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FEDERAL RESEARCH

Small Business Innovation Research Program Shows Success But Could Be Strengthened

Statement of
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Mr. Chairman and Members of the Committee:

We are pleased to discuss the preliminary results of our review of the Small Business Innovation Research (SBIR) program. The Small Business Innovation Development Act of 1982, which authorized the SBIR program, emphasized the benefits of technological innovation and the ability of small businesses to transform research and development (R&D) results into new products. As part of its continued oversight of the SBIR program, which is scheduled to sunset in 1993, the Congress directed GAO to evaluate the commercial trends (primarily sales) of products in the third, or final, phase of the program. This phase of the program, which follows the developmental work of Phases I and II, is intended to pursue commercial or government applications of the SBIR technology.

My discussion today represents a summary of our work to date. We will make the final results available in a report to the Congress before the end of the year. In addition, in response to your request for this hearing, we are including a discussion of our findings about the quality of SBIR research based on the report that we released in January 1989.[1]

In summary, even though many SBIR projects have not yet had sufficient time to achieve their full commercial potential, overall they have achieved a high level of activity. In addition, in our January 1989 report, we found that the quality of SBIR research compares favorably with other federal research. As of July 1991, the SBIR program had generated more than $1.1 billion in Phase III activity related to two of the main indicators of the program's commercial trends--sales of products, processes, and services in Phase III and additional funding obtained for further technical development. In addition, the majority of sales and additional developmental funding came from the private sector, indicating that R&D projects funded by the SBIR program are moving toward one of the program's key goals--increasing private sector commercialization. Private sector commercialization of SBIR-funded R&D is important not only as one of the key goals of the SBIR program but also as part of a wider concern about the United States' competitiveness in a global economy and the transfer of federally funded technologies into the marketplace.

Although the program has achieved generally favorable results in Phase III (and even more are expected by the end of 1993), we believe that four issues should be addressed to further strengthen the program. These include (1) the extent of DOD's commitment to the goal of increasing private sector commercialization, (2) inconsistent practices in requiring competition for projects

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[1]GAO/RCED-89-39, Federal Research: Assessment of Small Business Innovation Research Programs, Jan. 23, 1989.

entering Phase III, (3) uncertainty and conflict concerning who--the company or the agency--should perform additional work for the agency after the end of Phase II, and (4) the somewhat lower performance of companies winning 5 or more Phase II awards, thus diminishing the overall achievements of the program in Phase III and limiting participation by other companies.

Before discussing our findings in more detail, let me present some background concerning the SBIR program and the approach that we took in conducting our survey.

BACKGROUND

The Small Business Innovation Development Act established four goals for the SBIR program: (1) to stimulate technological innovation, (2) to use small business to meet federal research and development (R&D) needs, (3) to foster and encourage participation by minority and disadvantaged persons in technological innovation, and (4) to increase private sector commercialization derived from federal R&D.

Eleven federal agencies participate in the SBIR program. Five of them--the Department of Defense (DOD), the National Aeronautics and Space Administration (NASA), the National Institutes of Health (NIH), the Department of Energy (DOE), and the National Science Foundation (NSF)--provide over 90 percent of all SBIR funds. By itself, DOD accounts for slightly over half of the total expenditures. Each agency manages its own program, while the Small Business Administration (SBA) is responsible for issuing policy guidelines and annual reports for the program.

SBIR legislation established a uniform 3-phase process for SBIR projects. Phases I and II are intended to develop an innovative idea. Phase III generally involves the use of non-federal funds for commercial application of this technology or follow-on non-SBIR government contracts for government application.

Based on discussions with the SBIR program managers at the agencies with SBIR programs, we decided that the best source of information about Phase III activity would be the companies that had won Phase II awards. We sent questionnaires to all the Phase II awardees from the first 4 years--1984 through 1987--in which the agencies made Phase II awards. We chose the earliest recipients because studies by experts concluded that 5 to 9 years are needed for a company to progress from a concept to a commercial product. We did not include Phase II recipients from 1988 or later because, in most cases, they have not had sufficient time to "make or break" themselves in Phase III.

