

November 2010

SPACE ACQUISITIONS

Challenges in Commercializing Technologies Developed under the Small Business Innovation Research Program



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Why GAO Did This Study

To be competitive in the global economy, the United States relies heavily on innovation through research and development (R&D). The Small Business Innovation Development Act of 1982 established the Small Business Innovation Research (SBIR) Program to stimulate technological innovation among small businesses. SBIR offers one avenue for introducing technological innovation in the Department of Defense (DOD) space sector. GAO was asked to assess (1) the extent to which DOD is utilizing the SBIR program to develop and transition space-related technologies; and (2) whether small businesses face challenges to participating in the space industrial base. To do this, GAO analyzed program documentation and DOD data on the SBIR program and interviewed key officials.

What GAO Recommends

GAO recommends that DOD consider collecting data on all SBIR technologies that transition into DOD acquisitions or the commercial sector and ensure these data are defined and recorded consistently; complete efforts to develop and issue SBIR program guidance; and review the challenges identified by stakeholders in this report to assess the extent to which there are improvements that could be made to address them. DOD partially concurred to collect data, and concurred to develop and issue guidance. DOD did not agree to review the challenges identified by stakeholders. GAO believes this recommendation remains valid.

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Challenges in Commercializing Technologies Developed under the Small Business Innovation Research Program

What GAO Found

DOD is working to commercialize space-related technologies under its SBIR program by transitioning these technologies into acquisition programs or the commercial sector, but has limited insight into the program's effectiveness. DOD has invested about 11 percent of its fiscal years 2005–2009 R&D funds through its SBIR program to address space-related technology needs. Also, DOD is soliciting more space-related research proposals from small businesses. For example, the number of space-related research requests submitted by the military services and DOD components has increased from less than 8 percent in 2005 to nearly 14 percent in 2009. Further, DOD has implemented a variety of programs and initiatives to increase the commercialization of SBIR technologies and has identified instances where it has transitioned space-related technologies into acquisition programs or the commercial sector. For example, a small business developed an aluminum ring that enables multiple payloads to attach to a single launch vehicle. However, DOD lacks complete commercialization data to determine the effectiveness of the program in transitioning space-related technologies into acquisition programs or the commercial sector. Of the nearly 500 space-related contracts awarded in fiscal years 2005 through 2009, DOD officials could not, for various reasons, identify the total number of technologies that transitioned into acquisition programs or the commercial sector. For example, there are inconsistencies in recording and defining commercialization. Further, there are challenges to executing the SBIR program that DOD officials acknowledge and are planning to address, such as the lack of overarching guidance for managing the DOD SBIR Program.

Most stakeholders GAO spoke with in the space industrial base—DOD, prime contractors, and small-business officials—generally agreed that small businesses participating in the DOD SBIR program face difficulties transitioning their space-related technologies into acquisition programs or the commercial sector. Although GAO did not assess the validity of the concerns cited, stakeholders GAO spoke with identified challenges inherent to developing space technologies, challenges because of the SBIR program's administration, timing, and funding issues and other challenges related to participating in the DOD space acquisitions environment. For example, some small-business officials said that working in the space community is challenging because the technologies often require more expensive materials and testing than other technologies. They also mentioned that delayed contract awards and slow contract disbursements have caused financial hardships. Additionally, several small businesses cited concerns with safeguarding their intellectual property.

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Abbreviations

AFRL	Air Force Research Laboratory
AT&L	Acquisition, Technology and Logistics
CBD	Chemical and Biological Defense
CCR	Company Commercialization Report
DARPA	Defense Advanced Research Projects Agency
DDR&E	Director, Defense Research and Engineering
DLA	Defense Logistics Agency
DMEA	Defense Microelectronics Activity
DOD	Department of Defense
DTRA	Defense Threat Reduction Agency
EELV	Evolved Expendable Launch Vehicle
ESPA	Evolved Expendable Launch Vehicle Secondary Payload Adapter
FPDS-NG	Federal Procurement Data System–Next Generation
IRT	integrated review team
MDA	Missile Defense Agency
NGA	National Geospatial-Intelligence Agency
OSBP	Office of Small Business Programs
OSD	Office of the Secretary of Defense
R&D	research and development
RDT&E	research, develop, test, and evaluate
SBA	U.S. Small Business Administration
SBIR	Small Business Innovation Research
SMC	Space and Missile Systems Center
SOCOM	Special Operations Command
SST	Standard Space Trainer

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Accountability * Integrity * Reliability

United States Government Accountability Office
Washington, DC 20548

November 10, 2010

The Honorable Ben Nelson
Chairman
The Honorable David Vitter
Ranking Member
Subcommittee on Strategic Forces
Committee on Armed Services
United States Senate

The Honorable Bill Nelson
United States Senate

To be competitive in the global economy, the United States relies heavily on innovation through research and development (R&D). Recognizing the potential of small businesses to be a source of significant innovation, Congress enacted the Small Business Innovation Development Act of 1982.¹ The act established the Small Business Innovation Research (SBIR) Program to stimulate technological innovation, use small businesses to meet federal R&D needs, foster and encourage participation by minority and disadvantaged persons in technological innovation, and increase private-sector commercialization of innovations derived from federal R&D. The act provided for a three-phased program: Phase I to determine the feasibility and scientific and technical merit of a proposed research idea; Phase II to further develop the idea; and Phase III to continue research and development, or commercialize the resulting product or process with no further SBIR funding. Commercialization occurs when a Phase II product or process transitions into a federal acquisition program or a commercial-sector product or service. Federal agencies that have budgets of at least \$100 million for research conducted by others, called extramural research, are required to use 2.5 percent of these budgets to establish and operate an SBIR program.

The Department of Defense's (DOD) current space systems play an increasingly important role in military operations; however, military space acquisition programs over the past two decades have experienced problems that have significantly increased costs and delayed schedules. Moreover, the supplier base for space programs has consolidated to a

¹Pub. L. No. 97-219.

point where there are just a few prime contractors that compete for new efforts. SBIR offers one avenue for introducing new ideas and technological innovation in the DOD space sector. Other solutions that have been proposed to help revitalize space acquisition include programs such as DOD's Operationally Responsive Space initiative, which focuses on developing and launching smaller satellites in order to deliver capability quicker, reduce technology challenges, and widen the field of potential suppliers, as well as efforts focused on stabilizing requirements, introducing incremental technology advancements to satellite constellations, improving cost estimates, and strengthening program management. There are also other types of programs within DOD that are designed to increase small-business participation in major acquisitions.

DOD is seeking to stimulate ideas and innovation and gain access to cutting-edge technology by offering opportunities to small businesses to develop technological innovations. For space, this may be particularly necessary since government space programs tend to introduce technological advancements well before commercial space programs. Additionally, DOD—in mission areas such as missile warning and space surveillance—has requirements that do not exist in the commercial sector. In these areas, DOD funds technology development and acquires specific capabilities because they are not commercially available.

In this context, you requested that we determine (1) the extent to which DOD is utilizing the SBIR program to develop and transition space-related technologies to DOD acquisition programs or a commercial-sector product or service; and (2) whether small businesses face challenges to participating in the space industrial base.

To do this, we interviewed DOD officials from the Office of Small Business Programs (OSBP) and military services and components, and analyzed DOD data. We also interviewed 28 small businesses to obtain their perspectives on whether challenges to participating in the space industrial base exist. We identified the small businesses primarily through DOD's SBIR program Web site, a network of small aerospace companies in the Los Angeles, California, area, and additional referrals by existing SBIR companies. We did not verify the validity of the concerns or recommendations cited by these officials and are not generalizing this information to the entire space acquisition community or the DOD SBIR program. We conducted this performance audit from August 2009 to October 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audits to obtain sufficient appropriate evidence to provide a reasonable basis for

our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. Additional details on our objectives, scope and methodology are provided in appendix I.

Background

DOD received approximately \$2.6 billion in funding for fiscal year 2009 to research, develop, test, and evaluate (RDT&E) space systems.² The Air Force conducts the majority of the DOD space-related technology development. DOD's current portfolio of space systems comprises satellites, ground-based systems, and associated terminals and receivers. All of these systems are expected to play an increasingly important role in military operations.

The bulk of major space system acquisitions in DOD's space portfolio, however, have experienced problems during the past two decades that have delayed deployment and driven up cost. In our past work, we found that satellite programs cost more than expected and took longer to develop and launch than planned. We recently reported that estimated costs for major space acquisition programs increased from initial estimates of \$11.4 billion to \$22.4 billion for fiscal years 2008 through 2013, and programs are facing potential capability gaps in areas such as positioning, navigation, and timing; missile warning; communications; and weather monitoring.³ Cost and schedule problems like these are commonly tied to unstable requirements, weak investment practices, poorly executed acquisition strategies, and immature technologies.

