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Observations on the Small Business Innovation Research Program

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As a nation competing in a global economy, the United States depends heavily on innovation through research and development (R&D). Because small business is a principal source of significant innovation, the Congress established the Small Business Innovation Research (SBIR) program in 1982. The program was reauthorized in 1992 by the Small Business Research and Development Enhancement Act[1] to (1) expand and improve the SBIR program, (2) emphasize the program's goal of increasing the private sector's commercialization of technologies, (3) increase small businesses' participation in federal R&D, and (4) improve the federal government's dissemination of information concerning the program, particularly with regard to participation in the program by women-owned small business concerns and by socially and economically disadvantaged small business concerns. The act also mandated that we prepare two reports: an interim report by March 30, 1995,[2] and this final report. (See app. I for the requirements for the final report.) The program's funding in fiscal year 1997 totaled approximately $1 billion.

As agreed with your offices and in accordance with the 1992 act, this report discusses the following aspects of the SBIR program:

- Agencies' adherence to statutory funding requirements.
- Agencies' audits of extramural (external) R&D budgets.
- The effect of the application review process and funding cycles on award recipients.
- The extent of companies' project activity after receiving SBIR funding and agencies' techniques to foster commercialization.
- The number of multiple-award recipients and the extent of their project-related activity after receiving SBIR funding.
- The occurrence of funding for single-proposal awards.
- Participation by women-owned businesses and socially and economically disadvantaged businesses.
- SBIR's promotion of the critical technologies.
- The extent to which foreign firms benefit from the results of SBIR.
- The geographical distribution of SBIR awards.

[1]P.L.102-564, Oct. 28, 1992.

[2]Federal Research: Interim Report on the Small Business Innovation Research Program (GAO/RCED-95-59, Mar. 8, 1995).

To address these issues, we interviewed agency officials from five of the SBIR participating agencies, which accounted for over 95 percent of the program's overall budget in fiscal year 1996. We also relied on a database of SBIR award recipients maintained by the Small Business Administration (SBA), as well as the results of our 1991 survey of award recipients from the first 4 years of the program[3]—1984 through 1987—and the results of a 1996 Department of Defense (DOD) survey of DOD's award recipients, which closely followed our 1991 survey format. SBA currently has a survey under way of all non-DOD SBIR award recipients, which is being conducted by the same contractor that performed the DOD survey and which also closely follows our earlier format. Because of the ongoing SBA survey, we did not conduct our own follow-on survey. SBA expects to report on this survey by February 1999.

Background

Ten federal agencies participate in the SBIR program. Five of them—DOD, the National Aeronautics and Space Administration (NASA), the Department of Health and Human Services and, particularly, its National Institutes of Health (NIH), Department of Energy (DOE), and the National Science Foundation (NSF)—provided over 95 percent of SBIR funds in fiscal year 1996. (See table 1.) DOD provides over 50 percent of SBIR funding. Each agency manages its own program, while SBA plays a central administrative role, such as issuing policy directives and annual reports for the program.

[3]Federal Research: Small Business Innovation Research Shows Success but Can Be Strengthened (GAO/RCED-92-37, Mar. 30, 1992).

Table 1: SBIR Funding by Agency for Fiscal Year 1996

Dollars in millions

Agency	SBIR funding	Percentage of SBIR funding[a]
DOD	$453	51.0
NIH	188	21.0
NASA	117	13.0
DOE	62	7.0
NSF	41	5.0
USDA	9	1.0
Commerce	6	1.0
Transportation	5	1.0
EPA	5	1.0
Education	3	0.3
Total	**$889**	**100.0[a]**

[a]Percentages do not add to 100 because of rounding.

Source: SBA.

The Small Business Innovation Development Act of 1982[4] required that agencies with extramural R&D budgets of $100 million or more set aside not less than 0.2 percent of that amount for the SBIR program and provided for annual increases up to a ceiling of not less than 1.25 percent of the agencies' budgets. The act provided for a three-phase program. Phase I is intended to determine the scientific and technical merit and feasibility of a proposed research idea. Work in phase II further develops the idea, taking into consideration such things as the idea's commercialization potential. Phase III generally involves the use of nonfederal funds for the commercial application of a technology or non-SBIR federal funds for continued R&D under government contracts.

The Small Business Research and Development Enhancement Act of 1992 reauthorized the SBIR program through fiscal year 2000. The act emphasized the program's goal of increasing the private sector's commercialization of technologies and provided for further incremental increases in SBIR funding up to not less than 2.5 percent of agencies' extramural R&D budgets by fiscal year 1997. Moreover, the act directed SBA to modify its policy directive to reflect an increase in funding for eligible small businesses, that is, businesses with 500 or fewer employees. The funding was increased from $50,000 to $100,000 for phase I and from

[4]P.L. 97-219, July 22, 1982.

$500,000 to $750,000 for phase II, with adjustments once every 5 years for inflation and changes in the program.

