering, technical, and technical management staff to increase their knowledge and skills related to assessing the potential commercial usefulness of laboratory technology and innovations to industry or state/local governments? (*Check all that apply*) (62-66)

1. ☐ In-house technology transfer training courses
2. ☐ In-house technology transfer briefings, lectures
3. ☐ External technology transfer training courses
4. ☐ Other (*please specify*)

_____

5. ☐ None of the above

103. Approximately how many laboratory scientific, engineering, technical, and technical management staff received technology transfer training during FY 1989? 5(5-20)

_____ Number who received in-house technology transfer training courses

_____ Number who received in-house technology transfer briefings, lectures

_____ Number who received external technology transfer training courses

_____ Other (*please specify*)

_____

104. How many of the courses, lectures, or briefings attended by the staff indicated in question 103 above were developed or administered by the Federal Laboratory Consortium? (21-23)

_____ Number of courses, lectures or briefings developed or administered by the FLC

105. Please indicate which, if any, of the questions in this section required you to get answers from some office outside your laboratory (e.g., your agency budget office, agency technology transfer office, etc.). (24-30)

| Question # | Source of Data (Name and location of Office) |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

106 If you have any comments that would further explain, better illustrate, or qualify *any of your answers in this section* please write them in the space below. Also if you have any suggestions about other questions you feel we should have asked, please note them here. (99)

_____

_____

_____

_____

# Selected Provisions of the Legislation

## The Stevenson-Wydler Technology Innovation Act of 1980

In 1980, the Congress enacted the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480), making the transfer of federally owned or originated technology to state and local governments, and to the private sector, a national policy and the duty of each laboratory. The Congress, in noting that many new discoveries and advances in science occur in universities and federal laboratories, also recognized that application and commercialization depend largely on the business sector. As such, the Stevenson-Wydler Innovation Act of 1980 had as its purpose the renewal and expansion of mechanisms that would foster and encourage cooperation among academia, federal laboratories, labor, and industry in technology transfer, personnel exchanges, and joint research projects.

Section 11 of the Stevenson-Wydler Act created the means by which federal agencies and their laboratories can transfer technology. Each federal agency with one laboratory or more must make available at least 0.5 percent of its R&D budget for transfer activities.[1] And to further facilitate transfers, it required each federal laboratory to establish an Office of Research and Technology Applications (ORTA). Also, each laboratory with an annual budget exceeding $20 million was instructed to provide at least one full-time professional staff member to this Office.

## Federal Technology Transfer Act of 1986

The Federal Technology Transfer Act of 1986 (P.L. 99-502) was enacted October 20, 1986, amending the Stevenson-Wydler Act to provide additional incentives for the transfer and commercialization of federally developed technologies. Selected provisions authorize activities designed to encourage industry, university, and federal laboratories to work cooperatively. The act also establishes incentives for federal laboratory employees to enter into cooperative R&D agreements (CRDAs). Specifically, it permits federal agencies to delegate authority to government-operated laboratory directors to negotiate cooperative research and development agreements with other agencies, private industry, state and local governments, and nonprofit organizations.[2]

The 1986 act also amended the 1980 requirements regarding the establishment of ORTAs. The Technology Transfer Act required laboratories

[1]This requirement can be, and has been, waived in certain cases.

[2]The 1986 act made agency delegation of authority to laboratory directors permissible; however, it was Executive Order 12591, Apr. 10, 1987, as amended, that stated that agencies, within overall funding allocations and as permissible by law, shall delegate authority to their laboratories to enter into CRDAs.

with 200 or more full-time-equivalent scientific, engineering, and related technical positions to provide one or more full-time-equivalent positions for their ORTAs.

To further promote the use of federal R&D, certain agencies must create a cash awards program and a royalty-sharing activity for federal scientists, engineers, and technicians in recognition of their efforts to commercialize federally developed technology. In addition, the individual laboratory is allowed to retain a certain portion of royalties resulting from inventions made in that laboratory for further technology transfer efforts.

The act directs federal agencies to either (1) pay an employee inventor 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 federal agency that spends more than $50 million per fiscal year for R&D in 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.

## Executive Order 12591 of April 1987

Executive Order 12591 of April 10, 1987, "Facilitating Access to Science and Technology," provided further support to the federal effort to promote technology transfer with its provision ordering executive departments and agencies, to the extent permitted by law, to encourage and facilitate collaboration among federal laboratories, state and local governments, universities, and the private sector, particularly small business, in order to assist in the transfer of technology to the marketplace. The order included provisions for establishing a technology-sharing program, an exchange of scientists and engineers between the private sector and federal laboratories, basic science and technology centers, and guidance with respect to international science and technology transfer.

# Federal Departments and Agencies in the Study Population

| Department | Laboratories Number | Laboratories Percent[a] |
|---|---|---|
| National Aeronautics and Space Administration | 9 | 3% |
| Environmental Protection Agency | 13 | 4 |
| Department of Agriculture | 59 | 20 |
| Agricultural Research Service (48) | | |
| Forest Service (11) | | |
| Department of Commerce | 27 | 9 |
| National Institute of Standards (4) | | |
| National Oceanic and Atmospheric Administration (22) | | |
| National Telecommunications and Information Administration (1) | | |
| Department of Defense | 69 | 23 |
| Department of the Army (41) | | |
| Department of the Air Force (11) | | |
| Department of the Navy (17) | | |
| Department of Energy | 18 | 6 |
| Conservation and Renewable Energy (1) | | |
| Defense Programs (4) | | |
| Energy Research (11) | | |
| Fossil Energy (2) | | |
| Department of Health and Human Services | 24 | 8 |
| Alcohol, Drug Abuse, and Mental Health (3) | | |
| Centers for Disease Control (3) | | |
| Food and Drug Administration (6) | | |
| National Institutes for Health (12) | | |
| Department of Interior | 28 | 9 |
| Bureau of Mines (9) | | |
| Bureau of Reclamation (1) | | |
| U.S. Geological Survey (5) | | |
| Fish and Wildlife Service (13) | | |
| Department of Transportation | 3 | 1 |
| U.S. Coast Guard (1) | | |
| Federal Aviation Administration (1) | | |
| Federal Highway Administration (1) | | |
| Department of Veterans Affairs | 47 | 16 |
| Veterans Health Services and Research Administration (47) | | |
| **Total** | **297** | **100%** |

[a]Percentage does not total 100 due to rounding.

# Laboratory Perspectives on the Current Status of Technology Transfer

To help us more completely understand the current status of technology transfer implementation, we used our questionnaire to seek opinions from departments and laboratories about: (1) the effectiveness of the legislation; (2) factors that could constrain, facilitate, or potentially facilitate technology transfer in their units; and (3) examples of success or failure experienced in attempting to implement the legislation.

## Views on the Legislation's Effectiveness

With respect to opinions about the Stevenson-Wydler Innovation Act of 1980, as amended by the Federal Technology Transfer Act of 1986, we asked the respondents: (1) how they would rate the effectiveness of the legislation, (2) if it had changed laboratory operations, and (3) what concerns it had raised.

