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Briefing Report to the Chairman, Subcommittee on Innovation, Technology and Productivity, Committee on Small Business, U.S. Senate

February 1988

FEDERAL RESEARCH

Small Business Involvement in Federal Research and Development

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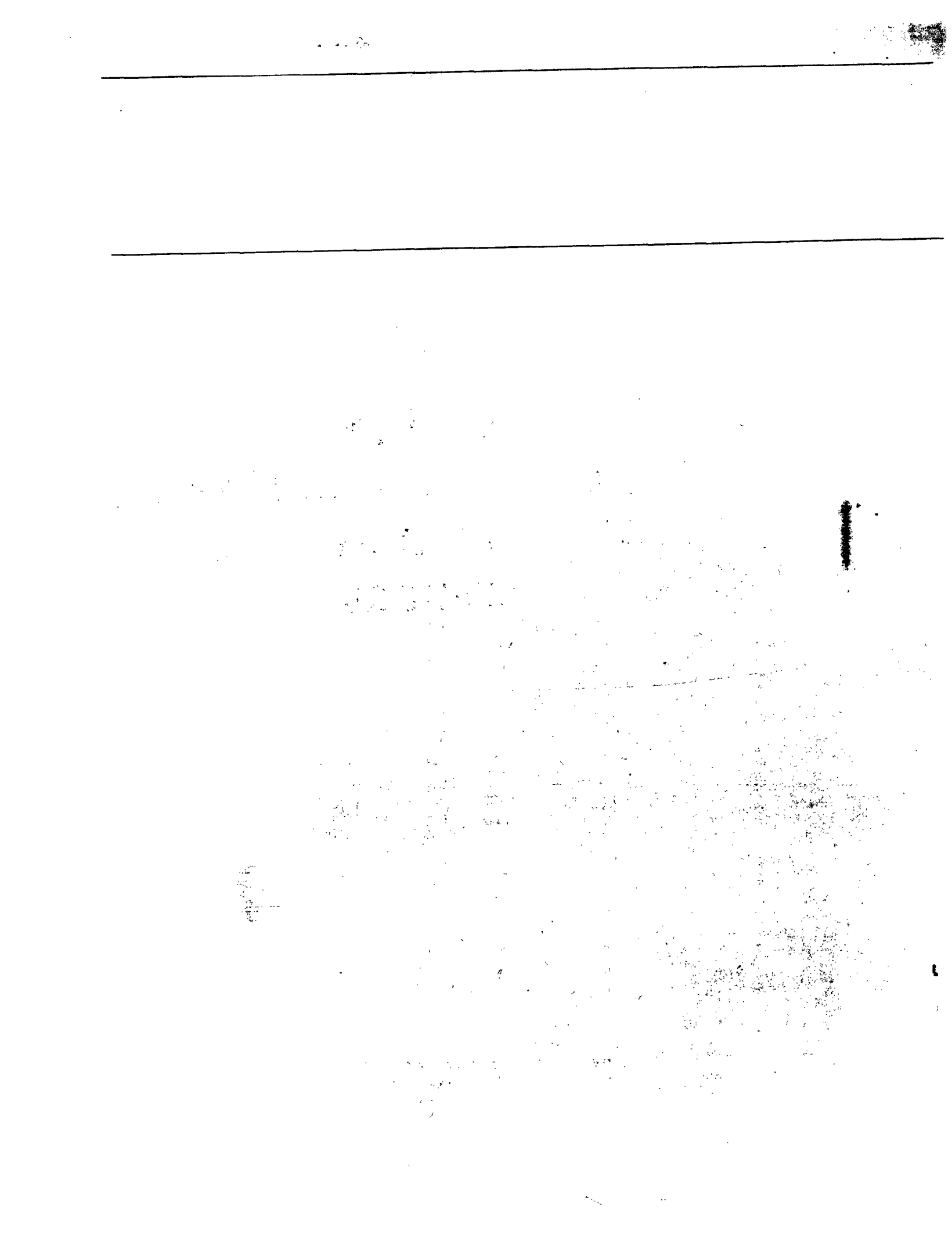