Our past work and studies on the defense industrial base indicate space system acquisitions could benefit from a greater diversity of suppliers. A 2008 report for DOD states that over the past few decades, the space industrial base has consolidated from over 50 suppliers in the early 1990s to four prime contractors who now manage thousands of subcontractors for DOD systems.⁴ According to a 2007 DOD study, the U.S. space industry

²This RDT&E total was calculated by adding the RDT&E appropriations for Fiscal Year 2009 for all seven space-based systems listed in the DOD Fiscal Year 2010 Budget Request (May 2009).

³GAO, *Defense Acquisitions: Challenges in Aligning Space System Components*, GAO-10-55 (Washington, D.C.: Oct. 20, 2009).

⁴Institute for Defense Analyses, *Leadership, Management, and Organization for National Security Space* (Washington, D.C.: July 2008).

has had to adjust to declining demands in the areas of satellites and launch, which has led to consolidation.⁵ We reported in 2008 that the consolidation of numerous firms over two decades to a small number of major space contractors has made it difficult for new suppliers to enter the market.⁶

Federal agencies with an annual extramural R&D budget of at least \$100 million are required to establish and operate an SBIR program. The SBIR program budget is computed as 2.5 percent of an individual agency's extramural R&D budget. Within DOD, each military service and DOD component uses this percentage to determine its own SBIR budget. The U.S. Small Business Administration (SBA) communicates federal SBIR guidance through the SBIR Policy Directive and reports on the implementation and operation of the SBIR program at 11 federal agencies.⁷ DOD is the largest agency participating in the SBIR program, and DOD's fiscal year 2009 SBIR program budget was over \$1.22 billion—more than half of the entire fiscal year 2009 governmentwide SBIR program budget of over \$2 billion.⁸

DOD's Office of Small Business Programs (OSBP) oversees the DOD SBIR program, develops DOD SBIR policy, annually collects reporting data from each of the services and components, and oversees the topic-generation and solicitation process. DOD generally relies on its military and defense components to implement its SBIR program. The DOD SBIR program comprises 12 services and components, of which the Air Force, Army, Navy, Missile Defense Agency (MDA), and Defense Advanced Research Projects Agency (DARPA) are the major services and components

⁵Department of Defense, *Defense Industrial Base Assessment: U.S. Space Industry* (August 2007).

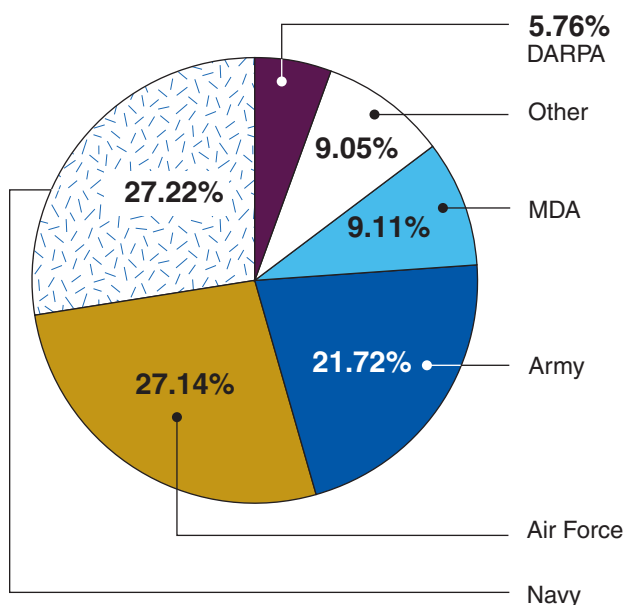
⁶GAO, *Space Acquisitions: DOD Is Making Progress to Rapidly Deliver Low Cost Space Capabilities, but Challenges Remain*, [GAO-08-516](#) (Washington, D.C.: Apr. 25, 2008)

⁷The 11 federal agencies participating in the SBIR Program are the Departments of Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, Homeland Security, Transportation, the Environmental Protection Agency, the National Aeronautics and Space Administration, and the National Science Foundation.

⁸ Fiscal year 2009 SBIR data are based on preliminary SBA estimates, but are consistent with fiscal year 2008 SBIR data.

contributing to the program (see fig. 1). The DOD SBIR program is currently authorized through January 31, 2011.⁹

Figure 1: DOD SBIR Budget Allocation for Fiscal Year 2009



Source: GAO analysis of DOD information.

Note: "Other" includes Chemical and Biological Defense (CBD), Defense Logistics Agency (DLA), Defense Microelectronics Activity (DMEA), Defense Threat Reduction Agency (DTRA), National Geospatial-Intelligence Agency (NGA), Director, Defense Research and Engineering (DDR&E), and Special Operations Command (SOCOM).

The Small Business Innovation Development Act of 1982 required the SBA, after consultation with certain agencies, to establish a policy directive for the three-phase structure (see table 1) to include, among other things, timing for receipt and review of proposals and funding guidelines.¹⁰

⁹ Pub. L. No. 111-251, § 1 (2010).

¹⁰ Pub. L. No. 97-219, § 4 (1982).

Table 1: The SBIR Program Framework

Phases of SBIR competitive process	Time and funding thresholds	Potential sources of funding
Phase I: Determination of project feasibility	Usually 6 to 9 months, up to \$150,000	SBIR program funding
Phase II: Project development to prototype	2 years, up to \$1,000,000	SBIR program funding, can include external funding
Phase III: Continued project development or transitioning a technology into a commercial product or process for sale to government or private-sector customers	Unlimited	Non-SBIR government or private-sector funding

Source: DOD.

The SBA recently raised the award limits for Phase I and Phase II contracts,¹¹ and the first DOD solicitation using the increased funding limits for its SBIR program had a closing date for receipt of proposals of June 2010. The SBA's SBIR Policy Directive provides agencies the discretion to make awards in amounts higher than the limits set forth in the guidelines, and they must provide written explanation to the SBA for these instances at the end of the year. Awards can be made to successful applicants in the form of grants, contracts, or cooperative agreements. DOD uses contracts to make awards.

Before Phase I of the award process, DOD develops research topics to solicit R&D ideas that address critical technology needs of a DOD program.¹² Research topics are generated by DOD service and component representatives—typically scientists and engineers—based on DOD technology needs and are approved in a departmentwide review process. The Director of Defense Research and Engineering, and a multiagency integrated review team (IRT), review and approve the SBIR topics. DOD announces SBIR project opportunities through three annual solicitations for which small businesses can submit Phase I SBIR proposals to address the research topics. Small businesses submit proposals electronically through the DOD SBIR Electronic Submission Web site. DOD published

¹¹Notice of Final Amendments to Policy Directive, 75 Fed. Reg. 15,756 (Mar. 30, 2010).

¹²R&D is a systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

109 space-related topics throughout the 2009 fiscal year solicitation cycles. After the solicitation's closing date, proposals are evaluated, and source-selection and contract-award decisions are made. DOD invites small businesses with promising technologies that have completed Phase I to submit proposals for a Phase II contract. The Phase II award decision considers, among other things, a proposal's commercial potential. Contracting officials and technical monitors are involved in the evaluation and selection of SBIR proposals.

In Phase III, the SBIR technology is expected to transition into a DOD acquisition program or into a commercial-sector product or service. We have previously reported technologies in this phase of development typically need to have customer "pull" into commercialization or entry onto an acquisition program. However, SBIR technologies that demonstrate significant potential for advancing capability or reducing cost can be picked up by the commercial or government sector for further development or use in an acquisition program in Phase II or III. In Phase III, small businesses must find non-SBIR funding from acquisition programs or private investors, or both, to produce or continue developing their technology.

DOD Is Commercializing Space-Related SBIR Technologies but Lacks Complete Data on These Efforts

DOD is working to commercialize technologies under its space-related SBIR program to deliver warfighter capabilities, but lacks complete data on its commercialization efforts and therefore has limited insight into the program's effectiveness. DOD invests about 11 percent of its SBIR budget in R&D and is soliciting more space-related research proposals from small businesses. DOD has taken steps departmentwide and within individual services and components to encourage the use of SBIR technologies and to enhance activities and efforts that can increase the transition of those technologies. DOD can document the results of its efforts with various examples of space-related technologies it has transitioned for use by major space-system acquisition programs. However, DOD currently lacks complete data on the number of technologies commercialized and therefore cannot determine the return on its space-related SBIR investment. Further, there are challenges to executing the SBIR program that DOD officials acknowledge the agency needs to address, such as the lack of overarching guidance for the management of the DOD SBIR Program.

DOD Is Using Its SBIR Program to Respond to Space Technology Needs

DOD is investing in R&D through its SBIR program to meet space-related technology needs. Specifically, from 2005 through 2009, DOD invested approximately 11 percent of its total SBIR budget on space-related¹³ Phase I and II SBIR contract awards (see table 2).