Results in Brief

In summary, we found the following:

Agencies' Adherence to Statutory Funding Requirements

The agencies' SBIR officials reported that they have adhered to the requirements that preclude them from using SBIR funds to pay for the administrative costs of the program, such as salaries and support services used in processing awards. The program officials also believe that they are adhering to statutory funding levels for the program, that is, 2.5 percent of the agencies' extramural research budgets. However, some said that they are uncertain whether the agencies are correctly adhering to the requirements for establishing their extramural research budgets. The agencies may be interpreting the definition differently, resulting in items incorrectly being excluded or included in their budgets.[5] For example, DOD's SBIR program manager said that all eight military departments and defense agencies that participate in DOD's SBIR program are responsible for determining their own extramural research budgets on an "honor system." However, in one case, research funds for Lincoln Laboratory were excluded from the extramural research budget when they should have been included, according to DOD's SBIR program manager. NSF found that items, such as education, training, and overhead, were included in the extramural research budget when they should not have been.

Agencies' Audits of Extramural R&D Budgets

Only two of the five agencies that we reviewed have conducted audits of their extramural research budgets. In 1997, the Office of Inspector General at the NSF audited the agency's extramural budget and found that it contained over $100 million of unallowable costs, such as ones for training and overhead. NASA has conducted an internal study, which it considers an audit, of its extramural budget and is in the process of updating it with more recent budget data. NASA officials said that the results of the audit will be used to help establish future levels of SBIR funding. DOD, NIH, and DOE have not audited their extramural R&D budgets nor do they plan to in the near future.

[5]Current law essentially defines "extramural budget" as an agency's budget obligations that do not support activities conducted by the agency's employees. Section 638 (e)(1) of title 15 defines (with certain exceptions) "extramural budget" as the sum of total obligations minus amounts obligated for such activities by employees of the agency in or through government-owned, government-operated facilities.

The Effect of the Application Review Process and Funding Cycles on Award Recipients

While most of the SBIR officials we interviewed said that neither the application review process nor current funding cycles have had an adverse effect on award recipients' financial status or ability to commercialize their ideas, some recipients have said that any interruption in funding awards, for whatever reason, affects them negatively. In response to these concerns over the continuity of funding, some agencies have begun programs to minimize funding gaps. For example, DOD has implemented a "Fast Track" Program whereby award recipients who are able to attract third-party funding are given the highest priority in the processing for an additional award. NIH has also instituted a similar program.

The Extent of Companies' Project Activity After Receiving SBIR Funding and Agencies' Techniques to Foster Commercialization

The companies responding to GAO's and DOD's surveys reported that approximately 50 percent of their projects had sales of products or services related to the research or received additional developmental funding after receiving SBIR funding. In both the GAO and DOD surveys, approximately 35 percent of the projects had resulted in the sales of products or services, and approximately 45 percent of the projects received additional developmental funding. In addition, the agencies identified various techniques to foster the commercialization of SBIR-funded technologies. For example, DOD, in conjunction with the NSF and SBA, sponsors three national conferences annually. These conferences introduce small businesses to SBIR and assist SBIR participants in preparing proposals, business planning, strategic partnering, market research, and the protection of intellectual property.

The Number of Multiple-Award Recipients and the Extent of Project Activity After Receiving SBIR Funding

The number of companies receiving multiple awards, defined here as those phase I award recipients that also received 15 or more phase II awards in the preceding 5 years, grew from 10 companies in 1989 to 17 in 1996. In addition, our analysis shows that multiple-award recipients and non-multiple-award recipients commercialized their ideas at almost identical rates. Our 1991 survey found that 40 percent of the multiple award recipients had commercialized products. This was the same rate of commercialization as that for non-multiple-award recipients.

The Occurrence of Funding for Single-Proposal Awards

When an agency funds research for a given solicitation topic where only one proposal was received, it may appear that competition was lacking. We found that the funding of such single-proposal awards was rare. DOD's SBIR official reported that there were only three instances when a single proposal was submitted for a given solicitation topic out of the 30,000

proposals that were received from various solicitations; none of the cases resulted in an award.

Participation by Women-Owned Businesses and Socially and Economically Disadvantaged Businesses

All of the agencies we examined reported that they engaged in activities to foster the participation of women-owned or socially and economically disadvantaged small businesses. For example, each year, DOD's SBIR managers participate in a number of regional small business conferences and workshops that are specifically designed to foster increased participation by women-owned and socially and economically disadvantaged small businesses. According to NSF's Director of Industrial Innovation Programs, NSF's SBIR managers are directed to consider whether a company is woman-owned or is socially and economically disadvantaged when deciding whether to make an award.

SBIR's Promotion of the Critical Technologies

All of the agencies' SBIR officials we interviewed felt that the listings of critical technologies, as identified by DOD and the National Critical Technologies Panel, are used in developing their respective research topics or that the research being conducted falls within one of the two lists.[6] For example, during DOE's annual call for topics, SBIR officials are instructed to give special consideration to topics that further one or more of the national critical technologies. DOE's analysis of its fiscal year 1995 solicitation topics showed that 75 percent of the subtopics involved one or more of the national critical technology areas.

