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Review of the SBIR and STTR Programs at the Department of Defense

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Social and Economic Systems

Center for Health, People, and Places

Consensus Study Report

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This Consensus Study Report was reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. The purpose of this independent review is to provide candid and critical comments that will assist the National Academies of Sciences, Engineering, and Medicine in making each published report as sound as possible and to ensure that it meets the institutional standards for quality, objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

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Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations of this report nor did they see the final draft before its release. The review of this report was overseen by **MARCIA RIEKE** (NAS), The University of Arizona, and **SALLIE KELLER** (NAE), U.S. Census Bureau. They were responsible for making certain that an independent examination of this report was carried out in accordance with the standards of the National Academies and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authoring committee and the National Academies.

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Preface

This report is the result of a request by Congress for an assessment of the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs at each of the principal agencies that conduct or fund research and development (R&D) activities across the federal government. The SBIR program has become the largest and most comprehensive public R&D funding program for small business research in the United States, and indeed has been emulated by other countries. An underlying tenet of the SBIR program, and the related STTR program, is that small and young firms are an important source of new ideas that provide the basis for technological innovation, productivity increases, and subsequent economic growth. Predicated on the observation that it is difficult for small and young firms to find financial support for their ideas, the SBIR/STTR programs have become known as America's Seed Fund.

Yet this characterization captures only one dimension of the legislative objectives and operation of the programs. By involving qualified small businesses in the nation's R&D efforts, SBIR/STTR awards stimulate the development of innovative technologies, help move research closer to the market, and address the needs of citizens underserved because of limited market incentives. Equally important, and particularly relevant for the current report, the SBIR/STTR programs aim to help federal agencies fulfill their missions and objectives by stimulating technological innovation that meets agency needs—first by funding early-stage R&D, and ultimately by integrating successful technologies into use through procurement and other means.

Specifically, this report focuses on the operation and performance of the SBIR/STTR programs at the Department of Defense (DOD). As the largest and most complex of the federal SBIR/STTR programs, encompassing more than a dozen distinct service and agency components, the DOD SBIR/STTR enterprise reflects the scale and diversity of the Department's mission—from fundamental science to applied technology and procurement. The committee convened by the National Academies of Sciences, Engineering, and Medicine to carry out this study undertook a detailed assessment of the process by which SBIR and STTR awards are made at DOD; a survey of the landscape of awards that have been granted; and a detailed quantitative analysis examining the innovation, commercialization, and follow-on funding outcomes of firms participating in the programs. Collectively, these analyses, documented in this report, are intended to

offer a more comprehensive and precise assessment of the SBIR and STTR programs than has been provided in previous studies of this agency carried out by the National Academies. Here we highlight three broad themes from the report and make one plea for a more systematic data infrastructure to help understand and quantify outcomes stemming from the programs.

First, the DOD SBIR and STTR programs play a central role in advancing DOD's mission by connecting the nation's small business innovators directly to defense research, development, and operational needs. These programs strengthen the Department's ability to identify, fund, and integrate innovative technologies that support national defense—first through early-stage R&D and, ultimately, through procurement and fielding of new capabilities. While the evidence for large procurement contracts is more difficult to ascertain (both because of data issues related to subcontracting and also because these technologies are typically part of larger systems whose primary contractors are much larger firms), the overall tenor of the evidence in the report supports the idea that the DOD SBIR/STTR program has been successful in its goals of supporting the mission of DOD itself. Moreover, the cumulative effect of the program is to serve as a vital bridge between the small business and startup innovation ecosystem and the Department's mission-oriented R&D enterprise.

Second, firms require substantial experience engaging with DOD before their innovations are effectively incorporated into the defense R&D and acquisition system. Firms that have received multiple SBIR/STTR awards—particularly those with at least five Phase I projects—are substantially more likely to generate inventions, secure follow-on DOD or private funding, and contribute meaningfully to defense capabilities. These findings highlight that learning to navigate DOD's complex contracting and technical environment is itself an important part of the innovation process. Recent legislative provisions that restrict the participation of "experienced" firms in the SBIR/STTR programs are therefore not supported by the data and risk constraining the pool of high-performing small businesses that the Department depends upon. Moreover, these requirements impose additional administrative burdens on DOD program managers and reduce flexibility to fund the most meritorious projects. The evidence suggests that experience in the DOD context should be viewed as an asset (or at least a neutral rather than negative attribute) in leveraging small business innovation to meet defense needs.