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United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

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February 2, 1988

The Honorable Carl Levin
Chairman, Subcommittee on Innovation,
Technology, and Productivity
Committee on Small Business
United States Senate

Dear Mr. Chairman:

In your September 30, 1987, letter and in subsequent discussions with your office, you asked us to obtain information on the role of small business in the federal government's technology transfer and research and development (R&D) programs. In particular, you asked whether (1) large federal laboratories have developed and implemented plans to transfer technology to small businesses, as required by the Federal Technology Transfer Act of 1986 and Executive Order 12591, "Facilitating Access to Science and Technology"; (2) two large R&D efforts funded in part by the federal government--Sematech and the National Science Foundation's Engineering Research Centers--are detrimental to small business' potential share of federal R&D funding by excluding them from participating in these efforts; and (3) the more rapid growth of federal R&D funding for defense/space, as opposed to civilian, research since 1982 has been detrimental to small business.

In summary, we found that none of the 10 federal laboratories we reviewed has developed formal plans to transfer technology to small businesses. Technology transfer officials at the laboratories indicated, however, that three laboratories have special outreach programs for small businesses; in addition, six laboratories provided specific information about cooperative research and development activities with small businesses. Other laboratories also indicated outreach and cooperative research and development activities that included small businesses; they stated, however, that they do not distinguish between small and large businesses and therefore could not provide more detailed information about interactions with small businesses in particular. They also emphasized that many agencies have only begun to implement the 1986 act and the April 1987 Executive Order. Section 1 provides further details on collaboration between small business and federal laboratories.

We also found that small businesses are expected to participate in both of the large research efforts that we reviewed. One of these projects is Sematech, a cooperative arrangement between federal, state, and local governments and private industry that is intended to focus on the production of semiconductors. According to officials at Sematech and a trade association representing 800 small businesses involved in the semiconductor industry, Sematech will improve business opportunities for small manufacturing concerns. We further found that all 13 of the Engineering Research Centers, the second large R&D effort, are including small businesses in their activities. Section 2 provides further information on the role of small businesses in large federal R&D efforts.

Finally, with regard to federal R&D funding for small businesses, information on contracts awarded to small businesses during the period from 1982 through 1986 shows that small businesses have made significant gains in both actual dollars awarded and in percentage of contracts awarded. Details on trends in federal contract funding to small businesses for civilian and defense/space efforts are provided in section 3.

In our discussions with federal and private officials, we defined small businesses as firms having 500 or fewer employees. The Small Business Administration, according to its Size Standards Staff, applies this figure as a basic standard to differentiate between small and large businesses that are involved in manufacturing and in R&D activities.

We obtained the information in this briefing report primarily from interviews and documentation provided by officials at 10 selected federal laboratories (the two largest at the Departments of Energy, Commerce, Agriculture, and Health and Human Services, and the National Aeronautics and Space Administration), Sematech, the Semiconductor Equipment and Materials Institute, the National Science Foundation, and selected Engineering Research Centers. (The laboratories and centers we contacted are listed in appendixes I and II.) We also obtained information from the General Services Administration; the Office of Management and Budget; the Office of Science and Technology Policy; the Small Business Administration; the Departments of Defense, Agriculture, Commerce, Energy, and Health and Human Services; and the National Aeronautics and Space Administration. We discussed the information presented in the report with cognizant officials at these agencies and have incorporated their comments where appropriate.

Agency officials identified various limitations in the completeness of their documentation, particularly for technology transfer activities in federal laboratories and trends in federal R&D contract funding for small business from civilian and defense/space agencies since 1982. Laboratory officials indicated that they may not be aware of all of the technology transfer to small businesses. Factors cited by laboratory officials to explain the incomplete documentation included (1) lack of a clear and consistently used distinction between small and large businesses, (2) lack of centralized recordkeeping within some laboratories, (3) informal interactions with the private sector that are not documented, and (4) uncertainty concerning the results of these informal interactions. As a result, other technology transfer activities involving small business may have occurred but could not be documented.