Table 2: Value of DOD SBIR Phase I and II Awards for Fiscal Years 2005–2009

Dollars in millions

Awards	Total DOD SBIR awards	Space-related DOD SBIR awards	Percent
Phase I	\$951.4	\$111.1	12%
Phase II	4,035.9	440.4	11
Total	\$4,987.3	\$551.5	11%

Source: GAO analysis of DOD information.

DOD awarded 1,122 space-related Phase I SBIR awards and 501 space-related Phase II awards for fiscal years 2005-2009; both represent around 11 percent of total DOD Phase I and II SBIR awards for the same time period. Of the roughly 500 Phase II space-related contracts, Air Force officials could not identify how many received space-related Phase III contracts. Table 3 identifies the number of Phase I and II contracts awarded by DOD and those that were space-related for fiscal years 2005 through 2009.

Table 3: Numbers of SBIR Phase I and II Awards for Fiscal Years 2005–2009

Awards	All DOD SBIR awards	Space-related DOD SBIR awards	Percent
Phase I	10,023	1,122	11%
Phase II	5,031	501	10

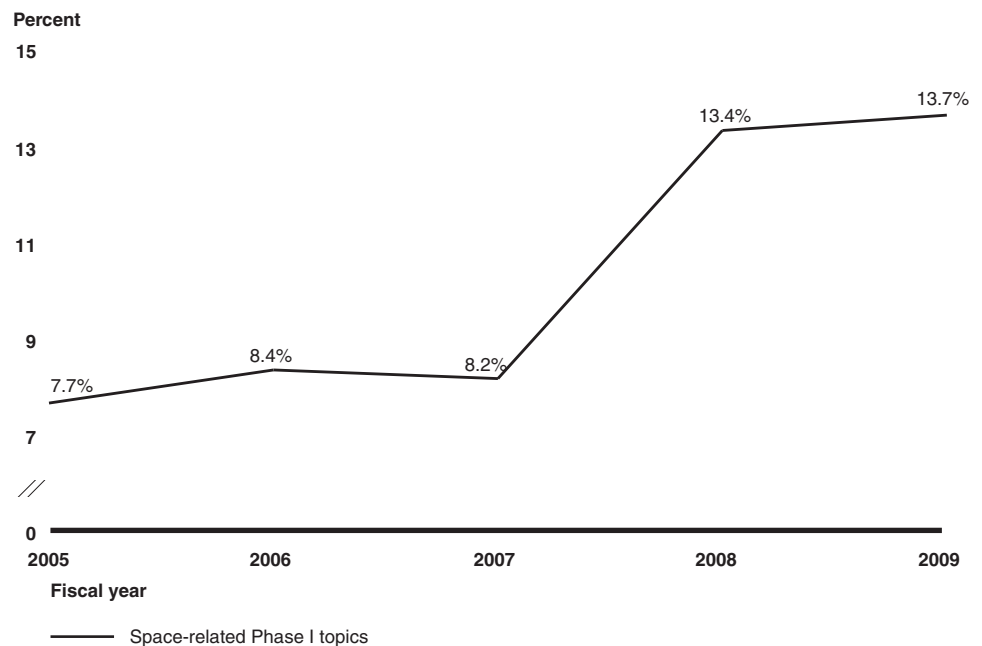
Source: GAO analysis of DOD information.

The number of space-related Phase I research topics submitted by DOD services and components has increased from less than 8 percent in 2005 to nearly 14 percent in 2009 (see fig. 2). Topics are generated based on user needs to fill technology gaps in DOD acquisition programs. According to OSBP officials, DOD requires that at least 50 percent of SBIR topics are

¹³In this report, “space-related” refers to the technologies in the Defense Technology Area Plan that are categorized for use within “space platforms,” and does not reflect space-related technologies that may be categorized in other technology areas.

endorsed by acquisition programs to increase the likelihood of transitioning a technology into an acquisition program. Officials from the Air Force's Space and Missile Systems Center, which itself represents the majority of DOD's space-related technology development, said that almost all of their topics are based on technology needs of space program offices. DOD officials said the agency takes steps to clearly define program needs throughout the topic-generation process so SBIR technologies are more likely to align with DOD acquisition needs. We previously reported that technologies are more apt to be successful in technology transition if they are relevant, marketable, and gain product-line support from the acquisition community.¹⁴

Figure 2: Percentage of Space-Related DOD Phase I SBIR Topics for Fiscal Years 2005–2009



Source: GAO analysis of DOD information.

¹⁴GAO, *Best Practices: Stronger Practices Needed to Improve DOD Technology Transition Processes*, [GAO-06-883](#) (Washington, D.C.: Sept. 14, 2006).

DOD Has Implemented Efforts to Increase Commercialization

There are a variety of programs and initiatives within DOD designed to increase the commercialization of SBIR technologies. Several are unique to individual military services and agencies. Although these efforts are not specific to space technology development, they are intended to accelerate the commercialization of technologies through their transition into DOD acquisition programs or commercial-sector products or services. DOD officials described the following initiatives; however, we did not assess their effectiveness.

- **Commercialization Pilot Program:** The National Defense Authorization Act for Fiscal Year 2006 authorized this program in 2006 under the Secretary of Defense and the Secretary of each Military Department. The Act authorized the program to increase commercialization and accelerate the fielding of capabilities by identifying and selecting projects that meet high-priority requirements, and by formalizing collaboration among small businesses, prime contractors, and DOD science and technology acquisition communities. But, according to DOD officials, it is too soon to determine the results. DOD has provided support for the annual conference on commercialization and issued memorandums to encourage services and components to identify technologies with the greatest potential, link science and technology with acquisition programs, and leverage all available technology-development and transition tools and mechanisms. The military services and DOD components have implemented varying approaches to the program. The Air Force's version of the program emphasizes the involvement of DOD, prime contractors, and small businesses and uses SBIR technology-transition plans to ensure all parties sign an agreement to transition a technology. Air Force officials believe their efforts under this program will increase technology transition.
- **Missile Defense Agency (MDA) Technology Applications Program:** MDA implemented this program in 1986, which attempts to accelerate the maturation and commercialization of small-business technologies by leveraging the expertise of technology professionals and business experts. This program is available to all SBIR contract awardees on a voluntary basis, and assists small businesses in technology maturation and transition for the life cycle of the technology. MDA uses non-SBIR funds to administer this program.
- **Navy Transition Assistance Program:** The Navy started this program about 10 years ago to help small businesses understand and facilitate the transition of their SBIR technologies. Under this program, consulting services are offered to all small businesses with a Phase II award, free of charge, by Dawnbreaker, an outside contractor that specializes in acquisition support; market assessments and studies; and technology-readiness management. Dawnbreaker can provide consulting services with

small businesses for a 10-month period and provides information and tools on technology transition, and helps small businesses develop marketing tools. About 250 Phase II small businesses participate in this program, of the 400 Phase II contracts awarded by the Navy annually.

- **Defense Advanced Research Projects Agency (DARPA) Transition Support Pilot Program:** DARPA developed a program to transition innovative technologies to the most critical U.S. military end users as well as within DARPA, civilian agencies, and in the private sector. DARPA developed the program in collaboration with The Foundation for Enterprise Development, a nonprofit organization that creates and engages in research and education programs to inspire innovation and entrepreneurship for solving problems of national and global importance. DARPA offers the program to all small businesses with an active DARPA SBIR Phase II contract. Small businesses that participate in the program receive guidance and assistance from the Foundation for Enterprise Development, in identifying and facilitating introductions to potential collaborators, funding sources, and end users to expedite the transition of promising technologies.
- **Army Technical Assistance Advocates:** The Army initiated a network to coordinate small businesses, research laboratories, and prime contractors to increase Army SBIR technology transition and commercialization success. The advocates provide technical assistance to small businesses engaged in SBIR projects through a network of scientists and engineers engaged in a wide range of technologies.
- **Air Force Commercialization Pilot Program Initiatives:** These initiatives include interactive technology interchange workshops, such as “Industry Days,” that bring small businesses, prime contractors, and DOD representatives together to discuss technology needs and partnering opportunities. The partnering efforts are solidified by the signing of SBIR technology-transition plans, or agreements between all of the interested parties that state the terms for commercialization of a particular technology. The Air Force also assigns transition agents to facilitate collaboration and assist in technology transition. In our previous report, we found that technology-transition agreements and product-line relationship managers, with responsibilities similar to transition agents, reflect best practices and are tools used by leading commercial companies to aid in the transition of technologies to product development.¹⁵
- **Other Initiatives:** DOD established the Fast Track Program in fiscal year 1996 and the Phase II Enhancement Program in fiscal year 2000 to leverage funds from outside investors and address funding gaps among SBIR

¹⁵ [GAO-06-883](#).

phases. Both programs are designed to encourage rapid transition of SBIR R&D into commercialization and DOD acquisition programs. A small business can apply to participate in the Fast Track Program during Phase I, and the Enhancement Program in Phase II. Under the Fast Track program, small businesses can potentially receive interim funding of \$30,000 to \$50,000 in matching funds from non-SBIR sources to alleviate a funding gap between Phase I and Phase II. Under the Enhancement Program, a military service or DOD component can provide additional Phase II funding that matches the investment funds the small business obtains from non-SBIR sources. The Enhancement Program can extend an existing Phase II contract for up to 1 year and match up to \$500,000 of non-SBIR funds. DOD military services and DOD components can tailor the implementation of these two programs to meet their own needs.

