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FEDERAL RESEARCH

Small Business Innovation Research Program Shows Success But Can Be Strengthened

Statement of Keith O. Fultz, Director, Planning and Reporting,
Resources, Community, and Economic Development Division

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Mr. Chairman and Members of the Subcommittee:

We are pleased to discuss the 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 oversight of the SBIR Program, which is scheduled to expire in 1993, the Congress directed GAO to evaluate the aggregate 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 within a month. In addition, because the quality of SBIR research is a major factor in reviewing the program, we are including a brief discussion of our findings from 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, the program is showing success in Phase III 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 key indicators of the program's commercial trends--sales of products, processes, and services in Phase III and additional funding obtained for further technical development. The majority of sales and additional developmental funding came from

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

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 U.S. competitiveness in a global economy and the transfer of federally funded technologies into the marketplace.

Although the program is showing success in Phase III (and even more are expected by the end of 1993), we believe that three issues need to be addressed to further strengthen the program. These include (1) the extent of the Department of Defense's commitment to the goal of increasing private-sector commercialization, (2) inconsistent practices in requiring competition for projects entering Phase III, and (3) the need to clarify the circumstances under which an agency may work on its own or continue working with the company through follow-on contracts after SBIR funding ends. A further issue is being addressed by the Small Business Administration. This issue deals with the lower performance (in terms of sales and additional developmental funding) by companies with five or more Phase II awards. In addressing the first three issues, our report will contain several matters for congressional consideration.

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

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 Department of Health and Human Services (HHS), 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) plays a central administrative role and has published policy directives and annual reports for the program.

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

On the basis of 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. We received responses from 1,457 projects, or 77 percent of the projects that we surveyed.

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. We also found that the SBIR selection process was highly competitive, as indicated by the large "pool" of technically qualified proposals available for agencies to consider.

I would like now to turn to our 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 additional 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 private sector; export markets; DOD, NASA, and other federal agencies; and others such as state and local governments. Combining the private sector 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 took the form of further federal funding. Figure 2, included as attachment II, summarizes the sources of these funds in greater detail. The sources included many types of nonfederal 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 was the insufficiency of additional funding for further technical development. About 55 percent of the discontinued projects identified this factor 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 HHS and NSF reported substantially higher sales per project than those funded by DOD, DOE, and NASA. HHS' projects achieved an average of about $677,000 and NSF's, $531,000 for each project responding to the survey. DOD, the largest SBIR agency, achieved a project average of about $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 HHS. 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. In particular, the program managers for the Army and Navy indicated that steps have been taken or are under way 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 place greater emphasis on increasing private-sector commercialization. NASA's program manager required in 1991 that at least half of the SBIR subtopics in which R&D may be performed must have identifiable commercial potential. He also required in November 1991 that at least half of all Phase I NASA awards have a clear indication of a significant commercial application. DOE's program manager has focused on preparing DOE Phase II awardees to think as entrepreneurs. To this end, DOE has sponsored a Commercialization Assistance Project for its Phase II awardees for the past 3 years (1988-91), through which its awardees make business presentations to corporations and venture capital companies as potential sources of funding. As an important part of NSF's efforts to enhance private-sector commercialization, one NSF program manager noted NSF's policy of placing strong emphasis on a follow-on funding commitment for potential Phase II awardees. He said that potential awardees have to be encouraged to think as much about the commercial applications as about the research. The program manager for the NIH program, which funds more than 90 percent of HHS' SBIR Program, told us that NIH was making no specific efforts to enhance Phase III activity because NIH's SBIR awardees have achieved a high level of activity and additional agency efforts were not being considered.

ISSUES THAT NEED TO BE ADDRESSED TO STRENGTHEN PHASE III ACTIVITY

Four issues emerged in our review of Phase III activity. The first issue is 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.

Although DOD projects have achieved 40 percent of their sales in the private sector, there may be greater opportunities for DOD to respond to the goal of increasing private sector commercialization without weakening its commitment to 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, nine DOD Phase II projects responding to our survey achieved sales of $500,000 or more to both DOD and 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 a question about the need for further competition in awarding a Phase III contract when an SBIR project has already competed successfully in Phases I and II. In particular, DOD and NASA officials have

expressed a need to clarify the contractual procedures that should 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.

Federal agencies are following different approaches to contracting under Phase III because of two differing 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 competition requirements.

According to some program managers and contracting officers, the current uncertainties about the relationship between Phase III and CICA have also 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.

In general, federal officials 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 raises a question of who--the federal agency or the company that developed an SBIR technology--should perform additional work for the government after SBIR funding ends. 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 in Duarte, California, expects to lose a $10 million Phase III contract because a Navy laboratory, the Naval Air Engineering Center in Lakehurst, New Jersey, has continued to work on its own with the company's SBIR-developed technology after the end of Phase II funding. 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 lower performance of frequent winners in Phase III and the need to review their performance more closely. We are concerned that their 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. Companies receiving fewer than 5 awards reported a Phase III sales average per project of about $353,000. 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 a 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 response to our concerns, SBA initiated a study of the operating attributes of these firms in August 1991 and expects to complete the study in early 1992.