Documentation regarding funding trends was limited to contracts in excess of $25,000, as reported by the agencies to the Federal Procurement Data Center of the General Services Administration. The Center's database contains no information on grants or cooperative agreements that these agencies may have let to small businesses. As a result, we obtained information only on that portion of federal R&D funding provided to small businesses through contracts.

We are sending copies of this briefing report to the heads of the federal agencies listed above and the Engineering Research Centers and federal laboratories that we contacted. We will also make copies available to others upon request. If you have additional questions or if we can be of further assistance in this matter, please contact me at (202) 275-1000.

Major contributors to this briefing report are listed in appendix IV.

Sincerely yours,

Sarah Frazier Jaggar

Sarah Frazier Jaggar
Associate Director

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ABBREVIATIONS

DOE	Department of Energy
ERC	Engineering Research Centers
FDPC	Federal Data Procurement Center
GAO	General Accounting Office
JPL	Jet Propulsion Laboratory
LANL	Los Alamos National Laboratory
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NSF	National Science Foundation
ORNL	Oak Ridge National Laboratory
OSTP	Office of Science and Technology Policy
R&D	research and development
RIMTech	Research Institute for the Management of Technology
SBA	Small Business Administration
SEMI	Semiconductor Equipment and Materials Institute

SECTION 1

WHAT COLLABORATION IS TAKING PLACE BETWEEN FEDERAL LABORATORIES AND SMALL BUSINESSES?

INTRODUCTION

The transfer of new technology that is developed in federal laboratories to business firms, and particularly to small businesses, has received legislative support in recent years. For example, the Federal Technology Transfer Act of 1986 and Executive Order 12591, "Facilitating Access to Science and Technology," issued in April 1987, intend to promote technology transfer by authorizing government-operated laboratories to enter into cooperative research and development agreements with the private sector. They also state that, in promoting technology transfer, special consideration is to be given to small businesses.

The act and Executive Order are providing a new stimulus for technology transfer to small businesses, but more time is needed to develop and implement laboratory and agency policies in response to them, according to technology transfer officials. The officials also indicated that, even though they expect the act to stimulate more technology transfer, small businesses are already included in their technology transfer activities. For example, although officials at a majority of the laboratories in our review indicated that they have not developed formal plans to transfer technology to small businesses and have not targeted them in their outreach efforts, they reported a wide range of formal agreements and informal interactions involving small businesses.

The following discussion focuses on (1) plans, (2) outreach, and (3) agreements and informal interactions involving small businesses. It also discusses technology transfer officials' concerns about laboratory constraints on technology transfer that affect both small and large businesses.

PLANS FOR SMALL BUSINESSES

Technology transfer officials at the 10 laboratories[1] in our review indicated that their laboratories have not developed formal plans for targeting small businesses in their technology transfer activities. A majority of the laboratories emphasized the type of

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[1] National Aeronautics and Space Administration's Jet Propulsion Laboratory and Lewis Research Center, Commerce's National Bureau of Standards and Environmental Research Laboratory, Energy's Los Alamos National Laboratory and Oak Ridge National Laboratory, Agriculture's Beltsville Agricultural Research Center and Northern Regional Research Center, and Health and Human Services' National Cancer Institute and National Heart, Lung, and Blood Institute.

technology to be transferred more than the size of the business to which it was going. Officials noted, however, that the absence of a formal plan has not prevented their inclusion of small businesses in various technology transfer activities.

OUTREACH FOR SMALL BUSINESSES

According to the technology transfer officials that we interviewed, the laboratories vary in the degree to which their outreach activities are focused on small businesses. Seven laboratories[2] make no distinction between small and large businesses for the purposes of outreach. Rather, they disseminate information about new technologies through various channels (including trade and scientific journals, conferences, tours of facilities, and technical databases) without regard to the size of company that may respond to it. Officials said that, despite this general approach, they have received requests from small businesses for more information about technology transfer opportunities.

