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Barriers Limit Royalty Sharing's Effectiveness

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and Transportation
United States Senate

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

As required by law, this report reviews the effectiveness of various royalty-sharing programs established by the Federal Technology Transfer Act of 1986 (P.L. 99-502). This report contains recommendations to department and agency heads operating royalty-sharing programs under the act and a matter for congressional consideration.

We are sending copies of this report to the Secretary of Commerce, the Director of the Office of Management and Budget, and the heads of departments and agencies operating royalty-sharing programs under the Federal Technology Transfer Act. Copies will be made available to others upon request.

This report was prepared under the direction of Victor S. Rezendes, Director, Energy and Science Issues, who can be contacted at (202) 275-1441. Major contributors to this report are listed in appendix XI.

J. Dexter Peach
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Executive Summary

Purpose

Responding to concern about U.S. industry's weakened competitive position in domestic and international markets, the Congress enacted the Federal Technology Transfer Act in 1986 to further promote the transfer of federal technology to U.S companies. Together with earlier technology transfer legislation, this act was intended to reorient federal scientists' traditional reliance on publication of research results with attitudes and practices that also promote the patenting and licensing of suitable invention technology. Proponents of the act believed that patent protection for federal invention technology would encourage businesses to adopt commercially useful inventions. Under this legislation, the Congress provided incentives, such as royalty sharing, to reward inventors for reporting potentially patentable inventions.

The 1986 act required that GAO report to the Senate Committee on Commerce, Science and Transportation and the House Committee on Science, Space, and Technology on the effectiveness of agencies' royalty-sharing programs after the first 5 years. As agreed with the committees' offices, GAO evaluated (1) federal scientists' interest in reporting inventions and (2) the extent to which agencies' implementation of their programs, including their disbursement and use of invention income, supports the incentive character of royalty sharing. To do this, GAO selected 21 agencies that have the potential to produce a variety of patentable technology and obtained invention-reporting and income data for government-employee inventions both before and after the act. To obtain views reflecting attitudes on royalty sharing and agency management, GAO identified a cross section of eight agency laboratories and conducted focus groups with federal scientists.

Background

Proponents of the act indicated that royalty sharing would become a strong incentive to encourage employees at over 700 federal laboratories to report inventions. In part, the act directs that at least 15 percent of each invention's income be paid to the inventor(s) before the remaining income is transferred to the agency laboratory(ies) for specified uses, including certain scientific areas, and expenses incidental to the administration and licensing of inventions.

Results in Brief

Overall, royalty-sharing programs at federal laboratories have not increased scientists' interest in patenting. A comparison of the rates at which scientists reported inventions before and after the 1986 act became law showed no real improvement in the rates for 14 of the 21 agencies.

Furthermore, real improvement at the seven other agencies cannot be attributed to royalty sharing alone because scientific or legal events and other legislation that preceded or coincided with royalty sharing may have had an impact on federal scientists' interest in patenting certain technologies. The statements of many federal scientists participating in focus groups supported GAO's analysis. The scientists said that small financial rewards, such as those paid under some royalty-sharing programs, offer little incentive to patent.

Certain agency practices help explain why the programs have not made a real difference. For example, 17 of 21 agencies use royalty-sharing formulas that often result in annual payments to each inventor of a few hundred dollars for an invention. In addition, GAO found inadequate financial controls over the payments to inventors. GAO's analysis also indicates that agency management is using virtually all of the laboratory's share of invention income to cover the administrative costs of technology transfer and, as a result, royalty sharing's benefits are not visible to other potential inventors. Most notably, Health and Human Services, citing the act's authority to cover expenses incidental to the administration and licensing of inventions, has, to settle an invention ownership dispute, supported a private autonomous foundation with $20.1 million from the government's single largest source of invention income. In addition, laboratory directors, who are most familiar with the needs of their scientists, are sometimes not included in decisions on the use of their laboratory's share of invention income, and assistance at federal laboratories on many aspects of reporting inventions and obtaining patents is limited.

Principal Findings

Royalty Sharing Has Had Little Impact on Scientists' Interest in Patenting

Since the Federal Technology Transfer Act was passed in 1986, invention-reporting rates have not increased for 14 out of 21 federal agencies. Scientists at these 14 agencies represent 67 percent of the research and development (R&D) scientists and 86 percent of all scientists at the 21 agencies in 1991. Moreover, improvement at the other seven agencies could be attributed not only to royalty sharing but also to events, such as the emergence of a new industry influenced by biotechnology, that preceded or coincided with the incentive's impact on federal scientists. Scientists participating in focus groups emphasized that small monetary

payments provided a less-than-optimal reward for inventing. Many of these researchers described scientists as motivated more by pride and a desire to be recognized by their peers. Others said that they value patents because patents protect their ideas from being claimed by others and confirm the utility and originality of their inventions.

Agencies Need to Improve Their Implementation of Royalty Sharing at the Laboratories

Seventeen of 21 agencies are using small percentage-based royalty-sharing formulas that often result in payments to inventors of only a few hundred dollars per year for each invention. Alternatively, four agencies are using "threshold" formulas that maximize inventors' rewards, giving the inventor 100 percent of the first $1,000 (three agencies) or $2,000 (one agency). In addition, only one of eight agencies where GAO conducted focus groups routinely checked the accuracy of inventor-payment records against invention patent, licensing, and income records. This lack of financial control over agencies' royalty sharing has allowed at least four inventors at three agencies to miss or receive delayed payments.

Many agencies are not using the laboratory share of invention income in scientific areas where the tangible benefits, such as attendance at conferences, would be visible to other potential inventors. Of the 13 agencies that received invention income through 1990, 5 have used or are holding almost 100 percent of their laboratories' share to support the costs of administrative functions related to technology transfer. Furthermore, under the category of expenses incidental to the administration and licensing of inventions, Health and Human Services has used 80 percent, or $20.1 million, of the AIDS test kit invention income to support the French and American AIDS Foundation.

Many laboratory personnel who have invested in technology transfer activities have derived little or no direct benefit from royalty sharing. In some cases, this is because laboratory directors have had little input in allocating the laboratories' share of the royalties.

Five years after the programs were established by the law, awareness of royalty sharing at federal laboratories remains low. Scientists also complained that (1) advice on the types of inventions suitable for patents and on the commercial potential of inventions was not readily available at their laboratories, (2) patenting restricted their ability to share scientific information with peers, and (3) agency procedures for selecting inventions to patent were slow and arbitrary.

Recommendations to Agencies

GAO recommends that heads of departments and agencies operating royalty-sharing programs under the Federal Technology Transfer Act (1) adopt royalty-sharing formulas that establish an annual threshold of 100 percent of a set amount of invention income (for example, the $1,000 or $2,000 threshold now in use by some agencies) to more adequately reward inventors for their work, (2) establish procedures that routinely check inventor-payment records against patent, licensing, and income records, (3) channel a major part of the laboratory share of invention income to areas in laboratories that are visible to federal scientists, and (4) require that the director of the laboratory where the invention originated be included in decisions governing the use of the laboratory's share of invention income. GAO further recommends that agencies (1) provide more information and training for scientists at their laboratories on the kind of subject matter that is patentable and on the proper approach for evaluating an invention's commercial demand and (2) establish procedures for the timely and consistent selection of inventions for patenting.

Matter for Congressional Consideration

To ensure that the agencies share invention income with the laboratories as the Congress intended, GAO believes that the Congress may wish to consider more specifically defining the permissible uses of "expenses incidental to the administration and licensing of inventions."

Agency Comments

A draft of this report was sent to the Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, the Interior, and Transportation; the National Aeronautics and Space Administration (NASA); the Environmental Protection Agency (EPA); and the Tennessee Valley Authority (TVA). NASA and Transportation chose not to provide comments. Defense, Energy, Health and Human Services, Interior, and TVA all generally agreed with the report's recommendations. However, Agriculture, Commerce, and EPA raised questions concerning certain conclusions, particularly those they believed were solely supported by several aspects of GAO's statistical analysis. GAO's conclusions are based on an integration of the results from both statistical analysis and opinions expressed during focus group discussions with almost 100 federal laboratory scientists across the country.

Agencies' comments and GAO's responses to them appear in appendixes III to X. Suggested technical changes have been made where appropriate.

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Abbreviations

ADAMHA	Alcohol Drug Abuse and Mental Health Administration
AIDS	Acquired Immune Deficiency Syndrome
ARS	Agricultural Research Service
CDC	Centers for Disease Control
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FTTA	The Federal Technology Transfer Act (P.L. 99-502)
GAO	General Accounting Office
NASA	National Aeronautics and Space Administration
NHTSA	National Highway Traffic Safety Administration
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
R&D	research and development
TVA	Tennessee Valley Authority

Introduction

Technology developed in laboratories by scientists is an economic resource vital for the production of commercially successful goods and services. The transfer of this technology to U.S. companies is increasingly viewed as a means of making the United States more competitive in international and domestic markets. In October 1986, the Federal Technology Transfer Act of 1986 (FTTA) (P.L. 99-502) amended the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480), in part by establishing a new program for sharing royalty income from federal inventions that are commercialized.[1] Royalty sharing is intended to provide federal agencies and scientists with an incentive to report, develop, and help license inventions with commercial potential by giving federal agencies the authority to retain and distribute royalty income to government employees and laboratories.

The Royalty-Sharing Program

Prior to the enactment of FTTA, federal law generally required that royalty income, received under agency agreements that licensed patents, had to be turned over to the U.S. Treasury and could not be retained by the agency. During the 1970s, the National Technical Information Service (NTIS),[2] under the Department of Commerce, began an award program for government-employee inventors whose agencies used NTIS to patent and license federal inventions. This program was authorized through the Federal Incentive Awards Program at the Office of Personnel Management. Each agency had to approve any such awards, which typically paid the inventor annually the greater of $300 or 15 percent, generally up to a maximum of $10,000, of all invention income.

FTTA expanded NTIS's initial royalty-sharing program, making available to inventors and laboratories the royalties and other income received by federal agencies from the licensing or assignment of inventions.[3] Proponents of the law believed that the provision of an incentive for government employees would encourage the transfer of more federal technology to U.S. industry. Recognizing the diverse nature of the over 700 federal laboratories, the Congress authorized each agency to select its own

[1]An invention is defined as any invention or discovery that is or may be patentable under the patent statute or any novel variety of plant that is or may be protectable under the Plant Variety Protection Act.

[2]In 1976, the Department of Commerce chartered the Office of Federal Patent Licensing at NTIS to provide patent and licensing expertise to federal agencies that requested their services.

[3]For purposes of this report, "royalties and other income" is referred to as invention income. Typically, "other income," which is not defined in the legislation, includes an initial fee payable with the execution of the license and an annual minimum fee. Invention assignment occurs when one invention owner transfers the invention's property rights to another owner.

formula for allocating invention income between the inventor and the laboratory as long as the inventor (or co-inventors), during any one fiscal year, received at least 15 percent of the invention income up to $100,000 for each inventor. The act also requires that a majority of the laboratory share of invention income go to the laboratory where the invention occurred but requires the balance of this invention income, remaining after inventor payments, to be used at any laboratory for

- payment of expenses incidental to the administration and licensing of inventions;
- rewards to scientific, engineering, and technical employees of that laboratory;
- scientific exchange among government-operated laboratories of the agency; or
- education and training of employees consistent with agency-mission research and development, and for other activities that increase the licensing potential of technology.

Any of these laboratory funds not used or obligated by the end of the fiscal year succeeding the fiscal year in which they are received must be paid into the U.S. Treasury. The law's distribution provisions also carry two exceptions. First, if the laboratory's share exceeds 5 percent of the agency's government-operated laboratory budget for that year, 25 percent of the excess over 5 percent must be used as described, and the remaining 75 percent must be transferred to the U.S. Treasury. Second, a federal agency, typically NTIS, may retain invention income to cover the costs and expenses of managing invention services, such as paying inventors and paying for the administration and licensing of inventions, for another agency. The remaining invention income must then be transferred to the agency authorizing the services and be used in the previously specified manner.

The House Conference Report accompanying the legislation further stated that (1) depending on the amount of invention income, a single fixed-royalty share might be an inadequate reward for an inventor and (2) a percentage of royalties could be allocated to a research team or project, in addition to the inventor's share, before the remainder was allocated to the laboratory director. The conferees also stressed the importance of giving agencies the freedom to devise different systems so that royalty sharing would meet the cultures, needs, and technology transfer problems of federal laboratories.

FTTA designates the Department of Commerce, through its Under Secretary for Technology, as a responsible adviser and reporting agency for certain technology transfer activities within the federal government. In this capacity, the Under Secretary convenes an interagency group monthly to discuss technology transfer issues with representatives from all agencies that sponsor federal research. In addition, under the biennial reporting requirement, Commerce has issued one report and is reviewing a second.

From Research to Royalties—the Technology Transfer Process

In fiscal year 1991, the federal government obligated about $66.1 billion for research and development (R&D). Almost $50 billion was obligated through contracts and grants to extramural—or nonfederal—recipients, such as universities, industrial firms, federally funded R&D centers, state and local governments, and government-owned, contractor-operated laboratories. Federal agencies, both civilian and defense, obligated about $16.4 billion for intramural R&D performed by federal employees at laboratories owned and operated by the government.

Generally, federal laboratories employ scientists and engineers trained in a variety of scientific disciplines, [4] such as chemistry, physics, or engineering, to perform R&D that supports an agency's mission. Within this framework, each agency laboratory develops its own culture, which generally corresponds to the character of the research performed. Basic research is focused on gaining a fuller knowledge of fundamental phenomena without seeking specific applications for that knowledge; applied research is done to gain understanding to meet a recognized need; and development is the application of knowledge to achieve useful production. Federal laboratories engaged in all three types of research have the potential to develop patentable technology; however, each laboratory—even a laboratory involved in non-R&D problems in testing, evaluating, and maintaining systems—is a separate and distinct source of inventions, scientific expertise, and techniques, all with varying suitability for commercial application. Therefore, although inventions are typically reported by scientists who perform R&D, an invention can be made by anyone who matches a solution and a problem.

An inventor reports an invention by requesting and completing a document known as an invention or patent disclosure. The disclosure generally serves as the inventor's evidence of the date of conception of the invention. Submission of the disclosure usually makes agency

[4]Scientists and engineers are the primary professional groups working at federal laboratories. In this report, scientists and engineers will be referred to simply as scientists.

management aware, for the first time, of a potential invention and of a scientist's interest in patenting. Within agencies, individuals or committees generally conduct a technical review to determine whether the invention can be made and will perform as intended; in some cases, the review also considers the extent to which the invention resulted from the use of government resources. At some agencies, laboratory or headquarters managers also evaluate the commercial utility or demand for the invention.

Usually, a search of patent records follows to ascertain whether the invention was previously patented. In general, the new idea or invention can be patented if no previous publication or patent is identified and if the idea or invention is also found to be novel and nonobvious and to have utility. Approval or clearance at the agency level will generally be followed by the filing of a patent application in the U.S. Patent and Trademark Office. Agencies may then license the patent application or resulting patent.

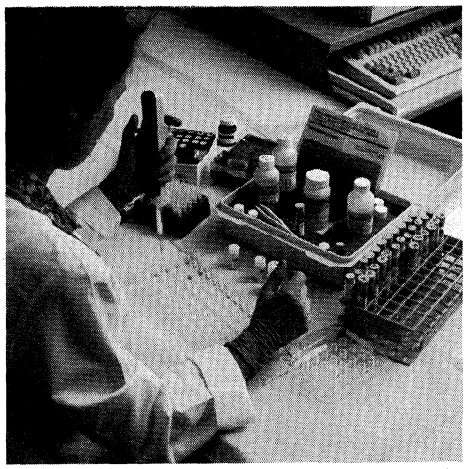
By licensing the patent, the government can restrict the number of companies that may make, use, or sell an invention during the patent's 17-year life. Depending on whether or not the patent's owner wants to collect invention income, licenses are royalty-bearing or royalty-free. If the license is royalty-bearing, the licensee typically pays fees to cover (1) costs associated with obtaining the patent and maintaining it in effect and/or (2) royalties, a percentage collected from the commercial sale of the invention.

Some research can yield inventions, some inventions can be patented, and some patents can, in turn, be licensed. However, royalties cannot be shared among federal inventors and laboratories unless (1) the inventor reports the invention on an invention disclosure, (2) the federal agency is able to license the patent or patent application to a company,[5] (3) a customer buys the product from the company, and (4) the company or licensee annually returns royalties, at the agreed rate, to the licensing federal agency. Although this technology transfer process typically takes many years from beginning to end, it can come to an abrupt halt at any of these steps. Thus, efforts to increase invention reporting are different from, and may have little effect on, an agency's licensing activity.

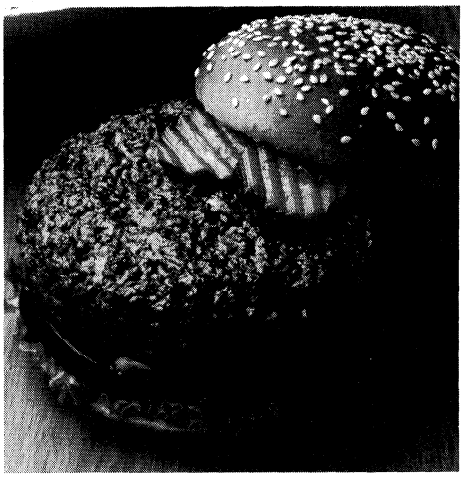
[5]It is the patent's right to exclude others from making, using, or selling an invention that is licensed by a company. We will use the term "inventions licensed" to be consistent with other data on inventions used in this report.

As figure 1.1 shows, examples of the successful commercialization of federal technologies are visible to the public every day. National Aeronautics and Space Administration (NASA) scientists invented, and NASA licensed, a protective coating used on the supporting structure of many bridges and the Statue of Liberty that allows the exterior copper to weather to its natural blue-green patina. National Institutes of Health (NIH) scientists invented, and NTIS, on behalf of NIH, granted licenses for, the Acquired Immune Deficiency Syndrome (AIDS) test kit used to detect the illness and protect the public. Agricultural Research Service (ARS) scientists invented, and ARS granted licenses for, (1) a no-fat replacement for fat in ground beef products, which is made from oat flour and which, when cooked, maintains the appearance and taste of the familiar "American hamburger" but has been shown to displace "bad" cholesterol in the human circulatory system and (2) a polymer material that absorbs hundreds of times its weight in water that can be used as an agent to improve plant growth and health, as a drying powder, and as a medical treatment for skin wounds.

Figure 1.1: Government-Employee Inventions in Use Today

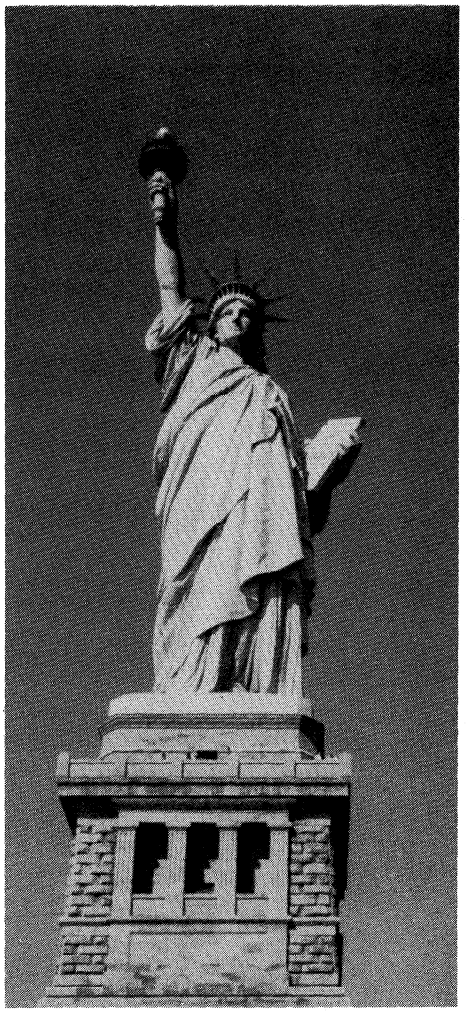


U.S. Patent 4,520,113 - A Method of Detecting Antibodies to the Virus That Causes AIDS



ConAgra Specialty Grain Products Company

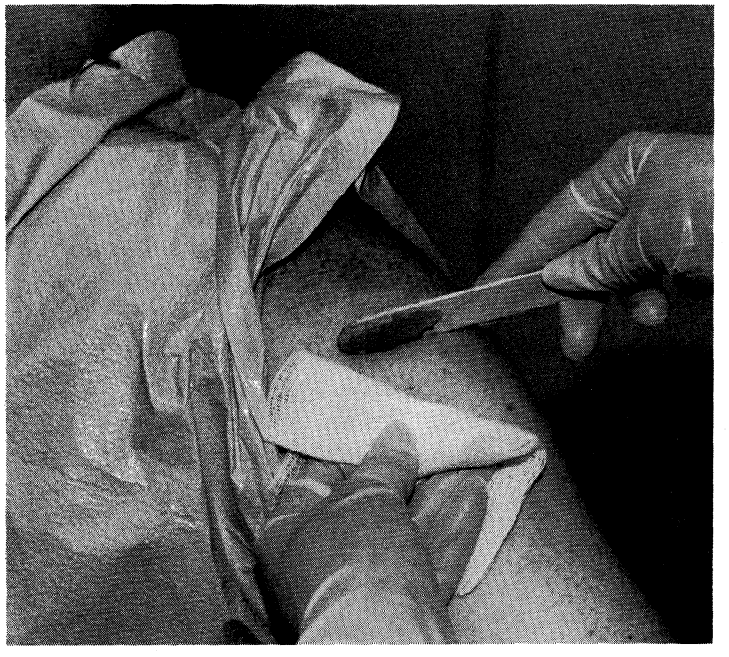
U.S. Patent 4,996,063 - A Method of Converting Oats Into a Soluble Dietary Fiber



Inorganic Coatings, Inc.

U.S. Patent 4,162,169 - Protective Metal Coatings and Methods of Manufacture

Super Absorbent Company, Inc.



U.S. Patent 3,935,099 - A Method of Reducing Water Content with Highly Absorbant Starch-Containing Polymers

Objectives, Scope, and Methodology

FTTA requires that we report on the effectiveness of federal agencies' royalty-sharing programs after the first 5 years to the Senate Committee on Commerce, Science and Transportation and to the House Committee on Science, Space, and Technology. As agreed with these committees' offices, we assessed the programs' effectiveness by evaluating (1) federal scientists' interest in reporting inventions before and after the act's passage and (2) the extent to which agencies' implementation of the program, including their disbursement and use of invention income, supports the incentive character of royalty sharing.

To evaluate these objectives, we obtained data from 21 agencies that (1) represent a cross section of R&D missions with the potential for producing patentable technology,[6] (2) obligated $13.4 billion, or about 82 percent, of the total $16.4 billion obligated for intramural R&D in fiscal year 1991, and (3) employed 177,000 federal scientists.[7] Table 1.1 provides an overview of the federal government's fiscal year 1991 financial and human resources available to these agencies to support the production of commercially useful technology.

[6]For the purposes of this report, we refer to administrations, bureaus, institutes, and services within executive departments and independent agencies as agencies.

[7]Throughout this report, the figures for the Department of Energy exclude activity at government-owned, contractor-operated laboratories because inventors at these facilities generally are not government employees. Contractors' inventing activity was excluded to maintain the consistency of 11 years of data.