The Extent of Foreign Firms' Benefits From SBIR Results

We found little evidence of foreign firms, or U.S. firms with substantial foreign ownership interests, benefiting from technology or products developed as a direct result of SBIR-funded research. In our 1992 report, we noted that fewer than 5 percent of the 1,457 respondents to our questionnaire said they had finalized licensing agreements with companies or investors in foreign countries. Only 1 percent had finalized manufacturing agreements. These same questions were included in the recent survey of DOD's award recipients, which reported similar responses.

The Geographical Distribution of SBIR Awards

SBIR awards are concentrated in the states of California and Massachusetts. In fiscal year 1996, California received 904 awards, or 23 percent of the total number of awards given that year, which amounted to

[6]These lists indicate technologies that are critical to meeting national needs, such as competitiveness, defense, energy security, and quality of life.

$207 million. Massachusetts received 628 awards, or 16 percent of the awards, for a total of $148 million. However, every state received at least two. Previous studies of SBIR have linked the concentration of awards to local characteristics, such as the prevalence of small high-tech firms.

It Appears That Agencies Are Adhering to Statutory Funding Requirements; However, the Definition of Extramural R&D on Which the Funding Levels Are Based May Not Be Consistently Applied

The agencies' SBIR officials reported that they have adhered to the act's requirements that they not use SBIR funds to pay for the administrative costs of the program, such as salaries and expenses for support services used in processing awards. However, they added that the funding restriction has limited their ability to provide some needed administrative support. For example, DOD reported that its laboratories and field organizations do not have the necessary funds to provide personnel to act as mentors to their SBIR contractors or engage in activities that could possibly increase the program's success in phase III. Similarly, NIH, NASA, and NSF have also reported problems in providing outreach for current and potential SBIR participants because of this funding restriction. According to NSF's SBIR official, this funding restriction has resulted in NSF's inability to provide SBIR participants with much-needed training in business skills. DOE has reported experiencing administrative problems that are attributed to cuts in the Department's administrative budget. DOE's SBIR officials reported that further cuts, without the lifting of the restrictions on the use of SBIR funds, would diminish their ability to complete award selections in a more timely fashion, respond to the needs of the program's constituents, and ensure that high-quality research is being performed.

Although program officials believe that their agencies are adhering to statutory funding levels, some expressed concern because they feel that agencies are using different interpretations of the "extramural budget" definition. This may lead to incorrect calculations of their extramural research budgets. For example, according to DOD's SBIR program manager, all eight of DOD's participating military departments and defense agencies that make up DOD's SBIR program have differing views on what each considers an extramural activity and on the appropriate method for tracking extramural R&D obligations. As a result, the program and budget staff have not always agreed on the dollar amount designated as the extramural budget.

Only Two of the Agencies We Reviewed Have Conducted Audits of Their Extramural Budgets

Of the five agencies we reviewed, only two—NSF and NASA—have recently audited their extramural R&D budgets. DOD, NIH, and DOE have not audited their extramural R&D budgets nor do they plan to conduct any audits in the near future.

Both NSF and NASA audited their extramural R&D budgets in fiscal year 1997. NSF's audit, which was performed by its Office of Inspector General (OIG), concluded that NSF was overestimating the size of its extramural R&D budget by including unallowable costs, such as ones for education, training, and overhead. NSF estimated that these unallowable costs totaled over $100 million. The OIG audit report concluded that the SBIR portion of NSF's extramural budget should be reduced by approximately $2.5 million. The OIG audit report further concluded that by excluding these "unallowables," NSF will reduce the funds available for the SBIR program by approximately $13 million over a 5-year period. These funds could then be used for other purposes that further NSF's objectives.

Likewise, NASA has completed a survey of fiscal year 1995 budget data and is currently reviewing fiscal year 1996 data at its various field centers. NASA officials say this is an effort to (1) determine the amount spent on R&D and (2) categorize the R&D as for either intramural or extramural activities. According to NASA's SBIR official, the results of these surveys will be used to establish appropriate future funding levels for the SBIR program.

Application Review Process and Current Funding Cycles Are Not Adversely Affecting Recipients' Financial Status or the Commercialization of Projects

The SBIR officials we interviewed felt that neither the application review process nor the current funding cycles are having an adverse effect on award recipients' financial status or their ability to commercialize their projects. Specifically, DOD, DOE, NSF, and NASA stated that their respective review processes and funding cycles have little to no adverse effect on the recipients' financial status or the small companies' ability to commercialize their technologies. Furthermore, NIH believes that having three funding cycles in each year has had a beneficial effect on applicants.

While the effects of the review processes and funding cycles on the recipients' financial status and ability to commercialize projects were not specifically mentioned as problems, SBIR officials did state that some recipients had said that any interruption in funding awards, for whatever reason, affects them negatively. One SBIR program manager who did think that these were problems, stated that at DOD, most award recipients often have no way of paying their research teams during such a funding gap. As a result, ongoing research may be delayed, and the "time-to-market"—that

is the length of time from the point when research is completed to the point when the results of the research are commercialized—may be severely impaired, thus limiting a company's commercial potential. The DOD official said that time-to-market is of paramount importance in most high-tech industries—so much so, that a new product that reaches the market a year late may be partly or mostly obsolete.