Third, the emergence of open topic SBIR programs—first pioneered by the Air Force under AFWERX and subsequently adopted by other DOD components—represents an important experiment in widening access to the defense innovation system. The evidence suggests that these open approaches can be valuable for identifying nontraditional suppliers and attracting new entrants, particularly in large and technologically diverse organizations. However, the report also finds that a single, uniform approach is unlikely to serve the entire Department effectively. Smaller or more specialized agencies often face significant administrative burdens in processing open topic proposals and may

find traditional, solicitation-driven approaches better aligned with their specific mission needs.

Finally, with the ongoing evaluations of the DOD SBIR/STTR programs, there remains a critical need for a coherent framework and system that track these investments and communicate their outcomes effectively across the Department. The committee's work demonstrates that a more integrated data infrastructure (linking awards across phases and components and making those linkages visible through a more visible and accessible portal) would provide the foundation for assessing progress and informing both leadership and the broader innovation community. Further, research and innovation are driven by individuals (scientists, engineers, and entrepreneurs whose careers intersect repeatedly with the defense innovation system). Enhancing the capacity to track the role of individual researchers would yield a deeper understanding of knowledge flows, supply chain linkages, and the cumulative contribution of SBIR/STTR to DOD's mission. Greater transparency and accessibility of data would not only strengthen program management but also reinforce public confidence in the value and stewardship of these vital national investments.

Maryann P. Feldman, *Co-Chair*
Scott Stern, *Co-Chair*
Committee on the Review of the Small Business Innovation Research and Small Business Technology Transfer Programs at the Department of Defense
December 2025

Acronyms and Abbreviations

AI	artificial intelligence
APFIT	Accelerate the Procurement and Fielding of Innovative Technologies
ASA(ALT)	Assistant Secretary of the Army for Acquisition, Logistics, and Technology
BAA	Broad Agency Announcement
CBD	Chemical and Biological Defense Command
CR	continuing resolution
CSO	Commercial Solutions Opening
CUI	controlled unclassified information
CYBERCOM	United States Cyber Command
DARPA	Defense Advanced Research Projects Agency
DHA	Defense Health Agency
DIU	Defense Innovation Unit
DLA	Defense Logistics Agency
DMEA	Defense Microelectronics Activity
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy

DSIP	Defense SBIR/STTR Innovation Portal
DTRA	Defense Threat Reduction Agency
FAR	Federal Acquisition Regulation
FFRDC	Federally Funded Research and Development Center
FOCI	foreign ownership, control, or influence
FPDS	Federal Procurement Data System
FY	fiscal year
GAO	U.S. Government Accountability Office
GPS	Global Positioning System
HBCU	historically Black college or university
HHS	U.S. Department of Health and Human Services
HSI	Hispanic-serving institution
IC	Intelligence Community
IP	intellectual property
IPO	initial public offering
JPEO-CBRND	Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense
JSTO-CBD	Joint Science and Technology Office for Chemical and Biological Defense
KOSBIR	Korea Small Business Innovation Research
KOSGEB	Small and Medium Industry Development Organization (Turkey)
MDA	Missile Defense Agency
MSI	minority-serving institution

NASA	National Aeronautics and Space Administration
NDAA	National Defense Authorization Act
NDS	National Defense Strategy
NDSTS	National Defense Science & Technology Strategy
NGA	National Geospatial-Intelligence Agency
NNSA	National Nuclear Security Administration
NSF	National Science Foundation
OCEA	Office of Commercial and Economic Analysis
OMB	Office of Management and Budget
OSC	Office of Strategic Capital
OSD	Office of the Secretary of Defense
OSRD	Office of Scientific Research and Development
OUSD(R&E)	Office of the Under Secretary of Defense for Research and Engineering
PI	principal investigator
POR	program of record
PPBE	planning, programming, budgeting, and execution
PSC	Product or Service Code
R&D	research and development
RDER	Rapid Defense Experimentation Reserve
RDT&E	research, development, test, and evaluation
RIF	Rapid Innovation Fund
RISE	Rapid Integrated Scalable Enterprise