DOD Has Successfully Commercialized Some Space Technologies

DOD efforts have resulted in successful transitions that services and components describe on a Web site that highlights successful transitions to promote the SBIR program. Air Force officials described the commercialization of some space-related technologies that range from software training solutions to hardware that supports multiple payloads aboard a single launch vehicle, and various DOD officials highlighted the potential value of developing space-related technologies through the SBIR program. The following examples are considered commercialization success stories for technology transition.

- **Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA):** The Air Force had a need for a low-cost launch capability to launch smaller secondary satellites. To address this need, a small business, through an SBIR contract, developed a standard adaptor to accommodate several small satellites for the Evolved Expendable Launch Vehicles (EELV) that will allow low-cost access to space for the small-satellite community. The ESPA is an aluminum ring that attaches to a rocket and has the capability to mount one primary satellite and up to six small satellites, resulting in increased access to space by the small-satellite community and decreased launch costs. The ESPA was successfully demonstrated on Space Test Program-1 in March 2007. The Secretary of the Air Force issued a policy in 2008 to make ESPA-hosted satellite launches a routine operation starting no later than fiscal year 2012.
- **Standard Space Trainer (SST):** DOD awarded a Phase III contract for the SST in August 2008. The Air Force had a significant need for an integrated simulation-based operator training and rehearsal capability for satellite-system ground control, because future generations of military satellites will be expected to use one common ground system to operate multiple satellite constellations. The SST is a satellite-operator

instructional simulation that supports multiple satellite systems through the use of a system similar to a video game console, increasing efficiencies and potentially reducing training costs. The SST can be used to support various types of training—independent qualification training, unit qualification training, and crew training—and it supports instructional simulations that mimic the behavior of common military satellites, subsystems, space flight, orbital mechanics, and satellite operations. Advantages of using the SST include flexible instructor control features, increased instructor and student productivity, quick setup, and lower training costs. For example, with this SBIR technology, an instructor can monitor up to six students, provide targeted instruction to any student, and alter the events during a scenario. In addition, according to officials from the 533rd Training Squadron, the squadron that evaluated the SST, required instructor manpower has been reduced significantly and student evaluation productivity has increased dramatically as a result of the SST.

- **Low Shock Separation System (Lightband system):** According to the Air Force, vibration during the launch and satellite separation from the rocket has caused government satellites to malfunction. Small satellites are particularly susceptible to launch- and separation-related vibrations because of the close proximity of sensors and instruments to the shock source, necessitating a low-shock separation system. A small company developed the Lightband system under SBIR contracts to provide a capability that would reduce on-orbit failures. The Lightband system is the first payload-separation system that generates significantly less vibration during payload separation from the launch vehicle. According to the Air Force, the Lightband system is 25 percent lighter, 50 percent smaller, 40 percent cheaper, and generates less than 5 percent of the vibration of existing conventional separation systems, and it is estimated that this SBIR technology could save spacecraft programs several million dollars in life-cycle costs per spacecraft.

DOD Lacks Complete Data on Commercialization Efforts

According to DOD officials, DOD collects and maintains data on Phase I and II of the SBIR contract process, but it does not have complete and consistent data on Phase III. Various DOD officials stated that data are hard to track and there are inconsistencies in recording and defining commercialization. Further, DOD does not require the services and components to track and report these data. As a result, DOD does not have a complete picture of contract awards and does not know how effectively it is commercializing SBIR technologies by transitioning them into a DOD acquisition program or a commercial-sector product or service. Although a 2006 RAND study and a 2009 National Research Council study found that DOD is to some extent achieving SBIR program goals, as stated in the SBIR Policy Directive, the studies noted that DOD can not understand how

well the SBIR program is performing or if improvements are necessary without complete commercialization data. Furthermore, we have previously reported that complete, accurate, and timely government contracting information is essential for tracking how public funds are being spent governmentwide.¹⁶

Of the roughly 500 Phase II space-related contracts awarded in fiscal year 2005 through 2009, DOD officials could not determine or specify the total number of space-related Phase III contract awards. According to OSBP officials, DOD does not require the services and components to track and report Phase III award data, and DOD officials we spoke with explained that it is hard to track the data because the two databases available for tracking SBIR contract award data are limited in capturing all commercialization activity. The databases were designed to track only government and not commercial transactions. For example, the Federal Procurement Data System–Next Generation database is used departmentwide by contracting officials to track all DOD contract actions. According to DOD officials, if a small business secures commercial-sector funding for its Phase III SBIR project, that contract may not be captured in this database because it only captures federal contract awards. Subcontracts to prime contracts are not captured. Additionally, when small businesses merge, change names, or are bought out by large businesses, DOD contracting officials, who are responsible for entering contract results in this database, lose sight of the transition of technologies and are unable to input accurate information concerning the outcome of SBIR projects. The Company Commercialization Report (CCR) database, which is maintained by OSBP, contains historical contract information for small business participating in the DOD SBIR program.¹⁷ According to DOD officials, OSBP uses the commercialization database to reconcile with data from the Federal Procurement Data System–Next Generation database to prepare an annual report required by the SBA, but the reporting of Phase III contract data by small businesses through the commercialization database is voluntary and may not include all commercialization actions. According to OSBP officials, DOD services and

¹⁶GAO, *Federal Contracting: Observations on the Government's Contracting Data Systems*, [GAO-09-1032T](#) (Washington, D.C.: Sept. 29, 2009).

¹⁷According to OSBP officials, when submitting a Phase I and II proposal, an SBIR small business is required to electronically prepare the CCR report, and companies with more than four Phase II contracts must provide information that is used by DOD to calculate a Commercialization Achievement Index (CAI) value. The CAI value is used by DOD as an evaluation criterion to measure a firm's commercialization potential.

components may be using different methods or approaches to quantify their commercialization efforts.

In addition to the limitations with DOD databases and tracking capabilities, we heard from several key DOD officials that the Phase III data entered into the Federal Procurement Data System–Next Generation database is not always entered consistently, and some services and components have different definitions for Phase III. For example, some SBIR contracting officials do not consistently include the SBIR contract-phase determination when they enter information into the database. We previously reported that the definition of Phase III awards is not clearly defined by the authorizing legislation and—as acknowledged by DOD officials and a 2009 National Research Council study—agencies sometimes differed on the meaning of “commercialization.”¹⁸ Also, as previously noted, interpretation of SBIR policy can vary across DOD services and components.

In our previous reports, while not specific to the SBIR program, we highlighted long-standing data-collection and evaluation issues related to the Federal Procurement Data System–Next Generation database. For example, we previously reported on concerns regarding the timeliness, accuracy, and ease of use of this federal database.¹⁹ Furthermore, although we reported in 2009 that moving to electronic data submission improved the accuracy and timeliness of data, we also reported that data in this federal database remained inaccurate and that officials do not always input required information into the database.²⁰

DOD Faces Challenges in Implementing the SBIR Program

DOD SBIR program officials acknowledge challenges in executing their SBIR programs, including ongoing revisions to SBIR guidance and limited resources. For example, DOD has issued SBIR program management guidance to its services and components through more than 40 memorandums, including some supplemental e-mail guidance, over 17 years, rather than a comprehensive SBIR program manual or instruction

¹⁸GAO, *Small Business Innovation Research: Agencies Need to Strengthen Efforts to Improve the Completeness, Consistency, and Accuracy of Awards Data*, [GAO-07-38](#) (Washington, D.C.: Oct. 19, 2006).

¹⁹GAO, *Improvements Needed to the Federal Procurement Data System-Next Generation* [GAO-05-960R](#) (Washington, D.C.: Sept. 27, 2005).

²⁰[GAO-09-1032T](#).

that encompasses all required policy and procedures. One Air Force official said his office relied on a binder compiled with guidance his office received over the years from DOD and did not know if it was complete. To address this issue, OSBP recently established a working group to draft an overarching DOD Directive that will delineate policy as well as responsibilities and authorities under the SBIR program.²¹ The group will work with contracting officials and program managers to determine the best way to balance the need for standardization while maintaining flexibility in executing the program. However, because the officials we spoke with believe that any changes to the SBIR program, which is currently authorized through January 31, 2011, could affect the content of the DOD Directive, DOD officials suspended this effort until Congress reauthorizes the program.