Most of the participating SBIR agencies have established special programs and/or processes in an effort to mitigate any adverse effect(s) caused by funding gaps. One such effort is the Fast Track Program, employed at DOD, whereby phase I award recipients who are able to attract third-party funding are given the highest priority in the processing of phase II awards. At DOE and NIH, phase I award recipients are allowed to submit phase II applications prior to the completion of phase I. NASA has also taken steps to lessen any adverse impact on small businesses while applications are being processed. For example, NASA has established an electronic SBIR management system to reduce the total processing time for awards and is currently exploring the possibility of instituting a fast-track program similar to DOD's. Unlike the other participating federal agencies, NSF has not established any programs or procedures to mitigate the possible impacts of funding gaps on its SBIR participants. The reason for this, according to NSF, is that the agency's experience has been that phase I awardees, when given the choice, request more time to submit phase II applications, thus effectively increasing the funding gap by their own choosing.

Phase III Participation Rates Continue at Previously Reported Levels, While Agencies' Commercialization Techniques Vary

The third phase of SBIR projects is expected to result in commercialization or a continuation of the project's R&D. During this phase, additional federal funds or private-sector funds may be included, but additional SBIR funds may not be included. In 1991, we surveyed 2,090 phase II awards that had been made from 1984 through 1987. Our survey received responses on 1,457 awards—a response rate of 77 percent—and included questions that covered phase III activity. In 1996, DOD conducted its own survey, which closely followed our format, and also gathered information on phase III activity. DOD provides almost half of the total federal funding for SBIR, which amounted to over $500 million in fiscal year 1997. DOD's survey included all 2,828 of DOD's SBIR projects that received a phase II award from 1984 through 1992. DOD received 1,364 responses to this survey, for a response rate of 48 percent. SBA currently has a survey under way that also follows our format and will similarly cover phase III activity. This survey will include all projects that received a phase II award through 1993 and

will cover all of the 10 SBIR agencies except DOD. Because of the SBA survey, we did not conduct our own; however, we did additional analyses of our 1991 survey information. We also performed our own analysis of DOD's survey data, which we obtained from the contractor.

While analyzing the response data from our 1991 survey, we found that approximately half of the phase II awards were followed by phase III activity (e.g., sales or additional funding), while the other half had no phase III activity. (See table 2.) Overall, 515 respondents, or 35 percent, indicated that their projects had resulted in the sales of products or processes, while 691, or 47 percent, had received additional developmental funding.[7] Out of total sales of $471 million that award recipients attributed to SBIR projects, most of that amount came from nonfederal customers—35 percent went to the federal government, while 64 percent was nonfederal. In the case of additional developmental funding, the ratios were somewhat consistent, since most of the funding, once again, came from nonfederal sources (76.5 percent) and the rest came from the federal government (23.6 percent).

Our analysis of DOD's 1996 survey responses showed that phase III activity was occurring at rates similar to those in our survey. Our analysis of these responses showed that 653 projects, or 48 percent, reported that they were active in phase III at the time of DOD's survey, while the other half did not report any phase III activity. The respondents indicated that 442 awards, or 32 percent, had resulted in actual sales, while 588 reported that the awards had resulted in additional developmental funding. DOD's sales data broke down differently from the data in our survey results. The sales reported to DOD split almost evenly into federal (52.8 percent) and nonfederal (47.2 percent) customers. The sources of additional developmental funding were also about an even split between federal (48.8 percent) and nonfederal (51.2 percent) customers.

Table 2: Summary of Reported Phase III Activity

Survey responses	GAO survey	DOD survey
Projects with phase III activity	765	653
Projects with sales	515	442
Projects with additional developmental funding	691	588
Projects with no phase III activity	692	711
Total	**1,457**	**1,364**

Source: GAO's 1991 survey data and DOD's 1996 survey data.

[7]Figures do not add to 100 percent because some projects may have reported both types of activity.

Agencies are currently using various techniques to foster commercialization, although there is little or no empirical evidence suggesting how successful the particular techniques have been. For example, in an attempt to get those companies with the greatest potential for commercial success to the marketplace sooner, DOD has instituted a Fast Track Program, whereby companies that are able to attract outside commitments/capital for their research during phase I are given higher priority in receiving a phase II award. According to DOD's SBIR program manager, getting a product with commercial potential quickly to the marketplace is critical if the company is to be successful. The Fast Track Program not only helps speed these companies along this path but also helps them attract outside capital early and on better terms by allowing the companies to leverage SBIR funds. In 1996, for example, DOD's Fast Track participants were able to attract $25 million in outside investment. Companies that qualify for an award under the Fast Track Program can be granted a phase II contract without any interruption in funding.

Additionally, DOD, in conjunction with NSF and SBA, sponsors three national SBIR conferences annually. These conferences introduce small businesses to SBIR and assist SBIR participants in the preparation of SBIR proposals, business planning, strategic partnering, market research, the protection of intellectual property, and other skills needed for the successful development and commercialization of SBIR technologies.