ROI	return on investment
SAM	System for Award Management
SBA	U.S. Small Business Administration
SBIR	Small Business Innovation Research
SBIRI	Small Business Innovation Research Initiative (India)
SME	subject matter expert
SOF	Special Operations Forces
STEM	science, technology, engineering, and mathematics
STP	SBIR/STTR Transition Program
STRATFI	Strategic Funding Increase Program
STTR	Small Business Technology Transfer
TABA	Technical and Business Assistance
TACFI	Tactical Funding Increase Program
TPOC	technical point of contact
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
USAF	United States Air Force
U.S.C.	United States Code
USPTO	United States Patent and Trademark Office
USSOCOM	United States Special Operations Command
VC	venture capital

Summary[1]

The Small Business Innovation Research (SBIR) program, established in 1982, sets aside a portion of an agency's external research and development (R&D) funding for awards to small businesses, with the aim of translating scientific findings and engineering achievements into technology developments and innovation activities. This program was augmented in 1992 by the Small Business Technology Transfer (STTR) program, which includes the requirement for the small business awardee to partner with a college, university, Federally Funded R&D Center (FFRDC), or qualified nonprofit research institution on a cooperative R&D project, thereby helping to promote technology transfer and commercialization of the parties' research collaborations. The programs were most recently authorized through September 2025; as of this writing, their reauthorization is pending in Congress.

The two programs are overseen and coordinated by the U.S. Small Business Administration (SBA). Participation is governed by the size of an agency's extramural R&D budget, and participating agencies enjoy wide autonomy in managing their programs to best achieve their mission and objectives. Today, 11 federal agencies have SBIR programs; 6 operate STTR programs, including the Department of Agriculture as of 2022. The largest of these programs, and the subject of this report, are those of the Department of Defense (DOD). Over the lifetime of the programs, DOD has made awards to more than 13,400 unique firms.

DOD asked the National Academies of Sciences, Engineering, and Medicine (the National Academies) to conduct a quadrennial review of DOD's SBIR and STTR programs, in accordance with a legislative mandate. The committee convened by the National Academies to carry out this request gathered and analyzed quantitative and qualitative data to produce this report on program operations and outcomes stemming from DOD SBIR/STTR awards.

This report presents a detailed analysis of DOD's SBIR and STTR programs in accordance with the legislative mandate. Drawing on published research plus existing data, the study committee examined (1) the extent to which

[1] This summary does not include references. Reference citations for the content herein can be found in the body of the report.

the programs have stimulated technological innovation and engaged small businesses to meet DOD needs; (2) the effectiveness of the STTR program in stimulating new collaborations between small businesses and research institutions and potential barriers to those collaborations; (3) the effectiveness of the STTR program in transferring to acquisitional and operational use the technology and capabilities developed through federal funding; (4) challenges facing DOD in outreach to potential applicants for program awards; (5) application and award procedures and their effectiveness in meeting DOD mission needs; (6) support provided for awardees, especially those with connections to DOD prime contractors; and (7) the impact of statutory changes to the programs, especially those related to the number of awards or award sizes. To further assess whether DOD's SBIR/STTR programs serve as a gateway for engagement for innovative small firms in the defense innovation ecosystem, the committee also analyzed whether firms that participate in DOD's SBIR/STTR programs receive other sources of funding from DOD.

DOD is a complex organization comprising service branches such as the Army, Navy, Air Force, and Space Force; defense agencies such as the Defense Advanced Research Projects Agency (DARPA) and the Defense Threat Reduction Agency (DTRA); and combatant commands such as the United States Special Operations Command (USSOCOM). Each military service and component (defense agency or combatant command) has a distinct mission, budget, and organizational structure. Organizational entities have emerged and evolved over time to address emerging threats and adapt to changing national security priorities. Examples include the creation of the United States Cyber Command (CYBERCOM), the Defense Innovation Unit (DIU), and the Space Force. There are currently 14 military services and component agencies within DOD that operate SBIR/STTR programs, all managed individually within DOD and SBA guidelines, with oversight by a central body within the Office of the Under Secretary of Defense for Research and Engineering (OUSD[R&E]).

Different services and components within DOD execute R&D that is specific to their individual missions. For example, DARPA funds high-risk, high-payoff science and technology programs to generate technological advantage over adversaries, and organizations such as DTRA and the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) fund research to address threats resulting from weapons of mass destruction. DOD funds small business research performers through the SBIR/STTR programs, as well as with other research, development, test, and evaluation (RDT&E) funds.