Military service and DOD component officials we interviewed stated they have limited resources to manage the program because the SBIR Policy Directive prohibits using SBIR funds to administer the program. For example, Air Force officials noted that some systems engineers had to split their time between SBIR responsibilities, including technical oversight and other assigned responsibilities. Additionally, Army officials said the Army's Director of SBIR oversees over 600 SBIR contracts at any given time, and they stated that SBIR resources—both funding and personnel—are inadequate to manage the program. According to DOD, OSBP are investigating methods to improve overall commercialization results within the department, including the consideration of a policy for more consistent resource allocations throughout the department.

To address these and other issues with managing the SBIR program, DOD OSBP officials said they established an SBIR Improvement Working Group in December 2008. The group drafted a report in December 2009 that identified the top eight initiatives for the DOD SBIR program. According to the DOD OSBP officials we interviewed, three of the eight initiatives have already been accomplished: DOD has pursued legislative proposals to allow a portion of SBIR funding for program management, reauthorized the Commercialization Pilot Program so the services can continue to utilize SBIR funds to implement the program, and clarified/improved discretionary technical assistance rules. According to DOD officials, the following initiatives are still in progress:

²¹Based on recommendations by the Inspector General of DOD, "DOD Small Business Innovation Research Program" (Jan. 30, 2009).

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- Develop and issue an overall DOD Directive for SBIR.
 - Establish a steering committee to work on improvements including standardization of best practices.
 - Coordinate SBIR integration into acquisition strategies.
 - Evaluate quality of information in SBIR database.
 - Update the SBIR topic criteria and improve the review process.

Stakeholders Perceive That Small Businesses Face Challenges to Participating in the Space Industrial Base

Most stakeholders in the space industrial base that we spoke with—DOD, prime contractors, and small businesses—generally agreed that small businesses participating in the DOD SBIR program face difficulties transitioning their space-related technologies into a DOD acquisition program. Stakeholders we spoke with told us there are difficulties inherent to the development of space technologies, challenges due to SBIR program timing and funding parameters, and other challenges related to participation in the DOD space acquisitions environment. All three groups we interviewed offered suggestions for improving DOD’s SBIR program. We did not verify validity of the concerns or recommendations cited by these officials and are not generalizing this information to the entire space acquisitions community or the DOD SBIR program; rather we present common opinions and observations of only those individuals interviewed.

Difficulties Inherent in Developing Space Technologies

Stakeholders we spoke with in the space industrial base—DOD, prime contractors, and small businesses—agreed that small businesses face inherent challenges in developing space technologies. They agreed that some small businesses have fewer in-house resources, limited DOD contacts, and they find working in the space community unique and challenging. Some of the difficulties they cited follow.

- **Harsh space environment:** To meet DOD’s requirements to be flight-ready for the harsh space environment, technologies need more expensive materials and testing in specialized facilities. For example, flight-ready hardware for the space environment requires electronic components that can withstand radiation from space-derived particles or nuclear detonations. All three groups interviewed noted that small businesses typically do not own the appropriate testing facilities, such as thermal vacuum chambers, that are used for testing spacecraft or parts under a simulated space environment and instead must rely on government, university, or large-contractor testing facilities, which can be costly. However, an official from one prime contractor said it offers a discount on using its testing facilities to small businesses that subcontract with it during Phase II of the SBIR program.

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- **Sustaining operations through delays and cancellations:** According to a small-business official, DOD space and weapons acquisitions program delays and cancellations can affect small businesses' ability to stay in business. Air Force officials agree that small companies can be at a greater disadvantage than larger companies when space acquisition programs are delayed or system development goals are far off into the future, because some small companies that rely on a specific government contract may not be able to stay in business if they have to wait too long to receive the contract award. For example, Air Force officials stated that nine SBIR contracts may have been canceled as a result of the cancellation of the Transformational Satellite Communications System in fiscal year 2010.
 - **Obtaining security clearances:** Small business, DOD, and prime contractor officials said small businesses' participation in DOD space acquisition programs may be inhibited by their lack of security clearances. One small business said some small businesses are unable to learn enough about potential projects that are deemed classified to submit a proposal, because DOD provides limited information regarding project requirements to those companies without security clearances. However, several small businesses noted that because security clearances are costly, many are unable to invest in security clearances without an assured contract award. Moreover, one told us that the development time frames for SBIR contracts are too short to apply for and receive top-secret clearances. In addition, two of the three prime contractors we spoke with said that the lack of a security clearance represents a major barrier for any small business that aspires to participate in DOD space acquisition programs.
 - **Forging relationships:** Small businesses struggle to break through the insular culture of space system acquisitions to develop working relationships with DOD officials and prime contractors, according to all three groups interviewed.
 - **With DOD:** According to small businesses we interviewed, it is difficult to identify appropriate points of contact within DOD, and one small business said that DOD consistently awards contracts to those companies with whom it has previously worked, making it difficult for new, small companies to develop similar relationships. Two small-business owners said access to the space acquisition community is difficult because it is a cohesive network of space system developers. Specifically, one of the small businesses noted that the domination of the space industrial base by a few prime contractors prevents small-business participation because the prime contractors usually serve as the lead integrators for space programs. Prime-contractor officials acknowledged they have some of their own preferred suppliers. One DOD official agreed that it is difficult for small businesses to forge new relationships within the DOD space system acquisitions community because it is difficult for DOD's SBIR program officials to convince

program managers to consider SBIR technologies as potential solutions for technology gaps as the solutions may not be the same as those advocated by the prime contractors. In addition, he noted that large prime contractors partner with many of the program managers and advise them about acquisitions concerning new technologies—and these prime contractors may see the SBIR program as a source of competition.

- **With prime contractors:** Officials from all the prime contractors we spoke with generally agreed that small businesses face challenges in working with prime contractors for several reasons. First, DOD does not require prime contractors to work with small businesses to commercialize their technologies. Two prime contractors suggested that DOD could facilitate these working relationships by providing incentives for larger contractors to work with SBIR companies. Second, two of the three prime contractors interviewed indicated that they would prefer to buy a small business with a promising technology, rather than partner with the business in question, to maintain exclusive rights to the technologies developed. Third, one prime contractor noted that it prefers to use established subcontractors that have a history of being reliable, are expected to be around in the future, and are able to manufacture the volume of units requested. Despite the challenges noted, all the prime contractors we spoke with have developed initiatives for working with small businesses. For example, one prime contractor established the position of a full-time SBIR program manager in 2005 to provide information and guidance regarding the government's SBIR program to the entire small business community, work with those leaders associated with research and technology and technology integration regarding SBIR activities, and release a bimonthly SBIR activity report.
- **Risk-averse space community:** All three groups we interviewed said that small businesses find it difficult to break into the DOD space system acquisitions environment because the space community is risk averse—DOD officials see unproven companies as risky for expensive space programs because any delays, problems with technologies, or other issues have significant consequences. Various small businesses we spoke with believe that program managers prefer to award space-related contracts to large contractors, in whose quality, practices, and longevity they have confidence. Air Force officials we spoke with agreed that most program managers are risk averse to integrating technologies developed by small businesses before they have been demonstrated for a space environment because they are trying to meet cost, schedule, and performance goals. In addition, an official claimed the ingrained belief that only large businesses can handle the complexities of building major space systems, such as satellites, constituted the largest obstacle faced by those officials

attempting to implement the SBIR program. Two prime contractors agreed that the DOD space community is highly risk averse and consider small business technologies risky investments—specifically, one noted that technologies are perceived to be risky because of the uncertainty associated with small businesses’ ability to remain in business over the long development cycle of a space system.

Aspects of SBIR Program Administration, Timing, and Funding Impede Small Business Efforts

The three groups we interviewed—small businesses, DOD officials, and prime contractors—described how SBIR program administration, timing, and funding impede the efforts of small businesses developing space-related technologies to transition their technologies. The following reflects the opinions of most of the interviewees.