In contrast to this undifferentiated approach, three of the laboratories have special outreach activities for small businesses. For example, the National Aeronautics and Space Administration's (NASA) Lewis Research Center in Cleveland, Ohio, hosted 180 small businesses at a technology transfer conference in 1986. The Center is also assisting in preparing a multistate conference for small businesses in 1988 or early 1989. The Department of Energy's (DOE) Los Alamos National Laboratory has an Innovator's Forum, originally established in 1983, to which small businesses are invited for learning about a broad spectrum of issues relating to technology transfer and available technologies. A special technology transfer program at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, targets a particular market, identifies small businesses that can develop a product for the market, and brings these companies together with the resources of the federal laboratory for product development.

AGREEMENTS AND INFORMAL INTERACTIONS WITH SMALL BUSINESSES

Technology transfer officials at 6 of the 10 laboratories described agreements and informal interactions between their laboratories and small businesses. Officials at the remaining four did not provide specific information in this regard primarily because their laboratories do not clearly distinguish between large and small businesses.

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[2]Commerce's National Bureau of Standards and Environmental Research Laboratory, Agriculture's Beltsville Agricultural Research Center and Northern Regional Research Center, Health and Human Services' National Cancer Institute and National Heart, Lung, and Blood Institute, and Energy's Oak Ridge National Laboratory.

Agreements include cooperative R&D agreements and the license or transfer of patents. Cooperative R&D agreements permit federal laboratories to provide personnel, services, facilities, equipment, or other resources with or without reimbursement to nonfederal parties; in turn, nonfederal parties are permitted to provide all of the above resources and funds for conducting R&D efforts consistent with the missions of the laboratory.

The following examples cited by the six laboratory technology transfer officials illustrate a wide variety of arrangements for transfering technology to small businesses.

NASA's Jet Propulsion Laboratory: The Research Institute for the Management of Technology (RIMTech) consists of 10 companies, 6 of which are small businesses. (The others had been small businesses but have grown rapidly in the last 3 years and no longer fit the small business profile of 500 employees or fewer.) Each member paid a fee of $25,000 annually for the right to direct access to JPL's staff and facilities. The fee pays for the time that JPL engineers work on projects specified by the companies. NASA considers the RIMTech program a success and is developing plans to apply it at other NASA laboratories.

NASA's Lewis Research Center: The Technology Utilization Officer said that the Center's routine activities conducted on an informal basis have played a greater role than formal arrangements such as patent transfers or licenses. Generally, the Center does not enter into formal agreements; instead, it responds directly to small business' requests for assistance. The majority of the center's daily contacts (80 percent) are with small businesses. The Center has been involved in about 60 projects to help develop a wide range of special products for small businesses since 1982. It has also made equipment available to them for a nominal fee or entirely free of charge.

Department of Commerce's National Bureau of Standards (NBS): Among the many activities conducted by the NBS, the Industrial Research Associates Program provides for the transfer of researchers and other staff from the business community to NBS. According to the technology transfer officer, currently about one third of the 220 research associates come from small businesses.

DOE's Los Alamos National Laboratory (LANL): The technology transfer official reports that LANL has taken an aggressive stance to encourage successful small business spin-offs. About 30 to 35 such spin-offs have occurred in the last five years, as researchers at the laboratory have left to start their own small businesses. LANL has developed and submitted a proposal to DOE as part of this technology transfer approach; the proposal would smooth the way for funding researchers with promising ideas that could evolve into small businesses. In addition, LANL has lent personnel and

equipment to small businesses and has brought small business people to the laboratory for hands-on training.

DOE's Oak Ridge National Laboratory (ORNL): Operated under contract to DOE by Martin Marietta Energy Systems, ORNL has let 15 licenses, 11 of them to small businesses. Martin Marietta has developed one R&D agreement with a small business to transfer copyrighted software and three patents relating to a device for remotely manipulating hazardous radioactive fuels. The company is also using special facilities at ORNL for hands-on training to understand how ORNL's system works and how to adapt the equipment to its own needs. In addition, Martin Marietta contributes funds to the Tennessee Innovation Center, which facilitates technology transfer and has formed about 12 small businesses, half of them based on Department of Energy technologies.