### Assessment of Effectiveness

Forty-four percent of all laboratories responding (N=268) were of the opinion that the legislation had been effective, 38 percent were neutral, and 18 percent felt that the legislation was ineffective. Responses varied by department. More than one-half the respondents from four departments—DOE, EPA, HHS, and USDA—reported the legislation as effective.

### Opinions on Work-Related Effects

In response to our request for opinions about possible negative effects on such areas as scientific peer relations, focus of laboratory research, and channeling of resources, nine departments, each accounting for 75 percent or more of its laboratories, reported no problems in these areas. Yet, HHS concentrated 50 percent of its responses across two categories; specifically, 25 percent reported that scientists and technical staff have begun to communicate less and 25 percent cited an increase in legal conflicts of interest as possible negative effects. Also, 21 percent of USDA's laboratories responded that the focus of laboratory research is more on innovations with commercial application.

### Concerns About the Legislation

Most items in the questionnaire were "forced-choice." We therefore decided to solicit open-ended opinions about concerns arising from the recent legislation or areas where there might be a need for new legislation. Overall, 66 percent of the laboratories did not comment. Of this subset, a high percentage of DOD (83 percent), EPA (77 percent), VA (76 percent), and Commerce (74 percent) laboratories did not respond. The majority of the laboratories representing the following departments gave opinions about the recent technology transfer legislation: DOT (100

percent), NASA (67 percent), DOE (67 percent), HHS (50 percent), and Interior (50 percent). Of the comments provided, 17 percent indicated no concerns about the current legislation and 14 percent mentioned that the question was not applicable to their laboratory because either implementation was minimal or more experience was needed. We classified the other 69 percent of the responses into three categories: procedural (16 percent), financial (13 percent), and legal (40 percent).[1]

## Procedural Concerns

Procedural concerns ranged over such issues as a need for the clarification of lines of authority vis-a-vis the agency as well as the need for guidelines and consistent policies. One respondent felt that the recent legislation had spawned a bureaucracy with no added value. It was stated that the legislation should be modified to encourage industry, et al., to seek solutions from the laboratories and provide the laboratories with the wherewithal to respond. Another procedural concern that affects the laboratories pertains to the language of the legislation, in particular, the authority to enter into CRDAs hinges on the fact that agencies "may" delegate this authority to laboratory directors. This last concern is highlighted by our finding that 56 percent of the federal laboratory directors in this population do not have the authority to negotiate CRDAs. Laboratories also commented on the need to streamline the process; they felt there was too much legislation.

## Financial Concerns

Financial concerns pertained mainly to a lack of resources and funding at the laboratory level for technology transfer activities. One respondent explained that technology transfer expenditures are mandated as a percent of the R&D budget, but agencies do not provide this funding to their laboratories as dedicated technology transfer allocations. Agencies currently expect laboratories to take it out of declining overhead accounts.

Another respondent suggested that the legislation should provide and allocate funds at the laboratory level for technology transfer. The cost of patenting was another financial concern respondents wanted to see addressed through legislated funding.

## Legal Concerns

Legal concerns about the legislation were presented most frequently. Some of the particular issues cited were conflict of interest for laboratory staff, copyright protection of software, Freedom of Information Act concerns, security of information, and the right to get patents. Respondents referred to the need for statutory authority to copyright and

[1]Although 101 laboratories provided comments, some gave more than one statement; thus, the actual number of comments provided was 125.

license software developed by federal employees and the need for appropriate legislation to protect computer software in development in federal laboratories. With respect to freedom of information, one respondent suggested that there is a need to tighten information security so that industry would have more confidence in sharing proprietary studies. Another problem was with access rights to data and the potential for access to proprietary information through the Freedom of Information Act.

## Views on Improvements to Technology Transfer

We requested opinions on how to increase U.S. industry involvement in federal laboratory technology transfer. The suggested areas for change turned out to be the same categories—albeit with different emphases—as those given in response to legislative concerns: here, 59 percent of the suggestions were procedural, 16 percent financial, 7 percent legal, and 18 percent of the responses fell into the category "no suggestions." Laboratory respondents did claim, however, that they have been very successful in tapping industrial expertise via contracts or that little of their program is of direct interest to industry. In general, the departments' laboratories were responsive to this request for suggestions. Sixty percent of the laboratories provided at least one comment with a few offering several suggestions.[2] The majority of laboratories for eight of the departments provided suggestions; the laboratories of Commerce (48 percent) and VA (35 percent) were less inclined to offer suggestions for increasing U.S. industry involvement in federal laboratory technology transfer.

### Procedural and Financial Suggestions

Procedural suggestions for increasing industry participation included clarification of policy, outreach, and advertising. One comment was that copies of the 1986 legislation should be sent to all laboratories. Over eighty percent of the suggestions pertaining to financial concerns referred to increases in resources. For example, one respondent suggested funding outreach programs at federal laboratories; others suggested that funds should be provided for cooperative ventures, for developing prototype pilot demonstrations, or for technology transfer activities.

### Legal Suggestions

Suggestions involving legal aspects of increased industry participation ranged from conflict of interest to trade secrets, and from the Freedom of Information Act to patent regulations. One respondent indicated that

[2]There were 212 suggestions made for increasing U.S. industry participation.

laboratories collaborating with industry should ensure the confidentiality of data and allow industry a limited period of exclusivity for trade secrets. Other respondents suggested that laboratories provide access to patent attorneys and obtain authority to enter into cooperative R&D agreements.

## Examples of Successful and Unsuccessful Transfer Attempts

We asked each federal laboratory to tell its own story about successes and failures with technology transfer. Taken together, our laboratory respondents reported 169 examples of successful efforts and 81 examples of unsuccessful ones. We then looked for patterns across these accounts that would help us categorize features common to successful versus unsuccessful ventures. Many more respondents reported successful transfer efforts (68 percent) than reported failures (32 percent); however, these are not validated examples of success, and in any case, as our respondents pointed out, the Technology Transfer Act is relatively recent legislation. Although laboratory respondents were willing to discuss their efforts to successfully transfer technology, many also believe it is still too soon to know what the outcome of those efforts will be; it often requires a number of years to take a promising idea from the laboratory and bring it to a successful application.[3] Still, the reporting of 169 instances of successful technology transfer augurs well for future achievement.

## The Response "Not Applicable"

Twenty-eight laboratories (10 percent) answered the question about successes with "not applicable"; 44 laboratories (16 percent) answered the question about failures the same way. In trying to understand these responses, we assumed that a laboratory engaged in highly classified research might be expected to answer in this manner. However, many laboratories engaged in military research were open in reporting both successes and failures and did not mark "not applicable." It is possible that many of the laboratories have not received guidelines for implementing the technology transfer legislation and, thus, were not aware of its transfer mission.

[3]To underscore this point, we refer to prior results reported on CRDAs and patents. Given 254 draft CRDAs reported for fiscal year 1989 and given also that the projected duration of such an agreement can be 5 years, then it is indeed too soon to know whether the outcome will be successful or not. For patents in the pipeline, clearly the fate of the 2,233 patents pending is unknown. This is also the case for the 2,528 invention disclosures. In our opinion, the trajectory of licensing hinges upon the success or failure of these draft agreements and innovative ideas.