DOE has employed a different technique aimed at increasing the commercial potential of SBIR participants. DOE's Commercialization Assistance Program provides phase II award recipients with individualized assistance in preparing business plans and developing presentation materials to potential partners or investors. This program culminates in a Commercialization Opportunity Forum, which helps link SBIR phase II award recipients with potential partners and investors.

Although NSF's efforts to foster commercialization are limited in scope, the agency provides (1) its phase I award recipients with in-depth training on how to market to government agencies and (2) its phase I and II award recipients with instructional guides on how to commercialize their research. Similarly, NASA assists its SBIR participants through numerous workshops and forums that provide companies with information on how to expand their business. NASA also provides opportunities for SBIR companies to showcase their technologies to larger governmental and commercial audiences. For example, SBIR companies are encouraged to participate in NASA's American Institute of Aeronautics and Astronautics

conferences, Tech 200X annual shows, Space Technology and Applications International Forum, and Oshkosh Fly In. Moreover, NASA has established an SBIR homepage on the Internet to help promote its SBIR technologies and SBIR firms and has utilized several of its publications as a way for SBIR companies to make their technologies known to broader audiences.

Unlike the other SBIR agency participants, NIH does not promote any particular techniques to foster commercialization. However, NIH cites its participation in workshops and forums, including the national conferences, which have a significant focus on commercialization.

Multiple-Award Recipients Commercialize at Rates Similar to Those of Non-Multiple-Award Recipients

Using SBA's data, we determined the number of phase I award recipients who had received 15 or more phase II awards in the preceding 5 years. (See table 3.) Throughout all of the 5-year cycles we reviewed, seven companies received multiple awards in each and every cycle. In addition, the recipient of the most SBIR awards in each cycle was the same throughout all of the cycles.

Table 3: Phase I Award Recipients That Received Over 15 Phase II Awards in the Previous 5 Years

Year of phase I award	Number of companies	5-year period of phase II awards	Number of phase II awards[a]
1989	10	1984-88	15-32
1990	13	1985-89	15-45
1991	13	1986-90	15-50
1992	14	1987-91	15-53
1993	13	1988-92	16-53
1994	17	1989-93	15-58
1995	16	1990-94	15-60
1996	17	1991-95	15-61

[a]Range: lowest to highest.

Source: GAO analysis of SBA data.

We compared the commercialization rates, as well as the rates at which projects received additional developmental funding, for the multiple-award recipients with those of the non-multiple-award recipients. This comparison of the phase III activity is summarized in table 4. This analysis shows that the multiple-award recipients and the non-multiple-award recipients are commercializing at comparable rates, on the basis of the data from GAO's and DOD's surveys. According to both surveys, however, multiple-award recipients receive additional developmental funding at rates higher than those of the non-multiple-award recipients.

Table 4: Comparison of Multiple-Award Recipients and Non-Multiple-Award Recipients

Survey	GAO (governmentwide)	DOD
Projects by multiple-award recipients	200.0	261.0
Projects by non-multiple-award recipients	1,257.0	1,103.0
Commercialization rates for multiple-award recipients	40.5%	40.2%
Commercialization rates for non-multiple-award recipients	40.3%	39.3%
Percentage of multiple-award recipients' projects receiving additional funding	46.5%	43.7%
Percentage of non-multiple-award recipients' projects receiving additional funding	45.7%	42.3%
Commercialization rate for all award recipients	40.4%	39.4%

Source: GAO's 1991 survey data and DOD's 1996 survey data.

Table 5 shows another comparison between multiple-award recipients and non-multiple-award recipients. This table shows that the average levels of sales and additional developmental funding for the multiple-award recipients are lower than those for non-multiple-award recipients. Our survey data show that multiple-award recipients' sales are, on the average, $12,000 lower than those for non-multiple-award recipients, while the levels of additional developmental funding are almost $90,000 lower for the multiple-award recipients. An analysis of DOD's data shows differences that are even more pronounced. DOD's survey data show that average sales are over $250,000 lower for the multiple-award recipients and the average levels of additional developmental funding for the multiple-award

recipients are over $175,000 lower than those for the non-multiple-award recipients.

Table 5: Comparison of Multiple- and Non-Multiple-Award Recipients Based on Averages Dollars in Thousands

Survey	GAO (governmentwide)	DOD
Multiple-award recipients' average sales (sales/all multiple-award recipients' projects)	$306	$356
Non-multiple-award recipients' average sales (sales/all non-multiple award recipients' projects)	318	626
All award recipients' average sales (sales/all award recipients)	316	574
Multiple-award recipients' average additional funding (funding/all multiple-award recipients' projects)	251	431
Non-multiple-award recipients' average additional funding (funding/all non-multiple-award recipients' projects)	339	608
All award recipients' average additional funding (funding/all award recipients)	327	573

Source: GAO's 1991 survey data and DOD's 1996 survey data.