Table 1.1: Agency Financial and Human Resources Available for Inventing

Dollars in millions

Department/agency	Fiscal year 1991 Federal obligations for intramural R&D[a]	Fiscal year 1991 Total number of agency scientists
Agriculture		
ARS	$ 551.5	3,100
Forest Service	130.1	10,300
Commerce		
NIST[b]	126.8	1,600
NOAA[c]	209.6	6,400
Defense		
Air Force	1,533.4	10,700
Army	2,200.3	38,200
Navy	3,088.6	62,700
Energy[d]	427.3	400
Health and Human Services		
ADAMHA[e]	241.5	500
CDC[f]	87.5	2,300
FDA[g]	118.3	3,000
NIH	1,401.6	2,400
Interior		
Bureau of Mines	69.1	1,500
Fish and Wildlife Service	62.8	600
Geological Survey	277.2	6,100
Transportation		
Coast Guard	15.9	1,400
FAA[h]	129.2	3,000
NHTSA[i]	14.4	100
EPA[j]	129.3	7,500
NASA	2,573.0	13,000
TVA[k]	25.3	2,200
Total	**$13,412.7**	**177,000**

(Table notes on next page)

[a]Source: National Science Foundation. Federal Funds for Research and Development: Fiscal Years 1989, 1990, and 1991 (NSF 90-327).

[b]National Institute of Standards and Technology (NIST).

[c]National Oceanic and Atmospheric Administration (NOAA).

[d]Intramural research at the Department of Energy includes R&D activities at two government-owned and -operated laboratories. The Department's R&D is primarily performed at government-owned, contractor-operated laboratories, which were not included in our review.

[e]Alcohol Drug Abuse and Mental Health Administration (ADAMHA).

[f]Centers for Disease Control (CDC).

[g]Food and Drug Administration (FDA).

[h]Federal Aviation Administration (FAA).

[i]National Highway Traffic Safety Administration (NHTSA).

[j]Environmental Protection Agency (EPA).

[k]Tennessee Valley Authority (TVA).

Agencies supplied data for 11 years from fiscal years 1981 through 1991, reflecting the federal resources that have supported the development and transfer of technology and the income that has resulted from government-employee inventions. Resource and income data include personnel levels; the number of inventions reported, generating income, and newly licensed each year; and the amount of income earned by each invention. Because documentation, particularly in the years preceding FTTA's enactment, was not always readily accessible, we asked agency officials to estimate these data, to the extent necessary, using existing documentation and knowledge of prior program activities and budgets.

To compare scientists' interest in patenting among agencies, we developed a common standard—an invention-reporting rate—by dividing the number of invention disclosures submitted by the number of R&D scientists for each year. Although anyone can be an inventor and the royalty-sharing program extends to all government employees, we used the number of R&D scientists to determine the invention-reporting rate because a higher number of government-employee inventors are likely to be engaged in R&D than in other kinds of government activities.

To examine the changes possibly caused by establishing royalty sharing under FTTA, we subtracted the average of scientists' invention-reporting rates for the 5 years after the law was passed from the average rate for the

6 years before the law's enactment. Around this difference we calculated a 95-percent confidence level—an upper and lower bounds—that shows the possible range for that difference in 95 out of 100 samples. If that difference was shown to be statistically significant, then the agency's rate showed real improvement for the 5 years after FTTA's enactment. Conversely, if the difference was not statistically significant, then the rate at which the agency's scientists reported inventions did not improve, and we assumed then that the interest of the agency's scientists in patenting did not increase.

To show the support that each agency had provided for transferring patentable technology and, in turn, the extent to which the agency had realized royalty sharing for its scientists, we analyzed each agency's invention-licensing rate for the 6 years before and the 5 years after FTTA's enactment. The comparison of licensing rates was based on the average of the number of inventions licensed for the first time during a year. The rates excluded any additional licenses signed with other companies for the same invention in that same year or any inventions that remain licensed in subsequent years.

To review the distribution of invention income to inventors and the disbursement and use of invention income by agencies, (1) we obtained agencies' financial records and schedules to verify amounts of invention income that agencies received and subsequently paid to inventors and the dates on which they received and paid this income, and (2) we accepted summaries prepared by the agencies indicating how the laboratory shares of invention income had been disbursed and used. Invention income totals are reported for the fiscal year in which the income for each invention was received by the agency. Our analysis of the agencies' laboratory share of invention income covers each agency's income for fiscal years 1987 through 1990 to allow the consistent comparison between agencies of disbursement and use data in June 1991.

In addition, we obtained invention income data on the AIDS test kit and verified payments to inventors. We obtained and examined documents from the Department of Health and Human Services and from the French and American AIDS Foundation made available to us by the Public Health Service's General Counsel. We did not review the use of the French and American AIDS Foundation funds returned to NIH and subsequently deposited in the NIH Director's Gift Fund.

To obtain the views of existing and potential inventors in a variety of research disciplines, we conducted nine focus groups—eight groups with scientists who had and had not reported inventions and one group with research leaders—at federal laboratories across the United States. Participants in the focus groups for existing inventors were recruited from lists of scientists who had submitted invention disclosures to their agencies after FTTA's enactment. We selected participants in the focus groups for potential inventors from lists prepared by the agencies or by laboratory management of the "best" or most productive scientists who had not submitted any invention disclosures since 1987. Appendix I identifies the laboratory locations and specific characteristics of each focus group.

Because focus groups use a style of moderation that elicits opinion spontaneously, specific topics of discussion varied within and among our focus groups. General questions addressed in the groups included (1) what scientists like about doing research at federal laboratories, (2) what motivates scientists to report inventions and seek to have them commercialized, and (3) how the government could increase scientists' motivation to patent inventions. In addition, we asked the participants about royalty sharing at their laboratories, their experiences in reporting inventions, and their opinions about federal technology transfer policy. Because the results of the focus groups presented in this report are based on the perceptions and experiences of selected scientists, they may be representative of some groups within the federal scientific population but cannot be generalized to the entire scientific population.

We also interviewed laboratory directors and top-level agency officials in charge of technology transfer, research, patenting and licensing activities, and financial management to obtain their views on the impact of royalty sharing at their laboratories.

We performed our review between October 1990 and September 1992 in accordance with generally accepted government auditing standards.

Royalty Sharing Has Had Little Impact on Scientists' Interest in Patenting

Federal scientists' interest in patenting appears generally unaffected by the existence of FTTA's royalty sharing. Although the act's royalty-sharing arrangement enabled federal scientists to share in the commercial sales of their inventions, the overall rate of reporting inventions for R&D scientists at 21 agencies before and after the act was unchanged. Rates at 14 agencies—representing 67 percent of the R&D scientists and 86 percent of the federal scientific work force in 1991—showed no real improvement after the act's enactment. Real improvement at six of the seven other agencies could be attributed to the effects of scientific, legal, or other legislation on patenting activity that preceded or coincided with FTTA rather than to the implementation of royalty sharing. Furthermore, this limited impact on federal scientists' motivation to patent may also reflect (1) the limited number of inventors who begin receiving royalty payments every year because the number of inventions licensed by most agencies has increased only modestly since the act's passage, (2) the small number of federal scientists—fewer than 2 out of every 1,000—who received a share of invention income, and (3) the limited amounts of invention income collected by most agencies annually.

Comments from federal scientists who participated in focus groups further underscore a laboratory culture that

- believes that patents for inventions should be sought for reasons other than obtaining financial rewards,
- values peer recognition of research achievements,
- is wary of any restriction or delay in publishing or discussing research results with peers such as might result from reporting inventions, and
- believes that collaboration on research between federal and private-sector scientists is difficult because of incompatibilities in the two groups' research objectives and time frames to achieve results.

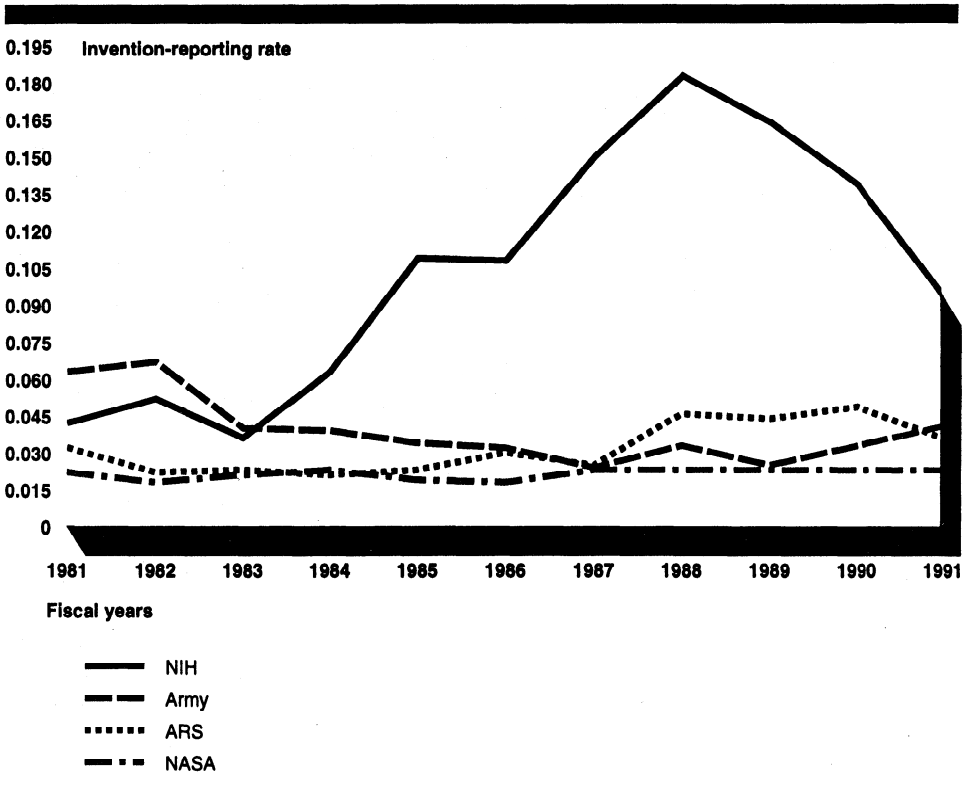
Invention-Reporting Rates Have Not Improved Since Royalty Sharing Began

The governmentwide implementation of FTTA's provision to reward federal scientists with a share of their invention's royalties has not enhanced federal scientists' interest in patenting. Each agency has its own intrinsic invention-reporting rate that reflects the general level of interest that the agency's scientists have in patenting. For example, TVA scientists have the highest average annual invention-reporting rate for the 11-year period from fiscal year 1981 through fiscal year 1991—about 0.2 invention disclosures per R&D scientist. In contrast, nine agencies—the Forest Service, NOAA, FDA, the Fish and Wildlife Service, the Geological Survey, the Coast Guard, FAA, NHTSA, and EPA—have fewer than 0.02 disclosures per scientist for the

same period. Table II.1 shows the overall number of invention disclosures and R&D scientists, the R&D operating budget, and the invention-reporting rate for each agency by fiscal year.

Figure 2.1 selects four principal agencies reviewed for this report and illustrates how the scientists' invention-reporting rates at these four agencies have varied annually between fiscal years 1981 and 1991.

Figure 2.1: Trends in Invention-Reporting Rates at Selected Principal Agencies



As figure 2.1 shows, both ARS's and NIH's invention-reporting rates have increased slightly since 1981, but NIH's rate began to increase before the enactment of FTTA's royalty-sharing provision and then began falling consistently, starting in fiscal year 1988, to fiscal year 1986 levels. In contrast, NASA's invention-reporting rate has remained fairly constant for the whole 11-year period. Army's rate, which fell after fiscal year 1982, had not reached the reporting-rate highs of fiscal years 1981 and 1982 by fiscal year 1991.

Confidence level analysis performed on the annual averages of invention-reporting rates before and after FTTA's enactment indicates whether the implementation of royalty sharing has increased interest in patenting among federal scientists. Table 2.1 shows the averages of each agency's annual invention-reporting rate before and after FTTA's enactment as well as the agency's corresponding category of improvement.

Table 2.1: R&D Scientists' Invention-Reporting Rates by Agency Before and After FTTA's Enactment

	Average of the R&D scientists' invention-reporting rates per year		"Real" improvement[a]	
	Fiscal years			
Department/agency	**1981-86**	**1987-91**	**Yes**	**No**
Agriculture				
ARS	.025	.040	X	
Forest Service	.009	.008		X
Commerce				
NIST	.029	.028		X
NOAA	.002	.003		X
Defense				
Air Force	.039	.034		X
Army	.043	.032		X
Navy	.047	.039		X
Energy	.045	.106	X	
Health and Human Services				
ADAMHA	.006	.024	X	
CDC	.003	.024	X	
FDA	.008	.019	X	
NIH	.069	.141	X	
Interior				
Bureau of Mines	.022	.012		X
Fish and Wildlife Service	0	.001		X
Geological Survey	.003	.002		X
Transportation				
Coast Guard	0	.002		X
FAA	.008	.010		X
NHTSA	.002	0		X
EPA	.008	.007		X
NASA	.020	.023	X	
TVA	.216	.201		X
Agencies' overall average	.032	.032		X

[a]Real improvement was determined by observing a statistically significant difference between the average rate before and the average rate after FTTA's enactment. The determination of statistical significance was calculated by an analysis of the 95-percent confidence level around each agency's difference in rates.

Analysis of the statistics in table 2.1 shows that invention reporting at 14 agencies has not shown real improvement since 1986, indicating that the royalty-sharing program has had little impact on potential inventors at these agencies.

Analysis of the confidence level around scientists' invention-reporting rates at seven other agencies does show some real improvement. However, this improvement could be the result of things other than the initiation of royalty sharing. According to officials at the U.S. Patent and Trademark Office and NTIS, increased interest in patenting inventions at agencies whose research is generally considered to be of interest to biotechnology-influenced industries—ARS, ADAMHA, CDC, FDA, and NIH—might be attributable (1) to the rapid advent of those biotechnology-influenced industries and (2) to the creation of a new invention-reporting area. The new area was made possible by technology that allowed products of nature to be re-created in the laboratory, followed by (1) a Supreme Court decision in 1980 allowing the U.S. Patent and Trademark Office to grant patents on laboratory-created natural products and (2) the 1985 and 1987 administrative decisions by the U.S. Patent and Trademark Office establishing that plants, under general utility patent provisions, and animals are patentable subjects. Similarly, Energy's increase in reporting rates cannot be attributed solely to sharing royalties. According to officials from Energy laboratories, commercial interest in reducing fossil fuel pollution and legislation in the mid-1980s promoting clean coal technology were major influences in scientists' interest in patenting.

The difference in invention-reporting rates for the seventh agency, NASA, qualified statistically as significant but in practical terms was considerably smaller than the difference in rates for the other six agencies that showed improvement.

Increases in Licensing Rates Are Too Modest to Support Incentive

Increases in the number of federal inventions that are licensed are too modest to increase scientists' motivation to patent an invention. An inventor may be awarded a patent for an invention, but unless an agency is successful in securing a licensee for the patent or patent application, no invention income will be earned and therefore no royalty-sharing payment can be made to the inventor. As long as the number of inventions licensed every year remains about the same, the number of inventors eligible for rewards will not increase significantly.

Table 2.2 shows the average number of inventions licensed for 21 agencies for pre- and post-statute periods and the increase or decrease after FTTA's enactment. (See table II.2 for further details.) Between fiscal years 1981 and 1986, the average number of inventions licensed annually was 68.6.[1] For the 5 years after 1987, it was 86.8 inventions, corresponding to an average annual increase of 18.2 inventions for all 21 agencies.

[1]Before FTTA's enactment, ARS and NASA primarily granted nonexclusive, royalty-free licenses on their patents. It was thought that a nonexclusive license led to little commercial effort by the licensee. Since enactment of the royalty-sharing program, both ARS and NASA grant only royalty-bearing licenses.

Table 2.2: Agencies' Invention-Licensing Rates Before and After FTTA's Enactment

Change in number of inventions licensed

Department/agency	Average of number of inventions licensed per year — Fiscal years 1981-86	1987-91	Change
Agriculture			
ARS	4.2	18.2	+14.0
Forest Service	0.8	0.6	–0.2
Commerce			
NIST	1.7	1.6	–0.1
NOAA	0.2	0.6	+0.4
Defense			
Air Force	1.2	2.0	+0.8
Army	0.7	3.2	+2.5
Navy	10.2	9.2	–1.0
Energy	0.3	0.2	–0.1
Health and Human Services			
ADAMHA	0.8	0.2	–0.6
CDC	0	0.6	+0.6
FDA	1.0	0.6	–0.4
NIH	17.5	29.6	+12.1
Interior			
Bureau of Mines	0.8	3.2	+2.4
Fish and Wildlife Service	0	0	0
Geological Survey	0	0.2	+0.2
Transportation			
Coast Guard	0	0.2	+0.2
FAA	0	0	0
NHTSA	0.2	0	–0.2
EPA	0	0.2	+0.2
NASA	23.8	14.2	–9.6
TVA	5.2	2.2	–3.0
Total	**68.6**	**86.8**	**+18.2**

The overall increase of 18.2 inventions licensed since fiscal year 1987 primarily reflects improvements of more than two inventions licensed per year at four agencies: ARS, the Army, NIH, and the Bureau of Mines. At the

other agencies, the invention-licensing rates for nine declined, for two remained at zero, and for six increased by less than one invention per year.

Officials responsible for licensing at NIH and ARS said that the increased number of inventions they have been able to license is a result of both the dedication of additional resources to locating licensees and the increased interest shown by companies whose products are based on the technology developed by their agencies. Officials at the Bureau of Mines did not indicate any change in their efforts to license inventions after FTTA's enactment. An Army official in charge of technology transfer implementation attributed his agency's increase in licensing activity to the creation of an extensive network of laboratory representatives whose primary responsibility was to secure licensees.

The Acting Director of NTIS's Office of Patent Licensing predicts slow, steady growth in the licensing of patented inventions. The Acting Director said that the federal laboratory system does not produce a large amount of the kind of technology that would support an explosive growth in licensing. He also attributed increases in federal-invention licensing to agencies that primarily develop biotechnology-based inventions, citing (1) the growth of the private-sector industry influenced by biotechnology; (2) increased awareness, generated by the Stevenson-Wydler legislation in 1980, of the desirability of commercializing federal technology; and (3) the government's dedication of some additional federal resources toward licensing its inventions.

Motivation Created by Royalty Sharing Is Limited

Few potential inventors have the opportunity to observe their colleagues benefiting from royalty sharing. In the 5 years between fiscal years 1987 and 1991, fewer than 2 out of every 1,000 federal scientists—or about 300 at 21 agencies in laboratories across the country—have received a share of their invention's income.

The generally small amount of invention income to be shared and its uneven distribution across federal agencies further weakens any widespread motivation that the royalty-sharing program could stimulate. Between fiscal years 1987 and 1991, government-employee inventions returned a total of $35.8 million in income to 18 agencies. But over these 5 years, $25.2 million was returned to NIH from the AIDS test kit; $8.7 million was returned from inventions at ARS, ADAMHA, FDA, CDC, and other inventions at NIH; and $1.9 million was returned to the 13 other agencies receiving invention income in those years.

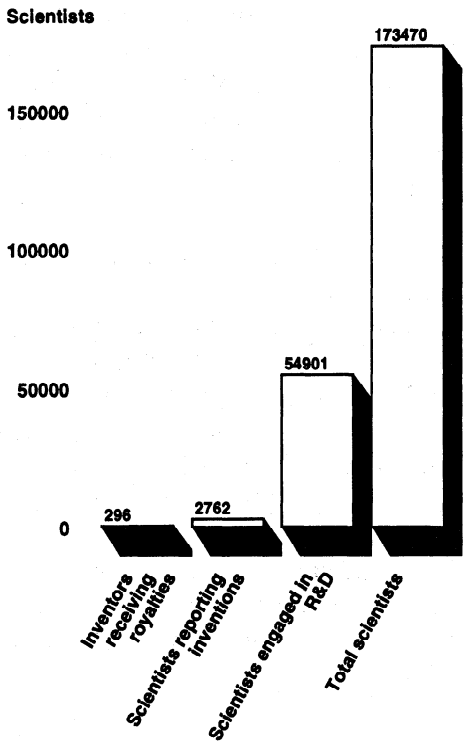
Few Scientists See Likelihood of Receiving Royalties

Given the small proportion of federal scientists who receive invention income, few scientists are likely to observe the benefits of royalty sharing directly from those receiving payments. In addition, the group of inventors rewarded with royalty sharing can remain largely the same because few new inventions are licensed every year and the number of licensed inventions can be further reduced by annual patent expirations and license terminations.

During focus group discussions, many federal inventors already holding patents told us that they had little expectation of receiving royalty payments. Many suggested that they were as likely to increase their income through royalty sharing as through buying one lottery ticket weekly. One agency patent counsel who has counseled aspiring inventors for many years explained that many of the ideas that scientists find new and exciting are not of commercial interest. He said that encouraging inventors with the promise of large financial rewards was not realistic.

Figure 2.2 shows, on the basis of a 5-year average, the proportion of all of the 173,000 federal scientists at the 21 agencies that (1) received royalties, (2) reported inventions, and (3) were engaged in R&D.

Figure 2.2: Percentage of Federal Scientists Affected by Royalty Sharing, Fiscal Years 1987-91



0.17 percent of all scientists receive royalties

1.59 percent of all scientists are reporting inventions

31.65 percent of all scientists are engaged in R&D

Note: Numbers are 5-year averages.

Annual averages for fiscal years 1987-91 indicate that one-third, or about 55,000, of the federal scientists at 21 agencies were engaged in R&D. Over the same 5 years, about 2,800 scientists reported inventions in hopes of receiving a patent, and about 300 inventors benefited through royalty sharing.

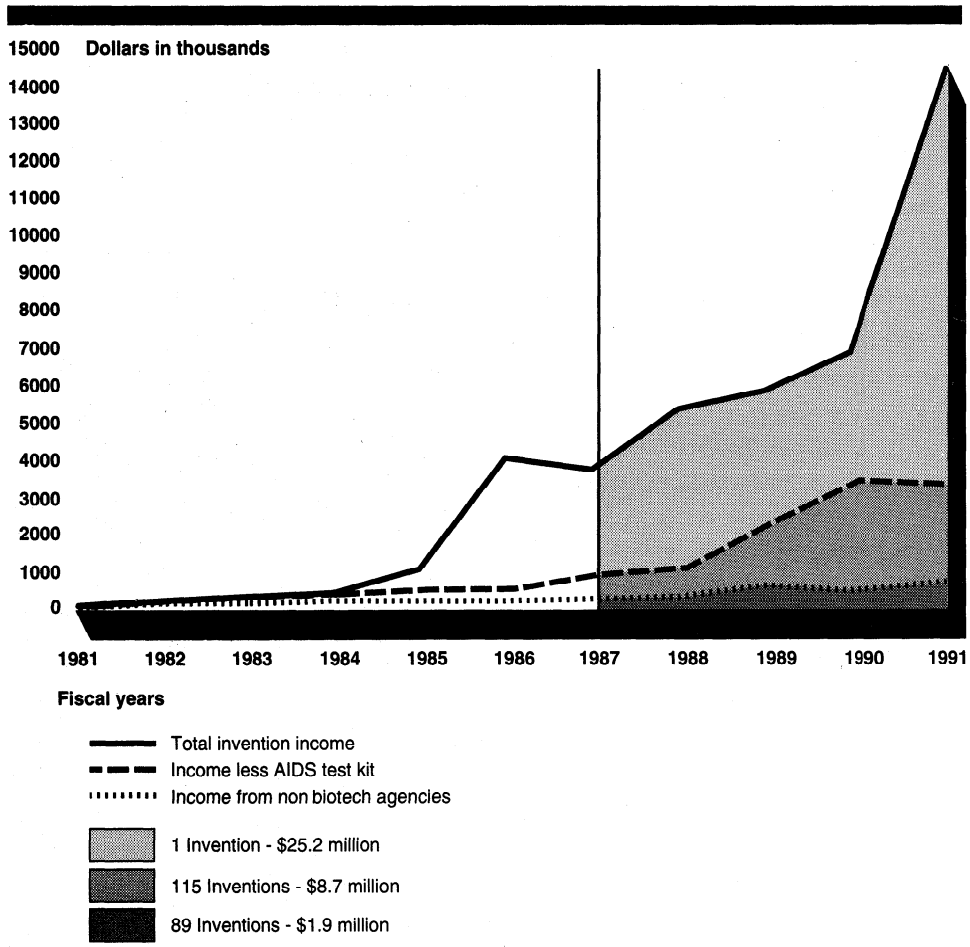
Invention Income Is Concentrated in Agencies That Transfer Biotechnology

In fiscal year 1991, 244 licensed employee inventions earned the government $14.4 million in invention income, including a $6.3-million, one-time payment to NIH and NTIS to settle a contract dispute with an existing licensee of the AIDS test kit patent. [2] (Table II.3 shows invention income data for each agency for fiscal years 1981-91.) However, if total invention income for the 5 years, from fiscal years 1987 to 1991, is broken down by agency, almost 95 percent ($33.9 million of $35.8 million) was earned by employee inventions at five agencies—ARS, ADAMHA, CDC, FDA, and NIH—where much of the R&D is related to biotechnology.