## Classification of Reported Transfers

We classified all accounts of successes and failures in terms of the patterns that emerged. We treated the positive and negative accounts separately and noted some commonalities across them, which allowed us to categorize them into four classes. They are:

- contextual change,
- legal, administrative, or ethical issues,
- user involvement, and
- the existence of a consortium.[4]

### Contextual Change

In the case of technology transfer, "contextual change" means that between the time a federal laboratory developed an innovative idea and the period in which it was to be applied, some major change occurred that directly affected the transfer. We found that about 12 percent of the accounts documented favorable changes, and 6 percent unfavorable ones.

An example of an innovation whose transfer seems to have been facilitated by a positive contextual change is provided by USDA (Honey Bee and Biological Control of Insects Research Unit).[5] This transfer project won an Agricultural Research Service Technology Transfer Award. This transfer effort involved Africanized ("killer") bees whose migration to the United States gave rise to a transfer opportunity. Until 1987, swarm traps—a technology for attracting and capturing honey bee swarms—did not exist. Independent researchers had constructed traps for their particular experiments, but there were no effective, inexpensive, and mass-produced swarm traps. The creation of this technology is important to the beekeeping industry and to governmental regulatory and action agencies. This technology is valuable beyond its use in controlling Africanized bees. But it is the fact that such bees were on their way to the United States (and have now arrived) that facilitated the development of this technology.

Another example of contextual change is DOE's research into pulsed neutron activation for measurement of mass flow rates. A Federal Aviation Authority project benefited considerably from this research. It had

[4]The four categories are listed in the order in which they are discussed and not in order of relative importance. Many laboratories volunteered more than one success and more than one failure. Thus, this classification is based on the number one success, or the number one failure.

[5]Agricultural Research Service Technology Transfer Awards, Nominees: Dr. Justin O. Schmidt, Research Entomologist, and Steven C. Thoenes, Biological Laboratory Technician. Citation of Technology Transfer Achievement: Development of an effective honey bee swarm trap for capturing swarms for addition to apiaries, and for regulatory survey and control of Africanized bees.

already led to the development of a detector for explosives in luggage, and there are a number of other possible future spin-offs. Changes in the aviation industry, and especially the new, redoubled concern about terrorism, seem to have greatly aided the transfer of this technology.

Two related technologies that were negatively affected by a contextual change have to do with solar energy. The Sandia National Laboratories reported that the development of a solar tower central receiver and a variable displacement engine technology failed to be transferred when the energy crisis "disappeared." Should the energy crisis reappear, the status of these "transferables" may be changed.

Unlike some other classes we describe below, there is not a great deal that can be done to assist transfers involving contextual change beyond providing the administrative flexibility needed to handle emergencies and other rapid forms of change. The next class concerns transfer assistance in which more aspects of the project can be anticipated; nonetheless, not all aspects can be anticipated.

## Legal, Administrative, and Ethical Issues

This class involved less than 10 percent of positive accounts of transferring technology, but around 30 percent of the failures. Most of these failures had to do with legal and administrative problems. Specific legal problems were: (1) disputes over inventorship, (2) inventors having disclosed inventions before patent filing, (3) the mismanagement of the licensing of inventions, and (4) the uncertain legal status of patenting or copyrighting software by government employees. Respondents indicated that administrative constraints on successful transfers, involved being "caught in a bureaucratic maze" and being unable to "get timely responses from agency officials."

A failure in this area can sometimes go beyond legal and administrative issues to reach ethical ones. As an example, USDA's Regional Poultry Research Laboratory attempted to transfer germline insertion to commercial poultry-breeding companies. At the time of this transfer effort, however, the poultry companies had not made a corporate commitment to get into transgenic chicken programs. On the one hand, the technology was perhaps not close enough to practical implementation, from their viewpoint, and on the other, it was based on ". . . fundamental biotechnology research where in addition to scientific barriers, a number of regulatory, public relations and ethical barriers exist at the present time."

It appears that many of the difficulties in making successful transfers that are related to legal and administrative blockages can be avoided by having properly trained ORTA staff immediately at hand at the laboratory level. Indeed, this is shown by some of the reports of success in this area.

Four laboratories indicated they thought it unlikely that they would have succeeded in transferring technology had it not been for outstanding ORTA assistance that helped them avoid legal and administrative problems. Nonetheless, regulations can benefit technology transfer. The Honolulu Fisheries Laboratory of the National Oceanic and Atmospheric Administration, for example, developed a device for lobster traps that allows illegal—undersized—lobsters to escape capture. As the Hawaii laboratory reported, "It was 'transferred' by regulation requiring its use by commercial fishermen."

## User Involvement

The third class of technology transfer involves either a close connection (successful cases) or a distant connection (unsuccessful cases) between the laboratory and the user. This class is the most frequently occurring one; a little less than 60 percent of laboratory respondents reported that at least one successful transfer falls in this class, while about 40 percent reported at least one unsuccessful technology effort of this kind.

USDA's Russell Agricultural Research Center reported a signal success in technology transfer that serves as an example of close user involvement. As this laboratory explained:

"Traditionally, broiler chickens were moved from the farms to the processing plants in coops hauled by tractor trailers. The catching crew routinely placed ten to fourteen broilers in each coop, and 520 coops were hauled on each truck. The loading and unloading of both chickens and coops were labor intensive operations. Furthermore, relatively high rates of mortality and downgrading due to bruising of the carcass cause substantial losses to the industry.

"After 15 years of research culminating in the late 70's, A.D. Shackelford, J.H. Holladay and W.F. Whitehead, in cooperation with a commercial poultry processing firm, developed a cage handling system that replaced the traditional use of coops. The cage handling system featured the use of large capacity transport cages (each holding about 350 chickens), and specialized equipment for field handling, loading, and automatic unloading of cages. The prototype cage handling system was developed and operated under commercial conditions; thus, the technology was transferred. Use of the system clearly demonstrated large savings in labor, reductions in product losses, and mechanical advantages in handling cages instead of coops. At present, about 95% of all broilers produced in the U.S. are transported by the cage

handling system. The success of the cage handling system is evidenced by the overwhelming acceptance and use of this transfer of technology."

Scientists at the Center specifically set out to work cooperatively with a commercial firm to bring a useful system to market. The problems of the industry and the interests of the researchers matched. This is not always the case.

An example of distant user involvement is the USDA's Subtropical Agricultural Research Laboratory, which developed a technology for treating cantaloupe with hot water plus a fungicide, followed by wrapping it in a plasticized film. This process extended the shelf life of melons by 30 to 45 days. The laboratory reported that:

"The producer/packer industry rejected the technology because they want the produce to perish. If fruit is sitting in the refrigerator it keeps the homemaker from purchasing more. In the words of some producer/packers 'our best customer' is the garbage can."

Not all cases of distant connection between federal laboratories and the potential recipients of the technology involve out-and-out opposition. A more typical case involves laboratory scientists who are simply not well connected to any user group. This may be because there aren't any clients yet who can use the research results. Therefore, to achieve successful technology transfer, it may be necessary to develop a market, something laboratory researchers cannot do while conducting research full-time.

## Existence of a Consortium

In the fourth class, a consortium exists to transfer technology. That is, a new organizational entity is created to support innovations and aid in their diffusion. We attributed about 13 percent of the successful examples of technology transfer to the existence of a consortium, and about 16 percent of the reported failures to the lack of a consortium.