Agriculture's Northern Regional Research Center: The Center's director reported a variety of informal interactions with small businesses and several technologies that have become the basis for small, successful companies. For example, a patent license for a corn-starch-based product was awarded to a small firm, and, with the help of two Center-assigned researchers, the firm has developed a marketable, biodegradable plastic product.

CONSTRAINTS

Technology transfer officials at all 10 laboratories cited and discussed a variety of constraints on technology transfer. Their remarks indicated that barriers exist within both the federal labs and the small business community. Their comments, as noted below, focus primarily on three laboratory constraints, which affect both small and large businesses, rather than on the problems faced specifically by small businesses.

First, several technology transfer officials perceive a gap between basic research conducted at their laboratories and the needs of the business community. The Technology Utilization Officer at NASA's Lewis Research Center said that federal laboratories do not usually develop technologies or products directly applicable to the needs of businesses. As a consequence, technologies need to be specially adapted before they can be successfully transferred. The National Technology Transfer Coordinator at Agriculture's Beltsville Agricultural Research Center told us that his laboratory is frequently engaged in basic rather than applied research and that the results of basic research can be more difficult to transfer to the private sector. An official at NBS believes that this problem has been somewhat magnified by the trend toward federal support of basic research. A Technical Staff Member at LANL said that it remains unclear what is permissible in using federal funds to take a technology from the laboratory to the commercial arena. The Director, RIMTech, said

that laboratories do not understand the marketing problems of small businesses.

Second, officials are also concerned about maintaining the laboratories' research mission. The Director, Office of Technology Development, at the National Cancer Institute expressed a concern that the laboratory might be overwhelmed with requests as companies become more interested in technology transfer opportunities. Occasionally, the Lewis Research Center has been too busy to respond to requests for technical assistance from the private sector and has had to refer the requesters elsewhere. Staff time for cooperative R&D activities with small businesses must be negotiated, according to the RIMTech Director. In general, officials expressed a need to arrive at a balance between maintaining the laboratories' research mission and being responsive to the private sector.

Finally, some laboratory officials expressed concern about the small number or lack of technology transfer specialists assigned to the laboratories. The Director of USDA's Northern Regional Research Center told us that he had no officially designated technology transfer specialist. The duties in this regard may be dispersed, according to a technology transfer officer at NBS, with no specific person or only a very few people responsible for them. The technology transfer staff is usually small, even at a large laboratory such as NBS, and therefore highly dependent on the quality and motivation of the few people assigned to this area.

Laboratory officials identified one of the principal constraints on technology transfer within the small business community as the limited awareness of new technologies and available assistance. For example, the Technology Utilization Officer at the Lewis Research Center stated that, in a majority of cases, small businesses are not aware of the latest technology, how to acquire it, or the willingness of local, state, and federal technology transfer offices to provide information and help. Officials also said that small businesses frequently lack the resources and time to explore these opportunities.

SECTION 2

ARE TWO LARGE R&D EFFORTS DETRIMENTAL TO SMALL BUSINESS?

We examined the trend toward consolidation of R&D efforts in two large programs--the Sematech consortium and the existing National Science Foundation's (NSF) Engineering Research Centers (ERCs)--to determine whether it might reduce opportunities for small businesses to participate in federal R&D. We found no evidence that these programs were detrimental to small businesses. Instead, small businesses are expected to participate heavily in Sematech and are already included in the activities of the ERCs.

SEMATECH

Sematech is a cooperative arrangement between federal, state, and local governments and private industry that focuses on the production of semiconductors. (Semiconductors are the "chips" containing the electronic circuitry used in computers; these chips are fundamental elements in a wide range of modern technologies and products.) The aim of Sematech is to improve the manufacturing technology of the U.S. semiconductor industry rather than the chips themselves. In particular, Sematech will construct an advanced production line in Austin, Texas. Current plans call for a 6-year program, with a $1.5 billion budget, or $250 million annually. The federal share is set at $100 million per year. The 14 members of Sematech, generally large corporations, will also contribute $100 million per year. The state and local governments where the production line is located are to provide the remainder.