Figure 2.3 divides federal invention income into three parts. The top line represents the total invention income earned by 21 agencies (including income from the fiscal year 1991 AIDS test kit settlement mentioned above), the middle line subtracts the AIDS test kit income from the total invention income for all of the agencies, and the bottom line represents invention income for 16 agencies—the Forest Service, NIST, NOAA, the Army, the Navy, the Air Force, Energy, the Bureau of Mines, the Geological Survey, the Fish and Wildlife Service, the Coast Guard, FAA, NHTSA, EPA, NASA, and TVA—whose inventions do not generally involve biotechnology.

[2]The royalties were compensation for a contract dispute between an existing licensee and the federal government, which took place from fiscal years 1987 to 1990. However, the payment was received during fiscal year 1991.

Figure 2.3: Trends in Total Invention Income, Fiscal Years 1981-91



Note:A one-time payment of $6.3 million was received in fiscal year 1991 to settle a contract dispute covering the AIDS test kit. The settlement covered royalties due the government from fiscal years 1987 through 1990.

For fiscal years 1987-91, the number of inventions specified for each section is a 5-year average.

For the 5 years between fiscal years 1987 and 1991, invention income and the annual average of the total of 205 inventions breaks down as follows:

- About $25.2 million from one invention—the AIDS test kit—was returned to NIH.
- About $8.7 million from 115 inventions, or about $76,000 per invention, was returned to ARS, ADAMHA, CDC, FDA, and NIH.

- About $1.9 million from 89 inventions, or almost $22,000 per invention, was returned to agencies involved in developing applications for technologies that, in most cases, are unrelated to biotechnology.

Furthermore, in 5 years, the royalty-sharing program has distributed a total of $3 million in invention-income payments to about 300 federal scientists. But when the payments totaling $1.5 million to three inventors for the government's single largest income earner—the AIDS test kit—are subtracted from the 5-year total of $3 million, the remaining group of inventors is left sharing $1.5 million. This means that over the 5-year period, the remaining 297 inventors have received an average of about $1,000 annually from royalty sharing.

Cultural Barriers Hamper Effectiveness of Incentives

Monetary payments of nominal sums to inventors represent a less-than-optimal reward for scientists who have developed, or might develop, a commercially useful invention. According to many scientists participating in our focus groups, the recognition of their research accomplishments by their professional peers and the personal pride they feel when others use their inventions are more rewarding than money. The scientists contrasted the values guiding scientific research and industry practices, pointing out that good research depends upon open communication among researchers, whereas industry places a premium on controlling access to research results. They discussed the difficulty in reconciling the demands of research and industry to make public/private collaboration possible. In particular, they noted that the private sector, unlike federal laboratories, needs successful commercial application and shorter time frames for achieving results.

Many Scientists Prefer Recognition to Financial Rewards for Inventing

Many of the focus group participants, both those who had and those who had not reported inventions after 1986, said that they had not reported, nor would they report, inventions so that they could earn money over and above their government salaries. Many of these scientists said that they wanted to work at federal laboratories because these laboratories provided an independent, creative, and competitive yet cooperative environment for their research.

Scientists with prior experience in inventing explained the personal fondness they felt for inventions resulting from their research. They said that the development of these inventions had become a central and consuming focus of their professional lives. They said that they do not

generally report inventions in hopes of receiving a financial reward. On the contrary, they feel rewarded when their invention receives a patent because a patent confirms the utility of their research. For these inventors, the value of patenting comes when they see many people using their inventions.

Many inventors held little expectation that their inventions would be licensed or commercially successful enough to produce royalties. Nevertheless, some inventors did say that the expectation of receiving royalties of more than nominal sums would affect their motivation to report and patent inventions. In fact, several inventors said that rewarding inventors from their inventions' royalties provided symbolic recognition of the positive value that inventors ascribed to their own inventions. Several inventors compared the pride they felt for their inventions to a parent's pride in his or her child.

During focus group discussions, scientists also said that a patent protects their accomplishment from being claimed by others and heightens an inventor's sense of personal achievement because a patent demonstrates that the inventor has accomplished something no one else has done before. One inventor said that the pride he felt when he learned of his patent was probably equal to the pride Newton felt when he discovered gravity.

Many other scientists, however, said that they prefer publishing their work in scientific journals or presenting their research at professional conferences to seeking a patent. Publication provides peer recognition for their research accomplishments. Scientists in the focus groups also spoke of the importance of freely and openly exchanging ideas and emphasized the serious limitations that seeking a patent can impose on communicating with scientific colleagues outside their laboratory.[3] Good research, they said, needs peer assessment of ideas, and restrictions on communication make the laboratory environment less attractive and lower the quality of the resulting technology.

Public and Private Laboratory Cultures Are Traditionally Incompatible

Collaboration on research between government and industry, some scientists said, is hampered by major and inherent cultural differences. Focus group participants said that they choose to do research for the government because it allows them to be creative and offers

[3]Restrictions are generally recommended on domestic and foreign patent filings to protect intellectual property claims. According to Agriculture officials, disclosure concerns can be reduced, in some cases, through use of confidentiality agreements.

independence, not because it pays them high salaries. They described the government as the primary supporter of basic, or fundamental, research. Federal research is important, they said, because it lays a foundation for industrial application or product development. It is not unusual for federal R&D programs to have a 5- to 10-year schedule to reach their research objectives. In contrast, private-sector research has to be short-term, have an applied focus, and have "making money" as its goal. As a result, these scientists saw collaboration between government and industry scientists as difficult at best.

An undercurrent of suspicion also emerged during focus group discussions, in part because federal scientists said that their R&D budgets are growing tighter. Some viewed federal technology transfer initiatives, particularly FTTA's policy to increase collaboration with industry, as the government's way of forcing federal scientists to replace federal support with private-sector sponsorship. They said that if federal financial support for basic research was substantially scaled back, the critical mass of scientific knowledge would shrink, and ultimately the budget reductions would have a negative effect on the development of commercially useful technology.

Conclusions

Our analysis of invention-reporting and invention-licensing rates, supported by our focus group discussions with federal scientists, indicates that royalty sharing has provided a limited incentive for patenting during the past 5 years. When improvement in scientists' interest in patenting has occurred, it has coincided with major events unrelated to governmentwide royalty sharing. On the basis of the frank discussions that took place during focus groups about the scientists' motivation to do research, invent, and patent, we believe the invention-reporting rate improvements at the seven agencies where improvement occurred are no more attributable to the presence of the financial incentive afforded through royalty sharing than to the development of specific technologies followed by events outside federal laboratories, such as major product innovations and related new industries.

Furthermore, royalty sharing has done little to change the traditional culture of the research laboratory. Although we believe that few people would refuse legally earned money given freely, we conclude from scientists' opinions that the availability of monetary rewards has stimulated only minimal motivation for inventors to report and commercially develop more of their inventions.

Agencies Need to Improve Their Implementation of Royalty Sharing at the Laboratories

FTTA provided a structure for royalty sharing so that both the inventor(s) and others at the laboratory where the invention occurred could experience the financial benefit of government-employee inventions. However, royalty-sharing formulas selected by 17 of the 21 agencies often reduce royalties that inventors can receive even though none of the formulas establish distributions to inventor(s) of less than the 15-percent minimum required by law. Because the income from most inventions falls below $10,000 annually, more than one inventor is typically responsible for an invention, and payroll deductions are subtracted from each inventor's royalty payment, qualifying inventors often receive only a few hundred dollars annually for each invention. When the extra work required to patent a federal invention and the time that elapses before inventors receive their first payment are factored in, any positive impact on the incentive character of the royalty-sharing program is diminished. Furthermore, efforts by agency management to enhance the motivation of existing and potential inventors generally have not been employed, making laboratory scientists' awareness and understanding of the program low.

In addition, seven of the eight agencies from which we requested procedural information lack adequate financial control of payments to inventors. Therefore, they cannot ensure that proper payments to all appropriate inventors have been made. Through conversations with several inventors and agency officials, we identified four cases in which government-employee inventors had missed or received delayed payments.

The laboratory's share of invention income has generally not been used in a manner that is visible or tangibly benefits potential inventors. Some agencies have used all or almost all of the laboratory's share to reimburse costs for technology transfer activities and not in laboratory areas where scientific activities are performed. NIH, for example, has transferred 80 percent of about $25.2 million ($20.1 million) earned from the AIDS test kit to a nonprofit private foundation. These payments were made pursuant to a settlement agreement resolving ownership rights to the invention. NIH officials consider this transfer to be authorized under FTTA as payment of expenses incidental to the administration and licensing of inventions.[1] Some of the foundation's money, received originally by NIH as a result of licensing agreements for the AIDS test kit patent, is then returned by the foundation to NIH annually as an award. NIH officials have then chosen to

[1]Expenses for the administration and licensing of inventions are some of the costs associated with administrative functions of technology transfer.

deposit this money in the NIH Gift Fund in a discretionary account for the NIH Director.

Agencies' use of the laboratory's share of invention income has also left some laboratory directors with little or no benefit from royalty sharing. Several laboratory directors said that they were not being included in decisions that agency management was making to determine the use of their laboratory's share of invention income.

Agencies have done little to overcome existing procedural impediments to an inventor's pursuit of a patent. For example, many scientists are dissatisfied with their access to advice and information on what is patentable subject matter and how to determine the commercial desirability of their invention. In addition, scientists said that their agency's process for selecting inventions to patent was slow, arbitrary, and sometimes biased.

Agencies' Distribution of Invention Income Between Inventors and Laboratories

FTTA directs agencies to distribute invention income between inventors and laboratories and allows agencies up to 2 years to use the laboratory's share of the income before returning the unused amount to the U.S. Treasury. Table 3.1 reflects the distribution between inventors and agency laboratories for the 13 agencies that earned invention income from fiscal years 1987 through 1990, as reported to us on or before June 1991.

Table 3.1: Distribution of Agencies' Invention Income for Fiscal Years 1987-90

Department/agency	Total invention income	Total payments to inventors[a]	Laboratory's share of invention income
Agriculture			
ARS	$1,190,599	$178,388	$1,012,211
Forest Service	3,407	511	2,896
Commerce			
NIST	209,859	31,164	178,695
NOAA	18,799	2,752	16,047
Defense			
Air Force	125,858	29,509	96,349
Army	42,205	14,547	27,658
Navy	308,339	75,904	232,435
Health and Human Services			
ADAMHA	426,807	68,005	358,802
FDA	109,310	13,371	95,939
NIH	24,630,514[b]	1,664,035[c]	11,161,714[d]
Interior			
Bureau of Mines	185,820	24,274	161,546
NASA	288,596	206,517	82,079
TVA	169,836	25,482	144,354
Total[e]	**$27,709,949**	**$2,334,459**	**$13,570,725**

(Table notes on next page)

Source:Agencies' work orders, payment vouchers, or other official documentation showing receipt and payment of invention income.

[a]Inventors were entitled to income in this amount from 1987 through 1990 but may not have received payment in the same fiscal year as their agencies did. In addition, circumstances have occurred and could occur in which total agency payments to all inventors were or would be less than the 15-percent distribution for an individual invention's income established by FTTA. For example, the AIDS test kit inventors each receive $100,000—a figure that corresponds to FTTA's statutory annual limit for an inventor, not to the actual 15 percent of their invention's income.

[b]NIH invention income includes $18.34 million for fiscal years 1987-90 and $6.29 million paid to NIH in settlement of a contract dispute that covered 1987-90.

[c]The $1.7 million in payments to inventors cannot be verified because the documentation provided to us revealed inconsistencies between NIH's Division of Financial Management payment vouchers and Office of Technology Transfer records.

[d]The laboratory share of NIH's invention income does not include $7.87 million accumulated in the NIH Director's Gift Fund that comprises $6.97 million of the French and American AIDS Foundation money awarded to NIH and $894,396 in interest earned by investing the Foundation's awards. Furthermore, we could not reconcile $29.1 million in expenditures ($1.7 million in inventor payments, $16.24 million in Foundation transfers, and $11.16 million in laboratory expenditures of royalties), to $24.6 million in NIH's invention income. Therefore, $11.16 million is the sum of the amounts reported by NIH laboratories, NTIS, and NIH's Division of Financial Management.

[e]The total invention income does not equal the total payments to inventors plus the total laboratory shares because we could not reconcile NIH's income figures.

Additional Action Could Enhance Inventors' Motivation

During focus group discussions, inventors described the pride they take in learning that their inventions are a commercial success. Yet 17 of the 21 agencies use royalty-sharing formulas that pay an inventor a small percentage of the invention's typically low annual income. In fact, if the invention has several inventors, as is frequently the case, the payment from the percentage formulas these agencies use must be shared by all the inventors. As a result, after years of effort, the amount of money many inventors receive can be disappointingly small and do little to reinforce the pride and satisfaction they take in inventing.

Agency management is not taking advantage of opportunities to provide information about the benefits of royalty sharing and to recognize inventors' achievements, both of which could build program awareness. Focus group participants displayed little awareness of the royalty-sharing program, and some inventors, who had reported inventions after royalty sharing was established, said that their invitation to participate in a GAO focus group had introduced them for the first time to royalty sharing. Furthermore, scientists reacted with apprehension when focus group questions addressed the government's interest in public/private collaboration.

Most Agencies' Formulas Lead to Small-Sized Rewards

FTTA gave agency heads the flexibility to develop their own formulas for distributing income to inventors as long as inventors received the 15-percent minimum and each less than $100,000 per year, as established by FTTA. Table 3.2 shows that the agencies' royalty-sharing formulas fall into three categories:

- The single-percentage formula is used by 11 agencies; through this formula, 15 or 35 percent of the invention income is paid to one inventor or divided among multiple inventors, and 85 or 65 percent, respectively, is reserved for the agency laboratory.
- The sliding-scale formula is used by six agencies; through this formula, one inventor receives 25 percent (or multiple inventors divide the 25-percent share) of the first $50,000 of invention income, 20 percent of the next $50,000, and 15 percent of the invention income above $100,000, while any remaining income goes to the laboratory.
- The threshold formula is used in two different ways by four agencies. Three agencies annually pay their inventors the greater of either (1) 100 percent of the first $1,000 of invention income received for each inventor or (2) 20 percent of an invention's income divided equally among multiple inventors. The other agency annually pays each inventor 100 percent of the first $2,000 of invention income, and once that threshold has been reached for each inventor, an additional 20 percent of any invention income over the threshold is divided equally among all inventors.

Table 3.2: Agencies' Formulas for Distributing Income to Inventors

Formulas in percent	
Formula	**Agencies**
Single percentage	
15	ARS[a] Bureau of Mines Energy FDA[b] Fish and Wildlife Service Forest Service[a] Geological Survey NIST[c] NOAA[c] TVA
35	EPA
Sliding scale	
25 ($1-$50,000) 20 ($50,001-100,000) 15 (Over $100,000)	ADAMHA[d] CDC[d] Coast Guard FAA NHTSA NIH[d]
Threshold	
100 of $1,000 per inventor or 20, whichever is greater	Air Force Army Navy
100 of $2,000 20 thereafter	NASA[e]

[a]25 percent, beginning in fiscal year 1991.

[b]FDA pays 15 percent to inventors. After patent costs for each invention have been covered, the inventor will begin to receive 35 percent. According to an FDA official, the agency has yet to pay the 35-percent rate to any inventors.

[c]30 percent, beginning in 1992.

[d]Health and Human Services calculates income in these ranges cumulatively over the life of the license, not annually.

[e]A NASA official said that a NASA license typically has only one patent.

Many focus group participants said that they had not previously, nor would they in the future, report inventions to their agencies simply to earn additional money, but—somewhat paradoxically—several scientists said that rewards of several thousand dollars would begin "to get their attention." They also said that the work and time required to get a patent—extra work and time beyond that needed by federal scientists to accomplish their typical scientific responsibilities—diminishes the

incentive value of rewards of less than $1,000. The payments become even smaller when the inventor's share of the royalty is divided among a number of co-inventors and may subsequently be reduced by taxes and other payroll withholding. One inventor said that about all he can do with his annual royalty payment is treat his laboratory colleagues to a pizza.

Typical Invention Income Ranges and Corresponding Payments to Inventors

For the 21 agencies evaluated, the average annual invention income earned after the enactment of FTTA has ranged from $77,400 for NIH to $0 for the Fish and Wildlife Service, FAA, and NHTSA. Further analysis for fiscal years 1987-91 indicates that the median, or midpoint, in the range of invention income for 21 agencies is $2,788. In addition, invention income for 15 of 21 agencies falls below the $9,237 mean, or average invention income for all 21 agencies. (See table II.3 for the number of inventions and the amount of associated income each agency has received for fiscal years 1981-91.)

Table 3.3 shows what payments for one, two, or three inventors would be for a single invention under the three different formulas, assuming the median of $2,788 and the mean of $9,237 per invention.

Table 3.3: Comparison of Hypothetical Annual Payments to Inventors

Formula Type		Number of		
Type	Percent	inventors	Median[a]	Mean[b]
Single	15	1	$418	$1,386
Sliding[c]	25	1	697	2,309
Single	35	1	976	3,233
Threshold	100 of $1,000 per inventor or 20, whichever is greater	1	1,000	1,847
Threshold	100 of $2,000, 20 thereafter	1	2,158	3,447
Single	15	2	209	693
Sliding[c]	25	2	349	1,155
Single	35	2	488	1,616
Threshold	100 of $1,000 per inventor or 20, whichever is greater	2	1,000	1,000
Threshold	100 of $2,000, 20 thereafter	2	1,394	2,524
Single	15	3	139	462
Sliding[c]	25	3	232	770
Single	35	3	325	1,078
Threshold	100 of $1,000 per inventor or 20, whichever is greater	3	929	1,000
Threshold	100 of $2,000, 20 thereafter	3	929	2,216

[a]The median, or midpoint, in the range of invention income for 21 agencies from fiscal years 1987 through 1991 is $2,788.

[b]The mean, or annual average, invention income for 21 agencies from fiscal years 1987 through 1991 is $9,237.

[c]Annual invention income—either the median of $2,788 or the average of $9,237—does not exceed the first ceiling of $50,000 on the sliding scale. Therefore, payments to inventors at agencies using the sliding scale that are calculated from incomes similar to the mean and median amounts are identical to payments calculated by using a single-percentage formula of 25 percent.

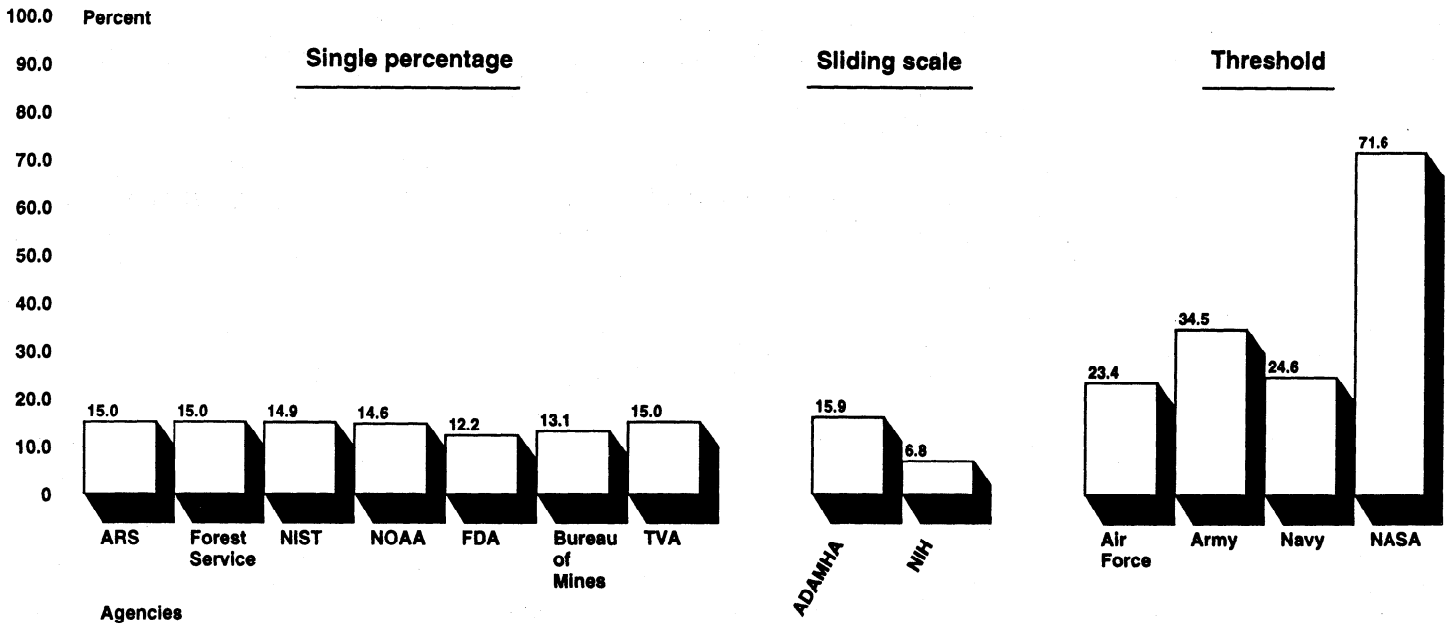
Because typical invention incomes fall between approximately $3,000 and $10,000 annually, the royalty-sharing distributions for 17 agencies are, in effect, produced by single-percentage formulas. Hence, inventors frequently receive payments that are lower than they would have been if sharing had been calculated by using a threshold formula. For example, if an invention developed by three inventors earns $5,000 during a given year

and the inventors' agency uses a distribution of 25 percent, each of the three inventors would receive a before-tax reward of $416.67. If the agency switched to a threshold formula such as that used by the Air Force, the Army, and the Navy, each of the three inventors would get $1,000. Under the NASA-style threshold, each of the three inventors would receive $1,667 ($5,000 divided by 3).

Figure 3.1 shows the percentage that inventor payments represent of each agency's invention income under the three types of royalty-sharing formulas.[2]

[2]For consistency with table 3.1, we have used invention income earned by agencies from fiscal years 1987 to 1990 to illustrate this analysis.