- **Inexperienced contracting staff:** Small-businesses and Air Force officials we interviewed believe issues regarding SBIR contract awards result from, in part, inexperienced contracting staff managing SBIR contracts in DOD. Air Force officials we spoke with acknowledged that the SBIR program is often used as a training ground for inexperienced contracting staff because contract award size is relatively small and the DOD’s SBIR program has a structured contract process in place. One official noted that this practice can create problems for small companies, because some of these inexperienced contracting officials may not understand the intricacies of the SBIR program. Two small businesses we spoke with indicated that they had experienced contract issuance delays because inexperienced contracting staff managed their SBIR contracts. Small businesses we spoke with said they experienced financial hardship because they needed to retain employees or project teams while waiting for contract awards. For example, one small business we spoke with noted that it encountered a 9-month delay in the awarding of a contract after receiving a notice of selection for a Phase II SBIR contract, and the delay was almost devastating. Two small businesses suggested that DOD expedite the contract-award process to limit the need for small businesses to retain expensive technical staff prior to the start of any contract work.
- **Low funding limits:** According to some small businesses and DOD officials, low SBIR funding limits may hinder space technology development because SBIR funding limits are not adequate to fulfill the stringent level of testing required to qualify materials for space technology development or to mature technologies to the degree required by DOD. Prior to March 2010, when the SBA increased SBIR funding limits for Phase I from \$100,000 to \$150,000 and for Phase II from \$750,000 to \$1,000,000, funding limits had remained stagnant since 1992. For example, one small-business official noted it was unrealistic to mature a technology to the extent some space programs require within the SBIR funding limits. Another small business said it had the opportunity to transition its

technology if it could effectively demonstrate the subsystem, but to do so, it needed an advanced microcircuit that cost \$750,000—as much as it would receive for a typical Phase II contract award. DOD officials said a small business typically needs additional funding to supplement its SBIR Phase I and II contracts to be in a position to insert its technology into a major space acquisition program. According to the SBA, DOD can award SBIR contracts in amounts that are larger than the prescribed limits to small businesses to help bridge the funding gap and mature their technologies further, but DOD is required to report annually to the SBA when it exceeds the funding limits. In addition, DOD implemented several initiatives to stimulate additional investment in promising SBIR technologies. For example, the Fast Track Program and Phase II Enhancement funding utilizes matching funds from outside the SBIR budget to help small businesses between phases of the SBIR program. One DOD official suggested that DOD provide stable funding for space-related SBIR technologies, because it is difficult to establish an effective development plan for space acquisition programs when funding for space-related SBIR projects is unstable.

- **Contract award disbursement amount and timing:** Two small-business officials said they experience financial hardships when contract award disbursements are misaligned with initial costs incurred to develop their technology. According to the small businesses we interviewed, if disbursements do not adequately match the development needs of the small business, the small business may need to use its own money for hiring or delay development of the product until it receives the remainder of the contract award. Further, they said the contract award disbursement schedule and amounts vary across and within the DOD military services and may not coincide with the development progress and test plans of the small business. One small businesses we spoke with noted that a larger contract award distribution allotment is particularly important at the beginning of a contract, because it needs the funding to hire new staff and begin development of the technology. Two small businesses suggested DOD distribute SBIR funding up front, instead of in equal increments throughout the contract period.
- **Synchronizing with the DOD acquisition timeline:** According to small businesses and DOD officials we interviewed, opportunities to transition technologies are missed because the SBIR program timeline is not aligned with the DOD acquisition timeline. DOD officials noted that opportunities for the insertion of new technologies by means of on-ramps typically occur when there is a new system acquisition or a system upgrade, but it may take too long to develop an SBIR technology to address needs. Furthermore, these opportunities are generally limited. Additionally, inserting a technology at the right time can be difficult due to technology freeze dates—the point at which no new technologies can be added—and

any SBIR technology in development would have to wait for the next program upgrade.

Small Businesses Identified Other Challenges to Participating in the DOD Space System Acquisitions Environment

Small businesses participating in the SBIR program identified other challenges they believe inhibit their ability to participate in DOD space system and weapon acquisitions, such as the potential for the loss of intellectual property and a lack of technology “pull” from DOD acquisition programs. Some of these identified challenges follow.

- **Loss of proprietary information:** Ten small businesses we interviewed are reluctant to enter into partnerships with prime contractors out of concern that they could lose their proprietary information through either an infringement from prime contractors or a mishandling of proprietary information by DOD program officials. The three prime contractors we spoke with said they take intellectual property rights of small businesses seriously, and they noted that specific procedures are in place to safeguard intellectual property rights of small businesses, such as the signing of nondisclosure agreements. A DOD official said that the fear of losing proprietary information is a misperception on the part of small businesses, because DOD services and components take steps to work with and protect the small businesses’ intellectual property rights. Additionally, the SBIR Policy Directive requires agencies to ensure SBIR businesses’ proprietary information is protected. However, according to five small businesses we interviewed, incidents have occurred in which DOD officials appear to have shared proprietary information with prime contractors. For example:
 - One small business we interviewed disclosed that DOD hired it to teach several prime contractors how to recreate a specific infrared technology it had developed so that the prime contractors could evaluate the technology. Although the prime contractors signed nondisclosure agreements that permitted them to use the technology for evaluation but did not give them the right to sell the technology, the small business said a DOD military service is currently procuring systems from the prime contractors that incorporated the technology they developed. The small business attempted to seek recourse against the prime contractors but could not sustain the legal fees.
 - Another small business developed a system to enhance data, and within 4 months of the successful use of the system in military operations, the Air Force turned to a prime contractor to assess and then expand upon the system to enable more users to access the technology. The small business claims that the prime contractor would not have been able to do this, however, without access to the small business’ proprietary information; thus the small business believes that the Air Force might have allowed the prime contractor to review

documents containing proprietary information during the prime contractor's initial assessment of the technology.

- **Limited technology “pull” from acquisition programs:** The small businesses we interviewed cited three reasons for the limited “pull”—identified need and support—for SBIR technologies: DOD segments may solicit topics for SBIR technologies for which they have no validated requirements, short tenure among DOD officials, and a lack of SBIR knowledge and training for program managers.
 - According to three small businesses we interviewed, the research ideas or SBIR topics are not created with a specific end-user or acquisitions customer in mind, which can limit the likelihood of insertion into DOD acquisition programs. One small business claimed that the DOD research laboratories use SBIR as a “sandbox” to research interesting ideas, reducing the benefits of the program to the warfighter. DOD officials told us, however, that at least 50 percent of SBIR topic solicitations must be endorsed by acquisition programs.
 - Four small businesses we spoke with noted that short tenures among DOD officials involved in developing SBIR technologies inhibits the ability of small businesses to transition their technology because those with decision-making authority may leave—and the interest in a technology with them. For example, one small business told us that a DOD service agreed to sponsor its technology for Fast Track funding but did not follow through because of a turnover in staff and a change in priorities. Another small business claimed that an official interested in its technology transferred, leaving it without a sponsor. According to DOD officials we spoke with, the network for sharing SBIR information is fractured and informal, and the short tenure of program managers can affect the effectiveness of informal sharing networks, making it is less likely small businesses will have the contacts needed to keep apprised of SBIR topics and technologies worked on by other DOD services and components. DOD officials suggested that DOD increase coordination efforts across services and components to share information on small-business technology development efforts. DOD officials we spoke with agreed that short tenure for program office officials affects small businesses trying to transition technologies into programs of interest, but one DOD official noted that small businesses also have a responsibility to market their product to various program offices and should not depend solely on technology “pull” by a program office or official. Several GAO reports have indicated that short program-manager tenure has hampered technology system acquisitions, and some of the reports noted the need to extend

program-manager tenure as a way of increasing stability and accountability on acquisition programs.²²

- Two small businesses we interviewed said that program managers, who are charged with planning and developing future and current acquisitions, do not understand the value of using an SBIR technology and therefore are less likely to consider it for insertion into an acquisition program. A DOD official we spoke with who is involved with the SBIR program agreed that some program officials lack a thorough understanding of the SBIR program, but he noted that DOD is currently developing training modules to address this concern. Two small businesses suggested that DOD increase program manager attention to SBIR technologies and improve their knowledge of SBIR policies and contract award process.

Conclusions

DOD is using the SBIR program to provide opportunities for small businesses to participate in the space industrial base. Its investment should be matched with efforts to get the most return. However, data needed to track commercialization success are limited. DOD is taking steps to increase the transition of SBIR technologies into DOD acquisition programs or commercial-sector products or services, and is addressing management challenges through the development of an overarching DOD SBIR directive and standardizing best practices. Despite these efforts, challenges remain as DOD strives to improve the program. Moreover, there are perceived challenges for small businesses, rooted in the costs associated with spacecraft development, the administration of the SBIR program, as well as reluctance on the part of prime contractors and program managers to work with new, unproven companies. While there are steps DOD can take that would offer improvements in the short run, additional improvements may require more insight and longer-term solutions.

Recommendations for Executive Action

We recommend the Secretary of Defense take the following three actions:

²²GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, [GAO-08-467SP](#) (Washington, D.C.: Mar. 31, 2008); *Best Practices: Better Support of Weapon System Program Managers Needed to Improve Outcomes*, [GAO-06-110](#) (Washington, D.C.: Nov. 30, 2005); *Global Positioning System: Significant Challenges in Sustaining and Upgrading Widely Used Capabilities*, [GAO-09-670T](#) (Washington, D.C.: May 7, 2009).