Generally, a consortium emerges when there is some highly innovative technology to be commercialized. An example is Terfenol-D, a new "giant" magnetostrictive material that was developed by DOE's Ames Laboratory and the Naval Surface Weapons Center. This materials-and-processing technology was transferred to Edge Technologies, Inc., a for-profit corporation that was created specifically to commercialize promising results of research projects from a consortium that included Ames Laboratory and Iowa State University. Edge established its first division to produce and market Terfenol-D and related materials. This division,

and others, will participate in the extensive product and device development efforts that will be required to properly exploit the technology. Edge, owned by the Iowa State University Research Foundation and a group of major Iowa-based corporations, supplies needed capital, legal services, a management team, and other important elements for successful technology transfer.

The emergence of this kind of consortium is noteworthy; as an organization for technology transfer, it lies somewhere between private and public sector organizations.[6] However, we found no trace of any comprehensive effort, to date, to build consortia into a technology transfer network, or as it is sometimes called, a diffusion "milieu."

## Hurdling Impediments

About 8 percent of the successful accounts overcame serious problems. Approximately 10 percent of the negative accounts could not do so. Innovators often found themselves in the position of having no readily discernible users anxiously awaiting solutions to their problems (the relation to users was distant). Further, there was no supportive consortium to underwrite and disseminate the innovation. Under these circumstances, many potentially valuable applications could have been lost. In the successful cases, they were not.

Take, for example, an innovation known as the General Electromagnetic Model for the Analysis of Complex Systems. This computer program was designed to reduce the possibility and severity of the occurrence of electromagnetic interference among specialized pieces of equipment. With the increasing use of low-power, small footprint microcircuit devices, ever-increasing numbers of transmitting and receiving equipment are being placed on the same platform, where they easily can interfere with each other. This program combines the capabilities of many models into one integrated, hybridized system. The innovation was the first software product to be integrated into and disseminated by

[6]In 1984, stimulated by the successes of foreign high-technology companies in U.S markets, the Congress passed the National Cooperative Research Act, which provided a mechanism for private firms to engage in collaborative R&D. Currently, there is a debate as to whether the federal government should take a more active role in fostering R&D consortia, including financial support where necessary. SEMATECH has been the model of such public-private collaboration. The Congressional Budget Office (CBO) has analyzed the benefits and limitations of using federally supported R&D consortia to encourage commercial innovations. (See Using R&D Consortia for Commercial Innovation: SEMATECH, X-ray Lithography, and High-Resolution Systems, CBO, July 1990.) They found that R&D consortia can be a useful tool, albeit limited, to support commercial innovation. According to CBO, to be successful, institutions must be developed to carry out the objective. CBO states that, "regardless of the institutions developed, the relationship among members of the consortium and between them and the federal government will be key to its success."

the Defense Technical Information Center, and the Air Force believes this occurred only because of the initiative of an individual innovator's active efforts to transfer this technology.[7] It appears that a growing number of companies are providing extensive support for the installation, maintenance, training, and specialized use of this program.

In reviewing accounts of successful cases that won out over difficult transfer situations, we often found successes came from enthusiastic individuals who simply resolved to disseminate the "brain child." However, there does not seem to be any magic checklist for technology transfer, and the foregoing discussion represents nothing more than potentially important relationships in the opinion data reported to us by our respondents.

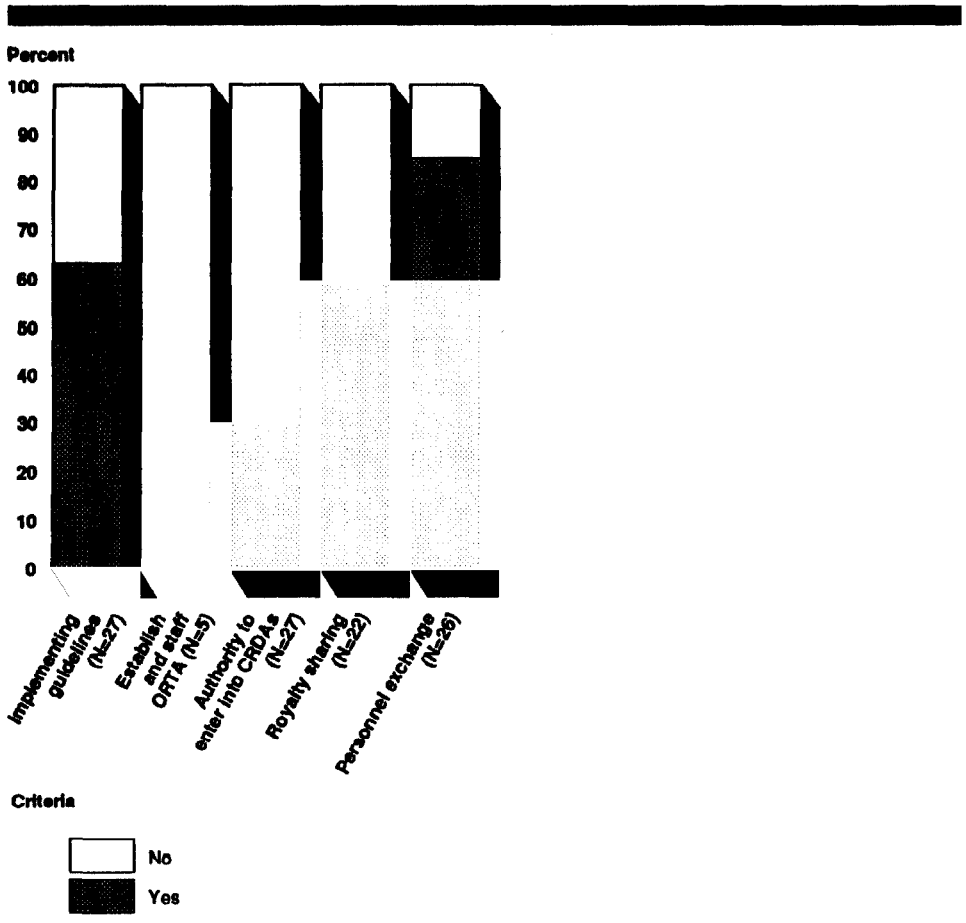
[7]The Rome Air Development Center nominated Kenneth R. Siarkiewicz for the Federal Laboratory Consortium's special award for excellence in technology transfer, noting: "The transfer of this technology was active. The nominee saw the potential of this technique, formulated the development program, promoted the government and private activity by publishing reports and papers and giving presentations at national conferences, seminars, and meetings. Personally meeting with numerous government and industrial agency personnel resulted in a growing number of companies providing customized support to the user community."

# Departments' Implementation of Selected Provisions of the Technology Transfer Legislation

Below, we illustrate how completely each of the 10 departments has implemented the 5 criteria we studied. They are:

- receipt of implementation guidance from headquarters;
- establishment and staffing of Offices of Research and Technology Applications (ORTAs);
- delegation of authority to laboratory directors to enter into cooperative research and development agreements (CRDAs);
- creation of royalty-sharing programs; and
- establishment of personnel exchange programs.