Still, as a defense mission agency, DOD performs a wide range of activities in addition to RDT&E to support its defense operations, including installation management, the provision of educational services, health care management, and policy development and execution. DOD's procurement enterprise (over $150 billion in fiscal year 2023) is an ancillary function of the Department's daily global military operational activities and the training, equipping, and fielding of military capabilities around the world to support the

execution of national defense missions, such as power projection, homeland defense, humanitarian assistance, and deterrence of future conflicts.

Total DOD RDT&E funding for fiscal year (FY) 2023 was $145 billion, which represented about one-sixth of the Department's overall budget in that fiscal year. DOD determines the share of its overall RDT&E funding that is distributed extramurally, and a fixed portion of that funding is set aside for the SBIR and STTR programs (currently 3.2 percent for SBIR and 0.45 percent for STTR). For FY2023, the total amount allocated to the SBIR/STTR programs within DOD was nearly $2.9 billion, or about 11 percent of DOD's total budget for "science and technology activities," which are the earlier stages of the R&D pipeline. While spending on SBIR/STTR represents a substantial portion of DOD's science and technology budget, it accounted for only about 2 percent of the Department's overall RDT&E funding and about 0.3 percent of its total spending in FY2023.

Overall, the committee considers the SBIR/STTR programs to be effective tools for achieving many of DOD's stated modernization and industrial base goals. They enable DOD organizations to develop and transition new and disruptive technological capabilities, address long-standing challenges that face operational forces and acquisition programs, and support efforts to expand the defense innovation and industrial base. The key findings and recommendations discussed in this summary highlight that a crucial strength of the programs is their flexibility: DOD organizations can execute and prioritize the programs in a manner that suits their mission requirements. On the other hand, the programs would benefit from increased attention by senior leadership, especially to address the transition of technologies from the programs into acquisition and operational use, as well as to overcome bureaucratic and policy challenges that sometimes reduce the programs' effectiveness.

KEY FINDINGS AND RECOMMENDATIONS

Although the SBIR/STTR programs represent only a small portion of the DOD budget, they are critically important for small business innovators working on defense-related topics. Practically speaking, these programs are the world's largest initiatives dedicated to small business innovation in defense technology. The committee's analysis led to several key findings about the importance of these programs to both the firms that receive the awards and the defense innovation ecosystem.

> Finding 7-1[2]: DOD's SBIR/STTR programs serve as a gateway for small firms to enter the defense innovation ecosystem and receive subsequent R&D funding from DOD, consistent with their role in expanding the defense industrial base.

[2] The committee's findings and recommendations are numbered according to the chapter of the main report in which they appear.

Finding 7-5: Firms that have participated in DOD's SBIR/STTR programs ultimately meet a significant and growing fraction of DOD's extramural R&D needs and represent nearly one-third of participants in the defense R&D base.

Finding 7-6: DOD SBIR/STTR firms ultimately attract more than 4 dollars in non-SBIR/STTR funding from DOD for each dollar of DOD SBIR/STTR funding.

Finding 8-3: DOD SBIR/STTR awardees register a significant rate of knowledge transfer to prime contractors. For example, patents attributed to DOD SBIR/STTR funding are cited nearly three times more often compared with non-SBIR/STTR patents among the same recipients. Additionally, nearly 20 percent of acquisitions of DOD SBIR/STTR-funded firms are by one of the top defense contractors.

Importantly, the committee found that DOD SBIR/STTR-funded firms do better on traditional innovation metrics, such as acquiring patents and attracting venture capital funding, compared with small firms that contract with the government for R&D but do not receive DOD SBIR/STTR awards. At the same time, while the committee found strong evidence of DOD's continued support for these firms using R&D dollars outside of the SBIR/STTR programs, it rarely found evidence of direct procurement by DOD. This finding may be attributable to data issues: Phase III awards are not reported uniformly, and subcontracting or the transfer of technology through acquisition by more established firms (e.g., Tier I suppliers or even prime contractors) is not always transparent.

Taken together, the key findings above served as the basis for the committee's key recommendations. First, because the programs serve their purpose and fulfill their statutory mission, the committee recommends that they be extended permanently. Second, the committee proposes a set of focused recommendations, articulated below, to raise the profile of the SBIR/STTR programs within the DOD hierarchy, and to increase their visibility to Congress and defense suppliers and funders.