Figure 3.1: Percentage of Total Invention Income Shared With Inventors



For the four agencies that use a threshold formula, payments to inventors exceeded 15 percent of the agency's total invention income. NASA paid 71.6 percent, the Army paid 34.5 percent, the Navy paid 24.6 percent, and the Air Force paid 23.4 percent of their total invention incomes to all their inventors. In contrast, one agency that uses the sliding scale, NIH, and two agencies that use the 15-percent formula, FDA and the Bureau of Mines, paid their inventors 6.8 percent, 12.2 percent, and 13.1 percent, respectively, of their total invention incomes.

Officials at agencies that employ the threshold formula said that their agencies chose it because

- a threshold of 100 percent of the first $1,000 or $2,000 in income more adequately rewards their scientists when the invention's income is low (as is typically the case) and
- it reduces the accounting burden of dividing and controlling small sums of money.

Opportunities for Communicating With Inventors Missed

Generally, under incentive programs, rewards are intended to affect individuals' expectations. According to economists, expectation motivates action. However, 5 years after FTTA established the royalty-sharing program, many focus group participants could not describe any details associated with their agencies' implementation of the program or explain how the program might work to their benefit. When the subject was introduced during focus groups at eight federal laboratories, many scientists indicated that they had not known of royalty sharing's existence before reporting their inventions. In fact, some scientists asked the GAO focus group moderator to tell them about royalty sharing or about how it was working at their own agencies. Some focus group participants acknowledged that they had attended meetings introducing federal technology transfer at their laboratory but added that their memory of these meetings was limited. One laboratory manager said that he saw no need to tell his scientists about royalty sharing before they attempted to get a patent.

In addition, we found federal scientists apprehensive of research collaboration between the government and private companies. In response to questions about potential joint projects, several focus group participants stated that they believed they could be "jailed" if they attempted to establish a cooperative research project with industry. Several officials of one agency acknowledged their scientists' lack of

understanding in this regard: They said that an apparent inconsistency between federal policies governing conflicts of interest and encouraging technology transfer is fueling scientists' apprehension and insecurity about collaboration between government and industry. These officials said that, basically, technology transfer legislation encourages federal scientists to engage in joint endeavors with private industry. In contrast, scientists suggested that conflict-of-interest policy threatens government employees who have extensive contact with industry.

Opportunities for Recognizing Inventors Missed

Many agencies are not taking advantage of opportunities to increase their laboratory scientists' awareness of royalty-sharing programs by publicly recognizing inventors' successes. Presently, payment checks from ADAMHA, CDC, FDA, and NIH are processed by NIH's Division of Financial Management; and checks from ARS, the Forest Service, NIST, NOAA, the Bureau of Mines, the Geological Survey, the Coast Guard, and EPA (which have had their invention income and checks processed by NTIS) are mailed directly to inventors' homes rather than presented publicly at the laboratory where the invention occurred.[3]

Some of these scientists told us that their payments were not accompanied by any explanatory or congratulatory cover letter. For example, an NIST inventor said that what he initially thought was a computer error turned out, upon inquiry, to be a royalty payment. An NIH inventor said she is frequently reimbursed for government-related travel and is also entitled to royalties from several patents. Because she never knows when her check will be mailed and no information is enclosed with her royalty check, she frequently is not sure what the check covers or whether the amount of the royalty payment is correct. In contrast, NASA officials told us that each check that NASA sends to its inventors is accompanied by a letter explaining what the money is for, what phone number to call if questions arise, and how to handle the money for tax purposes.

Using every opportunity to recognize inventors is important because long periods—10 to 20 years—can pass between the reporting of an invention and the payment of royalties to inventors. ARS officials said that patent and technology transfer activities are considered as part of a scientist's evaluation for career advancement. These officials also said that directors at two of their laboratories publicly present the first royalty check to

[3]NTIS officials said that when the NTIS financial management division assumed responsibility for sending checks to inventors to distribute fiscal year 1990 invention income, the practice of enclosing explanatory or congratulatory notices ceased. Commerce now says that it intends to reinstate this practice.

inventors whose inventions have been licensed through ARS's own licensing office. Navy focus group participants spoke about how they appreciated the small wall plaques that they had received in the past to thank them for specific achievements. In addition, scientists in the NASA focus group described the professional recognition that their ideas receive when the ideas are published in NASA's Tech Briefs. A NASA official said that scientists' individual achievements are selected and featured in a color, glossy, commercial-format publication, which is circulated to 200,000 people in both the research and industrial community. Every issue contains a reader-interest return card to facilitate further contact with the featured scientist, and for every selection, NASA awards $150 to the scientist.

Financial Control of Payments to Inventors Is Weak

Seven of eight agencies that we asked did not describe adequate financial control systems that could ensure that all eligible inventors received their share of invention income in the correct amount in a timely manner. In response to our questions, agency officials at NIH, the Navy, the Bureau of Mines, NIST, ARS, and the Army described payment procedures that have no routine check or system in place to ensure that all eligible inventors have been paid the royalties to which they are entitled. FAA officials said that they have no system because they have no invention income.

In contrast, officials at NASA told us that they had instituted a new interoffice system in 1991 to ensure that inventors are paid. Invention income is sent to the headquarters' patent counsel, who maintains the license records. The receipt of royalties is acknowledged to the proper file, and the check is transferred to NASA's financial management office, where the payments to inventors are calculated. The accuracy of the payments is cross-checked by the patent counsel, and the payments are then mailed out from NASA headquarters with a cover letter, as mentioned earlier.

We were told of four cases of nonpayment at three agencies from fiscal years 1987 through 1991. In two cases, the Navy and the Bureau of Mines inventors, who had relocated but were still employed by the agencies to which licensees were paying royalties, discovered through chance communication with former colleagues that they were entitled to royalty payments. In another case at NIH, an inventor observed that an extended period of time had elapsed since she had received a royalty payment. The delay was finally determined to be a result of nonpayment by the licensee, but in all of the above cases, despite notification of the omission to

appropriate agency officials, inventors said that final resolution, including payments, involved extended negotiation with agency management.

The fourth case, also involving the Navy, occurred when royalty income was transferred from the laboratory comptroller to the laboratory personnel official designated to pay the inventors. According to a Navy laboratory official, the inventors were never paid because, by the time the omission was discovered, the statutory time limit on the use of invention income had expired and the funds had to be returned to Navy headquarters.

In commenting on our draft report, (1) Health and Human Services officials said that such control procedures will be established during fiscal year 1993; (2) TVA officials, although not asked as part of our review of eight agencies, said that they had been aware of this administrative problem and had instituted a corrective process as of April 1991; (3) Army officials told us that they had implemented a letter-to-inventor procedure, similar to the one described by NASA, after we explained the control problem to them during a meeting on this assignment; and (4) Navy officials said that they are currently studying the feasibility of several procedures for checking inventor-payment records.

Agencies' Use of the Laboratory Share of Income Does Not Enhance Motivation

Many potential inventors are unfamiliar with the benefits of the royalty-sharing program because, among other reasons, their agencies are not using the laboratory's share of the invention income to provide tangible benefits to scientists working in the laboratories. FTTA permits the laboratory's share of invention income to be used for "payment of expenses incidental to the administration and licensing of inventions." We found that some agencies use or retain virtually all of the invention income available to the laboratories to cover both fundamental and incidental legal and administrative costs of meeting technology transfer program objectives, such as routine legal research for patent claims, office equipment for technology transfer staff at headquarters, and all costs of securing licensees for future inventions.

As a result, none of the laboratory share of invention income is left to be used in a manner that is visible to scientists in the laboratory where they do their work. Even though FTTA provides that all of the invention income remaining after the distribution of income to inventors be given to the laboratories and further provides that agency management shall have some discretion in spending this income, many agencies do not use any of

the laboratory share of invention income in a way that would enhance laboratory scientists' motivation to patent.

In addition, NIH officials treat the French and American AIDS Foundation funds awarded to NIH as not being subject to FTTA. As a result, 70 percent of the money, potentially available to NIH laboratories for FTTA purposes, could be used for other activities.

Benefits to Laboratories Are Not Visible

Some agencies have used virtually all of the laboratory's share of invention income to cover the costs of administrative functions related to technology transfer, such as the patenting and licensing of inventions—activities that are not visible to laboratory scientists. Ideally, for the incentive to motivate potential inventors, some of the income should be used for something that laboratory scientists come into contact with or can use to further their research work. The provisions of FTTA whose effects are generally visible to scientists at the laboratories direct that the laboratory's share be used to provide rewards for scientific, engineering, and technical employees of the laboratory; scientific exchanges between government-operated laboratories; education and training of employees consistent with the agency's R&D mission; and other activities that increase the licensing potential for transfer of the laboratories' technology. In addition, some agencies have been slow in using their invention income.

Between 1987 and 1990, 13 agencies have received invention income as a result of government-employee inventions. Table 3.4 shows our analysis of how each agency had or had not used its share of income as of June 1991.

Table 3.4: Agencies' Use of Available Invention Income

Dollars in thousands

Department/agency	Total laboratory share of income	Technology transfer expenses[a]	Percent spent on technology transfer	Unused[b]	Percent unused	Laboratory-visible activities	Percent visibility
Agriculture							
ARS	$1,012	$991	98	$0	0	$22	2
Forest Service	3	3	100	0	0	0	0
Commerce							
NIST	179	179	100	0	0	0	0
NOAA	16	16	100	0	0	0	0
Defense							
Air Force	96	0	0	56	58	40	42
Army	28	0	0	27[c]	96	1	4
Navy	232[d]	50	21	108[d]	47	75	32
Health and Human Services							
ADAMHA	359	179	50	159	44	21	6
FDA	96	57	60	24	25	15	15
NIH	11,162	5,343	48	2,373	21	3,446	31
Interior							
Bureau of Mines	162	162	100	0	0	0	0
NASA	82	12	14	28	34	42	52
TVA	144	1	1	–5[e]	0	148	103

[a]These funds were used by the agency or by NTIS as authorized by client agencies, or they were held by NTIS for future technology transfer activity.

[b]These funds either were unused as of June 1991 or had been transferred to the U.S. Treasury because authority for spending them had expired.

[c]Approximately $7,000 of the Army's $27,000 in invention income was transferred to the U.S. Treasury. (See note b.)

[d]Includes $5,664 recorded as miscellaneous expenses.

[e]TVA officials told us that they had purchased an electron microscope by pooling their laboratory's share of invention income with other funds. The contribution needed from invention income created an internal bookkeeping deficit balance as of June 1991.

Five of the 13 agencies—ARS, the Forest Service, NIST, NOAA, and the Bureau of Mines—have used or held almost 100 percent of this income to cover the costs of administrative functions related to technology transfer—such as patent, licensing, or Office of Research and Technology Application

expenses—either at their agencies or at NTIS. In contrast, as of June 1991, the Army had not used 96.1 percent of its invention income, and 23.7 percent of its unused income had already been returned to the U.S. Treasury.

Incentive Not Made Tangible to Scientists at Laboratories

Some agencies are not using their share of invention income to support programs or activities that would help to motivate larger numbers of scientists or potential inventors at the laboratories. In our focus groups, scientists said that their interest in patenting would increase if the laboratory's share of invention income could be used to further their research or be applied to personnel development activities, such as travel to conferences or sabbatical leaves to pursue particular scientific interests. Table 3.5 shows our analysis of the total amount of invention income used for laboratory-visible purposes, such as the amounts used for personal employee awards, scientific exchange, training, and/or other activities that increase the licensing potential of the laboratories' technology.

Table 3.5: Amount and Use of Laboratory-Visible Invention Income

Dollars in thousands

Department/agency	Laboratory-visible share	Employee awards	Exchange	Education and training	Other activities
Agriculture					
ARS	$22	$22[a]	$0	$0	$0
Forest Service	0	0	0	0	0
Commerce					
NIST	0	0	0	0	0
NOAA	0	0	0	0	0
Defense					
Air Force	40	1	0	39[b]	0
Army	1	0	0	0	1
Navy	75	62	0	9	4
Health and Human Services					
ADAMHA	21	1	0	0	20
FDA	15	15	0	0	0
NIH	3,446	1,589	8	27	1,821
Interior					
Bureau of Mines	0	0	0	0	0
NASA	42	20[a]	0	0	22
TVA	148	0	0	0	148[c]
Total	**$3,810**	**$1,710**	**$8**	**$75**	**$2,016**

Note: Figures presented in this table are as of June 1991. Totals may not add because of rounding.

[a]These awards were frequently used to further compensate existing inventors receiving royalties.

[b]According to an Air Force official, one Air Force laboratory disbursed $20,000 of its invention income as an endowment to a local community college. The endowment created a program that covered the tuition costs for local high school students at a nearby community college who were employed part-time at the laboratory.

[c]TVA has used all of its invention income, combining it with a supplement from another source, to purchase an electron microscope that, according to TVA officials, advances the research of many laboratory scientists.

NIH Treatment of AIDS Foundation Funds Awarded to NIH Not Subject to FTTA

Under FTTA, the AIDS test kit, a government-employee invention, has earned $25.2 million for NIH. To resolve a dispute over property rights to this invention,[4] Health and Human Services officials have altered the typical disbursement of invention income for NIH with a settlement agreement. As part of the settlement agreement signed by U.S. officials (including the NIH Director) and French officials from the Pasteur Institute and by both countries' inventors (1) 80 percent of the AIDS test kit income is to be used to operate the French and American AIDS Foundation,[5] (2) the Department of Health and Human Services and the Pasteur Institute are to be listed as joint owners on the AIDS test kit patent, (3) the Foundation is to be nonprofit and autonomous from the parties agreeing to the settlement, and (4) the Foundation is to be governed by a board of trustees, currently including the Assistant Secretary for Health and the General Counsel in the Department of Health and Human Services, the Director of NIH, and Pasteur Institute officials.

The settlement agreement provided, among other things, that (1) Health and Human Services and NTIS would retain 20 percent from the invention's initial income, which Health and Human Services and NTIS officials say is used to pay NIH's AIDS test kit inventors and is shared with the laboratories, and (2) NIH would annually transfer the remaining 80 percent of invention income from U.S. government licenses to a New York law firm chosen to administer the Foundation and represent French interests.

After the Foundation receives a similarly apportioned contribution from the Pasteur Institute for the French-held licenses, 25 percent of both countries' pooled invention income is used for administering the Foundation and for researching the cause and treatment of AIDS and other related diseases. The settlement agreement is silent with respect to how the remaining funds are to be allocated each year. As a result, under a resolution by the Foundation's board of directors, the board directs every year that the remaining 75 percent of the pooled license income be divided into equal awards of 37-1/2 percent to be paid to NIH and to the Pasteur Institute.

NIH accepts this 37-1/2-percent share of Foundation money, some of which NIH originally obtained under FTTA's authority as income from licensing the AIDS test kit. This money, which Health and Human Services officials told

[4]The dispute involved who could claim credit for discovering this retrovirus, a laboratory-engineered infectious agent that is used to detect the infection that causes AIDS.

[5]The Foundation is dedicated to researching the cause and cure of AIDS and related diseases and provides a means for equalizing all the royalties resulting from all licenses of the patented invention.

us has "all the attributes of gifts," is deposited in the NIH Director's Gift Fund, an account that has no set term or limit for expenditure and from which the NIH Director can draw funds at his or her discretion for, among other things, travel and entertainment purposes. The Foundation's award money is invested in Treasury bills as directed by the NIH Gift/Fund Authority. As of November 1991, the Director's Gift Fund had collected about $6.97 million and accumulated an additional $894,396 in interest, for a total of $7.87 million. If this money had been added to $11.16 million, which is the laboratory's share of invention income from all NIH inventions for fiscal years 1987-90 (including the amount that remained after the AIDS test kit inventors had been paid from the original 20 percent of invention income), the funds available to the laboratories would have been 70 percent larger. Because the Foundation's money has been deposited in the Director's Gift Fund, the funds are then allowed to be used for purposes other than the technology transfer purposes specified by FTTA.

Health and Human Services officials have used a large amount of invention income to fund the Foundation established under the settlement agreement. Therefore, we requested and received the Department of Health and Human Services' view on this matter. According to the Department's General Counsel,

> all expenditures of royalties under the agreement can be considered the payment of expenses incidental to the administration and licensing of inventions, as permitted under the FTTA. The agreement is the method HHS [Health and Human Services] chose by which to administer its inventions, rather than continuing the litigation, and the cost of that agreement, including payments to the French and American AIDS Foundation, are expenses incidental to that administration.

The response also asserted that under the terms of the Foundation's settlement agreement, "royalties from NIH inventions cease to be royalties when they are paid into the Foundation. Thus, they need not be treated as royalties," upon their return to NIH and subsequent deposit into the NIH Director's Gift Fund. As a result, the Department of Health and Human Services employs FTTA provisions to (1) retain, (2) transfer, and (3) use invention income to settle the AIDS test kit invention dispute, but NIH treats the 37-1/2 percent of the Foundation's money awarded to NIH as not subject to FTTA.

Agencies' Use of the Laboratory Share of Income Improved With Laboratory Directors' Input

Some laboratory directors question why, despite the FTTA requirement to share invention income with laboratories and the laboratories' programmatic and financial support of technology transfer, the laboratories have received little or no financial benefit from royalty sharing. Decisions to spend all of the laboratory's share of invention income for things outside of research, one laboratory director said, were "just not right." Another director said that as long as the cost of patenting was subtracted from his laboratory's research budget and he saw no return from the laboratory's share of the royalties, he did not want to see an increase in the number of scientists requesting patents. One laboratory director said that if the cost of getting a patent was the difference between his hiring a new engineer or an inventor's receiving royalties, he would hire the engineer.

Agency officials acknowledged that directors are less likely to encourage patenting or endorse royalty sharing when the cost of patenting increasingly consumes funds that could be used for laboratory research. ARS and NIH officials said that their scientists and laboratory directors have complained about using funds appropriated for research projects to cover the cost of patenting. These complaints were made despite ARS's cost-sharing approach, which takes only part of the cost of patenting from each inventor's research appropriations. Bureau of Mines officials said that criticism of the overall size of the agency's overhead account, expressed in an Interior Department audit, provided the basis for the agency's decision to charge the cost of patenting directly to the R&D project budget that had originally supported inventors' research program activities.

Several laboratory directors said that using the laboratory's share of invention income to further research at the laboratory can facilitate the development of technology and have a positive impact on many laboratory research teams. Instead of being used entirely to reimburse the cost of getting a patent and licensing it, these laboratory directors said, the laboratory's share of invention income should be used, in part, as an incentive to transfer technology. One director said that he would like to see invention income go back to the research project for "icing on the cake"—things that are eliminated when budgets are tight. Directors, focus group scientists, and research leaders said that rewards, such as travel, employee awards, sabbaticals, independent study, or even additional funds to support more research, would make scientists more interested in patenting.

Several other directors said that obtaining a patent always requires additional effort from laboratory personnel other than the inventors who generated the initial ideas. According to one director, a good laboratory director is doing everything he or she can to do good research, but a director needs flexibility to decide how best to spend the royalties to meet the different needs of the laboratory. Furthermore, research leaders—that is, those who manage the individual research programs undertaken at a laboratory—questioned where their laboratory's share of invention income was going and agreed that the director of the laboratory was in the best position to decide which of the laboratory's programs should receive invention income.

Procedural Impediments Continue

Federal scientists' comments during focus group discussions revealed serious dissatisfaction with their agencies' procedures and activities for patenting an invention. The scientists said that (1) their scientific training provided no instruction and they had little access to information that could help them decide which research results were patentable, (2) the procedures for selecting invention disclosures for patents were arbitrary and lengthy, and (3) seeking a patent frequently imposed major delays on publishing research.

Access to Advice About Patents Is Limited

Scientists participating in focus groups said that they needed advice to help them identify which invention ideas might result in commercially useful patents. Officials at two of the eight agencies we asked described how they ensured that this information reached their scientists. NASA officials said that all new employee orientations at NASA's field centers have included presentations by a field center patent counsel on NASA's policy and procedures for patenting inventions. Agriculture Department officials began conducting patent awareness presentations for ARS and Forest Service laboratory management and scientists as early as 1985. The presentations explain Agriculture's policy and procedures, review pertinent legislative and judicial history, and provide examples of potentially patentable technology. In 1988, ARS issued a "Plain Language Guide" pamphlet briefly explaining some of the steps in getting a patent.

Scientists said that they typically have little training or job experience in identifying patentable subject matter and commercially useful ideas. Without readily available information or advice, a patentable invention may remain undisclosed. According to one scientist, many scientists still do not have any idea what a patent and a license are, despite all the

memoranda that go forth. He said that his fellow researchers do not generally understand what a patent is and scientists hesitate to become involved in things outside of their research that are unfamiliar to them. Another said that he was sure his colleagues would be more interested in patenting if they understood what was and was not patentable. Scientists said that they have been taught to market their research by publishing it, not by commercializing it.

Other scientists said that 25 years ago the patent adviser came to them and solicited information about what they did but that in the past 15 years their agency had actually done less to cultivate or find patentable technology directly from the laboratories. Other scientists in focus groups said that they never "felt" they had a patentable invention or that they could recognize what to patent because they thought that only tangible objects could qualify as inventions. Another scientist said that he had not originally known whether a new application of technologies was patentable but had recently come to recognize that using ideas from various research areas, technologies, and manufacturing techniques and putting them together like building blocks could form the basis for a unique patentable invention.

A scientist said that when he worked in industry, patent advisers made so many visits to research laboratories that the scientists complained about the interruption to their work. He added that researchers had no personal contact with patent advisers at his present federal laboratory. Another scientist said that getting a patent requires the support of someone who is available to "walk you through the process." A scientist at another laboratory said that he was not sure whether other researchers knew that their laboratory now had an attorney who was supposed to be working directly with employees who had ideas for inventions. But another scientist at the same laboratory countered that this person was responsible only for forwarding paperwork to Washington, not for assisting scientists directly.

Scientists at several focus groups said that compared to 15 or 20 years ago, they now had fewer patent advisers visiting them in their laboratories to discuss what was currently being researched. However, the scientists said that at about the time of FTTA's enactment, the patent advisers had stopped their visits. Officials at this agency said that they have had to shift patent advisers away from contact with laboratory scientists to cover increased technology transfer office activities.

Procedures for Selecting Invention Disclosures Are Arbitrary and Slow

Focus group participants voiced many complaints about how their agencies select employees' inventions for patent applications. Although some agencies have established standing committees that meet regularly to evaluate inventions to be patented, other agencies have ad hoc groups of technical personnel that meet irregularly. One scientist described his frustration as follows:

> You write a disclosure and then it goes to "Never Never Land." Every once in a while the committee decides it has a whole bunch of these, so they ought to meet. Eleven months from the time we submitted the disclosure, the committee meets. They send it over to the Department, which has a committee that doesn't meet. They write a proposal [to contract] for a patent attorney . . . [to] put it out on bid which takes months. When are they meeting next? No meeting has been scheduled. If you [the inventor] are real aggressive, you can get it to the patent office in a year and a half . . . It's outrageous. If the government is going to be in this business, then the decisions should be made each week.

Scientists at another focus group said that their committee consisted entirely of technical people who lacked the specific knowledge necessary to understand their inventions. As a result, the committee tried to make preliminary judgments about whether the inventions were patentable and how much money the inventions would save the government. "The criteria the committee uses [are] not clear, or they have their own ideas." One scientist said the committee's rejection of her invention disclosure was a political, not a sound technical, decision.

Scientists also said that some agencies' requests for inventors to determine the commercial value of their inventions had led inventors to exaggerate the estimated value of their inventions just to receive a favorable decision on their disclosure. One scientist said, "We use a dart board . . . the honest bottom line is that you have to put down bad numbers that sound good, or it [the disclosure] will go to the bottom of the pile. It is not going anywhere unless its a nice, fat, juicy number."

ARS officials said that they are planning to revise their invention disclosure selection process to include consultation with retired business executives if their agency needs help in determining the commercial potential of an invention. ARS officials also said that they had implemented an on-line process for reporting inventions in September 1991.