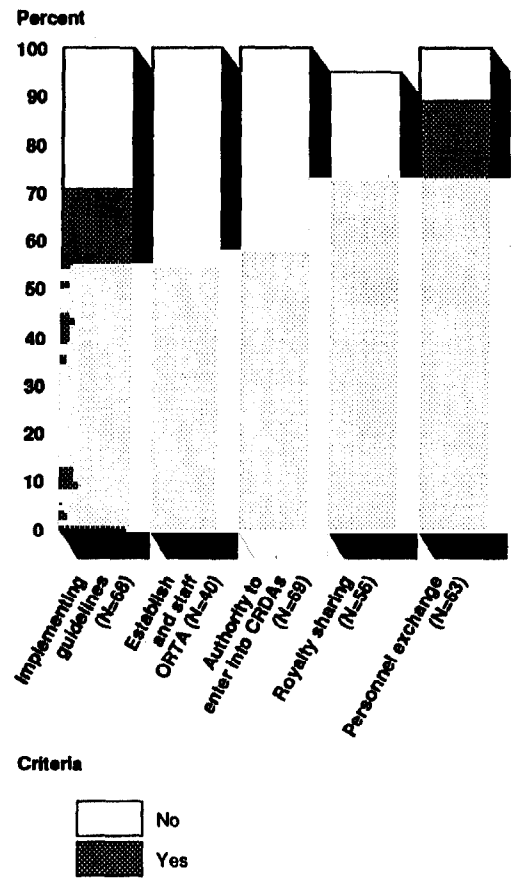
**Figure V.1: Scope of Implementation by Commerce**




- Overall, Commerce laboratories had not fully implemented the provisions of the technology transfer initiatives.

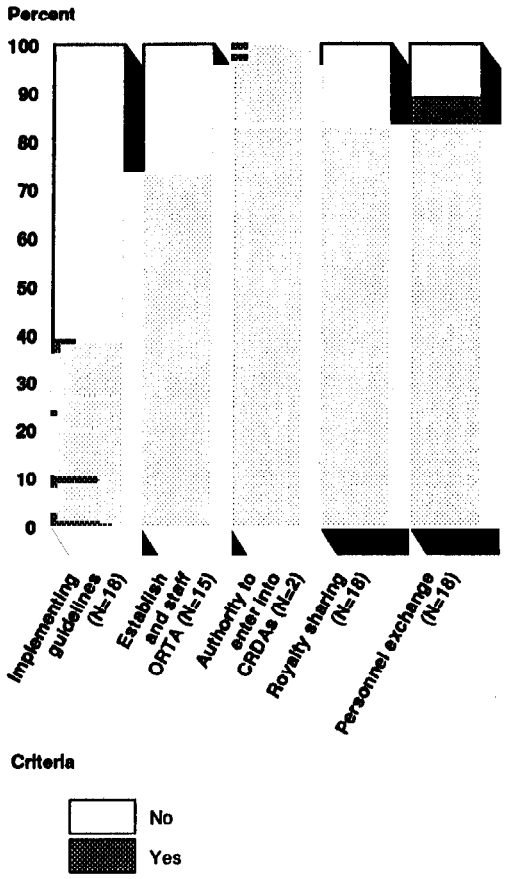
- About two-thirds of the laboratories had received implementing guidance.
- The personnel exchange provision had been the most fully implemented.

**Figure V.2: Scope of Implementation by DOD**




- Across the board, a high percentage of DOD laboratories had implemented each provision reported.
- The ORTA location and staffing provisions had been implemented by 22 of the 40 DOD laboratories for which the provision was applicable.
- By fiscal year 1989, DOD had delegated authority to over 50 percent of its laboratory directors.

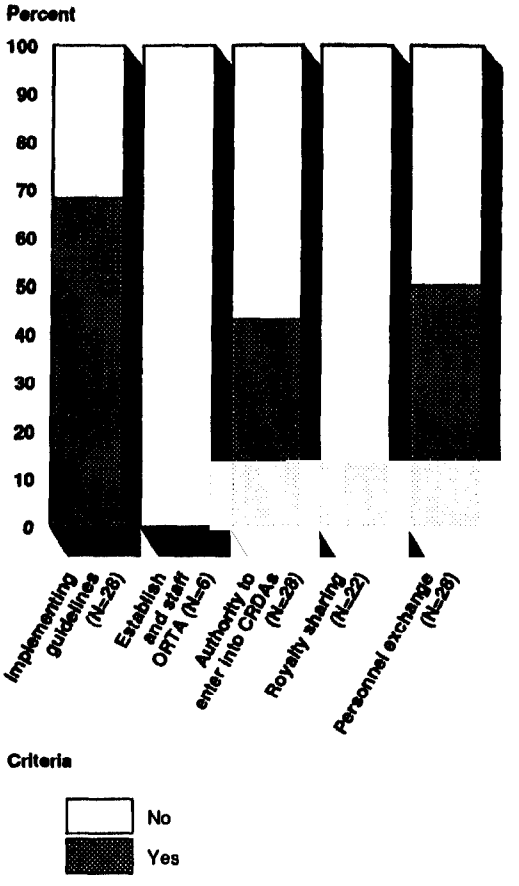
**Figure V.3: Scope of Implementation by DOE**




Note: When the questionnaire was sent out, government-owned, contractor-operated laboratories did not fall under the CRDA provisions of the Federal Technology Transfer Act of 1986. Sixteen of the DOE's laboratories are GOCOs; the 2 exceptions are represented in the figure.

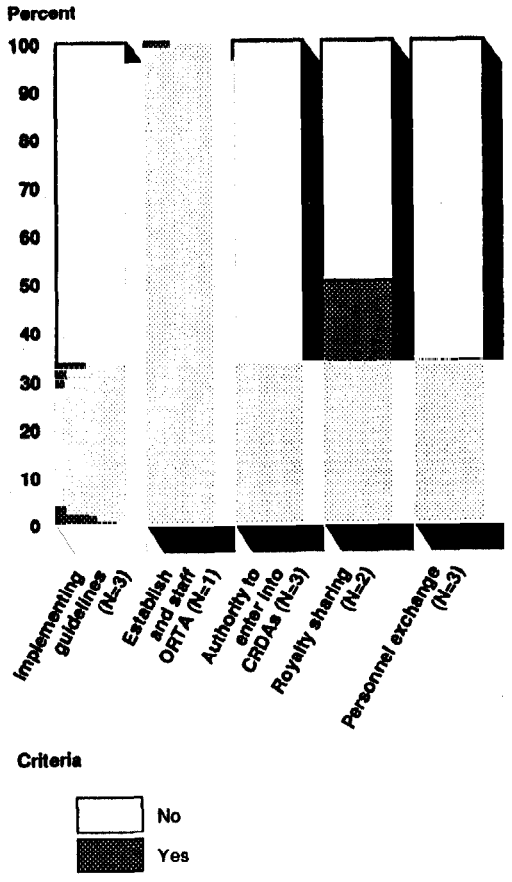
- Even though a majority of DOE laboratories had not received written guidelines for implementation, a high percentage had satisfied four out of five applicable provisions.
- All DOE laboratories had on-site ORTAs, and nearly all large ones were staffed by at least one FTE.
- Only two DOE laboratories were government-owned, government-operated and, thus, fell under the CRDA provision. The directors of both had been delegated the authority to enter into CRDAs.