Recommendation 7-1: Given the demonstrated impacts of the Department of Defense's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs on the development and fielding of new defense systems and capabilities, as well as on the defense innovation ecosystem and defense research and development industrial base, Congress should make the SBIR/STTR programs permanent.

Recommendation 4-1: The Department of Defense's (DOD's) Under Secretary of Defense for Policy should include in Defense Planning

Guidance that the DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs should be used as a mechanism for strengthening and broadening the defense industrial system, and direct the Department's services and components to promote the transition of SBIR/STTR-generated technologies into mainstream science and technology and acquisition programs.

Recommendation 4-3: The Department of Defense's (DOD's) Office of Local Defense Community Cooperation should include DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards in its annual Defense Spending by State report.

Recommendation 3-1: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering, working with the Under Secretary of Defense (Comptroller), should develop information systems to provide greater fidelity and precision for the tracking of DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards, and a single, public portal to access and sort this information. This portal should link awards from Phase I to Phase II to Phase III in a consistent, clear format. These actions would provide the foundation for improving the programs' effectiveness and efficiency, as well as communicating the value of DOD SBIR/STTR awards.

Maintaining Program Agility

DOD's federated nature means that each SBIR/STTR program is executed differently throughout the Department. Each entity within DOD operating SBIR/STTR programs must remain simultaneously responsive to SBA directives and to high-level DOD officials in the Office of the Secretary of Defense, as well as the leadership of the military service or defense agency where the individual SBIR/STTR program resides. Each service or component within the Department has significant autonomy in administering its programs and defining its portfolio of projects, tailored to meet specific defense needs. This decentralized approach presents challenges in evaluating DOD's SBIR/STTR programs. There are, in reality, numerous unique program implementations across the various DOD organizations, each reflecting different strategic priorities and technological focuses.

Given the federated nature of program management, the diversity of program goals, and a lack of consistent attention from leadership within DOD, those operating the programs face considerable challenges in shaping program activities to match institutional goals and strategies. The next three key findings

highlight some of the complexities related to several new program requirements, such as the use of open topics and due diligence requirements. Although the use of open topics has the potential to increase the number of new SBIR/STTR firms submitting proposals, it appears to work better in the larger organizations within DOD, such as the Air Force. For smaller and more specialized agencies, the number and range of proposals received in response to open topics can create a significant administrative burden for processing and review while not necessarily yielding the specialized capacity needed.

In addition to the mandate concerning the use of open topics, the SBIR and STTR Extension Act of 2022 required new due diligence procedures to enhance the security of proposals submitted by small businesses seeking DOD awards. A critical aspect of the due diligence process is a review of the information provided by small businesses regarding their foreign affiliations or relationships with foreign countries, including an analysis of cybersecurity practices, patents, employee backgrounds, potential foreign ownership and/or financial ties, and obligations to foreign entities. Currently, all proposals are evaluated, not just those deemed to be meritorious, and the committee found this process to be burdensome for smaller components within DOD.

> Finding 4-1: DOD's SBIR/STTR programs vary in terms of size, mission, and operational approaches. Codifying and communicating best practices would help all DOD organizations improve their SBIR/STTR programs.
>
> Finding 4-2: Certain activities related to the implementation of DOD's SBIR/STTR programs, such as due diligence, application assistance, and commercialization assistance, create an administrative burden for smaller DOD services/components.
>
> Finding 4-3: Open topics help bring into DOD's SBIR/STTR programs a broader range of firms that could reduce the concentration of awards, but the use of open topics is administratively burdensome for smaller DOD services/components.

In response to these findings, the committee offers three key recommendations for addressing these issues and helping different DOD organizations operate the programs more efficiently.

> **Recommendation 4-4: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering (OUSD[R&E]), which is the DOD office of primary responsibility for the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs, should codify and communicate best practices, such as those for integrating the SBIR/STTR awardees into programs of record or improving**

outreach to new small businesses. In addition, OUSD(R&E) should incentivize early collaborations across services and components for projects with potential multimission transition pathways.

Recommendation 4-5: Congress should allow but not require the use of Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) open topics. Congress should encourage more flexibility for the Department of Defense's services and components to experiment with approaches that help broaden their supply base.

Recommendation 4-10: The Department of Defense's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program Office should prioritize due diligence reviews for proposals that are being seriously considered for funding.