Although we surveyed 2,090 projects, 202 were eliminated because the questionnaires were undeliverable or the projects were incorrectly identified as Phase II awards. This left 1,888

projects, of which 1,457 responded, representing a 77 percent response rate. This provided the most complete data that we could obtain regarding commercial trends and formed a valid basis for evaluating the trends of the SBIR program in Phase III.

THE QUALITY OF SBIR RESEARCH COMPARED FAVORABLY WITH OTHER FEDERAL RESEARCH

I would like to briefly summarize the findings of our January 1989 report regarding the quality of SBIR research before discussing the commercial trends of the program. In general, our earlier report concluded that the quality of SBIR research compared favorably with other federal research. We based this conclusion on a survey of project officers responsible for overseeing and monitoring SBIR and other federal research.

Overall, project officers judged about half of the SBIR projects to be of about the same quality as other research for which they were responsible. They rated 29 percent of the projects as somewhat or much better and 19 percent as somewhat or much worse. A similar rating pattern was found for most of the 10 specific factors regarding research quality. These factors included the overall quality of the project and the likelihood that the project would lead to the invention and commercialization of new products, processes, or services. Responses concerning the likelihood that a project would lead to invention and commercialization were more positive than for other factors. For this factor, most projects (53 percent) were regarded as better than other research, while 29 percent were judged about the same. Only about 12 percent were judged worse than other research.

Our earlier report also discussed ways in which agencies try to ensure the quality of their SBIR research projects. Agency project selection procedures, for example, seek to identify and fund SBIR proposals of high scientific and technical merit. Among the factors indicating SBIR projects of high technical quality, we found that the SBIR proposal selection process was highly competitive, because a large "pool" of proposals was available for agencies to consider in selecting proposals that met standards of technical quality.

I would like now to turn to our preliminary findings regarding the commercial trends of the program.

THE SBIR PROGRAM SHOWS SUCCESS IN PHASE III

Most SBIR projects we analyzed remained active in Phase III and achieved the majority of this activity in the private sector, indicating that projects in general are moving toward the goal of private sector commercialization. Of the 1,457 projects, 939, or

about 64 percent, have obtained sales and/or additional developmental funding already or expect them by the end of 1993. As of July 1991, the SBIR program had generated about $1.1 billion in Phase III sales and funding for technical development, with up to about $3 billion more expected by the end of 1993.

Figure 1, included as attachment I in this statement, shows the total sales achieved by SBIR Phase II projects and the distribution of these sales to key customers as of July 1991. Overall, 515 projects (or about a third of the projects in our survey) reported actual sales of $471 million. Customers purchasing the results of SBIR activity in Phase III included the domestic non-federal sector; export markets; DOD, NASA, and other federal agencies; and others such as state and local governments. Combining the domestic non-federal sales with export sales, the private sector emerges as the major customer by a margin of about two to one.

A high concentration of this sales activity resulted from relatively few awards. For example, 22 projects accounted for about $232 million, or almost half, of the overall $471 million in sales. The two largest individual sales reached about $25 million each. By contrast, 175 projects reported sales of less than $100,000.

These overall sales results provide an early view of commercial trends. About half of the first sales reported for projects with sales occurred within 3 years of the time of our survey, and most of these projects expect further sales. In addition, another 238 projects reported that sales had not yet occurred but are expected. A total of $1.94 billion in further sales is expected between July 1991 and the end of 1993.

In addition to information on sales, we developed data on actual and expected additional developmental funding for SBIR projects--another key measure of the program's commercial trends. Among the projects in our survey, about half reported additional developmental funding that amounted to $646 million as of July 1991. Total additional developmental funding from private sources reached $363.8 million, while $282 million came from federal sources. Figure 2, included as attachment II, summarizes the sources of these funds in greater detail. The sources included many types of non-federal funding, such as the company itself, other private companies, venture capitalists, and private investors. Federal sources included non-SBIR federal funds and later related SBIR awards. As a supplement to the $646 million in additional developmental funding, projects remaining active expected a minimum of $335 million and a maximum of about $1 billion between July 1991 and the end of 1993.