A comparison between the sales recipients and the sources of additional developmental funding shows differences between our survey data and DOD's survey data with respect to multiple- and non-multiple-award recipients. (See table 6.) Our survey data show that both the multiple-award recipients and non-multiple-award recipients make approximately 35 percent of the sales to federal customers, while the remaining 65 percent goes to nonfederal customers. On the other hand, DOD's survey data show that most of the non-multiple-award recipients' sales go to federal customers (54 percent), while most of the multiple-award recipients' sales go to nonfederal customers (57 percent). Regarding the sources of additional developmental funding, our data show that a large majority of both multiple-award recipients (67 percent) and non-multiple-award recipients (77 percent) receive this funding from nonfederal sources. DOD's survey data show an almost even split, namely, that 51 percent of this funding comes from federal sources for multiple-award recipients and 49 percent for non-multiple-award recipients.

Table 6: Sales and Additional Developmental Funding for SBIR Projects

Dollars in millions

Survey	GAO		DOD	
	Multiple-award recipients	Non-multiple-award recipients	Multiple-award recipients	Non-multiple-award recipients
Total sales	$61.2	$400.0	$93.0	$690.3
Federal sales	35.0%	34.6%	42.9%	54.2%
Nonfederal sales	65.0%	65.4%	57.1%	45.8%
Total additional funding	$50.1	$425.7	$112.5	$668.5
Additional federal funding	33.0%	22.4%	51.2%	49.3%
Additional nonfederal funding	67.0%	77.6%	48.8%	50.7%

Source: GAO's 1991 survey data and DOD's 1996 survey data.

Solicitations Rarely Result in Single-Proposal Awards

When an agency funds research for a given solicitation topic where only one proposal was received, it may appear that competition was lacking. The majority of the SBIR officials we interviewed indicated that receiving a single proposal for a given solicitation topic is extremely rare. DOD reported that from 1992 through 1996, there were only three instances when a single proposal was submitted for a given solicitation topic out of 30,000 proposals that were received for various solicitations. DOD's SBIR official also stated, however, that none of the cases resulted in an award.

Both DOE's and NASA's SBIR officials reported that they did not receive any single proposals for this time period. Moreover, NASA's SBIR officials stated that their policy is to revise a solicitation topic/subtopic if it receives fewer than 10 proposals or to drop the topic/subtopic from the solicitation.

SBIR officials from both NIH and NSF reported that their respective solicitations are different from those of the other agencies because the solicitation topics are very broad. As a result, they receive a wide range of proposals for a given solicitation topic. The officials stated that despite the diversity of the proposals received, they still compete against one another for funding.

All of the Agencies Promote Program Participation by Women-Owned and Socially and Economically Disadvantaged Small Businesses

One of the purposes of the 1992 act was to improve the federal government's dissemination of information concerning the SBIR program, particularly with regard to participation in the program by women-owned small businesses and by socially and economically disadvantaged small business. All of the agencies we reviewed reported participating in activities targeted at women-owned or socially and economically disadvantaged small businesses. For example, DOD's program managers participate each year in a number of regional small business conferences and workshops that are specifically designed to foster increased participation in the SBIR program by women-owned and socially and economically disadvantaged small businesses. All of the SBIR managers participate in national SBIR conferences that feature sessions on R&D and procurement opportunities in the federal government that are available to socially and economically disadvantaged companies.

NSF encourages its program managers to take women-owned and socially and economically disadvantaged small businesses into consideration in order to promote balance in its program. According to NSF's Director of Industrial Innovation Programs, SBIR managers are directed to look not only at a company's commercialization track record but also at the company's status as a new participant, woman-owned business, or a socially and economically disadvantaged business when deciding whether to make an award. Furthermore, NASA has included all minority colleges and universities on its mailing list in an attempt to reach out to these special groups.

SBIR Programs Promote the Critical Technologies

Most of the SBIR agency officials whom we interviewed stated that they use the two listings of critical technologies as identified by DOD and the National Critical Technologies Panel in developing their respective research topics. The other agencies believe that the research being conducted falls within one of the two lists. At DOE, for example, research topics are developed by the DOE technical programs that contribute to SBIR. In DOE's annual call for topics, SBIR offices are instructed to give special consideration to topics that further one or more of the national critical technologies. DOE's analysis of the topics that appeared in its fiscal year 1995 solicitation revealed that 75 percent of the subtopics involved one or more of the national critical technology areas. Likewise, NASA's research topics, developed by its SBIR offices, reflect the agency's priorities that are originally developed in accordance with the nationally identified critical technologies. At DOD, SBIR topics that do not support one of the critical technologies identified by DOD will not be included in DOD's solicitation.

Both NIH and NSF believe that their solicitation topics naturally fall within one of the lists. According to NIH's SBIR official, although research topics are not developed with these critical technologies in mind, their mission usually fits within these topics. For example, research involving biomedical and behavioral issues are very broad and can be applied to similar technologies defined by the National Critical Technologies Panel. NSF's SBIR official echoes the sentiments of NIH. According to this official, although NSF has not attempted to match topics with the listing of critical technologies, it believes that the topics, by their very nature, fall within the two lists.