Although 14 large companies are the primary members of Sematech, small businesses are critical to the semiconductor industry and will be affected by Sematech's activities. A few large corporations manufacture the semiconductors, while numerous small businesses perform the underlying R&D for the industrial equipment used to make the chips.

Small businesses, in fact, play the dominant role in manufacturing this equipment. The growing specialization of the equipment helps account for the existence of hundreds of small manufacturers. Moreover, rapid innovation renders equipment obsolete within only two or three years, spurring intensive R&D activities among the small companies, according to industry officials. These companies are investing more than $500 million, or about 12 to 13 percent of their revenues, in research and development, a much higher percentage than is common in most other industries. Given Sematech's focus on improving the manufacturing process rather than the chips themselves, the small companies designing and developing the basic equipment are expected to be closely involved in Sematech's activities.

According to officials from the Semiconductor Equipment and Materials Institute (SEMI), Sematech will not be detrimental to small businesses by reducing their share of federal outlays for R&D. (SEMI is the trade association representing the equipment manufacturers; its membership includes about 900 United States-based companies, 80 percent of which are small businesses with 500 employees or fewer.) SEMI officials noted that federal funds have been very limited for small businesses in this area in the past and that the Sematech proposal contains a provision for contracts averaging about $40 million per year, some of which may go to small businesses. The potential financial benefit to these small businesses remains somewhat limited, however, when compared with their already large expenditures (exceeding $500 million annually) for research and development.

Further, SEMI officials believe that the proposed project may offer various benefits in addition to the potential contracts. The most important benefit for SEMI's member companies will be Sematech's role in improving the overall relationship between SEMI and the larger manufacturers of semiconductors. Sematech will help inform the numerous small equipment manufacturers where the industry is going. It will also bring together the equipment makers and their customers to give a more comprehensive view of the manufacturing process and how its parts can be integrated. Technical workshops sponsored by Sematech will provide a useful forum in this regard. Small businesses that develop new equipment will have more opportunity to make their products known and enter a difficult, rapidly changing market.

SEMI has established a special SEMI/Sematech chapter to foster this interaction. The costs to join for its small business members range from about $2,000 to $18,000. SEMI stated that the chapter provides smaller companies with the opportunity to participate on an equal basis with larger competitors in the Sematech initiative without their incurring the costs of full Sematech membership.

Sematech agreed with SEMI's views concerning the project's benefits to small businesses. According to the Managing Director, Sematech, a characteristic of the semiconductor industry has been the diversification of equipment manufacturers into hundreds of small companies. The equipment manufacturers are so small that they have been generally unable to deal with more than one or two large customers; they cannot cover all of their potential clients or afford marketing departments to expand their sales. Sematech, according to the Managing Director, will enable these small companies to interact more easily with the larger semiconductor manufacturers. The Director told us that Sematech has paid special attention to the small companies and believes that the SEMI/Sematech chapter will be an effective means of improving their connection with the larger companies. He also described the initial concern that Sematech might be detrimental to small businesses as completely invalid.

In general, the proposed Sematech arrangement offers certain benefits to small businesses while requiring only a moderate fee from them. The benefits include potential contracts and, perhaps more importantly, greater interaction between the large and small companies that may open up new markets for the small equipment manufacturers. The federal government and the large semiconductor manufacturers will shoulder the main financial burden. We found nothing to suggest that Sematech will be detrimental to small businesses by reducing their share of federal outlays for R&D.

ENGINEERING RESEARCH CENTERS

NSF established the ERC program in 1985 and requested proposals from universities to establish such centers. The goals of the centers were to develop fundamental knowledge in engineering fields that will enhance the international competitiveness of U.S. industry and prepare engineering graduates with the diversity and quality of education needed by industry. They are expected to have extensive relationships with industry in research, education, and technology transfer. To date, NSF has established 13 centers.

