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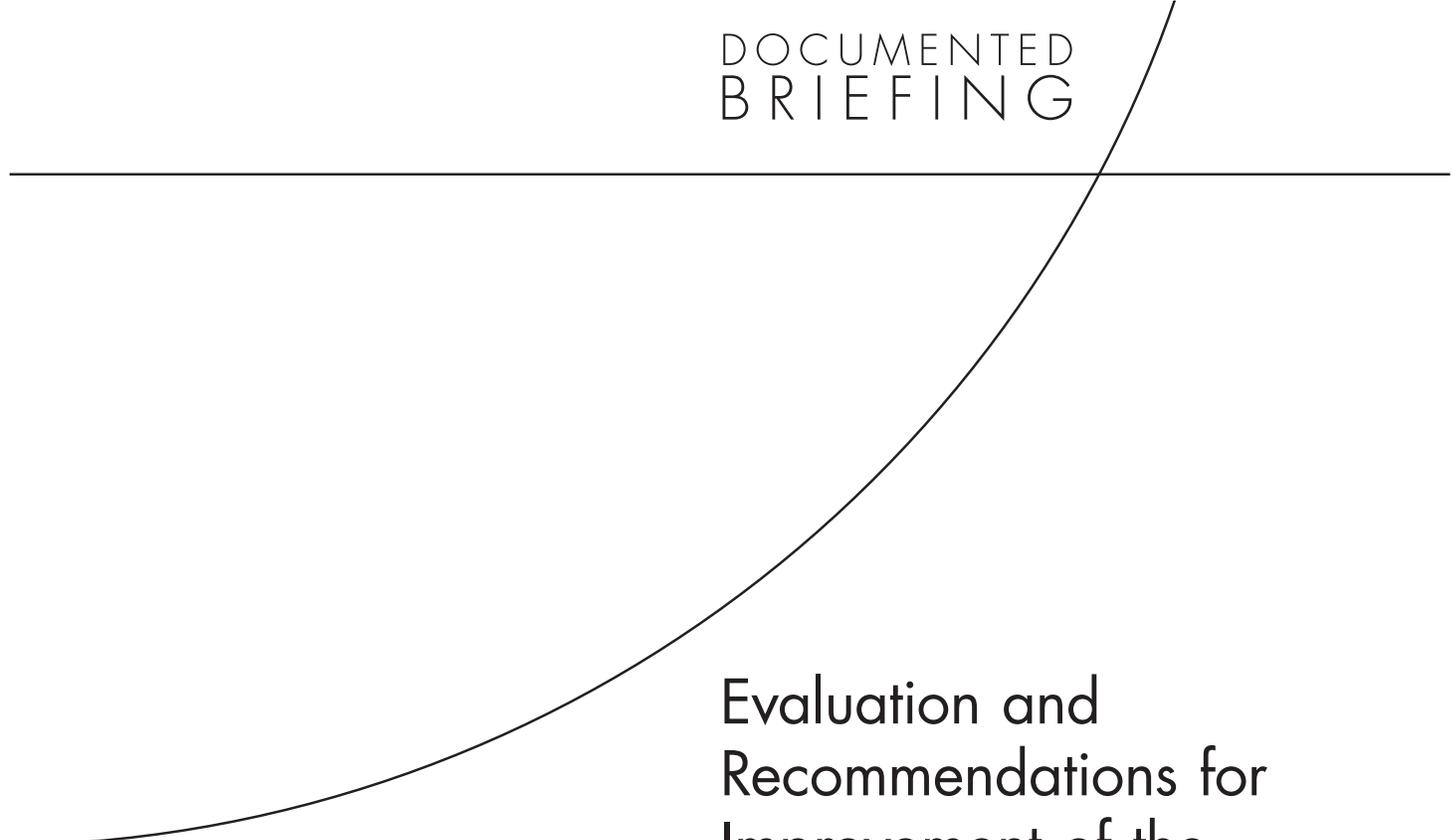
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# Evaluation and Recommendations for Improvement of the Department of Defense Small Business Innovation Research (SBIR) Program