**Figure V.4: Scope of Implementation by Interior**




- By fiscal year 1989, a little more than two-thirds of the Interior laboratories had received written guidelines for implementing the legislation.
- Nearly one-half of the laboratory directors had been delegated authority to enter into CRDAS.
- The royalty-sharing criterion had been satisfied by less than 15 percent the laboratories.

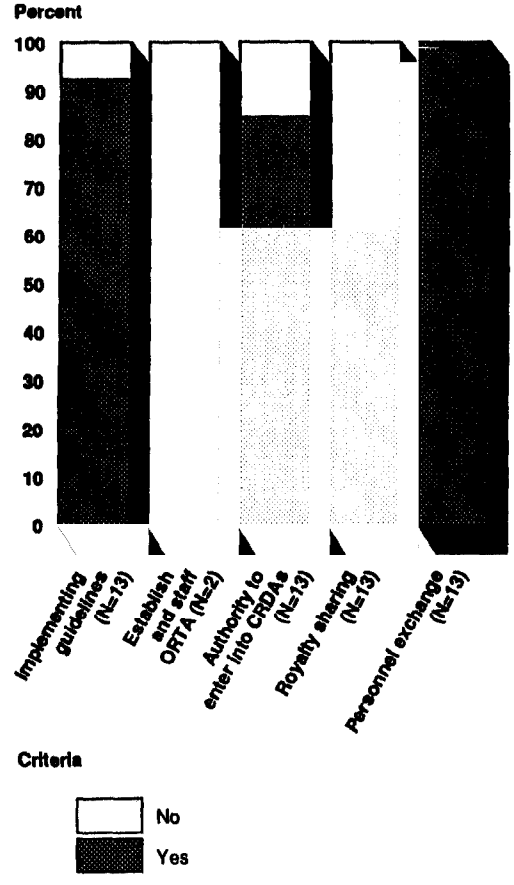
**Figure V.5: Scope of Implementation by DOT**




Note: There are only three cases representing the DOT.

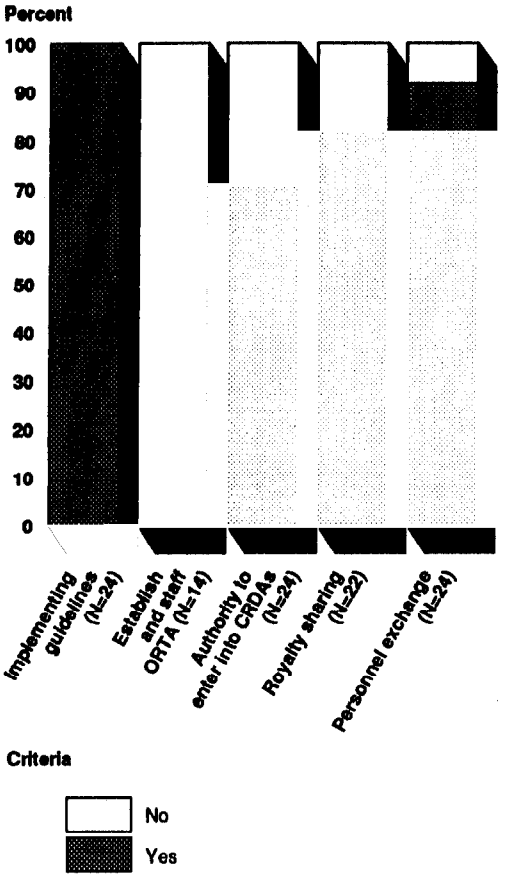
- Only one of the three DOT laboratories had met each of the provisions.
- The other two had met none or did not respond.

**Figure V.6: Scope of Implementation by EPA**



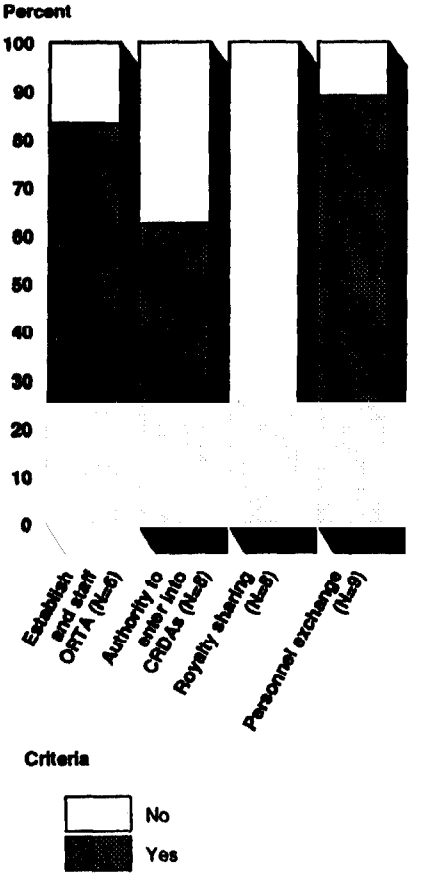

- EPA had provided guidelines for implementing the legislation to almost all laboratories.
- The highest degree of implementation was in the establishment of personnel exchange programs.

**Figure V.7: Scope of Implementation by HHS**




- HHS laboratories had all received guidance on implementing the Technology Transfer Act of 1986.
- A very high percentage of HHS laboratories had established incentive programs and had delegated authority to laboratory directors.

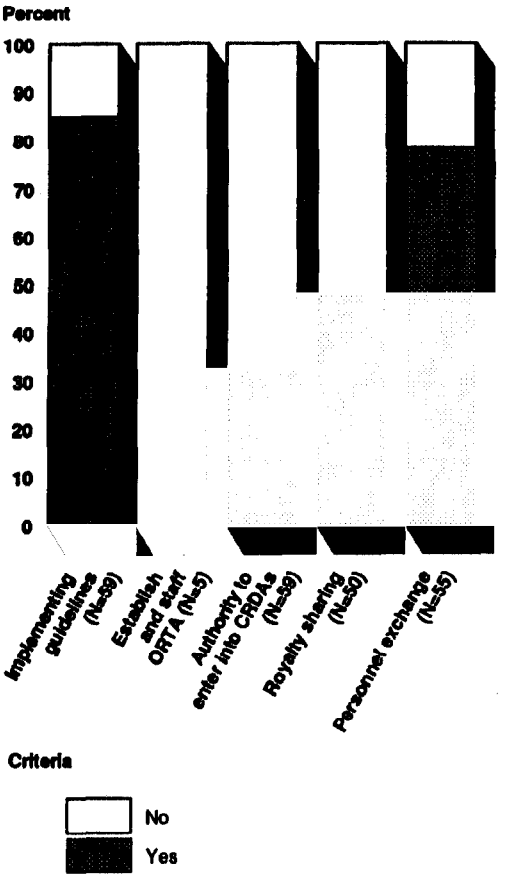
**Figure V.8: Scope of Implementation by NASA**




Note: Because NASA operates under the provisions of the National Aeronautics and Space Act of 1958, as amended, they are not included in responses to receipt of guidelines for implementing the Technology Transfer Act.