The Impact of Experienced Firms

The final set of key findings and recommendations resulted from the committee's investigation of whether firms that over time win multiple SBIR/STTR awards have a greater impact on DOD's missions and goals relative to those that receive fewer awards. Because the mark of success of these programs is their ability to serve DOD, it is not surprising that some of the most successful performers are those that receive multiple awards. DOD's procurement process is difficult to navigate for performers without prior experience with the Department. The committee found that there appears to be a certain threshold—five Phase I awards—beyond which firms are effective in producing inventions and innovations that attract follow-on DOD funding or private financing.

In its 2022 reauthorization of the programs, Congress placed heightened restrictions on program participation by what it deemed "experienced firms"—those that received more than 50 Phase I awards over a 5-year period or more than 50 Phase II awards over a 10-year period—based on either their transition from Phase I to Phase II or their commercialization record. The 2022 reauthorization also limited the definition of commercialization to sales to or investments from the private sector alone, which excludes continued engagement with the Department beyond Phase I and Phase II. Looking at Phase I award counts, the committee found that experienced DOD SBIR/STTR firms were more likely to receive subsequent financing (both from DOD and from the private sector) and more likely to receive patents compared with a similar set of small businesses that did not receive DOD SBIR/STTR funding. In addition, experienced firms were much more likely to receive DOD procurement contracts or private financing than were small businesses that had won a smaller number of DOD Phase I awards.

The 2022 reauthorization also restricted the measure of commercial success to include only sales to or investment by the private sector in order to

determine whether experienced firms are eligible to receive new awards. However, many of these experienced firms are from states in which firms receive lower levels of venture funding, so these firms often help expand the defense innovation ecosystem beyond those areas of the country viewed by some as traditional innovation centers.

> Finding 7-2: Firms that receive more than five DOD SBIR/STTR Phase I awards are more likely to become part of the broader defense innovation ecosystem than are firms that receive fewer.
>
> Finding 8-2: DOD SBIR/STTR firms with at least five Phase I awards are associated with higher levels of patenting and follow-on financing relative to those with fewer.
>
> Finding 9-1: Performance standards (concerning follow-on funding or transition to Phase II) that potentially limit participation in the SBIR/STTR programs by particular firms, whether by limiting the ability to submit proposals or the number of awards that can be received, add administrative burden and limit the discretion of program executive officers and program managers.
>
> Finding 9-2: DOD SBIR/STTR firms with more than 50 Phase I awards over a 10-year period are more likely to contribute capability and expertise to the defense supply chain and innovation ecosystem than are firms that receive fewer awards.
>
> Finding 9-3: DOD SBIR/STTR firms with more than 50 Phase I awards over a 10-year period often come from states that receive relatively low levels of venture capital and are outside of those areas of the country perceived as traditional innovation clusters.

Restricting experienced firms from participating in the SBIR/STTR programs—either by restricting them from submitting proposals or restricting DOD program managers from selecting their applications when those firms may be submitting the most meritorious applications—is a detriment to DOD's efforts to modernize warfighting capabilities. Indeed, eliminating additional investment by DOD based on the measure of private-sector commercialization success discounts the value that these firms are bringing to the Department.

> **Recommendation 9-1: Congress should direct the Small Business Administration to revise the Policy Directive restriction on proposal submission by certain applicants that do not meet commercialization or transition benchmarks. Doing so would ensure that the Department of Defense can review and select the best proposals to meet its needs.**

Recommendation 9-2: Congress should ensure that program executive officers and program managers have the flexibility to choose among applicants with the best technologies and those that can quickly deliver results for the warfighter. Congress should not mandate strict benchmarks restricting the receipt of awards based simply on the number of previous awards or prior Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) funding received by a small business.

Recommendation 9-3: Congress should include additional federal funding in calculations of commercialization.

CONCLUSION

In general, the committee found that DOD's SBIR/STTR programs are attracting small businesses with distinct capabilities to support the Department's mission and broaden the defense industrial base. SBIR is one of the most emulated government R&D programs in the world, with countries as diverse as India, New Zealand, South Korea, Taiwan, and Turkey adopting programs of a similar nature.

This summary has presented the key findings and recommendations resulting from the committee's analysis of DOD's SBIR/STTR programs. In addition to the key recommendations for improving the programs' effectiveness included here, the committee recommends that DOD provide tailored training to both program officers and acquisition officials. The committee also recommends that DOD improve its data collection, particularly with respect to subcontracting and Phase III awards, to provide additional transparency. The complete set of the committee's findings and recommendations is presented in Box S-1.