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**SUMMARY**

This project comprised four parts. First, the study team gained a broad understanding of the SBIR program. Next, the team evaluated the DoD SBIR program's success in terms of the current set of goals for the program as measured by the department's current set of SBIR metrics, as well as by additional RAND-developed metrics. Since the DoD SBIR program's goals reflect little of DoD's broader national security mission, the third part of the study developed a set of DoD-specific goals for its SBIR program that better reflect the national security mission of the department. This task also entailed suggesting a number of additional SBIR metrics to assess progress against the proposed goals. The study concludes with a number of policy options, which, if implemented, could make the DoD SBIR program more responsive to the department's broader defense mission.

**THE DOD SBIR PROGRAM HISTORY AND STRUCTURE**

The Small Business Innovation Development (SBID) Act of 1982 (Public Law 97-219) created the Small Business Innovation Research (SBIR) program by mandating that all federal research, development, test, and evaluation (RDT&E) agencies that award more than \$100 million in research and development (R&D) contracts annually create a SBIR program and set aside 1.25 percent of that extramural R&D budget for funding small business research awards. That set-aside percentage has grown over two legislative reauthorizations of the program (Public Laws 102-564 and 106-554); it is currently set at 2.5 percent of DoD's extramural R&D budget. The SBID Act outlined four broad congressional goals:

- Stimulate technological innovation.
- Use small businesses to meet federal R&D needs.
- Foster and encourage participation by minority and disadvantaged persons in technological innovation.
- Increase the private-sector commercialization of innovations derived from federal R&D.

Over the years, Congress has emphasized the commercialization aspects of the SBIR program. This emphasis has resulted in efforts to both better measure commercialization and include it as a selection criterion when making SBIR awards.

Congressional testimony prior to the reauthorizations, interim General Accounting Office (GAO)<sup>1</sup> reports, and the actual reauthorization texts strongly suggest that Congress believes the SBIR program to be effective in meeting its broader goals and will most likely continue to support the program.

In 2003, the DoD SBIR program was about \$900 million and represented about 63 percent of the total federal SBIR budget, making it the largest of the ten federal SBIR programs. The department's 2004 and 2005 SBIR budgets exceed \$1 billion.

DoD has decentralized administration of almost all aspects of its SBIR program. This means that topic generation, budgeting, and research emphasis are managed by the department's military services and defense agencies. At the Office of the Secretary of Defense (OSD) level, the Office of Small and Disadvantaged Business Utilization (SADBU)<sup>2</sup> manages SBIR policy and the centralized solicitations for DoD's entire SBIR program. The Office of the Director of Defense Research and Engineering within the Office of the Secretary of Defense for Acquisition, Technology and Logistics (OSD AT&L) also has a role in the SBIR program; it reviews (technically and administratively) research topics suggested by the various military departments and agencies for redundancy, clarity, and alignment.

The DoD SBIR program is structured into three phases: feasibility, principal R&D, and commercialization. Small businesses initially compete to win Phase I (feasibility) awards. The purpose of Phase I is to determine the scientific and technical merit of the proposed effort. Phase I contracts typically last up to six months and are normally funded at \$70,000 to \$100,000. The SBIR Phase I awardees with the most promising projects and results are invited to submit proposals for a

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<sup>1</sup> Now the Government Accountability Office.

<sup>2</sup> Now the Office of Small Business Programs.

Phase II contract. Phase II is intended as the primary R&D phase. Up to two years and \$750,000 may be allocated for Phase II performance. Phase III is essentially any additional work that follows from Phase II, although no SBIR funds are dedicated to Phase III. Instead, SBIR Phase II finishers are expected to obtain private funding or other non-SBIR federal funding to develop their research results for military or commercial markets.

#### **DOD SBIR PROGRAM GOALS AND METRICS**

DoD's broad goal for its SBIR program is "to harness the innovative talents of our nation's small technology companies for U.S. military and economic strength." Beyond this broad statement, however, DoD merely restates the goals of the SBID Act:

- Stimulate technological innovation.
- Increase private-sector commercialization of federal R&D.
- Increase small business participation in federally funded R&D.
- Foster participation by minority and disadvantaged firms in technological innovation.