In contrast to the 939 projects remaining active, 518 projects have been discontinued. A total of 96 of these discontinued

projects indicated that they had achieved Phase III activity but that the project subsequently ended. For another 422 projects, Phase III activity had not occurred and was not expected; no further work on these projects was under way. Thus, only about 29 percent of the projects responding to our survey were discontinued without ever entering Phase III.

Projects were discontinued for a wide variety of reasons. The most frequently cited reason proved to be the insufficiency of additional funding for technical development. In about 55 percent of the discontinued projects, this factor was identified as playing a moderate or great role in their discontinuation. Other key factors included a company shift of R&D priorities, the achievement of the project's goals, and a small market demand.

RESULTS OF PHASE III ACTIVITY, INCLUDING COMMERCIALIZATION, VARY BY AGENCY

Although many projects were carried forward to Phase III, the sales averages for the projects varied greatly among the agencies. Projects funded by NIH and NSF reported substantially higher sales per project than those funded by DOD, DOE, and NASA. NIH's projects achieved an average of $677,000 and NSF's $531,000 for each project responding to the survey. By contrast, DOD, the largest SBIR agency, achieved a project average of $285,000, DOE $215,000, and NASA $161,000.

The percentage of private sector commercialization achieved by the five major agencies' projects also varied widely. Figure 3, included as attachment III, provides an overview of the total sales for each of the major agencies' projects. This figure shows the distribution of sales to the private and federal sectors for those companies that identified their customers. It indicates a range in the percentage of private sector commercialization--from 40 percent for DOD to 92 percent for NIH. DOD, in fact, is the only federal agency among the five largest ones in the SBIR program whose SBIR projects made more sales to the federal government than to the private sector. Since DOD's 686 projects represented almost half of the projects included in our survey, these results significantly affect the overall direction of sales in Phase III.

Although DOD is the only major federal agency among the top five whose SBIR projects' sales to the federal government exceeded sales to the private sector, DOD's SBIR officials are further emphasizing the goal of meeting agency R&D needs rather than increasing private sector commercialization. In particular, the program managers for the Army and Navy indicated that steps have been taken or are underway to strengthen their SBIR programs by making them more responsive to their agency mission, which may further limit their potential for application in the private sector.

By contrast, SBIR officials in NASA, DOE, and NSF are taking steps to increase the emphasis on increasing private sector commercialization. NASA's program manager has required that in 1991 at least half of the SBIR topics in which R&D may be performed must have identifiable commercial potential; in addition, he expects to extend this requirement as a criterion for selecting new Phase I awardees in November 1991. DOE's program manager has focused on preparing DOE Phase II awardees to think as entrepreneurs. DOE hosted a conference in 1990 to introduce its Phase II awardees to corporate and venture capital companies as potential sources of funding; a similar conference is scheduled for October 1991. NSF's program manager requires Phase I awardees to provide proof of a follow-on, Phase III funding commitment, generally from a larger company, as a criterion for receiving a Phase II award. NIH's program manager said that NIH is making no specific efforts to enhance Phase III activity because NIH's SBIR awardees have achieved a high level of activity already and additional agency efforts are not warranted.

ISSUES THAT SHOULD BE ADDRESSED TO STRENGTHEN PHASE III ACTIVITY

Four issues emerged in our review of Phase III activity. The first issue relates to the differing emphasis among the major agencies on the program goal of increasing private sector commercialization. As the largest agency in the SBIR program, DOD, as I just mentioned, is also the only major agency whose projects made more sales to the federal agencies (primarily DOD) than to the private sector. In addition, the policies pursued by key program managers in DOD indicate a growing emphasis on the use of SBIR projects to meet agency R&D needs and a further shift away from private sector commercialization.