Patenting Delays Publication

Traditional operating policy at federal agencies on retaining intellectual property rights, both domestic and foreign, generally cautions inventors to

avoid the premature disclosure of an idea for an invention in communication with other research colleagues. This cautionary policy, scientists said, is inconsistent with the research community's tradition of publishing research as quickly as possible. Scientists have said that any publication delays or restrictions, particularly those brought about by slow procedures for selecting invention disclosures or decisions to file for foreign patent protection, threaten the peer recognition that they derive from publishing the results of their work.

One laboratory director said that professional advancement in the sciences has been and remains based on publications. A ban on, or even the rumor of a delay in, publication is the "kiss of death" for any scientist concerned with professional stature. Another scientist said, "Publishing is the currency of doing research . . . there is nothing else."

Conclusions

While many scientists rejected the idea that financial rewards motivated them to report inventions, some scientists (1) did acknowledge the symbolic message conveyed by the existence of a program that shares the financial return from inventing efforts with them, (2) spoke emotionally of the strong attachment they have to their inventions and the gratification they feel when they learn of the invention's commercial success, and (3) said that rewards beyond the very nominal amounts of money that some inventors are currently receiving might motivate them to consider what research results are patentable. If agencies employed a formula with an annual threshold of 100 percent of at least $1,000, they would minimize the number of times that inventors were rewarded with small amounts of money. We believe that if fewer inventors were disappointed in royalty sharing's rewards, more inventors would be motivated to report inventions.

Using the laboratory's share of invention income for rewards that are visible and tangible to potential inventors can also increase the incentive character of royalty sharing for an agency's scientists.

Although we believe that the Department of Health and Human Services had the authority to enter into a settlement agreement to resolve ownership questions surrounding the AIDS test kit, we are concerned that 80 percent of the invention's income is used annually to support an autonomous private foundation established under the settlement agreement. We recognize that neither the statute nor its legislative history clearly limits the scope of "expenses incidental to the administration and

licensing of inventions." However, we believe that the Department of Health and Human Services' funding of the French and American AIDS Foundation represents a very expansive reading of FTTA's direction for using the laboratory's share of invention income.

By participating in decisions governing the use of the laboratory's share of invention income, laboratory directors could further motivate scientists to report inventions. Their intimate knowledge of their laboratories' needs and of their staff's contributions is critical to using the laboratory's share of invention income to enhance the incentive character of royalty sharing.

Cultural barriers and procedural impediments, including insufficient controls to ensure that payments to inventors are made, may discourage many scientists in federal laboratories from trying to patent inventions. However, by making it easier for inventors to report inventions and obtain patenting advice and by ensuring that invention selection decisions are made in a timely and consistent manner, agencies could encourage more inventors to report their inventions.

Recommendations

We recommend that heads of departments and agencies operating royalty-sharing programs under the Federal Technology Transfer Act (1) adopt royalty-sharing formulas that establish an annual threshold of 100 percent of a set amount of invention income (for example, the $1,000 or $2,000 threshold now in use by some agencies) that would more adequately reward inventors for their work; (2) establish procedures that routinely check records of payments to inventors against patent, license, and income records; (3) channel a major part of the laboratory's share of invention income to areas in laboratories that are visible to federal scientists; and (4) require that the director of the laboratory where the invention originated be included in decisions governing the use of the laboratory's share of invention income. We also recommend that agencies provide more information and training for scientists at their laboratories on the kind of subject matter that is patentable and on the approach that is appropriate for evaluating an invention's commercial demand. Finally, we recommend that agencies establish procedures for the timely and consistent selection of inventions for patenting.

Matter for Consideration by the Congress

To ensure that the agencies share invention income with the laboratories as the Congress intended, we believe that the Congress may wish to

consider more specifically defining the permissible uses of "expenses incidental to the administration and licensing of inventions."

Agency Comments and Our Evaluation

The Departments of Defense, Energy, Health and Human Services, and the Interior, and TVA indicated general agreement with our report's recommendations. The Department of Commerce said that it found the report's recommendations interesting and intends to ask the Interagency Committee on Federal Laboratory Technology Transfer to consider them carefully. However, the Departments of Agriculture and Commerce and EPA raised questions concerning certain of our conclusions, particularly those that they believed were solely supported by our statistical analysis.

Commerce and EPA suggested that our report did not examine the broader issue of whether federal technology transfer efforts have been successful in assisting U.S. competitiveness. While we agree that this issue is important, it is substantially different from the scope of this review as conducted to carry out the FTTA mandate. The scope of this review was to assess the royalty-sharing programs' effectiveness in motivating federal scientists to patent their inventions.

Agriculture, Commerce, Health and Human Services, Energy, and EPA took issue with certain aspects of our statistical analysis. More specifically, Agriculture and Commerce raised questions regarding our use of invention-reporting rates—that is, invention disclosures per scientist—rather than the overall number of invention disclosures as the preferred measure of federal scientists' interest in patenting. Health and Human Services, Commerce, Energy, and EPA questioned whether our use of the first several years after FTTA's passage was appropriate for assessing the impact of royalty sharing. In addition, Health and Human Services and Commerce questioned our exclusion of inventing activity at government-owned, contractor-operated laboratories. Furthermore, the comments from Agriculture, Commerce, and EPA implied that we had relied solely on our statistical analysis to conclude that royalty sharing had little impact on scientists' interest in patenting.

Regarding our use of rates rather than numbers, we focused our statistical analysis on the act of reporting an invention. We believe that invention reporting is the best measure of scientists' interest in patenting because reporting is the first step that an inventor takes in patenting and is therefore an early and direct measure of the effectiveness of royalty sharing as an incentive for government-employee inventors. In addition,

we believe that analyzing invention-reporting rates is preferable to analyzing the number of invention disclosures submitted each year because it enables us to take into consideration annual increases or decreases in the number of federal R&D scientists who might report inventions to their agencies.

We believe that our inclusion of the first several years after FTTA was enacted to assess the impact of royalty-sharing programs is appropriate because we used the first step in patenting—invention-reporting rates—as an indicator in our analysis. As noted above, invention reporting could have taken place as soon as inventors became aware of royalty sharing. Thus, we believe that our analysis covering invention-reporting rates for the full 5-year period immediately following the act's passage, compared with the 6-year period immediately preceding it, gave us a valid basis for assessing any change in scientists' interest in patenting. In addition, use of confidence interval analysis on invention-reporting rates over 11 years provided a more comprehensive method of analyzing changing behavior than an alternative of selecting individual years on the assumption that a particular year's activity was typical or that a 1-year change was indicative of a trend.

Regarding the comments about our exclusion of inventors working at government-owned, contractor-operated laboratories, we excluded these scientists because FTTA, as passed in 1986, did not include them in its coverage. Accordingly, to preserve the consistency of 11 years of statistical data, we excluded all scientists working for contractors even though in some cases their status as employees eligible to receive royalties changed because of an amendment to the act in 1989. Their subsequent inclusion under this amendment for a 2-year, rather than a 5-year, period after FTTA's passage could have distorted the results of our analyses.

Furthermore, we disagree with Agriculture's, Commerce's, and EPA's comments that we relied solely on an analysis of statistical data in reaching our conclusions. Our conclusions were based on an integration of two analytical methodologies—the statistical analysis discussed above and an analysis of findings from our focus group discussions with almost 100 scientists at eight agency laboratories across the country. The opinions and attitudes disclosed during those meetings provided significant insight into the motivation of scientists, inventors, and laboratory directors. The group discussions also elicited many frank observations on the scientists' patenting and technology transfer experiences at their agencies that, in

turn, supported our finding that agencies need to improve their implementation of royalty-sharing programs.

In its response to our draft report, Health and Human Services noted that both (1) the laboratory's share of invention income from the AIDS test kit and (2) the French and American AIDS Foundation funds awarded to NIH and deposited in the Director's Gift Fund are being used for AIDS research. However, Health and Human Services, in its comments, provided little further information on how funds awarded to NIH by the Foundation and placed in a discretionary account for the NIH Director—an account with no set term limit for expenditures—were used. Moreover, none of the NIH disbursement summaries provided to us specified that the laboratory's share had been spent for AIDS research. In addition, Health and Human Services did not explain whether the use of the laboratory's share of invention income from the AIDS test kit is consistent with FTTA disbursement provisions. Thus, we remain concerned about how NIH is managing and using all the money associated with the AIDS test kit patent.

Finally, the agencies' comments included little discussion of our recommendation to include laboratory directors in decisions concerning the use the laboratory's share of income. Several agencies—particularly Commerce and Agriculture—expressed concern that if more invention income was spent for scientific purposes at the laboratory, some agencies would not have enough funds to operate their technology transfer programs. We recognize that the money to operate technology transfer has to come from somewhere. For this reason, we believe that our recommendations to involve laboratory directors in decision-making and to channel more of the laboratory's share of the invention income to areas more visible to laboratory scientists are interrelated. Good management practices would dictate seeking the input and advice of managers closest to the activity that the agency is trying to promote. In essence, laboratory directors would be allowed to participate in decisions affecting the use of income that they and their scientists have made possible. If the directors are not included in these decisions, we believe that they will be less willing to increase the level of awareness of royalty sharing among their scientists and facilitate invention reporting and patenting.

Agency comments on our draft report and our detailed responses to these comments appear in appendixes III through X. Suggested technical changes have been made where appropriate.

Focus Group Characteristics

Agency/Focus group laborator(y/ies)[a]	Group size	Years employed	Inventions reported[b]	Research areas	Type of research
1. Army					
Troop Support Command (RD&E) Natick, Mass.; Materials Technology Laboratory, Watertown, Mass.	11	4 to 38	Yes	Protective clothing, life support, food service and packaging, polymers, ceramics, metals	Applied (Troop Support); basic, applied, and development (Materials Technology)
2. ARS					
National Center for Agricultural Utilization Research, Peoria, Ill.	10	9 to 34	Yes	Research leaders[c]	Basic, applied, and development
3. ARS					
(same as above)	11	2 to 32	Yes	Oil chemistry, microbes, fermentation, plants, biopolymers	(See above)
4. Bureau of Mines					
Salt Lake City Research Center, Salt Lake City, Utah	10	2 to 25	No	Flotation, sedimentation, waste reprocessing, extraction metallurgy, mineral beneficiation	Applied and development
5. FAA					
Technical Center, Atlantic City International Airport, N.J.	13	1 to 30	Yes	Aviation security, flight safety, and propulsion and structures	Applied and development
6. NASA					
Goddard Space Flight Center, Greenbelt, Md.	10	1 to 32	Yes	Astronomy, materials, thermal engineering, space technology	Basic, applied, and development
7. Navy					
Naval Underwater Systems Center, New London, Conn.; Submarine Medical Research Laboratory, Groton, Conn.	11	2 to 30	No	Sonar, combat systems, electromagnets, environmental physiology, auditory research	Applied

(continued)

Agency/Focus group laborator(y/ies)[a]	Group size	Years employed	Inventions reported[b]	Research areas	Type of research
8. NIH					
National Institutes of Allergy and Infectious Diseases; Arthritis and Musculoskeletal and Skin Diseases; Cancer; Child Health and Human Development; Dental Research; Diabetes and Digestive and Kidney Diseases; Eye; Heart, Lung, and Blood; Neurological Disorders and Stroke; and Research Resources, Bethesda, Md.	11	4 to 33	No	Oncology; pharmacology; biomedical engineering; experimental therapeutics; molecular genetics; ocular, viral diseases; neurobiology	Basic
9. NIST					
National Institute of Standards and Technology, Gaithersburg, Md.	8	3 to 33	Yes	Materials, polymers, atomic spectroscopy, building materials, coatings, electronic devices	Basic, applied

[a]Army and Navy focus groups had participants from two different laboratories.

[b]After FTTA's passage, fiscal years 1987 and after.

[c]Two focus groups were conducted at ARS in Peoria, Illinois. One group was composed of research leaders (research program managers) and the other of active researchers.

Agency Invention-Reporting and Income Data

Table II.1: Laboratory Resources and Invention-Reporting Rates, Fiscal Years 1981-91

Dollars in millions		
Department/agency	**1981**	**1982**
Agriculture		
ARS		
Invention disclosures	93	65
R&D scientists	2,944	2,920
R&D operating budget[a]	$436.2	$435.3
Reporting rate	.032	.022
Forest Service		
Invention disclosures	9	9
R&D scientists	1,000	950
R&D operating budget	$117	$102
Reporting rate	.009	.009
Commerce		
NIST		
Invention disclosures	32	29
R&D scientists	1,217	1,192
R&D operating budget	$140	$136
Reporting rate	.026	.024
NOAA		
Invention disclosures	1	5
R&D scientists	1,789	1,801
R&D operating budget	$201	$222
Reporting rate	.001	.003
Defense		
Air Force		
Invention disclosures	147	129
R&D scientists	4,252	4,288
R&D operating budget	$1,047.8	$1,154.7
Reporting rate	.035	.030
Army		
Invention disclosures	325	366
R&D scientists	5,163	5,433
R&D operating budget	$475.4	$822.5
Reporting rate	.063	.067
Navy		
Invention disclosures	684	528
R&D scientists	9,416	9,580
R&D operating budget	$1,495.6	$1,639.9

1983	1984	1985	1986	1987	1988	1989	1990	1991
69	60	70	91	76	139	140	150	112
3,018	2,872	3,046	3,072	3,080	3,125	3,162	3,069	3,069
$469.1	$488.3	$502.8	$488.4	$530.1	$551.6	$575.8	$600	$639.3
.023	.021	.023	.030	.025	.044	.044	.049	.037
11	9	5	9	7	5	9	8	12
950	950	950	914	950	966	987	984	1,016
$99	$102	$108	$104	$112	$121	$123	$142	$157
.012	.009	.005	.010	.007	.005	.009	.008	.012
37	34	44	34	43	26	43	44	30
1,196	1,229	1,247	1,272	1,260	1,296	1,336	1,356	1,438
$149	$157	$168	$176	$178	$203	$219	$217	$220
.031	.028	.035	.027	.034	.020	.032	.032	.021
2	7	1	5	5	4	7	7	2
1,729	1,639	1,573	1,546	1,551	1,658	1,855	1,925	2,033
$222	$244.3	$269.8	$274.7	$286.1	$263	$268.6	$276.9	$267.5
.001	.004	.001	.003	.003	.002	.004	.004	.001
183	214	167	161	133	148	146	162	153
4,347	4,327	4,387	4,347	4,395	4,265	4,338	4,317	4,347
$1,216.2	$1,340.0	$1,422.3	$1,588.9	$1,633.7	$1,350.5	$1,461.2	$1,517.1	$1,498.8
.042	.050	.038	.037	.030	.035	.034	.038	.035
326	331	300	292	248	348	276	376	463
8,133	8,472	8,830	9,063	10,174	10,448	11,034	11,463	11,253
$744.1	$730.3	$830.8	$2,136.6	$2,228.3	$2,168.3	$2,357.7	$2,368.3	$1,930.4
.040	.039	.034	.032	.024	.033	.025	.033	.041
554	506	425	351	356	453	510	615	568
10,319	11,022	11,935	11,971	12,368	12,513	12,787	13,044	13,000
$1,759.8	$2,047.5	$2,048.7	$2,352.9	$2,416.5	$2,404.7	$2,289.8	$2,519.3	$2,367.7

(continued)

Dollars in millions

Department/agency	1981	1982
Reporting rate	.073	.055
Energy		
Invention disclosures	16	3
R&D scientists	225	235
R&D operating budget	$184.6	$185.6
Reporting rate	.071	.013
Health and Human Services		
ADAMHA		
Invention disclosures	3	0
R&D scientists	323	335
R&D operating budget	$49.1	$52.8
Reporting rate	.009	0
CDC		
Invention disclosures	1	1
R&D scientists	800	700
R&D operating budget	$30.6	$32.2
Reporting rate	.001	.001
FDA		
Invention disclosures	1	6
R&D scientists	720	683
R&D operating budget	$71	$73
Reporting rate	.001	.009
NIH		
Invention disclosures	45	56
R&D scientists	1,062	1,076
R&D operating budget	$413.4	$415.7
Reporting rate	.042	.052

1983	1984	1985	1986	1987	1988	1989	1990	1991
.054	.046	.036	.029	.029	.036	.040	.047	.044
3	7	22	15	21	33	23	35	26
273	194	269	266	264	267	256	249	272
$222.2	$254.2	$269.4	$269.8	$277.8	$370.6	$337.2	$446.1	$471.3
.011	.036	.082	.056	.080	.124	.090	.141	.096
1	0	4	5	7	12	6	10	12
334	372	383	351	399	455	459	343	303
$63.4	$64.5	$69.9	$70.6	$85.1	$91.8	$102.9	$119.2	$129.6
.003	0	.010	.014	.018	.026	.013	.029	.040
0	3	5	4	10	15	18	22	21
700	700	1,144	660	774	726	677	664	719
$36.0	$49.0	$78.4	$45.2	$53.1	$49.8	$46.3	$45.5	$49
0	.004	.004	.006	.013	.021	.027	.033	.029
3	6	13	5	10	12	17	20	15
703	703	704	677	730	735	759	862	913
$74	$79	$82	$79	$84	$91	$98	$99	$110
.004	.009	.018	.007	.014	.016	.022	.023	.016
45	86	136	131	180	235	211	212	179
1,247	1,369	1,254	1,218	1,203	1,285	1,289	1,525	1,913
$498.2	$539.5	$572.6	$571.6	$665.3	$715.0	$782.2	$859.1	$924.9
.036	.063	.108	.108	.150	.183	.164	.139	.094

(continued)

Dollars in millions

Department/agency	1981	1982
Interior		
Bureau of Mines		
Invention disclosures	36	32
R&D scientists	1,112	1,090
R&D operating budget	$95.7	$86.8
Reporting rate	.032	.029
Fish and Wildlife Service		
Invention disclosures	0	0
R&D scientists	350	362
R&D operating budget	$42.2	$37.5
Reporting rate	0	0
Geological Survey		
Invention disclosures	9	13
R&D scientists	2,211	2,051
R&D operating budget	$155.5	$139.4
Reporting rate	.004	.006
Transportation		
Coast Guard		
Invention disclosures	0	0
R&D scientists	135	101
R&D operating budget	$17.0	$12.2
Reporting rate	0	0
FAA		
Invention disclosures	2	3
R&D scientists	248	244
R&D operating budget	$85	$72
Reporting rate	.008	.012
NHTSA		
Invention disclosures	0	0
R&D scientists	84	72
R&D operating budget	$7.5	$8.8
Reporting rate	0	0
EPA		
Invention disclosures	14	12
R&D scientists	1,200	1,129
R&D operating budget	$102	$102
Reporting rate	.012	.011

1983	1984	1985	1986	1987	1988	1989	1990	1991
25	21	13	12	6	7	13	15	20
1,065	1,063	1,040	1,036	1,044	1,063	984	1,011	1,008
$87.1	$80.8	$80.2	$75.9	$84.3	$87.8	$90.9	$95.3	$103.3
.023	.020	.013	.012	.006	.007	.013	.015	.020
0	1	0	0	0	0	1	1	0
374	398	412	417	440	461	475	512	550
$42.5	$51.4	$43.0	$58.5	$60.6	$66.5	$70.4	$79.5	$90.3
0	.003	0	0	0	0	.002	.002	0
7	2	4	3	4	3	5	3	0
1,967	1,884	1,752	1,607	1,570	1,570	1,597	1,546	1,537
$146.3	$191.6	$196.7	$194.0	$202.4	$211.2	$249.1	$269.2	$306.2
.004	.001	.002	.002	.003	.002	.003	.002	0
0	0	0	0	0	1	0	0	0
119	133	133	125	125	79	66	66	80
$13.6	$15.3	$15.6	$12.1	$13.6	$12.9	$12.4	$14.5	$15.9
0	0	0	0	0	.013	0	0	0
4	3	0	0	0	5	3	3	1
229	285	285	284	222	234	224	242	251
$103	$263	$265	$237	$142	$153	$160	$170	$205
.017	.011	0	0	0	.021	.013	.012	.004
0	0	1	0	0	0	0	0	0
65	69	62	63	62	64	70	64	57
$6.0	$9.0	$11.7	$19.9	$19.0	$13.6	$10.9	$10.1	$10.1
0	0	.016	0	0	0	0	0	0
12	3	4	7	3	6	7	7	16
1,068	1,029	1,112	1,119	1,146	1,160	1,178	1,215	1,217
$98	$94	$105	$100	$106	$106	$111	$117	$102
.011	.003	.004	.006	.003	.005	.006	.006	.013

(continued)

Dollars in millions

Department/agency	1981	1982
NASA		
Invention disclosures	216	176
R&D scientists	9,765	9,575
R&D operating budget	$490	$535
Reporting rate	.022	.018
TVA		
Invention disclosures	49	83
R&D scientists	173	350
R&D operating budget	$131.9	$126.4
Reporting rate	.283	.237

1983	1984	1985	1986	1987	1988	1989	1990	1991
211	225	192	184	233	242	256	276	270
9,915	9,748	10,016	10,031	10,370	10,526	11,334	11,596	12,000
$615	$450	$500	$555	$695	$460	$710	$900	$1,105
.021	.023	.019	.018	.022	.023	.023	.024	.023
38	56	71	117	106	105	57	26	25
330	358	362	341	331	295	311	325	323
$123.9	$134.7	$148.6	$162.9	$117.7	$131.9	$93.6	$90.3	$83.0
.115	.156	.196	.343	.320	.356	.183	.080	.077

[a]The R&D operating budget includes both federally appropriated funds and nonfederal moneys used to perform R&D at federal laboratories. Although the R&D operating budget is not used to compute the reporting rate, the relative size of agency budgets is useful for describing and comparing R&D and technology transfer efforts between agencies.