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.

Although the SBIR program is showing success in its Phase III activities, we are suggesting that the Congress may wish to consider three issues that may help to strengthen the program. These issues include:

-- the question of whether DOD should place greater emphasis on commercialization through such means as giving preference to dual use technologies for SBIR awards,

-- the need to consider clarifying whether Phase III activity must comply with CICA's competitive procedures or whether the competition in the earlier phases of the program satisfies the CICA requirements, and

-- the need to consider whether SBA should issue a policy directive for agencies clarifying the circumstances under which it may be appropriate for an agency to work on its own or to continue working with a company through a follow-on, non-SBIR-funded contract.

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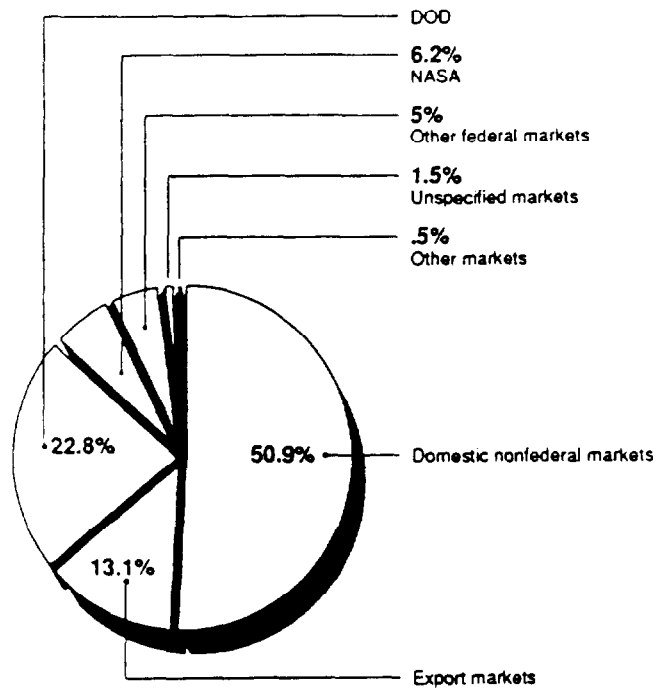
This concludes my statement. I would be happy to respond to any questions you or Members of the Committee may have.

ATTACHMENT I

Figure 1: Federal and Private-Sector Sales by Phase II SBIR Projects



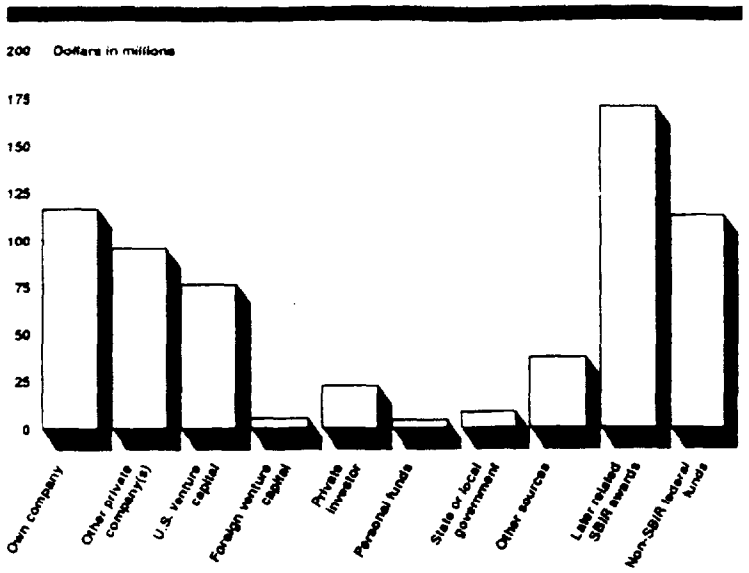
Total sales for 515 of 1,457 projects as of July 1991 were $471 million.

Private-sector commercialization includes domestic nonfederal and export markets.

Total may not add to 100 percent due to rounding.

ATTACHMENT II

Figure 2: Sources of Additional Developmental Funding

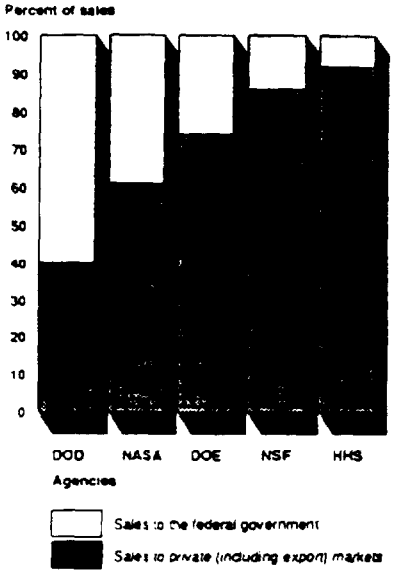


Sources of developmental funds

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

ATTACHMENT III

Figure 3: Major SBIR Agencies' Percentage of Sales to Federal and Private Markets



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

The above totals might exceed the sum of individual amounts allocated to various markets because some companies provided only their overall sales and did not specify the customer(s) for their projects.