There Is Little Evidence of Foreign Interest in SBIR Projects

According to our 1991 survey and DOD's 1996 survey, SBIR projects result in little business-related activity with foreign firms. For example, our 1991 survey found that 4.6 percent of the respondents reported licensing agreements with foreign firms and that 6 percent reported marketing agreements with foreign firms. It should also be remembered that both of these agreements refer to activities where the U.S. firm is receiving benefits from the SBIR technology and still maintaining rights to the technology. Sales of the technology or rights to the technology occurred at a much lower rate—1.5 percent—according to our survey. The DOD survey showed similar results. These data showed that less than 2 percent of the respondents had finalized licensing agreements with foreign firms and that approximately 2.5 percent had finalized marketing agreements with foreign firms. Sales of the technology or the rights to the technology developed with SBIR funds occurred only 0.4 percent of the time. Although the act called for us to make recommendations on foreign interest, we are making no recommendations on tracking the extent to which foreign firms are benefiting from SBIR at this time because of the limited activity to date.

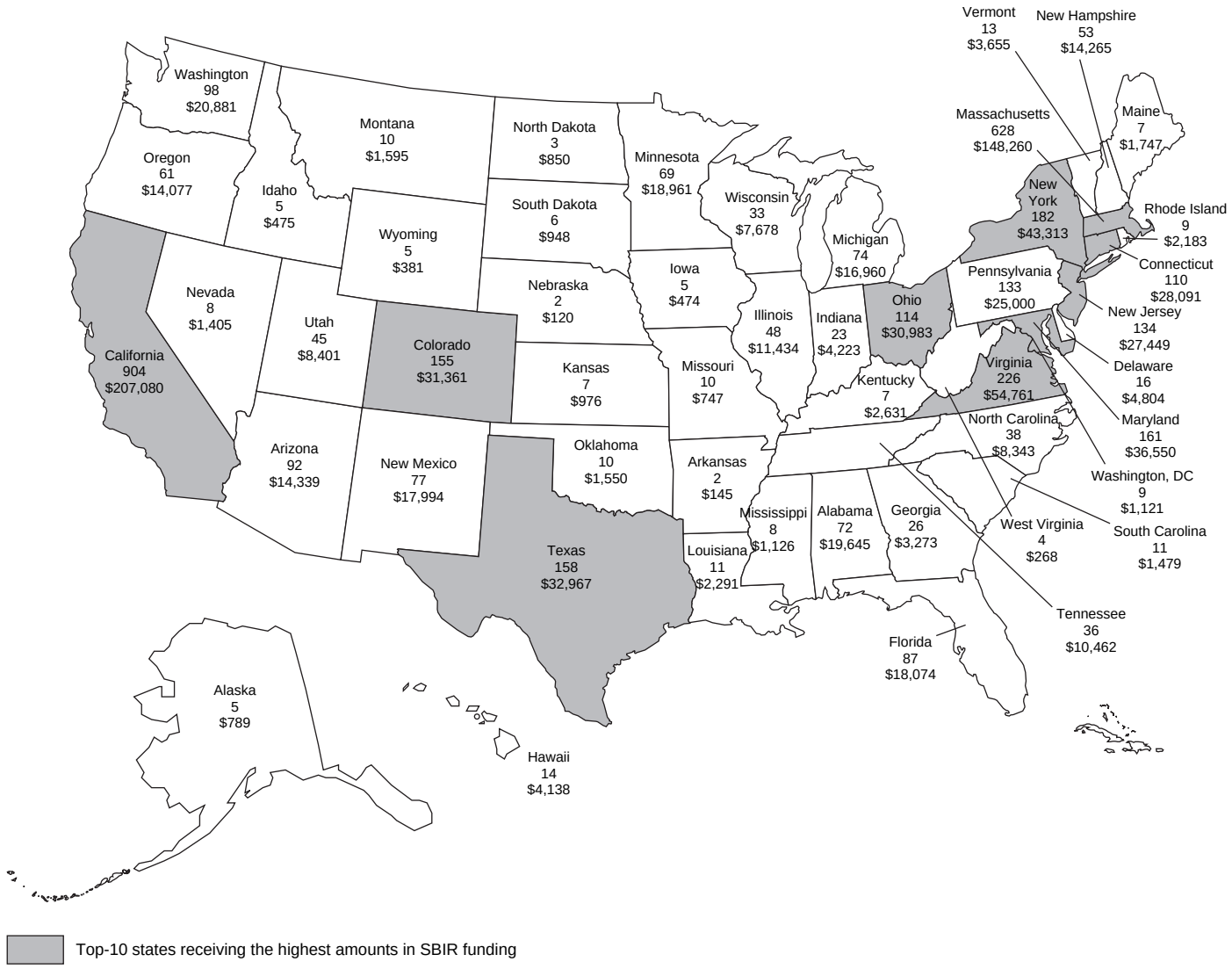
Geographic Distribution of SBIR Awards

A recent SBA study stated that one-third of the states received 85 percent of all SBIR awards and SBIR funds.[8] In fiscal year 1996, the states of California and Massachusetts had the highest concentrations of awards—904 awards, for a total of $207 million, and 628 awards, for a total of $148 million, respectively. However, each state has received at least two awards, and in 1996, the total SBIR amounts received by states ranged from $120,000 to $207 million. The SBA study points out that 17 states receive the bulk of U.S. R&D expenditures, venture capital investments, and academic research funds. Hence, the study observes that the number of small high-tech firms

[8] An Analysis of the Distribution of SBIR Awards by States, 1983-1996, Small Business Administration, Office of Advocacy (Jan. 1998).

in a state, its R&D resources, and venture capital are important factors in the distribution and success of SBIR awards. The geographic distribution of awards by state is presented in figure 1.