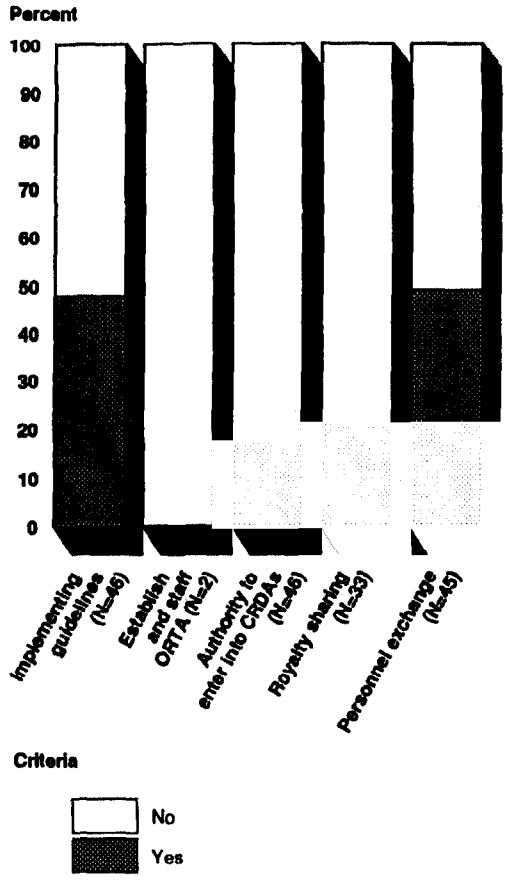
- In general, NASA had a high percentage of laboratories that had implemented almost all provisions.
- In particular, nearly all laboratories had personnel exchange programs.

**Figure V.9: Scope of Implementation by USDA**




- A large number of USDA laboratories had guidelines for implementing the technology transfer legislation.
- Less than 50 percent had established royalty-sharing programs within laboratories.
- Less than one-third of the laboratory directors had been delegated authority to enter into CRDAs.
- Over three-fourths of USDA laboratories participate in personnel exchange programs.

**Figure V.10: Scope of Implementation by VA**




In general, VA sites had not implemented the provisions of the Technology Transfer Act.

# Overview of the Implementation of Selected Provisions of the Technology Transfer Legislation

Below we illustrate the laboratories'

- staffing and location of Offices of Research and Technology Applications,
- focus of CRDA research activity,
- characteristics of CRDA, and
- patents, licenses, and royalties.

**Table VI.1: Staffing and Location of Offices of Research and Technology Applications[a]**

| | Labs with less than 200 FTEs[b] | | | | |
|---|---|---|---|---|---|
| | Have ORTA | | | Have FTE at | |
| Department | At lab | At agency | Other | lab ORTA | Total labs |
| Commerce | 17% | 78% | 6% | 0 | 18 |
| DOD | 58 | 25 | 17 | 8 | 24 |
| DOE | 100 | 0 | 0 | 2 | 3 |
| Interior | 10 | 76 | 14 | 1 | 21 |
| DOT | 50 | 0 | 50 | 0 | 2 |
| EPA | 9 | 64 | 27 | 1 | 11 |
| HHS | 0 | 90 | 10 | 0 | 10 |
| NASA | 100 | 0 | 0 | 1 | 1 |
| USDA | 6 | 90 | 4 | 1 | 50 |
| VA | 11 | 60 | 29 | 1 | 35 |
| Total[d] | 18% | 67% | 14% | 15 | 175 |

[a]The legislation recognizes that some agencies have established organizational structures outside the federal laboratories which have as their principal purpose the transfer of federally owned or originated technology to State and local government and to the private sector. They may perform the functions of the ORTA in such organizational structure.

[b]The FTEs reported here are for the scientific, engineering, and technical staff positions. Laboratories with less than 200 FTEs are not required to assign full-time staff to the ORTA.

[c]One VA laboratory did not provide data for scientific, engineering, and technical FTEs.

[d]Twenty-five laboratories did not provide sufficient information to be included in this analysis. Percentages do not total 100 due to rounding.

| Labs with 200 of more FTEs[b] | | | | | Overall location | | | |
|---|---|---|---|---|---|---|---|---|
| Have ORTA | | | Have FTE at lab ORTA | Total labs | Lab | Agency | Other | Total labs |
| At lab | At agency | Other | | | | | | |
| 0% | 100% | 0% | 0 | 5 | 13% | 83% | 4% | 23 |
| 93 | 0 | 7 | 22 | 40 | 80 | 9 | 11 | 64 |
| 100 | 0 | 0 | 11 | 15 | 100 | 0 | 0 | 18 |
| 0 | 83 | 17 | 0 | 6 | 7 | 78 | 15 | 27 |
| 100 | 0 | 0 | 1 | 1 | 67 | 0 | 33 | 3 |
| 0 | 100 | 0 | 0 | 2 | 8 | 69 | 23 | 13 |
| 7 | 86 | 7 | 0 | 14 | 4 | 88 | 8 | 24 |
| 100 | 0 | 0 | 5 | 6 | 100 | 0 | 0 | 7 |
| 0 | 100 | 0 | 0 | 5 | 5 | 91 | 4 | 55 |
| 50 | 50 | 0 | 0 | 2 | 13 | 61 | 26 | 38[c] |
| 64% | 31% | 5% | 39 | 96 | 34% | 55% | 11% | 272 |

**Table VI.2: Focus of CRDA Research Activity[a]**

| | Basic | | Applied | | Clinical | | Developmental | | evaluation | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Department[b] | Draft | Final | Draft | Final | Draft | Final | Draft | Final | Draft | Final | Draft | Final |
| Commerce | 1 | 3 | 3 | 9 | 0 | 0 | 7 | 22 | 7 | 18 | 17 | 49 |
| DOD | 9 | 12 | 32 | 33 | 7 | 7 | 18 | 28 | 15 | 17 | 75 | 56 |
| DOE | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 3 | 1 |
| Interior | 3 | 28 | 4 | 6 | 0 | 0 | 4 | 5 | 4 | 6 | 9 | 43 |
| EPA | 2 | 0 | 7 | 4 | 0 | 0 | 3 | 3 | 3 | 4 | 3 | 5 |
| HHS | 32 | 36 | 35 | 38 | 17 | 36 | 28 | 18 | 4 | 7 | 87 | 89 |
| NASA | 2 | 2 | 19 | 30 | 1 | 5 | 9 | 17 | 22 | 31 | 12 | 63 |
| USDA | 12 | 17 | 33 | 40 | 2 | 1 | 21 | 35 | 22 | 24 | 40 | 83 |
| VA | 5 | 31 | 3 | 4 | 10 | 33 | 3 | 3 | 6 | 31 | 8 | 42 |
| Total | 66 | 130 | 137 | 164 | 37 | 82 | 95 | 131 | 86 | 138 | 254 | 431 |
| Percent | 26% | 30% | 54% | 38% | 15% | 19% | 37% | 30% | 34% | 32% | 100% | 100% |
| Laboratories responding | 66 | 71 | 75 | 74 | 62 | 62 | 71 | 70 | 71 | 69 | 237 | 238 |

[a]The number of draft and final CRDAs across the categories do not total 254 and 431, respectively, because the categories are not mutually exclusive. For this reason, the percentages do not equal 100 but are based on the number of draft (254) and final (431) CRDAs.

[b]DOT is not included in this table because no responses were provided for these categories.