Table II.2: Number of Inventions Licensed, Fiscal Years 1981-91

Department/agency	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Agriculture											
ARS	1	3	6	4	7	4	9	16	9	26	31
Forest Service	1	0	0	2	1	1	0	0	0	0	3
Commerce											
NIST	0	5	2	2	1	0	2	2	2	1	1
NOAA	1	0	0	0	0	0	1	0	1	0	1
Defense											
Air Force	0	0	0	2	0	5	1	0	2	7	0
Army	0	0	0	0	0	4	2	2	7	4	1
Navy	7	15	12	22	5	0	6	2	14	10	14
Energy	0	0	0	0	0	2	0	0	0	0	1
Health and Human Services											
ADAMHA	2	1	0	1	1	0	0	0	0	1	0
CDC	0	0	0	0	0	0	0	0	0	1	2
FDA	0	2	1	0	2	1	1	0	1	1	0
NIH	8	14	17	15	15	36	25	30	30	24	39
Interior											
Bureau of Mines	1	0	1	1	2	0	4	5	1	1	5
Fish and Wildlife Service	0	0	0	0	0	0	0	0	0	0	0
Geological Survey	0	0	0	0	0	0	0	0	0	0	1
Transportation											
Coast Guard	0	0	0	0	0	0	0	0	0	0	1
FAA	0	0	0	0	0	0	0	0	0	0	0
NHTSA	0	0	0	0	1	0	0	0	0	0	0
EPA	0	0	0	0	0	0	0	0	0	0	1
NASA	32	31	20	35	11	14	31	8	13	4	15
TVA	6	6	0	2	8	9	0	3	4	4	0

Table II.3: Number of Income-Producing Inventions and Associated Income, Fiscal Years 1981-91

Dollars in thousands

Department/agency	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Agriculture											
ARS											
Inventions	2	6	10	15	26	28	24	26	30	39	25
Income	$5	$12.2	$21.7	$60.4	$84.2	$70.9	$126.0	$110.7	$411.1	$542.8	$465.9
Forest Service											
Inventions	1	0	0	1	2	3	2	0	1	1	2
Income	$2	$0	$0	$2	$4	$5.7	$1.5	$0	$.4	$1.5	$1
Commerce											
NIST											
Inventions	2	7	10	10	10	9	5	6	7	8	7
Income	$3.3	$16.2	$19.3	$27.2	$27.5	$29.7	$29.3	$78.9	$53.4	$48.2	$33.4
NOAA											
Inventions	2	2	1	1	1	1	1	1	2	2	3
Income	$4.1	$4	$2	$2	$2	$2	$4.5	$2.5	$8.3	$3.5	$2.5
Defense											
Air Force											
Inventions	0	0	0	0	5	7	1	2	3	7	12
Income	$0	$0	$0	$0	$5	$7.3	$26	$30.7	$26.1	$43.0	$39
Army											
Inventions	1	1	1	0	0	0	6	6	12	17	14
Income	$5.5	$30.6	$23.9	$0	$0	$0	$9.5	$3.6	$10.6	$18.5	$67.1
Navy											
Inventions	0	0	1	0	1	5	9	6	19	27	31
Income	$0	$0	$.2	$0	$.04	$.5	$4.8	$11.8	$139.2	$152.5	$122.1
Energy											
Inventions	0	0	0	0	0	2	0	0	0	0	1
Income	$0	$0	$0	$0	$0	$2.4	$0	$0	$0	$0	$10
Health and Human Services											
ADAMHA											
Inventions	1	2	2	2	2	2	2	3	5	4	5
Income	$4	$4	$4	$8.5	$5.3	$10.7	$9.6	$20.4	$101.1	$295.6	$437.1
CDC											
Inventions	0	0	0	0	0	0	0	0	0	0	2
Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20.1

(continued)

Dollars in thousands

Department/agency	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
FDA											
Inventions	0	2	4	5	6	5	2	4	4	5	4
Income	$0	$7.9	$9.4	$12.0	$23.3	$14	$29.7	$29.4	$22	$28.2	$74.1
NIH											
Inventions	11	14	28	26	32	46	52	68	91	92	91
Income	$41.7	$44.0	$140.5	$127.6	$733.7	$3,723	$3,295	$4,863	$4,671	$5,508	$6,540
Interior											
Bureau of Mines											
Inventions	1	1	1	2	3	3	9	10	11	10	9
Income	$4	$2.4	$2	$5	$10.9	$6.1	$45.6	$38.4	$60.6	$41.1	$105.8
Fish and Wildlife Service											
Inventions	0	0	0	0	0	0	0	0	0	0	0
Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Geological Survey											
Inventions	0	0	0	0	0	0	0	0	0	0	1
Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$.7
Transportation											
Coast Guard											
Inventions	0	0	0	0	0	0	0	0	0	0	1
Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1
FAA											
Inventions	0	0	0	0	0	0	0	0	0	0	0
Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
NHTSA											
Inventions	0	0	0	0	0	0	0	0	0	0	0
Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
EPA											
Inventions	0	0	0	0	0	0	0	0	0	0	1
Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20
NASA											
Inventions	35	34	44	45	39	43	22	29	43	30	34
Income	$11	$15	$24	$98	$82	$73	$54.0	$69	$76.8	$88.9	$148.3
TVA											
Inventions	6	6	0	2	8	9	0	1	4	6	1
Income	$1.3	$.6	$0	$.1	$.5	$.7	$0	$.1	$162.8	$6.9	$13.9

Comments From the Department of Health and Human Services

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Office of Inspector General

Washington, D.C. 20201

SEP 10 1992

Mr. Victor S. Rezendes
Director, Energy and
Science Issues
United States General
Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

Enclosed are the Department's comments on your draft report, "Technology Transfer: Barriers Limit Royalty Sharing's Effectiveness." The comments represent the tentative position of the Department and are subject to reevaluation when the final version of this report is received.

The Department appreciates the opportunity to comment on this draft report before its publication.

Sincerely yours,

Bryan B. Mitchell
Principal Deputy Inspector General

Enclosure

COMMENTS OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES ON THE GENERAL ACCOUNTING OFFICE DRAFT REPORT "TECHNOLOGY TRANSFER: BARRIERS LIMIT ROYALTY SHARING'S EFFECTIVENESS," GAO/RCED-92-211, JULY 1992

GENERAL COMMENTS

Royalty Income Will Increase With Time

See comment 1.

While some useful information and recommendations can be obtained 5 years after the passage of the Federal Technology Transfer Act (FTTA), statistics from other research organizations, such as Stanford, the Massachusetts' Institute of Technology, and the University of California (UC) suggest that royalties, and therefore their stimulatory effect on invention disclosures, will not be significant for another 5 to 10 years. The General Accounting Office (GAO) report itself states on page 58 that 10 to 20 years can pass between the reporting of an invention and the payment of royalties to inventors. UC's experience, as reported in an article by Roger Ditzel in Volume III, 1991 of the Journal of the Association of University Technology Managers, is that ninety-five percent (95 percent) of its 1989 royalty income came from inventions that were disclosed from 8 to 18 years earlier.

This suggests that the Federal agencies are now seeing less than five percent of the royalty income they can expect from inventions disclosed after the FTTA. Royalties and their stimulatory effects can be expected to grow dramatically in the next 10 years.

Active Licensing, Not Royalty Sharing Formulae, May Be Key To Increased Participation

See comment 2.

Based on its study, the GAO concluded that royalty sharing has had little impact on scientists' interest in patenting. This conclusion is based on (1) the lack of increased invention disclosure rates in most agencies following the FTTA, and (2) the fact that the agencies showing increased disclosure rates following the FTTA carry out research in the biotechnology area, where patenting activity has increased in general.

From the same information, one could conclude differently that royalties, when coupled with active patenting and licensing, do stimulate invention disclosures. For item (1), the lack of increased rates at many agencies could represent the lack of a selective and sophisticated pre-screening of disclosures and/or a lack of focus on licensing the disclosed inventions, leading to a lack of royalty income to provide incentive. For item (2), the dramatic increase in invention disclosures at the National Institutes of Health (NIH) following the FTTA could represent the release of a pent-up interest in participating in technology

transfer when royalty-sharing incentives exist and commercial development can be readily anticipated in the presence of an active commercial field and an active licensing program. The leveling off of this dramatic surge could simply represent the return of the rate of disclosures to one that would have been normal prior to the FTTA had the royalty-sharing incentive existed. In both cases, the focus may need to be on stimulating licensing the technology to generate royalty income, rather than solely on evaluating the way royalties are used.

Agency Differences Blur Impact Of Royalty Incentives

See comment 3.

In addition, the types of research conducted by the agencies differ, blurring the impact of the FTTA. For example, a large part of the research conducted by the Department of Defense agencies (Army, Navy, Air Force) is performed under contract. Under the Federal Acquisition Regulations, many of the contractors are permitted to retain intellectual property rights and license these rights themselves. Thus, royalty income and number of patent filings for these agencies appear constant, in spite of the FTTA.

Central Evaluation And Payment

See comment 4.

Currently many laboratories are required to pay patent application costs from their own budgets. This is a disincentive to patenting activities, as are delays in evaluation of invention disclosures by technology transfer professionals. It may be advantageous for each agency to centrally evaluate invention disclosures and fund patent application filings. Each agency should be encouraged to evaluate this option.

AIDS Test Kits Royalties Are Used For AIDS Research

The funds received by NIH from licensing of the AIDS test kits are used in support of research relating to AIDS. This is the case, even though the funds are received in part as direct royalties, and in part through an agreement that settled litigation between the Department and the Pasteur Institute (a non-profit research foundation partially owned by the French Government) on the AIDS test kits patents. With the ownership of the patents in dispute, the Department entered into this agreement to administer its inventions, rather than continuing the litigation. Expenditures of royalty funds made under the agreement are expenses incidental to the administration and licensing of inventions, as permitted under FTTA. The Department of Justice concurred with this settlement agreement, which was made under the authority of the Public Health Service Act, the FTTA, and the statutes governing the licensing of Federal inventions.

See comment 5.

As described on pages 68 to 70 of the GAO draft report, the settlement agreement calls for the Department to retain 20 percent of the royalty income from the AIDS test kits to be handled under its usual procedures, and to transfer the remaining 80 percent to a foundation set up under the agreement. The Pasteur Institute follows a similar procedure with the royalties from its licensing of the AIDS test kits. NIH and the Pasteur Institute then receive 75 percent (37.5 percent each) of the pooled license income. NIH receives its portion through the Director's gift fund, and uses that income to support research relating to AIDS.

GAO RECOMMENDATION

Adopt royalty-sharing formulas that establish an annual threshold of 100 percent of a set amount of invention income. This would more adequately reward inventors for their work.

DEPARTMENT COMMENT

We concur with the intent of appropriately rewarding inventors for their efforts. We do not concur with exclusive use of this particular formula for two reasons:

See comment 6.

1. For the four agencies (Army, Navy, Air Force, and NASA) identified in Table 2.1 as using this type of formula, "real improvement" in invention-reporting rates was shown for only one agency (NASA). In contrast, in all Public Health Service (PHS) agencies, where other formulae were used, "real improvement" was shown. Thus, no clear link exists between use of the recommended royalty-sharing formula and increased invention-reporting rates.

See comment 7.

2. The proposed formula may have the result of increasing the reporting of inventions with marginal commercial potential. This would not further the FTTA goals of stimulating the competitiveness of U.S. industry, but instead would burden the patent and licensing process at the agencies.

GAO RECOMMENDATION

Establish procedures for payments to inventors that check agency patent and licensing records against receipts of invention income.

DEPARTMENT COMMENT

We concur. Such procedures will be established for the PHS agencies during FY 1993. Royalty receipts will be checked against licensee royalty payment obligations by the Office of Technology Transfer (OTT) and the National Technical Information Service; agency and patent records will be checked against receipts

by OTT and the NIH Division of Financial Management; and, payments to inventors will be checked against records by the inventor's agency.

GAO RECOMMENDATION

Channel a major part of the laboratory share of invention income to areas in laboratories that are visible to Federal scientists.

DEPARTMENT COMMENT

We concur. However, there is limited flexibility in the allowed uses of royalty income by the laboratory which are set forth in the FTTA. The FTTA provides that royalty income, in addition to payments to inventors, may be used:

1. for payment of expenses incidental to the administration and licensing of inventions by that laboratory or by the agency with respect to inventions which occurred at that laboratory, including the fees or other costs for the service of other agencies, persons, or organizations for invention management and licensing services;

2. to reward scientific, engineering, and technical employees of that laboratory;

3. to further scientific exchange among the Government-operated laboratories of the agency; or

4. for education and training of employees consistent with the research and development mission and objectives of the agency, and for other activities that increase the licensing potential for transfer of the technology of the Government-operated laboratories of the agency.

See comment 8.

These allowed uses do not include expenditures for supplies, services, equipment, other general costs of research, i.e., areas that are highly visible to Federal scientists.

GAO RECOMMENDATION

Require that the director of the laboratory where the invention originated be included in decisions governing the use of the laboratory's share of invention income.

DEPARTMENT COMMENT

We concur. At PHS laboratories, institute or center directors currently are included in the decisions.

GAO RECOMMENDATION

Provide more information and training for scientists at their laboratories on the kind of subject matter that is patentable, the proper approach for evaluating an invention's commercial demand, and establish procedures for the timely and consistent selection of inventions for patenting.

DEPARTMENT COMMENT

We concur and believe that PHS's current implementation of this recommendation has led to increased participation in technology transfer. PHS has very active programs of training and invention evaluation, including printed training manuals, periodic training programs, training programs at satellite laboratories, a computerized training and reporting system in development, and streamlined processes for evaluation of inventions. In addition, PHS has been improving the response time for evaluation, selection and patent filing of inventions.

MATTERS FOR CONSIDERATION BY THE CONGRESS

To ensure that a greater portion of invention income is returned to the agencies' laboratories, GAO believes Congress should consider placing limits on the use of "expenses incidental to the administration and licensing of inventions."

DEPARTMENT COMMENT

See comment 9.

We suggest that agencies included in this survey be asked to comment on specific changes being proposed and their anticipated effect on the agencies' ability and willingness to support the filing of patent applications and other technology transfer activities.

Use of royalty income for "expenses incidental to the administration and licensing of inventions" as a percent of royalty income, will decrease as licensed technologies mature and royalties increase. The ability to use the royalty income for these expenses represents a useful alternative for most agencies, given the two main alternatives of charging laboratory research budgets or expanding overhead accounts.

The following are GAO's comments on the Department of Health and Human Services' letter dated September 10, 1992.

GAO Comments

1. We agree. In our view, assessment of the royalty-sharing programs' effectiveness would have to be delayed for several more years if the analysis relied on the growth of invention income to show a stimulatory effect on scientists' interest in reporting inventions. (See our comment on timing on p. 65.) However, in addition to delaying the analysis to collect additional data, reliance on invention income to assess the effectiveness of a technology transfer program creates a methodological shortcoming. For example, the income from the NIH AIDS test kit represented in the figure on page 34 of this report provides a case in point. Here, $25.2 million of a total of $35.8 million, or 70 percent of 21 agencies' invention income for 5 years, is attributable to the efforts of 3 out of 173,000 scientists. Because the potential exists for most of the invention income that the government collects to be derived from several "big winning" inventions, the likelihood of realizing large royalty payments for many inventors is limited. This suggests that measures, or analytical indicators, of the success of efforts to create an incentive for more scientists to patent must include more than the growth of invention income.

The concentration of invention income at several agencies whose research was relevant to biotechnology-influenced industry was only one of several factors that we considered in reaching our conclusions. Our conclusions are based primarily on (1) a comparative analysis of statistical data supplied by 21 agencies whose R&D represents a diverse group of technologies and (2) comments made by almost 100 agency scientists, including NIH researchers.

2. We agree that improved licensing activity may be the key that agencies hold to increasing scientists' participation in patenting. That is why we chose to analyze invention-licensing rates in our report. However, although we believe that a portfolio of quality invention disclosures and an active agency licensing program are necessary to transfer commercially useful technology to U.S. industry, in the end it is the existence of an active commercial field, or enough interested potential licensees, that both drives and limits the technology transfer process for federal inventions. For example, it was the existence of an active commercial market for biotechnology-related inventions that made inventors into royalty recipients at ARS, ADAMHA, CDC, FDA, and NIH.

3.All of our data, including the number of inventions reported, represent the results of government employees' efforts, not of inventors' activities at contractor-operated laboratories. Despite an amendment to the act in 1989 changing the status of inventors eligible to receive royalties, we limited our work to government employees, who were the only group continuously affected for the entire 5-year period.

4.We did not evaluate whether individual agencies should centrally evaluate invention disclosures. However, we agree that using a central fund to pay for the costs associated with obtaining a patent and securing a license would eliminate an important disincentive to patent. With a central fund, each decision to patent and license an invention would not entail an immediate and corresponding reduction in a laboratory director's R&D budget.

5.From the information provided by NIH during this assignment, we could not determine whether the balance of the AIDS test kit invention income remaining after obligations to the three inventors and the Foundation had been paid was actually used to support AIDS research at NIH. FTTA specifies several categories of uses for the laboratory's share of invention income. (See p. 11.) However, AIDS research is not one of these uses, and none of the NIH laboratory disbursement summaries provided to us specified that invention income had been spent for AIDS research. In addition, as stated on page 21, we did not review the use of Foundation funds deposited in the NIH Director's Gift Fund; therefore, we do not know how those funds have been used.

6.We agree that the intent in selecting a particular formula is to appropriately reward inventors. As a result, our recommendation for a threshold-style formula was based, among other things, on consideration of the opinions and attitudes expressed by federal scientists during focus groups. These scientists told us that for many of them, money was a less-than-optimal reward. In particular, nominal amounts of money did little to motivate them to bring their ideas to management's attention. The objective of using the threshold-style formula is to minimize the disappointment felt by inventors who do not find the high regard that they place on their inventions reflected in the small monetary rewards that they receive. In addition, because other factors, such as the activity of the commercial field (the number of companies interested in licensing that particular type of invention) affect the likelihood that royalties will be paid to inventors, we would have been surprised to find a clear direct link between formula types and improvement in invention-reporting rates.

7. We believe that if the criteria for selecting invention disclosures were clearly communicated, well understood, and consistent, the patent and licensing process would not be overburdened. Furthermore, we believe that any policy or procedures that prematurely discourage inventors from reporting inventions are more likely to damage than fulfill FTTA's goals. When inventors are encouraged to submit all reasonable invention ideas, it is less likely that unanticipated winners will remain unreported.

8. We believe that the disbursement categories specified in FTTA are sufficiently flexible to allow the laboratory's share of invention income to be used, in many cases, for visible and tangible benefits that would further the research of many laboratory scientists. Such benefits are also consistent with the text of the House Conference Report, discussed in chapter 1 of our report. These benefits are also consistent with the types of activities that focus group participants said would motivate them to patent. Therefore, we disagree that FTTA prevents a laboratory from using its share of invention income to pay for some research-related costs, such as equipment and supplies.

9. We have modified the matter for congressional consideration in our final report so that it will not be construed to suggest that limits should be placed on the amount of invention income that may be used for expenses incidental to the administration and licensing of inventions. Rather, it is our intent for the Congress to consider whether the use of invention income under this category should include continued funding of organizations autonomous to the U.S. government, such as the French and American AIDS Foundation.

Comments From the Department of Defense

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

WASHINGTON, DC 20301-3010

SEP 10 1992

Mr. J. Dexter Peach
Assistant Comptroller General
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Peach:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "TECHNOLOGY TRANSFER: Barriers Limit Royalty Sharing's Effectiveness," dated July 17, 1992, (GAO Code 385518/OSD Case 9145).

The Department generally agrees with the findings, with the first and third recommendations, and with the matter for congressional consideration. However, the Department only partially agrees with the second recommendation. Detailed DoD comments are provided in the enclosure. The Department appreciates the opportunity to review the report in draft form.

Sincerely,

Victor H. Reis

Enclosure

GAO DRAFT REPORT -- DATED JULY 17, 1992
(GAO CODE 385518) OSD CASE 9145

"TECHNOLOGY TRANSFER: BARRIERS LIMIT ROYALTY SHARING'S EFFECTIVENESS"

DEPARTMENT OF DEFENSE COMMENTS

* * * * *

RECOMMENDATIONS

See comment 1.

Now on pp. 5 and 63.

- RECOMMENDATION 1: The GAO recommended that the heads of departments and agencies operating royalty-sharing programs under the Federal Technology Transfer Act do the following:

  - adopt royalty-sharing formulas that establish an annual threshold of 100 percent of a set amount of invention income (for example, the $1,000 or $2,000 threshold now in use by some agencies), that would more adequately reward inventors for their work;
  - establish procedures for payments to inventors that check agency patent and license records against receipts of invention income;
  - channel a major part of the laboratory share of invention income to areas in laboratories that are visible to federal scientists; and
  - require that the director of the laboratory where the invention originated be included in decisions governing the use of the laboratory's share of invention income. (pp. 7-8, p. 78/GAO Draft Report).

  DoD RESPONSE: Concur. The recommendation is unnecessary since the Department is already in compliance. No further action is required.

See comment 1.

Now on pp. 5 and 63.

- RECOMMENDATION 2: The GAO recommended that agencies provide more information and training for scientists at their laboratories on the kind of subject matter that is patentable, the proper approach for evaluating an invention's commercial demand, and establish procedures for the timely and consistent selection of inventions for patenting. (p. 8, p. 78/GAO Draft Report).

Enclosure

See comment 2.

DoD RESPONSE: Partially concur. The DoD laboratories provide information on successful patents in laboratory newspapers, news letters, and reports which are widely read by their scientific staff. Scientists and engineers also serve terms on patent committees. Further, special recognition awards are frequently made for inventions deemed most beneficial, thus providing, by example, insight on what subject matter is considered most important. However, while many DoD technologies are dual-use, our primary focus must remain on addressing Defense Department needs. Training scientific staff in evaluating the commercial potential of inventions is not considered practical nor is it considered to be a primary DoD mission responsibility.

Now on pp. 5 and 63.

- RECOMMENDATION 3: The GAO recommended that to further strengthen the incentive character of the royalty-sharing program, agencies should also require that the directors of laboratories where inventions have originated be included in decisions governing the use of invention income. (p. 8, pp. 78/79/GAO Draft Report).

DoD RESPONSE: Concur. Again, the recommendation is unnecessary. The Department is already in compliance and no further action is required.

* * * * *

MATTER FOR CONSIDERATION BY THE CONGRESS

Now on pp. 5, 63-64.

- SUGGESTION: The GAO suggested that the Congress should consider placing limits on the use of expenses incidental to the administration and licensing of inventions. (p. 8, p. 79/GAO Draft Report)

See comment 3.

DoD RESPONSE: Concur. The Department asserts, however, that the matter for congressional consideration can benefit from further clarification. The subject matter apparently arose in connection with a particular one-of-a-kind activity. GAO apparently refers to placing limits on kinds of allowable activities, not to setting monetary limits on necessary expenses.

The following are GAO's comments on the Department of Defense's letter dated September 10, 1992.

GAO Comments

1.Although we acknowledge the Department of Defense's concurrence on this recommendation, the Army and the Navy were two of the seven agencies whose procedures, at the time of our review, did not have adequate controls to ensure that inventors were paid. We described this control problem during a meeting with Army officials in October 1991. In August 1992, they told us that after our 1991 meeting, they had begun a letter-to-inventors procedure similar to NASA's procedure. An Army official told us that these letters have prompted inventors to submit change of address notifications and designation of beneficiary information to their headquarters technology transfer office. A Navy official told us that the Navy continues to study the feasibility of a similar measure. Since we did not ask the Air Force to describe their controls, we do not know how their inventor-payment system works.

2.We remain concerned that Defense's approach to informing scientists about the criteria for patentable and commercially useful inventions is too indirect and passive to benefit scientists who know little about the attributes of such inventions. Under the Defense program for providing information on successful patents through newspapers, newsletters, and other media, we believe potential inventors, as well as scientists serving on patent committees charged with accepting or rejecting scientists' invention ideas, will continue to work from personal perceptions of selection criteria for patents and commercial utility. The arbitrary and inconsistent invention selection procedures that focus group participants spoke of will likely remain. Ultimately, we believe that this approach will only continue to discourage inventors with disclosures under consideration and other potential inventors. In our view, what these scientists described as an already small likelihood of receiving a reward is further reduced by their management's continued reliance on what some scientists also described as personally developed and inconsistently communicated decision criteria and procedures for selecting inventions.

3.As noted in Defense's response, our concern is with the use of—not the amount spent on—expenses incidental to the administration and licensing of inventions. Therefore the wording of our matter for congressional consideration has been clarified in the final report.

Comments From the Department of Energy

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

Department of Energy
Washington, DC 20585

September 15, 1992

Mr. Victor S. Rezendes
Director, Energy and Science Issues
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20584

Dear Mr. Rezendes:

The Department of Energy (DOE) appreciates the opportunity to review and comment on the General Accounting Office (GAO) draft report entitled "TECHNOLOGY TRANSFER: Barriers Limit Royalty Sharing's Effectiveness."

The report, required by the Federal Technology Transfer Act of 1986 (FTTA), accepts the premise contained in that Act's legislative history that royalty sharing would be a strong incentive to report commercially useful technology. Concluding that there has been no significant change in reporting since passage of the FTTA, the report then examines the workings of royalty sharing to identify internal barriers. The resulting summary of focus group interviews presents a useful discussion of the cultural, regulatory, and institutional barriers that may hinder the effectiveness of royalty sharing as a technology transfer incentive. This "checklist" should prove valuable in reinforcing efforts currently underway to accelerate technology transfer. Lacking from the report, but of potentially greater utility, would be a discussion of external barriers which may overshadow or even counteract the positive incentive of royalty sharing. An example is the conflict of interest issue.