Although DOD projects, based on our survey, have achieved 40 percent of their sales in the private sector and DOD has special mission-related agency needs, DOD could do more to respond to the goal of increasing private sector commercialization without weakening its commitment to meeting its own mission-related needs. One way is to emphasize commercialization that involves a greater role for "dual use" technologies capable of meeting civilian as well as military needs. For example, five DOD Phase II projects responding to our survey achieved sales of $500,000 or more both to DOD and to the private sector. One of these projects, conducted by Integrated Systems of Santa Clara, California, involved the development of software for a robot to load munitions. Despite the project's narrow focus, the core technology, according to the company's vice president, was equally adaptable to military robots and automobiles. As a result, the company achieved $2.5 million in sales to DOD and $5 million in sales to the automobile industry based on this Phase II award. It also reported $2.5 million in sales to NASA.

A second issue that needs to be addressed involves inconsistent practices in requiring competition for SBIR projects entering Phase III. In particular, DOD and NASA officials have expressed a need to clarify the contractual procedures that must be followed when entering into a follow-on non-SBIR-funded production contract under Phase III. These officials are unsure how the competition requirements of the Competition in Contracting Act of 1984, as amended (CICA), apply to such contracts.

Various approaches to contracting under Phase III have emerged among federal agencies. Even within individual agencies, contracting officers have used different contracting procedures. According to some program managers and contracting officers, the current uncertainties regarding the relationship between Phase III and CICA have resulted in a tendency by some contracting officers to remain within Phase II instead of moving forward to Phase III. In other words, contracting officers are modifying or extending Phase II contracts or simply discontinuing the SBIR project at the end of the original Phase II contract instead of attempting to contract under Phase III.

These various contracting procedures are based on two interpretations of the relationship between CICA and Phase III. One view is that since Phase III, unlike Phases I and II, is a procurement for products intended for government use and funded outside the SBIR program, the competition requirements of CICA must apply. Under this interpretation, competition is required unless the proposed Phase III award fits within one of CICA's recognized exceptions to the competition requirements. The other view is that Phase III is an integral part of the SBIR program and that sufficient competition has occurred in the previous phases to satisfy CICA requirements.

In general, federal officials strongly support the view that the competition requirements of CICA should not apply to Phase III because these requirements have already been met in the previous phases. However, most agree that the law is not clear on this point and suggest that a clarification of the law would be helpful. We agree that a clarification would be beneficial to achieve uniformity in contracting practices.

A third issue is whether the company or the federal agency that provided its Phase II award should perform additional work after the end of Phase II if the agency wishes to continue work on the technology. This question has arisen in at least two cases and led to serious disagreement between the company and the agency in one of them, resulting in the potential loss of the company's ability to pursue the technology it developed in the first two phases of the program. In this case, the company, Humbug Mountain Research Laboratory, expects to lose a $10 million Phase III contract because a Navy laboratory, the Naval Air Engineering Center, has tried to minimize the company's role in Phase III work.

In addition, senior officials at several other companies, including three companies with numerous SBIR awards, told us that they had encountered competition with federal laboratories in their SBIR-related activities.

This issue raises a basic question about what a company can expect after it conducts R&D for federal agencies in Phases I and II. The uncertainties surrounding this issue have not been resolved, and further controversy remains a possibility. Thus, a clarification of policy regarding this issue would be helpful.

A fourth issue involves the somewhat lower performance of frequent winners in Phase III and the need to review their performance more closely. We are concerned that their somewhat lower performance diminishes the overall achievements of the program in Phase III while at the same time limiting participation by other companies. In reviewing this issue, we defined frequent winners as companies receiving 5 or more Phase II awards during the 1984 to 1987 time frame covered by our survey. Frequent winners, which included 45 companies in our survey, reported a Phase III sales average per project of about $237,000 for 381 projects. Companies receiving fewer than 5 awards reported a Phase III sales average per project of about $353,000 for 1,076 projects. Frequent winners also obtained less additional developmental funding per project. In addition, they obtained substantially less additional developmental funding per project from the private sector than did other companies--$136,000 compared with $290,000.