We contacted all 13 centers by telephone to obtain information on their involvement with small businesses. Although officials at Columbia and the University of Delaware indicated that their centers' focus was directed toward large businesses, all ERCs reported activities with small businesses. These activities include meetings, workshops, courses, visits, special memberships, and joint projects, as discussed in more detail below.

All centers, as indicated in table 2.1, have invited small businesses to participate in meetings, workshops, or courses. The most extensive meeting activity reported to us is being conducted by Carnegie-Mellon University's ERC, which invited 60 small businesses to a meeting held in January 1988.

Reduced membership fees for small businesses were reported by five centers. For example, Brigham Young University's ERC has three small businesses as affiliate members at a reduced fee of $5,000, approximately 15 to 20 percent of the full membership fee. At Ohio State, fees were reduced by 80 to 90 percent for small businesses.

Three other centers have small business members through an "in-kind" arrangement; that is, the small business will provide components or materials for use by the center in its research program and in return will receive some member services from the center. For example, the University of Colorado's ERC has used components supplied by small businesses in their research and has provided limited membership services in return.

Six centers have developed joint projects that include small business. For example, Ohio State University reported successful

involvement through joint projects that have been developed with small business to be funded by the state of Ohio's Thomas Edison Project, a state-run initiative to transfer technology and promote economic development. Moreover, ERCs have used other outside organizations. For example, Purdue University's ERC reported being involved with over 100 small businesses through the state of Indiana's Technical Assistance Program.

NSF plans to issue a report early in 1988 on the centers' involvement with small- and medium-sized businesses and the variety of efforts being made to include them. The project director for the effort stated that the report will include data on information shared with small businesses through meetings, visits, workshops and courses, and publications. In addition, the report notes joint projects between the centers and small businesses and the role played by trade associations or state small business development organizations.

Table 2.1: Engineering Research Centers' Reported Involvement With Small Business

Center	Joint projects	Special memberships	Outreach through publications, meetings, visits
Brigham Young University	x	x	x
Carnegie-Mellon University			x
University of Colorado		x	x
Columbia University		x	x
University of Delaware			x
University of Illinois		x	x
Lehigh University		x	x
University of Maryland	x		x
Massachusetts Institute of Technology	x		x
Ohio State University	x	x	x
Purdue University	x	x	x
University of California at Los Angeles		x	x
University of California at Santa Barbara	x		x
Total	6	8	13

SECTION 3

WHAT HAS BEEN THE TREND IN FEDERAL R&D FUNDING FOR SMALL BUSINESS FROM CIVILIAN AND DEFENSE/SPACE AGENCIES SINCE 1982?

We examined the greater growth of federal R&D funding for defense/space, as opposed to civilian, research since 1982 to determine whether it has been detrimental to small business. From 1982 through 1986, significant gains have been made by small businesses both in actual contract dollars and in percentage of contracts awarded, according to information obtained from the General Services Administration's Federal Procurement Data Center (FPDC). Appendix III lists the civilian and defense/space agencies included in our analysis.

FEDERAL PROCUREMENT DATA CENTER

Public Law 93-400 requires that the Administrator for Federal Procurement Policy establish a system for collecting, developing, and disseminating procurement data. The Federal Procurement Data Center was established to operate the system, providing a central point to respond to the requirements of the legislative, executive, and judicial branches and the private sector.

The FPDC master file contains detailed information on the goods and services, including research and development activities, purchased by over 60 federal agencies. Data on individual contract actions over $25,000 must be included in the system. Agencies have the option of reporting detailed information on contract actions of less than $25,000. FPDC data are limited in that they do not contain information on grants or cooperative agreements or on the amount of funding going to small businesses through subcontracts. Despite these constraints, it is the best available information on the share of federal R&D contract funding for small business, according to the Director of the Federal Procurement Data Center.