See comment 1.

Now on pp. 48 and 49.

Although identified on page 57, the report omits any significant discussion of conflict of interest. The FTTA allows for sharing of royalties by Government inventors, but is silent on conflict of interest considerations. For instance, the language of 10CFR 1010.301 (c)(1) and (c)(2) could be interpreted to bar DOE inventors from profiting when royalties flow directly to the inventor, because the Government has waived ownership of the intellectual property or when royalties flow through the Government under the provisions of the FTTA from inventions made in Government labs. Since the potential penalties for conflict of interest violations are far greater than

2

the rewards offered by royalty sharing, conflict of interest may be a much more important factor affecting invention reporting rates than the presence of royalty sharing. Clarification of this issue should be included in the "Matters for Consideration by the Congress" section on page 79. A thorough discussion of this issue, prepared by the Department of Commerce, is enclosed for your information.

Now on pp. 63 and 64.

Though we recognize that report timing was dictated by the legislation, we question whether 5 years is an adequate time period to assess change. On page 43, the report observes that it is not unusual for Federal R&D programs to have a 5- to 10-year schedule to reach their objectives. Given this observation, should significant change be expected within 5 years? We recommend that the report address this apparent inconsistency. Perhaps the issue should be revisited after an additional period of time.

Now on p. 37.

See comment 2.

There were several instances where seemingly significant findings failed to elicit recommendations for action:

- The findings on page 60 suggest that use of the lab share of royalties for "payment of expenses incidental to administration...," while authorized by the FTTA, does not advance the objectives of the FTTA. This observation seems worthy of a recommendation that Congress clarify its intent in the "Matters For Consideration By The Congress" section.

Now on pp. 51 and 52.

See comment 3.

- Taken together, accounts of lack of technology transfer support from lab directors (p. 76), failure to communicate the importance of technology transfer (p. 43), failure to provide needed support and instruction (p. 73, 74) and failure to deal with procedural impediments (p. 72) suggest systemic breakdowns between senior management and program and lab directors coupled with a general lack of direction for the lab research agenda. This apparent management failure is sufficiently serious to warrant specific recommendations.

Now on p. 62.
Now on p. 37.

Now on pp. 59 and 60.
Now on p. 61.

Characterization of some data raises questions regarding investigative impartiality. For example (p. 32, last paragraph) an increase of 11.8 patents per year during the 5 years beginning in 1987 is a 17

See comment 4.

Now on pp. 29 and 30.

3

percent increase. While a 17 percent increase would be deemed significant by many, the decision to instead portray it on a by-agency, by-year basis seems designed to communicate the opposite. Does this reflect a decision by the investigative staff to downplay apparent successes?

See comment 5.
Now on p. 20.

Since footnote c on page 22 is the only explanation found for the low royalty dollar totals attributed to DOE, this report could mislead readers regarding the efforts of the Department as a whole. By considering only Government-operated laboratories, this report excluded DOE's large contractor-operated labs and the vast majority of its scientific and engineering staff. We recommend that a clearer and more pronounced explanation be set forth in the body of the report. For example, one could insert on page 20 after the last sentence of the second paragraph, "The Department of Energy utilizes the licensing facilities of its Government-owned Contractor-operated laboratories for the vast majority of the inventions which it generates. These figures are not included in this report since the inventors are not normally Government employees, and the inventions licensed are not Government-owned. If such figures were included, the Department of Energy would rank second to NIH in total royalty income for 1991."

See comment 6.

Minor editorial changes have been presented to GAO under separate cover. DOE hopes that the comments in both letters will be helpful to GAO in their preparation of the final report.

Sincerely,

Elizabeth E. Smedley

Elizabeth E. Smedley
Acting Chief Financial Officer

Enclosure

The following are GAO's comments on the Department of Energy's letter dated September 15, 1992.

GAO Comments

1.Although we agree that the potential for conflicts of interest between private companies and government employees might be an external barrier to scientists' interest in patenting, our focus group questions did not directly address this issue. However, we did observe confusion and apprehension in scientists' comments when we asked them about their working relationships with private companies. Some agency officials attributed this reaction to what they see as an apparent inconsistency between technology transfer legislation and conflict of interest policy. We recognize that this issue is currently of sufficient concern to be noted, but it was beyond the scope of our work to address in more detail.

2.We agree that 5 years is not long enough to evaluate the overall impact and effectiveness of FTTA, but we believe that 5 years is sufficient to observe a change in invention-reporting rates. Although, as stated in our report, some government projects/programs run for 5 years or longer, we believe that a project's completion date is not the only time for an invention to be discovered and reported. As one scientist said, inventions can be the result of integrating ideas from various research areas and technologies (p. 60). We believe that the integration of ideas to create an invention does not require the completion of a project. (See our comment on timing on p. 65.)

3.We disagree that our findings suggest that the objectives of FTTA are not advanced by the use of the laboratory's share of invention income for "payment of expenses incidental to the administration and licensing of inventions." However, we did find a general lack of awareness among focus group scientists of the existence and operation of individual agencies' royalty-sharing programs. Without this awareness, we believe that there will be little motivation for scientists to take an action, such as reporting an invention. In our view, greater use of the laboratory's share of invention income for visible and tangible benefits for scientists at their laboratories can help to increase awareness of the program and to motivate invention reporting. Thus, our report includes a recommendation that department and agency heads channel a major part of the laboratory's share of invention income to areas in laboratories that are visible to federal scientists.

4.As stated on page 11 of our report, the House Conference Report stressed that agencies should have the freedom to implement their royalty-sharing programs to meet the culture, needs, and technology transfer problems at federal laboratories. Although "systemic breakdowns between senior management. . . and laboratory directors," or disagreements over the appropriate uses for the laboratory's share of invention income may sometimes occur at some agencies, we believe that these difficulties do not necessarily warrant specific recommendations at this time. In our view, a proper balance in the priority and funding of a range of program objectives can be established through the normal give-and-take of agency decision-making. Our report's presentation of these issues is intended to reinforce the flexibility intended in the law.

5.It is not our intent to downplay the licensing activities of individual agencies. (Our final report contains some updated numbers supplied by ARS officials. See p. 29.) However, before FTTA's passage, 13 agencies had average annual invention-licensing rates of fewer than one invention per year. Six of the 13 agencies had 6-year average rates of 0 for the same period. If a percent increase were calculated with a starting rate of 0, six agencies would be represented as having achieved "infinite" improvement. This would be true even though the average number of inventions that the agencies had licensed had, in the 5 years after the act's passage, either remained at 0 or increased to some average number less than 1. We believe that it is more important to show, as with the invention-reporting rates, that the modest increase for 21 agencies is actually a function of successes at several individual agencies.

6.As suggested, we have added a footnote on page 18 to clarify that our analysis excluded Energy's contractor-operated laboratories.

Comments From the Department of Commerce

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

UNITED STATES DEPARTMENT OF COMMERCE
Chief Financial Officer
Assistant Secretary for Administration
Washington, D.C. 20230

10 AUG 1992

Mr. Victor S. Rezendes
Director, Energy and Science Issues
Resources, Community and Economic
Development Division
Washington, D.C. 20548

Dear Mr. Rezendes:

Thank you for the opportunity to comment on the draft report entitled, "TECHNOLOGY TRANSFER: Barriers Limit Royalty Sharing's Effectiveness."

We have reviewed the enclosed comments of the Under Secretary for Technology and believe they are responsive to the matters discussed in the report.

Sincerely,

Preston Moore

Preston Moore

UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary for Technology
Washington, D.C. 20230

AUG 10 1992

Mr. Victor S. Rezendes
Director, Energy and Science Issues
Resources, Community and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

Thank you for your letter requesting the Department's comments on the draft General Accounting Office report entitled "Technology Transfer: Barriers Limit Royalty Sharing's Effectiveness".

The report is of significant interest to the Department because of the different perspectives on technology transfer incorporated within the Department of Commerce. First, the Department, through the National Institute of Standards and Technology and the National Oceanic and Atmospheric Administration, performs important research and development in many scientific and technical areas. In addition, through our National Technical Information Service, the Department serves as a representative for many other agencies in the negotiation of patent licenses. Finally, the Department was given an important role in coordinating Executive Branch implementation of Federal technology transfer laws, and by chairing the Interagency Committee on Federal Laboratory Technology Transfer, which is the principal coordinating mechanism for implementation of the laws.

We have a number of detailed comments concerning the draft report, which are reflected in the enclosed compilation. We also have a number of general comments on the report which I will outline here.

As you may know, the Federal Technology Transfer Act mandates that the Department prepare a biennial report on agency activities under the Act, 15 U.S.C. § 3710(g)(2). As a part of that function, we collect data from the agencies concerning a number of aspects of their technology transfer activities, including the number of invention disclosures filed, the number of patent licenses entered into and the amount of licensing royalties received. The data cited by the report to support its recommendations appear to be different from the data we have received from the agencies concerning their technology transfer activities in a number of important respects.

-2-

See comment 1.

For example, the data supplied to the Department indicates what appear to us to be a substantial increase in invention disclosures over the 1987-1991 period, suggesting a different conclusion concerning the impact of royalty sharing from that offered by the report. In addition, the draft report does not appear to consider the contributions of the Department of Energy's Government-owned, Contractor-operated laboratories (GOCOs). While these laboratories do not share royalties with their employees pursuant to the provisions of the FTTA, their ability to engage in Cooperative Research and Development Agreements (CRADAs) was conferred by an amendment to the FTTA and their royalty practices have been influenced by the FTTA. For that reason, we believe any effort to assess the impact of royalty sharing on technology transfer in the Federal laboratories is incomplete without a consideration of their unique role. We would be pleased to work with you and your staff to explore any differences in data relating to agency technology transfer activities and to consider how best to reflect all agency activities in the report.

There has been an explosive growth in industry interest in the Federal laboratories during the past two years. This increased interest is now being reflected in a sharp increase in the number of CRADAs underway between the labs and industry. The National Technology Initiative, initiated by the Departments of Commerce and Energy, has been extremely successful in encouraging these changes and we expect these dramatic improvements to continue. In any event, as discussed in the attachment, we believe that even the data used in the draft report indicate substantial progress at some of the agencies that are the most frequent sources of potentially commercial technologies.

See comment 2.

We also think it important that the report's analysis of royalty sharing be placed in the broader context of Federal technology transfer and commercialization activities. In that broader context, the sharing of licensing royalties by Federal inventors is only one of a number of factors affecting the success of Federal technology transfer and commercialization efforts. For example, those efforts are also influenced by the level of resources devoted to technology transfer, the emphasis placed on that activity by the laboratory management and the degree to which a laboratory's mission-related research lends itself to commercial development. At this point in the evolution of these programs, we do not believe it is possible to define the relative importance of these factors in encouraging technology transfer or to quantify the role of a specific factor, such as royalty sharing.

-3-

See comment 3.

Although we have concerns about the factual analysis of the relationship between royalty sharing and laboratory technology transfer activities, we do believe that the report presents some interesting recommendations concerning agency and laboratory royalty sharing practices. Of course, adoption of some of these recommendations may pose difficulties for the agencies and laboratories. For example, in many instances the direct costs of licensing currently exceed any royalty income received by the agency. If royalty income were not used to cover some of these costs, the laboratories would be required to limit their research activities in order to find the money to meet these costs, which might in turn reduce the number of inventions produced by the laboratories and the potential for technology transfer and commercialization. We intend to ask the Interagency Committee on Federal Laboratory Technology Transfer, which the Department chairs, to carefully consider the recommendations.

We appreciate the opportunity to comment on the draft report.

Sincerely,

Robert M. White, Ph.D.

Enclosure

The following are GAO's comments on the Department of Commerce's letter dated August 10, 1992.

GAO Comments

1.As indicated in chapter 1, our analysis included data only for scientists employed by the government for fiscal years 1987-91. A Commerce official told us during our review that their data also include contractor-employee inventions at government-owned laboratories. We did not include contractor employees at government-owned laboratories in our research population for precisely the reason stated in Commerce's letter—"these [government-owned, contractor-operated] laboratories do not share royalties with their employees pursuant to the provisions of FTTA." For these reasons, we are not surprised that our data differ from the data Commerce received.

In addition, although Commerce draws its conclusions through observations of the overall numbers of invention disclosures, we consider invention-reporting rates—the number of invention disclosures submitted per R&D scientist—to be a preferable measure for statistical analysis. The rates take into account any increase or decrease in the overall number of scientists who might report inventions at each agency.

2.We agree with Commerce's statement that royalty sharing is only one factor associated with the overall success of technology transfer and commercialization efforts. However, we were not trying to evaluate the role royalty sharing has had in the success of technology transfer. The objectives and scope of our work, as mandated by FTTA, were limited to assessing the effectiveness of royalty sharing in motivating federal scientists to report inventions.

In addition, we disagree with Commerce that it is premature to quantify the role of royalty sharing and analyze its effect on federal scientists' interest in patenting. (See our comment on timing on p. 65.) FTTA was enacted and royalty sharing was established in October 1986. Although it can take years to perfect a patentable invention, only a relatively brief period of time is necessary for a scientist to submit a disclosure to responsible agency management.

3.We recognize that some agencies may have difficulty covering their legal, administrative, or operational technology transfer costs (either direct or indirect) if they allow laboratories to use substantial amounts of income for purposes that provide visible benefits to scientists at their laboratories.

However, we believe that the royalty-sharing programs were not established just to reimburse technology transfer expenses but also to create an incentive for government-employee inventors to patent inventions. Many of the almost 100 scientists said that they would be encouraged to patent their inventions if the laboratory's share of invention income provided tangible benefits for scientists at their laboratories.

Comments From the Department of Agriculture

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20250

August 5, 1992

Mr. Victor S. Rezendes
Director, Energy and Science Issues
Resources, Community and Economic
Development Division
U. S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

Thank you for the opportunity to review the General Accounting Office Draft (GAO) Report RCED-92-211, "Technology Transfer: Barriers Limit Royalty Sharing's Effectiveness."

I am forwarding the enclosed response prepared by the Agricultural Research Service (ARS). The Forest Service (FS) agrees with the ARS comments. In addition, the Forest Service would like to add the following:

Now on pp. 19 and 12.

See comment 1.

Page 21: The footnote on page 15 which defines "scientist" for the report may appear to apply that same definition of "scientist" to the chart on page 21. However, "scientists" in the chart on page 21 refers to all scientists in the agency, not just those involved in Research and Development (R&D). While the FS reports 10,300 scientists in the agency, only about 1,000 of these are involved in R&D. Without knowing the comparative number of scientists in R&D, the Federal intramural R&D outlay dollars ($130.1 million) can be misleading.

Now on pp. 36 and 37.

See comment 2.

Page 42: When discussing the tension between the importance of free and open exchange of ideas on a scientific setting and the constraints potential patenting can put on that, it would seem appropriate to mention the use of confidentiality agreements. The Forest Service finds confidentiality agreements to be useful in allowing for the exchange of scientific information without publicly disclosing the information.

Sincerely,

DUANE ACKER
Assistant Secretary
Science and Education

Enclosures

ARS Response to GAO Report on "Technology Transfer: Barriers Limit Royalty Sharing's Effectiveness"

Now on pp. 3, 27, 37.

Now on p. 27.

See comment 3.

ARS Increase in Invention Reports. In several places (e.g., p.5, lines 2-6; p.31, 2nd paragraph; p.43, last paragraph) the report attributes increases in invention reports to factors other than agencies' incentive and promotion programs based on FTTA. On page 31, the explanation given is that the increases began before FY87, the year the FTTA went into effect. In the case of ARS this argument fails. As the data in Appendix II shows, there was a one-year blip of about a one-third increase in 1986 over the 1982-85 level, but it still was not up to the 1981 level. Then in FY87, invention reports fell back nearly to the FY 82-85 level. ARS launched its aggressive technology transfer and patent promotion program in the last half of FY87. This was followed by an almost doubling of invention reports in FY88, and the increase was sustained through FY90. A drop in FY91 is attributable to a large increase in filing, issue, and maintenance fees, which scientists had to pay out of their own research funds. We have taken steps to alleviate this disincentive by adopting a policy of paying a major part of these fees with licensing income beginning in FY92.

Now on p. 27.

See comment 4.

The suggestion on page 31 that the increase in invention reporting was due to the advent of biotechnology is specious, at least for ARS. This Agency began a steady increase in biotechnology research several years before 1986. A better source of information than non-USDA agencies regarding the make-up of ARS inventions is our published list of patent applications. Admittedly, this may not be identical in technology distribution to invention reports, but it is unlikely we would have discriminated against biotechnology in filing patent applications based on invention reports.

Now on p. 39.

See comment 5.

Now on p. 62.

No Efforts by Agency Management to Enhance Inventor Motivation. This contention on page 45 is not true for ARS. We have increased the inventors' share of licensing revenue from 15 to 25% (beginning in FY91, not FY92 as incorrectly indicated in footnote a of Table 3.2), increased minimum awards to $300 per inventor/patent/year, and instituted a technology transfer awards program, totaling $10,000-$15,000 per year. We send congratulatory letters signed by the Agency Administrator with the first check to an inventor for each patent. Last, but not least, we give credit for patents and other effective technology transfer activities toward career advancement of scientists. The importance of such credit is not mentioned anywhere in the Report except indirectly in a statement on page 76 attributed to a laboratory director that "professional advancement has been and remains based on publications."

All of these incentives have been highly promoted to ARS scientists through seminars, newsletter items, brochures, Agency Directives, etc., beginning in late FY87. We believe they are responsible for the increase in invention reporting shown for ARS in Appendix II. Since ARS scientists publish over 3000 papers a year, but the Agency files only about 100 patent applications, it is not surprising that a random selection of scientists found them generally far more interested in (and hence knowledgeable of) publications than patents in spite of our promotion efforts.

Now on p. 35.

Scientists Awards from Licensing Income are Trivial. Language on page 40 and elsewhere in the report indicates that after the awards for the AIDS Test Kit are subtracted, those received by all other Federal laboratory inventors are insignificant. This is not true for ARS. In FY91 one ARS scientist-inventor received awards totalling $75,892, two others shared approximately $40,000, 11 inventors received over $3,000, and 6 inventors received close to $3,000--the level that should "begin to get their attention" (p.51).

See comment 6.

Now on p. 43.

Effect of Level of Licensing Income Sharing. The report concludes that the present levels of income sharing in Agency patent programs do not constitute a sufficient incentive to Federal scientists to report inventions. The report cites invention reporting statistics allegedly showing that licensing income sharing has not increased inventions reporting (e.g., p.31, 1st sentence). We believe that GAO's reasons for concluding that the present award levels are ineffective are faulty.

See comment 7.

Now on p. 27.

Information about licensing income is conveyed to employees as part of patent awareness programs. If an agency does not have a good patent awareness program, then its employees are not going to know anything about income-sharing, let alone the amount of such share. It would be more logical to conclude that the absence of information about the existence of licensing income sharing, rather than the dollar amount, is responsible for lack of increased invention reporting for most agencies.

See comment 8.

Furthermore, the data in the report do not support a conclusion that an increase in licensing income sharing levels would increase invention reporting. See statistics on NASA and U.S. Army on pages 28, 30, 55, and 34(top).

Now on pp. 26, 47, 29.
See comment 9.

Disposition of Licensing Income in Excess of Scientists' Awards. On page 7 and several other places the Report makes strong representation that these funds should be used in "areas that are visible to Federal scientists." In several places (last paragraphs of pp.6, 65, 71, and 72) there is implication that these funds should be used "to further research at the

Now on p. 5.

Now on pp. 4, 54, 58.

See comment 10.
Now on p. 51.

laboratory." This does not seem to be consistent with the language of the law. In several places the Report indicates agencies are using this share of the licensing income for "administrative functions." On page 60 this term is expanded upon to include a wide range of technology transfer related expenses. However, for the many who will only read the Executive Summary, it will suggest we are using the funds for indirect costs such as salaries of administrative personnel. In ARS this is a totally incorrect impression. We are using the non-award portion of licensing income available to ARS to cover only direct costs arising from activities initiated or increased to implement the FTTA. When our agreement with NTIS is terminated at the end of this fiscal year, this will be true for all non-grant licensing income from ARS patents, not just that coming directly to the Agency.

See comment 11.

Now on pp. 54 and 58.

If these funds were to be returned to the research units for uses such as indicated on page 65 (last paragraph) and 72 (lines 4-8), the technology transfer, patent awareness, and licensing activities for which they are now used would have to be eliminated or supported with funds from taxing research accounts. The latter would be strongly opposed by the vast majority of scientists whose research does not normally lead to patentable inventions. The result would predictably be the first option (elimination).

See comment 12.

See comment 13.

While we recognize and strive to aggressively implement the scientist incentive aspects of FTTA, the primary purpose of Government patent licensing is to give private industry the incentive to risk its money to transfer Federal laboratory technology from the "shelf" to the marketplace. Accordingly, we believe our first priority use of the non-award portion of licensing income to promote fulfillment of this purpose is appropriate. We are trying to achieve more visibility to scientists of use of these funds by adding more patent advisors, licensing agents, and field-located technology transfer agents to assist them with getting industry to pick up technology resulting from their research.

See comment 14.
Now on p. 50.

Financial Control of Payments to Inventors. The ARS did not state that we "...do not routinely check or have any system in place to ensure that all eligible inventors have been paid the royalties to which they are entitled" as indicated on page 59.

We began our inhouse license program late in calendar year 1989. By early 1990 we had a manual check and balance system in place both at the Coordinator's Office and at our Finance Office. Our Patent Coordinator's Office, working in coordination with our financial staff, had established a monitoring tracking system with quarterly reports by mid-1990. Checks are received in the

See comment 15.

Patent Coordinator's Office and are routinely hand-carried or special delivered to our Finance Office within two days from receipt. The Finance Office routinely treats these checks as high priority. Deposits are made and checks are ordered within two days from receipt at Maryland Finance Office. Our National Finance Center in New Orleans processes the actions and mails checks from four to six weeks after their receipt.

Inventors are personally routinely called by the Patent Coordinator upon receipt of a check. Inventors are asked for their social security number and whether they want their award check to go to their home address or USDA work address.

The following are GAO's comments on the Department of Agriculture's letter dated August 5, 1992.

GAO Comments

1. We revised the footnote on page 12 to indicate that the work performed by scientists and engineers at federal laboratories is not restricted to R&D.

2. We have added clarifying information to a footnote on page 36.

3. We agree with ARS that our report, in some cases, attributes "increases in invention reports [we believe that ARS intended to use the term reporting] to factors other than agencies' programs based on FTTA." For example, we state in chapter 2 that increases could be a result of factors other than the initiation of royalty sharing, such as the advent of biotechnology-influenced industries and the creation of a new area of patentable technology made possible by judicial decisions and administrative decisions of the U.S. Patent and Trademark Office.

However, most agencies, unlike ARS, did not show an increase in the rate at which scientists reported inventions. In some cases, from 1987 to 1991, while the total number of invention disclosures increased, the number of R&D scientists increased even more. Under these circumstances, confidence interval analysis of the invention-reporting rates before and after the law's passage—unlike observations of annual "blips"—revealed no improvement in rates after the law's passage. Because ARS's invention-reporting rate is significantly smaller than NIH's rate, the exact time any upward trend in invention reporting began is more difficult to detect. Therefore, we have deleted the observation, which was included in our draft report, that increases in ARS's invention reporting began before 1987.