Although the range of performance among frequent winners is great, extending from no sales to $16.8 million in sales, their overall performance raises some concern about their commitment to Phase III. At the same time, they are receiving an increasingly large amount of SBIR money. Five companies, for example, have won 529 Phase I awards and 173 Phase II awards, amounting to almost $100 million, through fiscal year 1990. In view of frequent winners' somewhat lower performance combined with their large numbers of awards, periodic reporting of their Phase III activity would be desirable. Since SBA is responsible for collecting, analyzing, and reporting SBIR data, it would be the appropriate agency to provide this information.

In summary, our survey indicates that, even though SBIR projects have not yet had sufficient time to achieve their full commercial potential, the program overall is showing success in Phase III activity. This is indicated by the $1.1 billion in sales and additional developmental funding reported as of July 1991, two-thirds of which has occurred in the private sector, showing a significant movement toward the program goal of increasing private sector commercialization. In addition, the outlook is positive--the majority of these Phase II projects remain active in Phase III and companies expect up to $3 billion in further sales and additional developmental funding through 1993. However, the extent

of commercialization varies widely by agency and could be enhanced if greater emphasis, particularly by DOD, were placed on increasing private sector commercialization. This, along with attention to the other issues dealing with company participation in Phase III, could further strengthen the effectiveness of the program.

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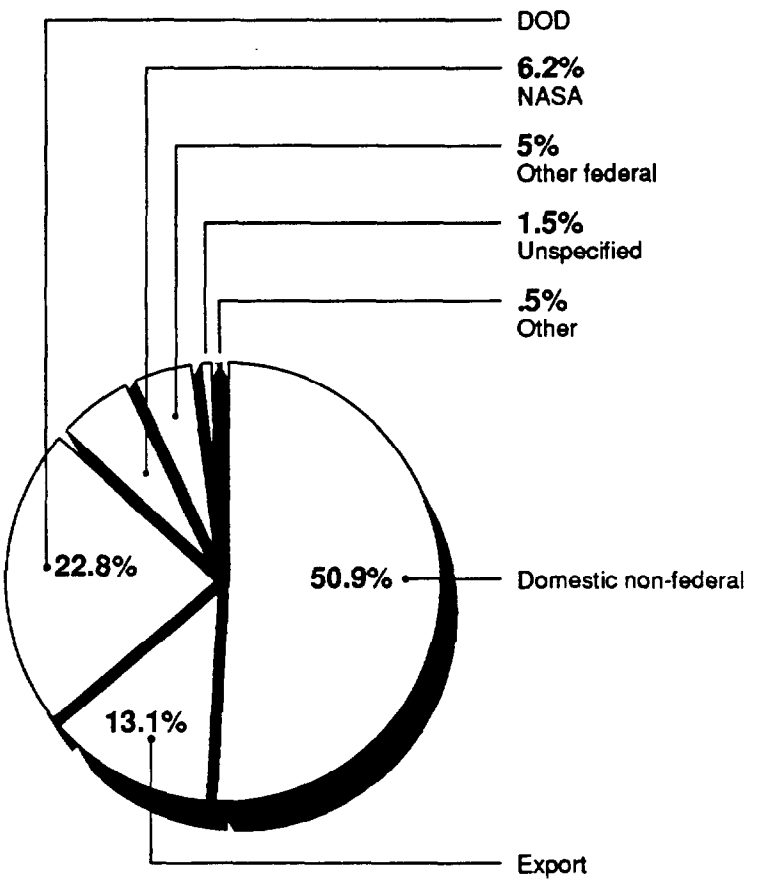
This concludes my statement. I would be happy to respond to any questions you or Members of the Committee may have.