As a result, evaluation of the DoD SBIR program focuses on these four goals. Although the DoD SBIR program is aimed at defense-related R&D through the topic selection process, there is currently no systemic assessment of the extent to which the outcomes of the thousands of DoD SBIR contracts completed to date have contributed to the department's primary national security mission.

The DoD SBIR program's first goal--to stimulate innovation--has two components. The first is the input side, "Stimulation." This is measured simply by counting the number of topics included in each solicitation, the number of proposals received, the number of SBIR contracts awarded, and ultimately how much money DoD spends on the program. The output side, "Innovation," is more difficult to measure, and there is, in fact, little attempt to do so within DoD.

As a result, RAND's evaluation of this goal focused on innovation. The RAND study team noted that companies the Office of the Deputy Under Secretary of Defense (Industrial Policy) identifies as

"transformational" make heavy use of the DoD SBIR program.<sup>3</sup> Additionally, in a survey of companies that entered the DoD market through the SBIR program, the study found that half the companies were start-ups and that a significant number of patents were associated with the start-ups. From this, the study team inferred that the SBIR program was stimulating innovative activity. It was not clear, however, whether this innovative activity was greater or less than a similar amount of funding some other R&D program would generate.

The second goal—commercialization of federal R&D—is measured in two ways: through "success stories" and the Commercialization Achievement Index (CAI). "Success stories" are anecdotes of DoD SBIR commercialization. While interesting, they provide little value in determining overall commercialization success. More importantly, DoD has developed the CAI, which measures the commercialization success of previous SBIR Phase II award winners when they compete for new Phase I awards. The introduction of the CAI is a positive development. It provides a quantitative measure of commercialization success that assists in evaluating both the individual small businesses and the overall DoD SBIR program. That said, the CAI can be improved. Currently, all information that is included in the CAI is self-reported by the small businesses with their Phase I proposals, and no auditing is done to validate the figures. Additionally, the CAI is not applied to as many companies as it could be, nor does it seem to act as a strong discriminator when selecting Phase I awardees.

The RAND study team looked for additional indicators of commercialization activity. The team noted, for example, that in a sample of 40 SBIR companies, commercial success in two cases could be linked to the SBIR program. An examination of non-SBIR DoD contracting also found that in a sample of almost 500 DoD SBIR award winners entering the DoD market through the SBIR program, the cumulative value of the non-SBIR contracts these companies were awarded by DoD exceeded the cumulative value of their DoD SBIR contracts. This finding is

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<sup>3</sup> The report that identified companies as transformational (DoD, 2003b) did not define "transformational." We made the assumption that some level of innovation was implied in the term.

mitigated, however, by the fact that 95 percent of the non-SBIR contracting was concentrated in just 1 percent of the sample.

The DoD SBIR program goal of increasing small business participation in federally funded R&D is measured by the dollars spent on the program. The current size of the DoD SBIR program, about \$1 billion per year, has been achieved through an average annual growth rate of about \$43 million per year over the past 20 years, ensuring that small business participation in the program has increased. Additionally, the program introduces small businesses to the DoD market. DoD claims that a third of the companies awarded Phase I contracts are new to the DoD market.

RAND's evaluation of the goal to increase small business participation in federal R&D found that over the past decade, 20 to 25 percent of the companies winning DoD SBIR awards, 375 in 2003 alone, were new to the DoD market. However, the RAND study team also found that the SBIR program represents a relatively small part (less than 25 percent) of DoD's R&D contracting with small businesses.

DoD measures the goal of fostering participation by minority and disadvantaged firms in technological innovation by counting the number of firms claiming women- and minority-owned status. According to DoD, the percentage of these kinds of firms in its SBIR program has grown over time and now represents approximately 20 percent of participating small businesses.