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- In the near term, consider collecting data on all SBIR technologies that transition into DOD acquisitions or commercial-sector products or services, as well as ensuring that these data are defined and recorded consistently. By collecting and analyzing these data, DOD would have a better understanding of its return on investment for space-related and other technologies developed under the SBIR program, and how public funds are being spent.
 - Complete efforts to develop and issue SBIR program guidance to ensure DOD military service and component-level SBIR officials are managing the program in a manner intended to meet the full intent of the SBIR Policy Directive.
 - In the long term, examine the challenges offered by small businesses, government officials, and prime-contractor officials in this report and assess the extent to which there are cost-effective improvements that could be made to address them. In doing so, DOD may want to compare and contrast SBIR efforts among all the military services.

Agency Comments and Our Evaluation

We provided a draft of this report to the Secretary of Defense and the office of the Administrator of the Small Business Administration (SBA). Written comments from DOD and SBA are included in this report as appendixes II and III, respectively.

DOD partially concurred with our recommendation that DOD, in the near term, should consider collecting data on all SBIR technologies that transition into DOD acquisitions or commercial-sector products or services, as well as ensure that these data are defined and recorded consistently. DOD agreed that collecting commercialization data on SBIR technologies is beneficial and that it has systems to collect these data; however, DOD also noted it would not be cost-effective to collect data on government and commercial/private awards at the prime and lower tier levels because DOD does not have the resources nor the responsibility to capture all public and private data for the DOD program.

For DOD to have a better understanding of its return on investment for commercializing space-related and other technologies, it must strengthen its evaluation of the SBIR program. To do this, DOD needs more complete data as well as data that are consistently defined and recorded, as we recommended. While DOD noted that it collects commercialization data in two ways—by requiring that proposing firms report prior SBIR commercialization and through the Federal Procurement Data System—the data being reported are not always recorded consistently. Improving data collection efforts in these areas would substantially improve DOD’s insight into the SBIR program’s effectiveness. Regarding the collection of

commercialization data for firms no longer participating in the DOD SBIR program, we recommended that DOD consider collecting this information. This consideration would involve identifying the cost to capture these data and identifying the benefit gained from better understanding the investment. If DOD determines that the collection of this information is cost prohibitive, DOD should not be expected to collect it. However, it would still behoove DOD to assess the extent to which collecting this data would be cost prohibitive against the potential value the data could bring to increasing small business participation in space.

In its comments, SBA noted that it is developing a commercialization data collection system that will capture public and private commercialization results for firms re-applying for awards under the SBIR program. We believe that SBA's efforts to improve data collection and management of SBIR data should ease the burden on DOD resources and costs to collect comprehensive data. While the SBA's new data system will provide programwide data, SBA stated that it encourages agencies to explore agency-specific approaches to collecting and measuring commercialization results. DOD did not address how it will ensure that commercialization data are defined and recorded consistently within the department. We continue to believe that inconsistencies in recording and defining Phase III data among the military services and components will not give DOD a good sense of what benefits industry and government are deriving from the SBIR program. Improvements in data collection would provide DOD with substantive data for evaluating its SBIR investment.

DOD agreed with our recommendation that the department complete efforts to develop and issue SBIR program guidance to ensure military service and component-level SBIR officials are managing the program in a manner intended to meet the full intent of the SBIR Policy Directive. In response, DOD stated that it suspended efforts on finalizing a DOD SBIR Directive because of multiple delays in SBIR program reauthorization and that draft legislation being proposed will create major changes to the program that will significantly affect the content of the DOD SBIR Directive. We acknowledge that the SBIR Directive may be significantly changed. DOD commented that it intends to finalize the DOD Directive within 180 days of issuance of the updated SBIR Policy Directive.

DOD did not concur with our recommendation that DOD should, in the long term, examine the challenges offered by small businesses, government officials, and prime contractor officials in this report and assess the extent to which there are cost-effective improvements that could be made to address them. DOD noted that it does not concur that

the individual challenges in our report should be assessed on an individual basis and that many of the cited challenges are issues facing the entire small-business community. DOD further noted that it addresses the challenges faced by SBIR program participants through an SBIR steering committee, working groups, conferences, and training workshops. We do not believe that our report focuses on individual concerns or challenges but rather examines broader challenges that DOD may want to address in the future. We acknowledge DOD's broad-scale efforts to address issues facing the entire small-business community. However, given the fact that most stakeholders in the space industrial base that we spoke with—DOD, prime contractors, and small businesses—generally agreed that small businesses participating in the DOD SBIR program face difficulties transitioning their space-related technologies into DOD acquisition programs, it would still be in DOD's best interest to assess the extent to which there are cost-effective improvements that could be made to address these difficulties. While we acknowledge that some of the transition challenges may be faced by the entire SBIR community, others, like the high cost of testing technologies so they are flight-ready for the harsh space environment and the high cost of obtaining security clearances that enable small businesses to submit classified proposals, may be more prominent to SBIR companies working in the space sector. To assist DOD with addressing the difficulties that SBIR companies state they are having in transitioning their space-related technologies, we continue to believe that DOD could look to the individual military services for ways to overcome these difficulties.

The SBA commented that it is interested in following up on the concerns expressed by small businesses regarding the safety of intellectual property when working with the SBIR or DOD acquisition programs. The SBA stated that it is currently working to clarify SBIR data rights in its SBIR Policy Directive. The SBA is also working with the various SBIR agencies on ways to provide further guidance to contracting officers who are new to the program and to prevent lengthy delays between selection of the awardees and funding agreement awards.

DOD also provided technical comments that have been incorporated where appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, and other interested parties. The report also is available at no charge on the GAO Web site at <http://www.gao.gov>.

If you have any questions about this report, please contact me at (202) 512-4841 or chaplainc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are provided in appendix IV.

A handwritten signature in black ink, appearing to read 'C. Chaplain', with a stylized, cursive script.

Cristina T. Chaplain
Director
Acquisition and Sourcing Management

Appendix I: Scope and Methodology

To determine the extent to which the Department of Defense (DOD) is utilizing the Small Business Innovation Research (SBIR) Program to develop and transition space-related technologies, we reviewed DOD acquisition policies, memorandums, and other guidance concerning the SBIR Program. We analyzed data and interviewed officials from the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (AT&L)—specifically the Office of Small Business Programs (OSBP), Small Business Administration (SBA), Army, Navy, Air Force, Space and Missile Systems Center (SMC), Air Force Research Lab (AFRL), Defense Advanced Research Projects Agency (DARPA), and the Missile Defense Agency (MDA). We reviewed SBA policies, and SBIR success stories. We also assessed the extent to which DOD is delivering space-related warfighter capabilities through the SBIR Program, by analyzing data and interviewing officials from the Army, Navy, and Air Force, and we attended conferences to identify small-business development opportunities and determine steps DOD is taking to involve small businesses.

We analyzed data from OSBP for fiscal years 2000 through 2009 to determine the investment DOD makes in space-related SBIR Phase I and II awards each year. To identify the space-related portion of total SBIR investment, OSBP officials provided data from the Federal Procurement Data System–Next Generation (FPDS-NG). FPDS-NG contains detailed information on contract actions and identifies, among other data, the contract types used by federal agencies in procuring goods and services.

Though we have previously reported that governmentwide FPDS-NG data are incomplete and lack internal controls, FPDS-NG is the official federal contracting database, and is therefore one of the systems DOD uses to track its SBIR contracts; the second system is the Company Commercialization Report (CCR) database, a system in which the reporting of Phase III contracts by small businesses is voluntary. DOD’s OSBP reconciles the CCR database with the FPDS-NG for its own annual reporting requirement to the SBA. An OSBP official pulled space-related SBIR contract information from the FPDS-NG database after we asked for the data for our review. However, a DOD OSBP official told us that the FPDS-NG database was not designed to extract space-related contract data from its database. Using a keyword search query, OSBP officials separated out all DOD SBIR efforts containing reference to “space platforms,” for fiscal years 2005 through 2009, which they explained were the best data available for identifying DOD’s space-related SBIR contracts. These are the data we used to determine DOD’s space-related topics,

proposals, and investments for fiscal years 2005 through 2009. We did not test the reliability of these data.

To identify challenges small companies face to participating in the space industrial base, we interviewed 28 small businesses to obtain their perspectives on existing challenges. We identified the small businesses primarily through DOD's SBIR program Web site, a network of small aerospace companies in the Los Angeles, California, area, and additional referrals by existing SBIR companies. Half of the SBIR companies represented in our sample are located in California, which is where most DOD space work takes place, while the remaining SBIR companies in our sample are located in Colorado, New Mexico, Ohio, Virginia, Connecticut, Massachusetts, and Washington, D.C. We contacted companies across all three Phases of the SBIR award process. Our findings, conclusions, and recommendations are limited by the evidence we have cited. We were unable to make generalizable statements about the target population because we conducted a nonprobability sample of interviews. We also interviewed various space and other program managers at the Army, Navy, Air Force, DARPA, and MDA to determine their views on existing challenges. Further, we interviewed representatives from three prime contractors currently working on DOD space acquisition programs to identify the challenges they believe exist to small businesses in participating in DOD space and weapon acquisitions. We attempted to assess the commercialization success of space-related technologies through the SBIR Program at DOD, but DOD does not have complete and consistent commercialization data. We also reviewed studies and reports on the overall SBIR Program, DOD's SBIR Program, and the defense space industrial base.