PERCENTAGE AND DOLLAR AMOUNTS OF R&D FUNDING FOR SMALL BUSINESS

Table 3.1 shows that during the period from 1982 through 1986, the percentage of defense/space funding going to small businesses grew by 1.6 percentage points, from 4.3 percent to 5.9 percent. During the same period civilian funding grew by 4.3 percentage points, from 7.5 percent to 11.8 percent.

Table 3.1: Percentage of Federal R&D Defense/Space and Civilian Contract Dollars Going to Small Businesses

	1982	1983	1984	1985	1986
Defense/ space	4.3	4.3	4.5	5.6	5.9
Civilian	7.5	7.8	9.3	9.1	11.8

Source: GAO analysis based on information obtained from the Federal Procurement Data Center

Further, table 3.2 shows the increase in the actual dollar value of contracts going to small businesses. For the civilian agencies total R&D funding has remained relatively static during the 5-year period, increasing slightly (about 4.6 percent) from almost $1.80 billion in 1982 to $1.88 billion in 1986. On the other hand, the portion of funding going to small businesses increased by 64 percent, from $135 million to $222 million. Total defense/space R&D spending increased substantially from about $17.8 billion to almost $23.8 billion, or about 33 percent, whereas small business received proportionally more of the increase, growing from $768 million to over $1.4 billion, an increase of about 84 percent.

Table 3.2: Dollar Value of Federal R&D Defense/Space and Civilian Contracts Going to Small Business

	Civilian agencies		Defense/space agencies	
Year	Total R&D spending	Small business share	Total R&D spending	Small business share
	- - - - - - - dollars in millions - - - - - - -			
1982	$1,797	$135	$17,845	$768
1983	1,973	153	19,717	843
1984	2,157	201	22,323	994
1985	2,056	188	23,333	1,309
1986	1,880	222	23,798	1,410

Source: GAO analysis based on information obtained from the Federal Procurement Data Center

SMALL BUSINESS ADMINISTRATION
DATA ON R&D FUNDING TRENDS

We were asked whether information on trends in R&D funding for small businesses can be substantiated from records kept by the Small Business Administration (SBA). SBA is required under the Small Business Innovation Development Act of 1982 (Public Law 97-219) to maintain information on small business R&D funding through its Small Business Innovation Research Program. However, according to SBA, complete information is not being reported by the agencies that are required to participate in the program. The reasons why complete data are not being reported will be explored during our ongoing review of the program.

FEDERAL LABORATORIES SELECTED FOR REVIEW BY AGENCY

Department of Agriculture
- Beltsville Agricultural Research Center
- Northern Regional Research Center

Department of Commerce
- Environmental Research Laboratory
- National Bureau of Standards

Department of Energy
- Los Alamos National Laboratory
- Oak Ridge National Laboratory

Department of Health and Human Services
- National Cancer Institute
- National Heart, Lung, and Blood Institute

National Aeronautics and Space Administration
- Jet Propulsion Laboratory
- Lewis Research Center

APPENDIX II

ENGINEERING RESEARCH CENTERS ESTABLISHED FROM 1985 THROUGH 1987

Center	Year designated
Columbia University	1985
University of Delaware	1985
University of Maryland	1985
Purdue University	1985
University of California	1985
Massachusetts Institute of Technology	1985
University of California at Santa Barbara	1985
Brigham Young University	1986
Carnegie-Mellon University	1986
University of Illinois	1986
Ohio State University	1986
University of Colorado	1987
University of California at Los Angeles	1987

CIVILIAN AND DEFENSE/SPACE AGENCIES INCLUDED IN REVIEW OF R&D PROCUREMENT DATA FOR SMALL BUSINESS

Civilian Agencies

- Department of Agriculture
- Department of Commerce
- Department of Education
- Department of Energy
- Department of Health and Human Services
- Department of the Interior
- Department of Transportation
- Environmental Protection Agency
- Nuclear Regulatory Agency
- National Science Foundation

Defense/Space Agencies

- Office of the Secretary of Defense
- Department of the Air Force
- Department of the Navy
- Department of the Army
- Defense Nuclear Agency
- National Aeronautics and Space Administration

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