Rather than looking at the number of women- and minority-owned firms participating the SBIR program, RAND examined the value of the DoD SBIR contracts going to these firms and compared this to the value of all DoD R&D contracts going to small, minority-, or women-owned businesses. The findings indicate that, while the SBIR program has succeeded in contracting with women- and minority-owned firms, the percentage of SBIR dollars going to these firms is smaller than the percentage of dollars going to similar firms across all DoD R&D contracts with small, minority-, or women-owned businesses. This is most likely due to the fact that there are other programs aimed specifically at increasing the rate at which disadvantaged small businesses participate in federal contracting. These programs give economically or socially disadvantaged firms advantages in competition for federal

contracts. The DoD SBIR program does not provide these advantages to disadvantaged small businesses, and therefore these companies will naturally tend to migrate to the programs that do.

Based on both DoD's own measures and this study's examination of the available data, it appears that the DoD SBIR program generally accomplishes the goals set out in the program's enabling legislation. That is, the legislated amount of money is spent on R&D contracts with small businesses, hence "stimulating" innovation. On the output side of the R&D process, companies identified as "transformational" take greater advantage of the SBIR program, and there is some level of patenting activity, directly and indirectly, associated with the program. Some commercialization of federal R&D also appears to occur as a result of the SBIR program, although how effective the SBIR program is in this area is unclear. The DoD SBIR program clearly attracts a large number of small businesses to the DoD R&D market, and, on average, roughly 250 per year are new to that market. Finally, the SBIR program provides opportunities for minority- and women-owned small businesses to win R&D contracts with DoD, although there seem to be other, more effective programs in DoD for this purpose.

#### **OTHER RAND FINDINGS**

During the examination of the SBIR program, the study team found additional information that did not relate directly to the current goals of the DoD SBIR program. These provide additional insights.

In general, DoD's SBIR topic allocation aligns well with the department's R&D priorities while remaining flexible enough to focus topics in areas that are more appropriate for small businesses. That said, the team found that the bulk of the SBIR contracts are focused on basic and applied research rather than later-stage development.

DoD SBIR topics are added at the rate of about one topic for every \$2 million of additional budget. This marks a departure from the first decade of the program, when more than three topics were added for every \$1 million of budget. This change means that more dollars are now available to address each topic, resulting in more Phase I and II contracts awarded per topic.

One issue that is generally included in any discussion of the SBIR program is the perception that there are companies that are frequent award winners. The study team found that frequent award winners do win a large percentage of the total SBIR contracts: 29 percent of all DoD SBIR Phase I contracts in the 1993–2002 period went to companies that won 20 or more SBIR Phase I contracts in that timeframe. More interestingly, this phenomenon is increasing. In 1994, 12 percent of all DoD SBIR Phase I contracts were with companies that had more than five SBIR contract actions in that year alone. By 2003 that percentage had doubled to 25 percent. In addition, the contracting data indicate that the ratio of DoD non-SBIR contract dollars to DoD SBIR contract dollars won by a company generally decreases as the number of SBIR contracts won increases. In other words, frequent SBIR award winners rely more, as a percentage of revenue from DoD, on the SBIR program than occasional SBIR winners do. This pattern may be on the decline, however. In the ten-year period from 1994 to 2003, the ratio of DoD non-SBIR contract dollars to DoD SBIR contract dollars significantly increased for frequent DoD SBIR winners. That trend should continue if the CAI is rigorously used as part of the selection criteria for SBIR awards.

More troubling was a finding that the DoD SBIR program is managed in a manner that may be too lean. While the study team expected the SBIR program to require greater-than-average management attention, the opposite seems to be the case. Resources to manage DoD contracts are generally about 2.7 percent of total contract value. The SBIR program, with the Department of the Navy as the exception, invests just 2 percent of the contract value to SBIR program management. In contrast, venture capital companies, perhaps the best commercial analogy to the DoD SBIR program, earn management fees that range from 2.5 to 5 percent of the fund size and also earn a significant percentage (usually around 20 percent) of return on investment.