We conducted our work from August 2009 to October 2010 in accordance with generally accepted government accounting standards. Those standards require that we plan and perform the audits to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Comments from the Department of Defense



ACQUISITION,
TECHNOLOGY
AND LOGISTICS

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

26 OCT 2010

Ms. Christina Chaplain
Director, Acquisition and Sourcing Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Ms. Chaplain:

This is the Department of Defense response to the GAO draft report, GAO-11-21, "SPACE ACQUISITIONS: Challenges in Commercializing Technologies Developed Under the Small Business Innovation Research (SBIR) Program," dated September 23, 2010 (GAO Code 120848).

The Department appreciates the opportunity to respond to your draft report and looks forward to working with you as we continue to ensure a strong and capable Defense Space Acquisition Community.

Sincerely,

A handwritten signature in black ink that reads "J E Misanin".

Joseph E. Misanin
Deputy Director, Program Operations
Office of Small Business Programs

Enclosure:
As stated

GAO DRAFT REPORT- DATED September 23, 2010
GAO CODE 120848/GAO-11-21

“SPACE ACQUISITIONS: Challenges in Commercializing Technologies Developed
Under the Small Business Innovation Research (SBIR) Program”

DEPARTMENT OF DEFENSE COMMENTS
TO THE RECOMMENDATIONS

RECOMMENDATION 1: The Government Accountability Office (GAO) recommends that in the near term, consider collecting data on all SBIR technologies that transition into the Department of Defense (DoD) acquisition or commercial sector products or services, as well as ensuring that these data are defined and recorded consistently. By collecting and analyzing this data, DoD would have a better understanding of its return on investment for space-related and other technologies developed under the SBIR program, and how public funds are being spent.

DOD RESPONSE: Partially Concur. The Department concurs that collecting commercialization data on SBIR technologies is beneficial and has established systems to collect this data; however, it would not be cost effective to collect all commercialization data resulting from the SBIR program. The U.S. Small Business Administration (SBA) SBIR Policy Directive defines commercialization as, “The process of developing marketable products or services and producing and delivering products or services for sale (whether by the originating party or by others) to Government or commercial markets.” All commercialization would have to include both Government and commercial/private awards at the prime and lower tier levels. The Department does not have the resources nor the responsibility to capture all public and private data for the DoD program.

The Department currently collects commercialization data in two ways. First, we require that proposing firms report SBIR Phase III activity (commercialization), derived from prior SBIR awards, in a DoD commercialization database. Participating firms are the only comprehensive source of commercialization information because only they know the extent and character of their phase III activity. Commercialization data for firms no longer participating in the DoD SBIR program is not captured.

The second way DoD collects commercialization data is through the Federal Procurement Data System – Next Generation (FPDS-NG). This system collects only Federal prime contract activity and therefore is a subset of all commercialization.

Section k, subparagraph (2) of 15 USC 638 requires the Small Business Administration (SBA) to, "...develop and maintain a database to be used exclusively for SBIR and STTR program evaluation. The evaluation shall include revenue from the sale of new products or services resulting from the research conducted under the [SBIR] award." The Department supports SBA efforts to develop and maintain a comprehensive database to capture commercialization data.

RECOMMENDATION 2: The GAO recommends that the Department complete efforts to develop and issue SBIR program guidance to ensure its military service and DOD component-level SBIR officials are managing the program in a manner intended to meet the full intent of the SBIR Policy Directive.

DOD RESPONSE: Concur. The Department concurs that the development and issuance of SBIR program guidance will ensure implementation of the DoD SBIR program consistent with the SBA SBIR Policy Directive. The Department suspended efforts on finalizing a DoD SBIR Directive due to multiple delays in program reauthorization. Draft legislation currently being proposed by the House and the Senate will create major changes to the program that will significantly impact the content of the DoD SBIR Directive. Once reauthorization is signed by the President, the SBA has 180 days to update the SBIR Policy Directive. After issuance of the SBIR Policy Directive, the OSBP will finalize the DoD Directive within 180 days.

RECOMMENDATION 3: The GAO recommends that the Department, in the long term, examine the challenges offered by small businesses, government officials, and prime contractor officials in this report and assess the extent to which there are cost-effective improvements that could be made to address them. In doing so, DOD may want to compare and contrast SBIR efforts among all the military services.

DOD RESPONSE: Nonconcur. The Department does not concur that the individual challenges offered by the small businesses, government officials, and prime contractor officials in this report should be assessed on an individual basis. Many of the cited challenges are broad small business and/or space related issues facing the entire small business community. The Department addresses the challenges faced by the SBIR program participants through an SBIR steering committee, working groups, conferences and training workshops. The DoD SBIR Program Managers meet regularly as members of an SBIR steering committee to identify, prioritize, and address DoD wide challenges. To address Federal-wide SBIR challenges, the Department participates in the SBA SBIR working groups and improvement initiatives. Collectively, Federal-wide initiatives and challenges are presented at the Department's annual Beyond Phase II Conference, an event that brings together small businesses, government officials and prime contractors to facilitate the transition of SBIR-funded technologies. DoD-wide challenges are further reviewed for potential solutions at the annual DoD Training Workshop for government SBIR personnel.

Appendix III: Comments from the U.S. Small Business Administration



U.S. SMALL BUSINESS ADMINISTRATION
WASHINGTON, DC 20416

October 25, 2010

Ms. Cristina Chaplain
Director, Acquisition and Sourcing Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

RE: "Challenges in Commercializing Technologies Developed Under the Small Business Innovation Research Program" (GAO-11-21)

Dear Ms. Chaplain:

Thank you for the opportunity to comment on your recent report, "Challenges in Commercializing Technologies Developed Under the Small Business Innovation Research Program" (GAO-11-21). In this report, GAO examines the extent to which the U.S. Department of Defense (DoD) utilizes the SBIR program in developing and transitioning space-related technologies. The report recommends that DoD collect data on all SBIR technologies that transition into DOD acquisitions or commercial products or services, complete its efforts to issue SBIR program guidance consistent with the SBIR Policy Directive, and further examine the small business challenges identified in the report.

SBA welcomes the analysis provided by the report and will support appropriate actions that DoD takes to address the recommendations. SBA is currently undertaking a comprehensive upgrade to the Tech-Net database. This effort aims to improve data collection and management program wide, and will address a number of concerns raised in the report. For example, GAO found that DoD is unable to track the number of space-related Phase III awards. Phase III award information will be collected from all SBIR agencies and integrated into the SBA SBIR/STTR database, along with an array of confidential data on commercialization results. This will enable new analysis of the technologies and projects transitioned to DoD space programs and other areas.

SBA is also developing a commercialization data collection system that will capture public and private commercialization results for firms re-applying for awards under the SBIR program. The new data system will provide program-wide data, but the SBA will continue to encourage agencies to explore agency-specific approaches to collecting and measuring commercialization results. SBA has recently retained a contractor that has initiated work on the improvement of the Tech-Net system. The improved Tech-Net system should be able to begin compiling improved data collection and commercialization information in the next nine to twelve months.

In addition, SBA is interested in following up on the concerns expressed by small businesses regarding the safety of intellectual property when working with the SBIR or DoD acquisition programs. SBA is currently working to clarify SBIR data rights in its SBIR Policy Directive. The SBA is also working with the various SBIR agencies on ways to provide further guidance to contracting officers that are new to the program, and to prevent lengthy delays between selection of the awardees and funding agreement award.

Ms. Cristina Chaplain
Page 2

Again, thank you for the opportunity to provide comments on this draft report. If you have any additional questions, please feel free to contact Alfonso Lopez, Assistant Administrator, Office of Congressional and Legislative Affairs (202) 205-6700.

Sincerely,

A handwritten signature in black ink that reads "Eric Zarnikow". The signature is written in a cursive style and is positioned above the printed name.

Eric Zarnikow
Associate Administrator
Office of Capital Access

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Cristina T. Chaplain, (202) 512-4841 or chaplainc@gao.gov

Staff Acknowledgments

In addition to the contact named above, key contributors to this report were Art Gallegos, Assistant Director; Maria Durant; Claire Buck; Amanda Jones; Morgan Delaney-Ramaker; Arturo Holguin; Sylvia Schatz; and Nathan Pope.

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