BOX S-1
Findings and Recommendations (by Report Chapter)

CHAPTER 2

Finding 2-1: SBIR/STTR firms bring distinct capabilities to advance the U.S. defense innovation system.

CHAPTER 3

Finding 3-1: It is difficult to link Phase I and Phase II awards because DOD

Recommendation 3-1: The Department of Defense's (DOD's) Office of

(Continued)

BOX S-1
(Continued)

SBIR/STTR award data available through the Small Business Administration database do not provide consistent identifiers for projects across the phases.

Finding 3-2: DOD's SBIR/STTR programs improve the geographic diversity of the defense supply chain, but more could be done to understand and diversify the geographic reach of the programs.

Finding 3-3: States underserved by venture capital markets benefit from the DOD SBIR/STTR programs.

the Under Secretary of Defense for Research and Engineering, working with the Under Secretary of Defense (Comptroller), should develop information systems to provide greater fidelity and precision for the tracking of DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards, and a single, public portal to access and sort this information. This portal should link awards from Phase I to Phase II to Phase III in a consistent, clear format. These actions would provide the foundation for improving the programs' effectiveness and efficiency, as well as communicating the value of DOD SBIR/STTR awards.

Recommendation 3-2: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering, working with the Under Secretary of Defense (Comptroller), should ensure that the DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards database includes subcontracting activity to SBIR/STTR awardees, whether from prime contractors or defense subcontractors.

CHAPTER 4

Finding 4-1: DOD's SBIR/STTR programs vary in terms of size, mission, and operational approaches. Codifying and communicating best practices would help all DOD organizations improve their SBIR/STTR programs.

Finding 4-2: Certain activities related to the implementation of DOD's SBIR/STTR programs, such as due diligence, application assistance, and

Recommendation 4-1: The Department of Defense's (DOD's) Under Secretary of Defense for Policy should include in Defense Planning Guidance that the DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs should be used as a mechanism for strengthening and broadening the defense industrial system, and direct the Department's services and compo-

commercialization assistance, create an administrative burden for smaller DOD services/components.

Finding 4-3: Open topics help bring into DOD's SBIR/STTR programs a broader range of firms that could reduce the concentration of awards, but the use of open topics is administratively burdensome for smaller DOD services/components.

Finding 4-4: Opinions vary across the military services (e.g., Army, Navy, Air Force, and Space Force) and components (e.g., Defense Advanced Research Projects Agency, Missile Defense Agency) with regard to the impact of SBIR/STTR open topics, and some services/components find them far more useful than do others.

Finding 4-5: DOD's SBIR/STTR program managers often lack sufficient expertise concerning the needs of startups and entrepreneurs or the commercialization of outcomes from DOD-funded research and development (R&D).

Finding 4-6: Input from industry stakeholders (for example, Tier 1 contractors/system integrators) on topic selection or transition to procurement could lead to more robust incorporation of SBIR/STTR-supported technologies into products and services for the warfighter.

Finding 4-7: The frequent use of cost contracting methods for DOD SBIR/STTR awards increases the bureaucratic burden on both DOD and awardee firms, creates contracting delays, and may limit participation by those small businesses without dedicated staff to deal with the data reporting requirements associated with these contracts.

nents to promote the transition of SBIR/STTR-generated technologies into mainstream science and technology and acquisition programs.

Recommendation 4-2: The Department of Defense's (DOD's) Under Secretary of Defense for Policy should include the DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs in the current planning, programming, budgeting, and execution processes, or in the proposed Guidance Document, as a mechanism for strengthening the defense industrial base, alongside metrics provided to DOD leadership to measure the strength, resilience, and diversity of the defense innovation system.

Recommendation 4-3: The Department of Defense's (DOD's) Office of Local Defense Community Cooperation should include DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards in its annual Defense Spending by State report.

Recommendation 4-4: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering (OUSD [R&E]), which is the DOD office of primary responsibility for the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs, should codify and communicate best practices, such as those for integrating the SBIR/STTR awardees into programs of record or improving outreach to new small businesses. In addition, OUSD(R&E) should incentivize early collaborations across services and components for projects with potential multimission transition pathways.