**Table VI.3: Characteristics of CRDAs[a]**

| | CRDA partners | | | | | |
|---|---|---|---|---|---|---|
| | U.S. small business | | U.S. business | | Foreign[c] | |
| Department[b] | Draft | Final | Draft | Final | Draft | Final |
| Commerce | 11 | 31 | 17 | 44 | 0 | 1 |
| DOD | 19 | 10 | 44 | 32 | 2 | 9 |
| DOE | 2 | 0 | 3 | 0 | 0 | 1 |
| Interior | 3 | 5 | 4 | 5 | 0 | 0 |
| EPA | 1 | 2 | 8 | 3 | 0 | 0 |
| HHS | 31 | 26 | 73 | 78 | 4 | 9 |
| NASA | 3 | 8 | 26 | 37 | 0 | 0 |
| USDA | 11 | 14 | 30 | 35 | 5 | 1 |
| VA | 1 | 0 | 12 | 38 | 0 | 1 |
| Total | 82 | 96 | 217 | 272 | 11 | 22 |
| Percent | 32% | 22% | 85% | 63% | 4% | 5% |
| Laboratories responding | 76 | 69 | 88 | 73 | 70 | 65 |

[a]The number of draft and final CRDAs across the categories do not total 254 and 431, respectively, because the categories are not mutually exclusive. For this reason, the percentages do not equal 100 but are based on the number of draft (254) and final (431) CRDAs.

[b]DOT is not included in this table because no responses were provided for these categories.

[c]Canadian businesses are considered separately from either foreign or U.S. firms.

| Expected duration of CRDAs | | | | | | | | Laboratory contributions to CRDAs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 year or less | | More than 1 year, less than 3 | | More than 3 years, less than 5 | | More than 5 years | | 25% responsibility | | Exchange personnel | | Provide equipment or facilities | |
| Draft | Final | Draft | Final | Draft | Final | Draft | Final | Draft | Final | Draft | Final | Draft | Final |
| 2 | 3 | 14 | 44 | 0 | 0 | 0 | 1 | 16 | 48 | 10 | 41 | 0 | 1 |
| 5 | 8 | 26 | 28 | 6 | 7 | 13 | 9 | 24 | 29 | 7 | 15 | 3 | 2 |
| 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 |
| 0 | 3 | 9 | 9 | 0 | 18 | 1 | 5 | 6 | 8 | 0 | 1 | 4 | 2 |
| 0 | 3 | 2 | 0 | 1 | 1 | 4 | 1 | 2 | 4 | 1 | 3 | 3 | 1 |
| 14 | 10 | 45 | 56 | 24 | 15 | 10 | 9 | 41 | 78 | 45 | 38 | 16 | 25 |
| 1 | 10 | 16 | 17 | 2 | 16 | 8 | 19 | 20 | 57 | 10 | 16 | 15 | 47 |
| 5 | 14 | 26 | 19 | 7 | 16 | 1 | 2 | 33 | 46 | 13 | 10 | 8 | 5 |
| 6 | 23 | 5 | 16 | 1 | 3 | 1 | 0 | 12 | 38 | 0 | 1 | 0 | 1 |
| 35 | 75 | 144 | 189 | 41 | 76 | 38 | 46 | 157 | 309 | 86 | 125 | 49 | 84 |
| 14% | 17% | 57% | 44% | 16% | 18% | 15% | 11% | 62% | 72% | 34% | 29% | 19% | 19% |
| 66 | 69 | 78 | 71 | 65 | 67 | 70 | 67 | 75 | 73 | 66 | 66 | 67 | 67 |

**Table VI.4: Summary of Patents, Licenses, and Royalties, Fiscal Year 1989**

| | Patents | | | | |
|---|---|---|---|---|---|
| Department | Disclosures | Applications | Foreign applications | Pending | Issued |
| Commerce | 44 | 19 | 2 | 20 | 2 |
| DOD | 824 | 852 | 17 | 1,142 | 289 |
| DOE | 866 | 317 | 230 | 548 | 211 |
| Interior | 34 | 23 | 5 | 14 | 8 |
| DOT | 1 | 0 | 0 | 0 | 0 |
| EPA | 5 | 17 | 0 | 6 | 1 |
| HHS | 91 | 86 | 65 | 139 | 22 |
| NASA | 561 | 123 | 720 | 253 | 98 |
| USDA | 79 | 101 | 14 | 99 | 44 |
| VA | 23 | 9 | 0 | 12 | 1 |
| Total | 2,528 | 1,547 | 1,053 | 2,233 | 676 |
| Laboratories responding | 251 | 254 | 236 | 241 | 247 |

[a]This value is larger than fiscal year 1989 total royalty income because license income for fiscal year 1988 was distributed in fiscal year 1989.

| Licenses | | Royalties | | |
|---|---|---|---|---|
| Exclusive | Nonexclusive | Total | Paid to inventors | Number of inventors |
| 0 | 7 | $ 0 | $ 0 | 0 |
| 17 | 15 | 4,570,472 | 40,795 | 26 |
| 24 | 30 | 888,800 | 55,068 | 104 |
| 1 | 0 | 13,900 | 3,900 | 3 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 814,232 | 614,913 | 149 |
| 30 | 19 | 35,100 | 14,055 | 2 |
| 10 | 8 | 1,500 | 48,052[a] | 28 |
| 1 | 3 | 0 | 400 | 1 |
| 85 | 82 | $6,324,004 | $777,183 | 313 |
| 247 | 242 | 272 | 123 | 110 |

# Major Contributors to This Report

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# Glossary

| | |
|---|---|
| Circular A-11 | Office of Management and Budget (OMB) Circular A-11, Information on Research and Development, requires executive departments to submit information annually on their research and development programs, including technology transfer activities. The information is used by OMB in its review of agency budget requests, governmentwide resource allocation, and preparation of the special analysis on research and development. |
| Cooperative Research and Development Agreement | Cooperative research and development agreements are contracts between one or more federal laboratories and one or more nonfederal parties under which a laboratory provides personnel, services, facilities, equipment, or other resources (not including funds) to conduct specified research and development efforts that are consistent with the missions of the laboratories. |
| Laboratory | The term laboratory means 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 employees of the federal government. For the purposes of our questionnaire, the determination of which research organizations count as laboratories was settled on an agency-by-agency basis. |
| License | A license is a contract that gives permission to make, use, or sell a patented product or process. |
| Office of Research and Technology Applications | Offices of Research and Technology Applications are organizational units created under Public Law 96-480. The primary function of these offices is to disseminate information on federally owned or originated products, processes, and services linking the research and development resources of the federal laboratories, and the federal government as a whole, to state and local government and to the private sector. |
| Patent | A patent is an agreement between the government and the inventor whereby, in exchange for the inventor's complete disclosure of the invention, the government gives the inventor the right to exclude others from making, using, or selling the invention for a certain period of time. |

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| Royalty | Royalty refers to income based on use (such as percentage of sales) that is returned to the owner of a patented invention by a licensee company. |
| Small Business | A U.S. small business is defined as one that: (1) has no more than 500 employees, (2) is independently owned and not dominant in its field of operation, (3) has its principal place of business located in the United States, and (4) is organized for profit. |

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