Figure 1: Geographic Distribution of SBIR Awards for Fiscal Year 1996 (Dollars in Thousands)



Conclusions

SBIR program officials have said that they are uncertain whether the agencies are correctly adhering to the requirements for establishing their extramural research budgets. Agencies have had different interpretations, resulting in items incorrectly being excluded or included in their budgets. Current law essentially defines "extramural budget" as an agency's budget obligations that do not support activities conducted by agency employees. Therefore, there is little assurance that the SBIR program is being funded at the levels required by statute.

Recommendation to the Small Business Administration

To ensure that SBIR funding levels are correct, we recommend that the Administrator of SBA provide additional guidance to the participating agencies on how to calculate their "extramural budgets."

Agency Comments

We provided DOD, DOE, NASA, NIH, NSF, and SBA with draft copies of this report for their review and comment. We discussed the draft with SBA's Assistant Administrator for Technology, who stated that the report was balanced and that the agency agreed with our recommendation that SBA provide participating agencies with more guidance in determining extramural activities. DOD, DOE, NIH, and NSF program officials provided us with technical corrections and clarifications that we incorporated where appropriate. NASA did not provide comments in time for us to include them in our report.

Scope and Methodology

The information provided in this report was gathered in two ways. First, we interviewed the senior SBIR program officials at the five agencies with the largest SBIR budgets. These five agencies account for over 95 percent of all SBIR funds. They were DOD, NASA, the Department of Health and Human Services (primarily, NIH), DOE, and NSF.

Second, we analyzed several databases containing information on award recipients. These databases came from the SBA, GAO, and DOD. SBA's database contained information on all SBIR phase I and phase II awards that had been granted from 1982 through 1996. We reviewed this database and revised it in several places where there appeared to be anomalous entries. We provided SBA with the revised database for review, and SBA agreed with our changes. We also analyzed the database that resulted from our 1991 survey and the database resulting from a 1996 DOD survey. These surveys were used to provide information on phase III activity and, in

conjunction with SBA's database, information on multiple-award recipients' phase III activity.

We performed our review from May 1997 through April 1998 in accordance with generally accepted government auditing standards.

We are sending copies of this report to the Secretaries of Defense, Energy, and Health and Human Services; the Administrators of NASA and SBA; the Directors of NSF and NIH; the Director, Office of Management and Budget; and other interested parties.

Please call me at (202) 512-3841 if you or your staff have any questions about this report. Major contributors to this report are listed in appendix II.

Susan D. Kladiva
Associate Director, Energy,
Resources, and Science Issues

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Legislative Requirements

Public law 102-564, dated October 28, 1992, mandated that the Comptroller General of the United States provide the Congress with a report on the Small Business Innovation Research program that containing the following:

(1) a review of the progress made by federal agencies in meeting the requirements of section 9(f) of the Small Business Act (as amended by this Act), including increases in expenditures required by that subsection;

(2) an analysis of participation by small business concerns in the third phase of SBIR programs, including a systematic evaluation of the techniques adopted by federal agencies to foster commercialization;

(3) an analysis of the extent to which awards under SBIR programs are made pursuant to section 9(l) of the Small Business Act (as amended by section 103(h)) in cases in which a program solicitation receives only one proposal;

(4) an analysis of the extent to which awards in the first phase of the SBIR program are made to small business concerns that have received more than 15 second phase awards under the SBIR program in the preceding 5 fiscal years, considering

(A) the extent to which such concerns were able to secure federal or private sector follow-on funding;

(B) the extent to which the research developed under such awards was commercialized;

(C) the amount of commercialization of research developed under such awards, as compared to the amount of commercialization of SBIR research for the entire SBIR program;

(5) the results of periodic random audits of the extramural budget of each such federal agency;

(6) a review of the extent to which the purposes of this title and the Small Business Innovation Development Act of 1982 have been met with regard to fostering and encouraging the participation of women-owned small business concerns and socially and economically disadvantaged small business concerns (as defined in the Small Business Act) in technological innovation, in general, and the SBIR program, in particular;

(7) an analysis of the effectiveness of the SBIR program in promoting the development of the critical technologies identified by the Secretary of Defense and the National Critical Technologies Panel (or its successor), as described in subparagraph 9(j)(2)(E) of the Small Business Act;

(8) an analysis of the impact of agency application review periods and funding cycles on SBIR program awardees' financial status and ability to commercialize; and

(9) recommendations to the Congress for tracking the extent to which foreign firms, or United States firms with substantial foreign ownership interests, benefit from technology or products developed as a direct result of SBIR research or research and development.

Major Contributors to This Report

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