This finding reinforces the study team's perception that the primary purpose of participation in the SBIR program, from DoD's perspective, is statutory compliance with the SBID Act. In other words, within DoD the SBIR program is managed more as a tax and burden to be borne than as an R&D resource to be leveraged. The study team initially got this impression during interviews with SBIR managers at the

component and agency levels. It was reinforced as the study team took advantage of a number of opportunities to talk to personnel in DoD labs and program offices about the SBIR program. While these discussions cannot be described as anything more than anecdotal, they nonetheless reinforced the impression that the R&D and acquisition leadership within DoD has been generally unenthusiastic about the SBIR program. Reactions about the SBIR program from small businesses were much more mixed. We found examples of small businesses using the SBIR program in a number of ways: as capital to help new businesses get established, as an entrée into the DoD market, as low-risk capital to conduct high-risk R&D, and as a revenue source for R&D service companies.

#### **RECOMMENDATIONS FOR IMPROVING THE DOD SBIR PROGRAM**

The findings of the study team, along with the very substantial size of the DoD SBIR program, naturally lead to the question of how the program could be improved so that DoD can leverage its resources for the department's national security mission while continuing to meet the statutory goals Congress established for the program.

There are three fundamental steps for improving the program. These three steps are all aimed at maximizing the value of the program to DoD rather than merely minimizing its budgetary impact. First, there needs to be continued emphasis within the defense R&D and acquisition communities, particularly at the leadership level, that the SBIR program is an investment that can generate a significant return. At \$1 billion per year, the DoD SBIR program is large enough to warrant substantial leadership attention. Importantly, these funds are very flexible and can be applied to specific problems and priorities without negotiating through the standard R&D programming and budgeting processes. Second, DoD-specific SBIR goals and metrics must be established. Finally, resources must be made available to manage the R&D outcomes from the SBIR program, not just the funding and contracting processes.

The SBIR program can be a part of the Acting Under Secretary of Defense's (Acquisition, Technology and Logistics) seven goals targeted at driving performance outcomes.<sup>4</sup> Two of these, technology dominance and

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<sup>4</sup> The acting Under Secretary of Defense for Acquisition, Technology and Logistics at the time of this study, and the source of the seven

strengthening the industrial base, are particularly applicable to the SBIR program. Six SBIR-specific goals that address these broader aims are:

**Technology dominance**

1. Improve invention-to-use time for military technologies.
2. Provide technology intelligence about what development exists or is planned in the United States.
3. Generate innovative solutions to DoD requirements.

**Improving the industrial base**

4. Broaden DoD's technological base and increase competition by building and strengthening innovative companies willing to do defense work.
5. Improve ties between prime contractors and the small, technology-oriented business community.
6. Expand intellectual capital in the United States.

**POLICY OPTIONS FOR THE DOD SBIR PROGRAM**

The study team identified a number of policy options for using the DoD SBIR program in ways that can help achieve these goals. In most cases, these options will require that the department invest additional resources into the SBIR program, but such investment holds the promise of extracting much greater value in terms of R&D outcomes from the SBIR program.

1. Emphasize later-stage R&D (6.3, 6.4, and 6.7 stages) rather than basic and applied research in topic selection.
2. Establish a quick-reaction SBIR program that utilizes SBIR resources to address the immediate operational requirements of DoD.
3. Use the SBIR program to understand developments in the commercial technology sector that are not being addressed in other defense-related R&D.

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goals, was Michael Wynne. Since this study was completed, Kenneth Krieg has been nominated and confirmed to the position, replacing Mr. Wynne.

4. Write some DoD SBIR topics to address operational, rather than technical, needs in order to explore innovative approaches to solving operational problems.
5. Use the DoD SBIR program as a tool to recruit small businesses that are successful in other federal markets into the DoD market.
6. Combine and integrate the resources of the DoD SBIR program with other DoD R&D funding programs, such as venture capital initiatives and the Manufacturing Technology Program, to provide a stream of funding at all stages of the product development cycle.
7. Look for greater opportunities to involve the defense prime contractors in the DoD SBIR program through mentoring and partnership arrangements with small businesses, such as by linking the SBIR program with the DoD Mentor-Protégé program or by facilitating consultation between DoD and the larger system contractors to identify potential SBIR projects and small businesses of most interest to those contractors managing larger system development.
8. Use the SBIR program to resource a more complex, larger product development effort, such as a small system acquisition program or advanced technology demonstrator, by combining a number of SBIR contracts over a period of time.