4. We disagree. Documents from Agriculture's patent awareness programs, which were begun as early as 1985, contain examples of biotechnology-based and plant-based inventions, as well as reference to and discussion of the judicial decision and administrative decisions at the U.S. Patent and Trademark Office that occurred in 1980 and 1985, respectively. These examples further support our argument that increases in ARS's invention reporting may be attributable to informing scientists of the existence of new areas of commercially useful patentable technology rather than to the existence of a financial incentive.

We do not agree that a list of Agriculture's patent applications impartially reflects Agriculture's potentially patentable ideas. In our view, multiple layers of agency management screening and annual fluctuations in budgets for patenting expenses can distort such a list.

5.We have changed our final report, on pages 43 and 49, to reflect actions by Agriculture officials to enhance inventors' motivation, including the career-advancement actions.

6.We neither state nor imply anywhere in our report that royalty payments to all federal inventors except those responsible for the AIDS test kit are "trivial" or "insignificant." The example presented is an average for all payments. As is the case with averages, some payments are higher and some are lower, but more are lower because 15 of 21 agencies have average invention incomes below the mean. (See p. 44.)

In addition, text in chapter 2 preceding the example cited by Agriculture includes ARS in the group of agencies whose (1) inventions are considered associated with applications for biotechnology-influenced industries and (2) average invention income for 5 years is $76,000—considerably higher than the $22,000 per invention for "nonbiotech" agencies.

7.We believe that our conclusions are valid. We conclude that the royalty-sharing program has provided a limited incentive for patenting during the past 5 years and has had only minimal effect in motivating scientists to patent their inventions. (See the report's conclusions at the end of chs. 2 and 3.) Our conclusions are not based solely on levels of invention income. Rather, they are based on a comprehensive and comparative analysis over 11 years and are further supported by the opinions gathered directly through confidential conversations with almost 100 scientists presently engaged in research at federal laboratories.

8.We disagree. There are many ways to create an awareness of royalty sharing among federal scientists. Including royalty-sharing information as part of a larger technology transfer or patent awareness program is just one way. Scientists in our focus groups who had attended such presentations made by headquarters-based Department officials had difficulty recalling any information conveyed about royalty sharing during these presentations. Because these individuals admitted knowing little or nothing before reporting their inventions or being contacted for our focus groups, their responses supported the need for management attention to this issue. The statement by one laboratory director that scientists need

not be informed about royalty sharing before they report inventions further supports this need. (See p. 48.)

9.We believe that our conclusions, as stated at the end of chapters 2 and 3, are correct. We do not advocate an across-the-board increase in the level of sharing but, where possible, a threshold for payments to inventors that would boost the amount received by inventors whose income from inventions is low.

10.We disagree. We believe that it is permissible to use some of the invention income for visible and tangible benefits that further the research of many scientists in laboratories as long as it is consistent with the statutory disbursement provisions of FTTA. We also believe that such use of the laboratory's share of invention income would be consistent with the types of activities that focus group participants indicated would motivate them to patent.

11.No distinction is made in our report between direct or indirect costs that are allowable expenses under FTTA. As shown by ARS documents covering the use of the laboratory's share of invention income or by the oral comments of an ARS official, these expenses can be salaries for Agriculture's technology transfer office's administrative personnel, facsimile charges, costs of computer equipment, or law books. We considered all such agency disbursements of the laboratory's share of invention income as technology transfer expenses incurred for administrative functions. As such, these charges appear in the technology transfer expense column, and the expenses that provide tangible, visible, and accessible benefits to current and potential inventors appear in the laboratory-visible activity column of table 3.4 in our report.

12.We disagree. Channeling more of the laboratory's share of invention income to the laboratory and including laboratory directors in decisions to spend the laboratory's share will not force the elimination of patent awareness and licensing activities. This redirection of funds will extend responsibility for effective use of the money to individuals closer to the source of the inventions.

13.We recognize that Agriculture has implemented some worthwhile scientist-incentive aspects under FTTA.

14.Our final report clarifies the attribution to reflect Agriculture's position on how we developed our financial control findings. (See p. 50.)

15.ARS's procedures for paying royalties to inventors whose patents were licensed by ARS appear to minimize processing time. However, the system described to us did not contain adequate controls to ensure that inventors received all the royalty checks mailed to them from New Orleans or processed through NTIS's financial management division.

Comments From the Environmental Protection Agency

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 10 1992

OFFICE OF
POLICY, PLANNING AND EVALUATION

Mr. Victor S. Rezendes
Director
Energy and Science Issues
Resources, Community, and Economic Development Division
U.S. General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Rezendes:

I am responding to your July 17 letter requesting the Environmental Protection Agency (EPA) review and comment on a draft General Accounting Office (GAO) report. The report is entitled "Technology Transfer: Barriers Confront Royalty Sharing Effectiveness" (GAO/RCED-92-211).

GAO issued the report responding to the Federal Technology Transfer Act (FTTA), 15 U.S.C. § 3710c(c)(2), requiring the Comptroller General to report on the effectiveness of royalty sharing to the appropriate Congressional committees five years after FTTA was passed.

Report Conclusions

The major conclusion of the report is that royalty-sharing has had little impact on scientists' interest in patenting. In reaching that conclusion, GAO interpreted the information at hand in several ways.

See comment 1.

First, GAO broke the 10-year period, 1981-1991, into just two ranges: 1981-1986, the six years prior to passage of FTTA, and 1987-1991, the five years subsequent to passage of FTTA. Use of just two wide ranges ignores two effects: the old law in the early part of the 1981-1986 range and the lead-time in the post-FTTA 1987-1991 range. For contracts awarded prior to mid-1981, contractors were obligated under then existing law to assign patent rights to the government, and reported those potentially patentable inventions through disclosure reports similar to those

Now on pp. 74 and 75.

used by employees. Such disclosures continued, at least for EPA, into 1983. Specifically, as can be seen on page 88, EPA received 14, 12, and 12 disclosures, respectively, but only 2 in 1984. Thus, a summation of the first six years' disclosures suggests that employees were more innovative in 1981-1986 than is actually the case.

See comment 2.

Use of one 5-year time frame, 1987-1991, subsequent to the passage of FTTA is also too broad. Although the FTTA was signed into law near the beginning of Fiscal Year 1987, it takes some time for a new law to become part of an agency's psychology. For instance, at EPA, the pragmatic start of FTTA was the Administrator's signing a delegation of authority to laboratory directors and other senior managers, and the announcement and distribution of that delegation in early calendar year 1989. Thus, the first relevant complete year at EPA was fiscal year 1990, and by 1991, disclosures (now only from employees) had risen to 16 -- the first year since 1983 that disclosures exceeded 7. In other words, the trend among employees at EPA is clearly upward subsequent to passage and implementation of FTTA.

See comment 3.

The report also concludes that royalty payments have not provided a significant incentive to employees. Here, the report again attempts to use quantitative data to prove its case, as well as relying on focus groups with some scientists. This conclusion is not justified. It is difficult to make conclusions strictly on the basis of actual payments. First, there is a lag time between conception of an idea and filing of a patent application, especially if the development work was accomplished through a Cooperative Research and Development Agreement (CRADA), first authorized, and therefore of necessity signed after the FTTA. Then, it takes approximately two years after filing for a patent to issue (and only about half of all patent applications filed mature to patents). Then, the patent must be made available for licensing; the announcement and negotiation phases also take time. Then, there is something of a Russian roulette whether a particular license arrangement leads to significant royalties. Thus, at best, visible effects from FTTA are only now hitting full stride, and if significant successes are to be measured only by royalty payments, such payments are too random to be used for statistical analysis. EPA's examples are again instructive. We have, to date, concluded only 3 license agreements under FTTA, 2 in 1991 and 1 in 1992. Only one of those has a large royalty payment. None of the 3 license agreements comes from work generated by an FTTA CRADA. Several other license agreements are now in various stages of negotiation -- some as a result of CRADAs, some not.

EPA disagrees with the conclusion of the focus groups which have concluded that the royalty payments do not create a significant incentive to employees. Although our evidence is anecdotal, it is instructive. First, for years, we have had a small awards system, independent of FTTA royalty streams, for filing of patent applications ($100 per employee co-inventor) and for issuance of a patent ($300 per employee inventor). Approval for those awards comes from the Office of General Counsel (OGC), but by early 1992, they had a backlog of unissued approvals. Several inventors contacted OGC on a number of occasions wondering where their awards stood. Clearly, the interest and incentive are there, even though the routine awards are not particularly lucrative. Beyond that, lab directors and their technology transfer coordinators have said that the beginning of royalty payments to colleagues has caught the interest of other Agency scientists in pursuing FTTA CRADAs, in filing disclosures and patent applications, and in pursuing licensing of their inventions.

See comment 4.

In any case, EPA's experience with the impact of royalties may be different from other agencies. That is because EPA is the only agency paying employees a flat percentage rate higher than the statutory rate -- 35% as opposed to 15%. The only other agencies with high effective payouts are the military services and NASA who pay 100% of the first $1000-$2000 per invention per year to the inventors, and then 20% of the payments above that threshold. Some agencies have a sliding scale (see table 3.2, p. 51), but their effective payouts are lower (see table 3.1, p. 48).

Now on p. 43. Now on p. 40.

Report Recommendations

The report recommends a modest increase of royalty shares in the threshold approach, but looks at EPA's percentage with favor. The threshold plus percentage formula would have been better for the employee inventors in 2 of EPA's license agreements; EPA's flat-rate is better for one of the agreements, because it is a larger royalty stream.

See comment 5.

With this specific experience at EPA as a backdrop, we wish to submit two alternative recommendations supporting the FTTA program:

1. Consider raising the percentage given to the inventor(s) to equal or approach the 35% set by EPA (note from Table 3.2 that EPA's allocation is significantly higher than any other Agency). This will increase the incentive more than awarding 100% of a modest threshold as suggested in the report.

4

See comment 6.

2. An issue not ever raised in the report is the legal requirement to treat royalties as two-year money which reverts to the Treasury if not spent by the end of the calendar year after receipt. There are two points to be considered:

a. These are not appropriated funds, but come from private sources. Therefore, it is not obvious that they should have any limit on their lifetime.

b. In many cases, the funds are received and/or certified to the Laboratory account very late in the fiscal year of receipt, effectively limiting the life to a little over one calendar year. This is potentially a major barrier to resource allocation decision and obligation through the cumbersome acquisition process. Therefore, it can severely limit the Laboratory Director's ability to spend the funds on the research activities that the statute seeks to promote. Revising the Act to make these no-year (or even 3-5 year funds) would be a major benefit.

Inconsistency and Error

Now on p. 62. See comment 7.

There is a logical inconsistency in the report. The report says one problem that needs correcting is educating employee researchers about patents, FTTA, license agreements, etc. (which EPA is now gearing up to do). On the other hand, the report decries agencies' use of retained royalties for administrative expenses in technology transfer rather than hands-on technology transfer (though the report admits, on p. 77, that such expenditures are legal). However, the recommended training is an administrative expense for technology transfer (though EPA has been using non-FTTA funds for this purpose). The draft report also recommends that royalty funds promote research that would lead to invention rather than being allocated to "administrative" expenses (alleged to be the practice at some agencies). We regard parent and licensing training expenses, and patent prosecution expenses both as expenses promoting research that do clearly lead to utilizable invention, but also as administrative expenses.

Now on p. 19. See comment 8.

The report is inconsistent in its array of resource data. In Table 1.1: Financial and Human Resources of Agencies Evaluated (page 22), the EPA line reflects $129.3 million and 7500 scientists. The dollar figure represents the intramural costs of operating the Office of Research and Development which supports only 1200 of the 7500 scientists appearing on the chart. Most of the remaining 6300 scientists are assigned to regulatory or enforcement positions and are not likely to be involved in scientific invention activities. In Apppendix II, Table II.1:

Now on pp. 74 and 75.

See comment 9.

See comment 10.

See comment 11.

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Laboratory Resources and Invention Reporting Rates, Fiscal Years 1981 -1991 (page 88), the EPA line reflects the number of R&D scientists (1217 for 1991) and the R&D operating budget ($434 million for 1991). This budget reflects the total R&D (intramural and extramural) expenditures, including the $129.3 million appearing Table 1.1. Only the latter fraction ($129.3 million) of that budget directly supports EPA R&D staff scientists. This may be confusing to the reader.

Conclusion

Although the Congressional direction to GAO is to evaluate the effect of royalty payments, the Agency believes that such a study does not answer the ultimate policy question. The goals of FTTA, and the Stevenson-Wydler Act which FTTA amends, are to transfer the results and knowledge of government sponsored R&D (approximately half of all the country's R&D) to the private sector such that the private sector can use the R&D to innovate and maintain or recapture technological competitiveness in the world. In that regard, a study of royalty payments to government scientists and their laboratories is a minor aspect in considering the impact of FTTA on technology transfer generally.

The Agency believes that FTTA is significant in enhancing invention, patents and licenses of EPA-developed innovative technologies. The EPA royalty policy is adequate. However, the funding mechanism could be broadened from two year to no-year funding allowing time to develop true "research" uses for these funds.

Under separate cover, my staff sent several page-specific, technical comments and corrections for consideration.

We appreciate the opportunity to comment on this report. We look forward to receiving the final report.

Sincerely,

Richard D. Morgenstern
Acting Assistant Administrator

The following are GAO's comments on the Environmental Protection Agency's letter dated September 10, 1992.

GAO Comments

1.In response to this comment, we asked EPA to provide us with revised invention-reporting data that excluded those invention disclosures submitted by contractor employees. According to EPA's Director of the Technology Transfer Staff and the Patent Attorney in the Office of General Counsel, the same data that they supplied in response to our original request, which appeared in our draft report and now appear in our final report, are the best representation of EPA's government-employee invention disclosures.

2.We disagree with EPA's assertion that we should not have begun our statistical analysis with 1987 data. The process for awarding a patent to an EPA or any federal inventor was in place and accessible to scientists prior to the advent of royalty sharing in October 1986. In effect, FTTA's royalty sharing added a financial incentive to encourage federal scientists' interest in patenting. More specifically, we selected invention reporting as the primary indicator for our analysis because reporting an invention is a government-employee inventor's first step in patenting and licensing, and the time required for it depends only on the time required for the scientist to complete and submit a disclosure form. (See our comment on timing on p. 65.) We believe that an increase in scientists' interest in patenting does not require "the Administrator's signing a delegation of authority."

3.We believe that our conclusions are valid. They were not based solely on actual payments to inventors but on an analysis of several indicators affecting scientists' interest in patenting, including scientists' invention-reporting rates and agencies' invention-licensing rates. In addition, we believe that comments from almost 100 scientists participating in focus groups confirm our conclusions.

4.EPA said that it disagreed with the conclusion of the focus groups that "the royalty payments do not create a significant incentive to employees." Our conclusion, drawn both from focus groups and from our statistical analyses, is that royalty sharing has provided a limited incentive for patenting for the first 5 years after the act's passage. (See p. 37.) Our conclusion was drawn from consistent opinions voiced by the almost 100 scientists who participated in our focus groups. We suggest that the reaction EPA may be observing may be less a concern over money than a reaction similar to the frustration expressed by the scientist who

compared the lengthy process by which his disclosures received consideration by agency management and patent counsel to a journey through "Never Never Land" (see p. 61).

5.EPA suggests that its 35-percent formula for royalty sharing is better than the threshold approach. We disagree. For the 5 years after FTTA's passage, only one EPA employee, in 1991, was entitled to an inventor payment. Although the income from this invention was large enough to pay the EPA inventor a substantial royalty, many inventions do not prove as rewarding.

Under all single-percentage formulas, including the 35-percent formula used by EPA, inventors receive payments of only several hundred dollars when (1) the annual income is low—in the range of several thousand dollars, (2) several inventors are responsible for an invention, and (3) typical payroll charges are withheld. For example, for an invention income of $1,000, under the 15-percent or 35-percent formula, the inventor's payment would be $150 or $350, respectively. On the other hand, under the $1,000-threshold formula, the inventor would be paid $1,000. Rewards of several hundred dollars, we were told during focus groups, do little to motivate inventors to make the effort to seek a patent.

6.Our final report contains a new reference to Section 3710c(a)(B) of FTTA which limits the period of use for the laboratory's share of invention income to 2 years. (Also see p. 39 and the footnote on p. 53.) Effective financial management of the laboratory's share of invention income should include projections of upcoming income and plans for using the income to meet the objectives of the program. We did not assess whether there was a problem with the 2-year statutory limit on expenditures of an agency's invention income. However, no one we spoke with during this review told us that the 2-year time frame to implement plans and obligate this money creates an unrealistic expectation.

7.We do not "decry" the use of funds for technology transfer administration. However, because this program was intended to provide an incentive for scientists, we believe that it is appropriate for scientists working in federal laboratories to experience its benefits.

8.The data included in table 1.1 reflect the overall resources available to the agency to realize its largest possible invention and technology transfer potential. Furthermore, as stated on page 12, an invention can be made by anyone matching a solution and a problem. Several agency officials told us

that some of their agencies' most successful inventions came from technical personnel who were not assigned to activities designated as R&D.

9. In response to this comment, we asked EPA to revise the numbers that it had provided previously for intramural R&D operating budgets. Our final report contains the intramural R&D operating budget figures provided by the Director of the Technology Transfer Staff.

10. We agree with EPA that FTTA and the original Stevenson-Wydler Act have broader ultimate goals. However, it was not our objective, in this report, to determine whether these goals had been accomplished.

11. We have made changes, where appropriate, to address technical and other comments provided by the federal agencies.

Comments From the Department of the Interior

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

United States Department of the Interior

OFFICE OF THE SOLICITOR
Washington, D.C. 20240

Mr. Victor S. Rezendes
Director, Energy and Science
Issues
General Accounting Office
Washington, D.C. 20548

AUG 18 1992

Dear Mr. Rezendes:

We have reviewed your proposed report entitled Technology Transfer: Barriers Confront Royalty Sharing Effectiveness (GAO/RCED-92-211) and agree with the findings and recommendations to stimulate invention and patent activity by Federal researchers. Furthermore, we have some comments based on our observations and experience with the Act.

It is our belief that the Federal Technology Transfer Act not only serves to encourage public and private cooperative research efforts, but also encourages increased patenting of inventions in the Government's name. Cooperative research agreements that provide for the private funding of research efforts in the Federal Government lessen the need for appropriated funds from Congress. Results of the cooperative research agreements should increase royalties on marketable inventions for which the Federal Government is the patent holder, thereby creating additional revenue for those departments and agencies that have research functions.

Now on pp. 23 and 27.

We have carefully considered the comments in the report on pages 27-32 which state that the statistics collected by your agency show little, if any increase, in invention reporting and in patent activity in the bureaus and agencies as a result of the Act. It is our position that changes in invention reporting and patent activity as indicated by the statistics was caused, in part, by an increase in the cost of processing patent applications since the passage of the Act in October of 1986. Even though there is more research and development being carried out now than in the past by Government researchers, management is considerably more selective in screening out the commercially sound inventions for patenting and licensing. As a result of this, inventors have not been filling out and submitting detailed and time-consuming invention reports on inventions which were not considered to have commercial potential.

See comment 1.

We also intend to establish a work group at Interior to study ways and means for stimulating and facilitating invention and patent activity in the Department that, in turn, should generate additional revenue.

We appreciate the opportunity to comment on this draft report and hope our comments will be of some service in the continuing implementation of this important legislation.

Sincerely yours,

John Schrote
Assistant Secretary for
Policy, Management
and Budget

The following is GAO's comment on the Department of Interior's letter dated August 18, 1992.

GAO Comment

1.This report did not evaluate the impact of increases in patent fees. However, our report entitled Patent and Trademark Office: Impact of Higher Patent Fees on Small-Entity and Federal Agency Users (GAO/RCED-92-19BR, Oct. 11, 1991) addressed federal technology transfer officials' views on this issue.

Comments From the Tennessee Valley Authority

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902

John B. Waters
Chairman, Board of Directors

August 4, 1992

Mr. Victor S. Rezendes, Director
Energy and Science Issues
Resources, Community, and
Economic Development Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Rezendes:

I appreciate the opportunity of providing TVA's comments on the draft GAO report: Technology Transfer: Barriers Confront Royalty Sharing Effectiveness.

Now on p. 23.

I am pleased to point out that TVA has the highest average annual invention-reporting record (p. 27) of all federal agencies and departments selected for this report for fiscal years 1981 through 1992. In fact, TVA had a higher rate by at least tenfold over nine of the responding agencies. We are proud of this record and wish to see it continue.

TVA concurs with the conclusions reached by GAO in the draft report and we offer the following comments on the recommendations contained in the draft report.

GAO recommendation 1: Departments and agencies operating invention income sharing programs under the Federal Technology Transfer Act adopt income sharing formulas that establish an annual threshold of 100 percent of a set amount of invention income that would more adequately reward inventors for their work.

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Mr. Victor S. Rezendes August 4, 1992

TVA comments: Subsequent to adoption of a single percentage formula for distribution of invention income, there have been several occasions where TVA inventors were rewarded with small amounts of money. It was felt that such small awards did not help motivate these or other would-be inventors. Accordingly, TVA is sensitive to this issue. However, in order to accommodate the interests of all laboratories, we respectfully suggest that any threshold amount be limited to $1000.

GAO recommendation 2: Establish procedures for payments to inventors that check agency patent and license records against receipts of innovation income.

TVA comments: TVA has been aware of this administrative problem and instituted a corrective process as of April 1991 for providing checks and balances between agency patents and license records and invention income.

GAO recommendation 3: Channel a major part of the laboratory share of invention income to areas in laboratories that are visible to federal scientists.

Now on pp. 53, 55.

TVA comments: TVA wholeheartedly agrees with this recommendation. TVA had full use of invention income and is pleased to see GAO acknowledge TVA's use of available invention income as highlighted on pages 64 and 67 of the draft report.

GAO recommendation 4: Require that the director of the laboratory where the invention originated be included in decisions governing the use of the laboratory's share of invention income. GAO further recommends that agencies provide more information and training for scientists at their laboratories on the kind of subject matter that is patentable, the proper approach for evaluating an invention's commercial demand, and establish procedures for the timely and consistent selection of inventions for patenting.

TVA comments: TVA agrees with this recommendation.

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Mr. Victor S. Rezendes August 4, 1992

Also as you requested, enclosed is our list of technical corrections to the draft report.

Again, we appreciate the opportunity of working with your staff on this report. Please let me know if we can provide you with any additional information.

Sincerely,

John B. Waters

Enclosure

United States
General Accounting Office
Washington, D.C. 20548-0001

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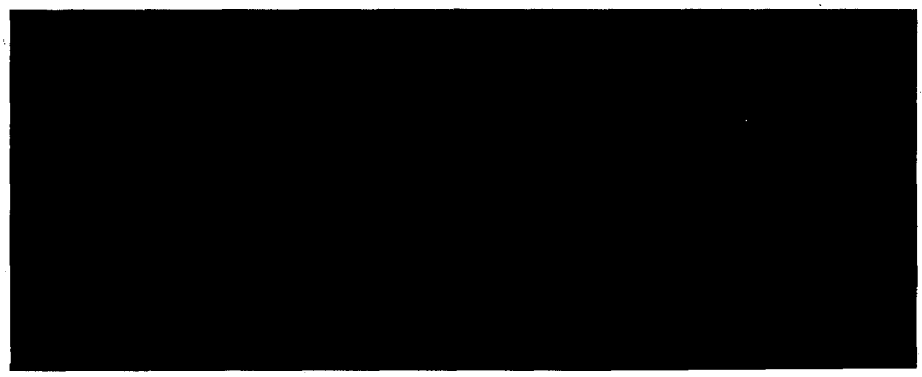
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