ATTACHMENT I

Figure 1: Two-thirds of Sales by Phase II SBIR Recipients Indicate a Trend Toward the SBIR Program Goal of Private Sector Commercialization

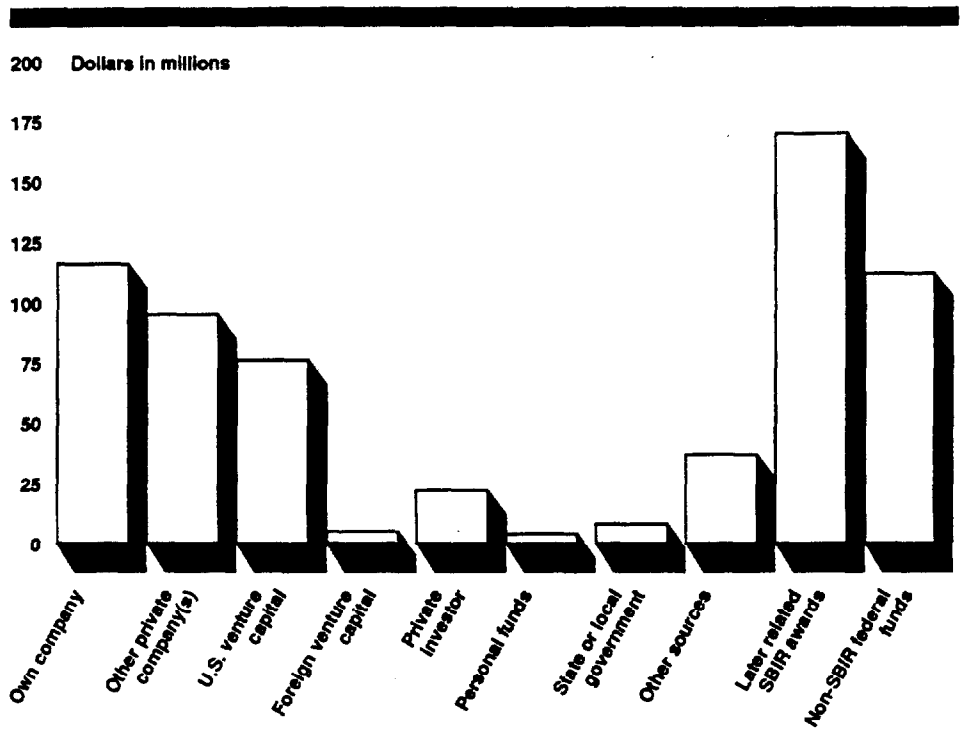


Total sales for 515 of 1,457 projects as of July 1991 are $471 million.

Private sector commercialization includes domestic non-federal and export markets.

ATTACHMENT II

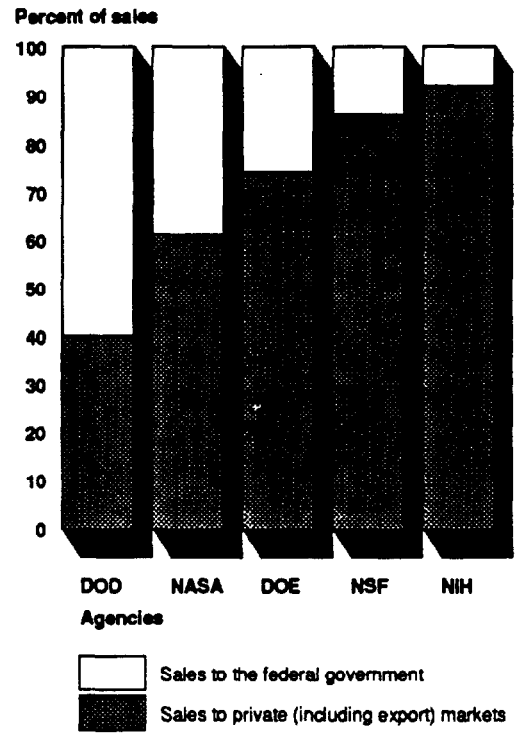
Figure 2: Non-federal Sources of Developmental Funding Amounted to About 56 Percent of All Developmental Funding



Total developmental funds for 732 of 1,457 projects as of July 1991 are $646 million.

ATTACHMENT III

Figure 3: Sales by the Five Major Agencies' Projects Show Wide Variations in the Percentage of Private Sector Commercialization



Total sales for DOD were $195.5 million, NASA were $36.4 million, DOE were $31.1 million, NSF were $58.9 million, and NIH were $127.3 million.