(Continued)

BOX S-1
(Continued)

Finding 4-8: Citing the SBIR/STTR programs in key strategy documents would elevate the programs' importance and utility within DOD and help in providing implementation guidance.

Recommendation 4-5: Congress should allow but not require the use of Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) open topics. Congress should encourage more flexibility for the Department of Defense's services and components to experiment with approaches that help broaden their supply base.

Recommendation 4-6: Department of Defense Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program officials, including contracting officers, should encourage the use of fixed-price contracts for Phase I and II awards.

Recommendation 4-7: The Department of Defense's Office of the Under Secretary of Defense for Research and Engineering should request and Congress should consider appropriating funds for entrepreneurial training for Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program managers, perhaps by having the National Defense University and Defense Acquisition University develop training modules and a certification for these program managers.

Recommendation 4-8: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering should request and Congress should consider requiring and appropriating funds to provide the requisite tailored training to DOD acquisition officials, through the Defense Acquisition University, on contracting and budget flexibilities available under the Small Business

Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs.

Recommendation 4-9: The Department of Defense's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program Office should streamline the due diligence process by creating a centralized database for firms that fail to meet the due diligence requirements, and make the initial due diligence/denial process automated within the Defense SBIR/STTR Innovation Portal.

Recommendation 4-10: The Department of Defense's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program Office should prioritize due diligence reviews for proposals that are being seriously considered for funding.

Recommendation 4-11: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering should revise DOD's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) instructions, regulations, and guidance to acknowledge program risk. This guidance should take into account the potential for transformational innovation and take into consideration the different needs, strengths, and challenges of large versus small services and components within the Department.

CHAPTER 5

Finding 5-1: DOD's SBIR/STTR programs employ competitive application processes. The applicant and

(Continued)

BOX S-1
(Continued)

awardee pools span the country, but there are significant differences in funding rates among and within states.

CHAPTER 6

Finding 6-1: The STTR program requirement to collaborate with a research institution is both a significant strength and a source of challenges.

Finding 6-2: The participation rate of first-time firms in DOD's STTR program is low, indicating potential barriers to entry.

Finding 6-3: DOD STTR awardees are geographically concentrated in states with major DOD research facilities and strong academic–industry partnerships, potentially limiting nationwide contributions to innovation.

Recommendation 6-1: Department of Defense Small Business Technology Transfer (STTR) program managers should prioritize and experiment with new means of targeted outreach and support for new firms and those from historically underutilized parts of the country in order to enrich the innovation ecosystem.

Recommendation 6-2: Department of Defense Small Business Technology Transfer (STTR) program managers should streamline collaboration requirements and provide support for negotiating intellectual property agreements to reduce complexities and expedite technology transitions.

CHAPTER 7

Finding 7-1: DOD's SBIR/STTR programs serve as a gateway for small firms to enter the defense innovation ecosystem and receive subsequent R&D funding from DOD, consistent with their role in expanding the defense industrial base.

Finding 7-2: Firms that receive more than five DOD SBIR/STTR Phase I awards are more likely to become part of the broader defense innovation ecosystem than are firms that receive fewer.

Finding 7-3: Available data indicate that DOD contracts for additional R&D from DOD SBIR/STTR-funded firms,

Recommendation 7-1: Given the demonstrated impacts of the Department of Defense's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs on the development and fielding of new defense systems and capabilities, as well as on the defense innovation ecosystem and defense research and development industrial base, Congress should make the SBIR/STTR programs permanent.

Recommendation 7-2: The Secretary of Defense should initiate a rigorous study on ways to encourage the timely transition of Department of Defense Small Business Innovation Re-

instead of procuring goods and other services.

Finding 7-4: Data on defense subcontracting are not always transparent, nor are they consistently captured in publicly available data; thus, it is difficult to determine the full extent of subcontracting by prime contractors or defense subcontractors to SBIR/STTR awardee firms in defense procurement.

Finding 7-5: Firms that have participated in DOD's SBIR/STTR programs ultimately meet a significant and growing fraction of DOD's extramural R&D needs and represent nearly one-third of participants in the defense R&D base.

Finding 7-6: DOD SBIR/STTR firms ultimately attract more than 4 dollars in non-SBIR/STTR funding from DOD for each dollar of DOD SBIR/STTR funding.

Finding 7-7: Both startups (firms less than 5 years old) and older firms that participate in DOD's SBIR/STTR programs receive follow-on R&D funding from DOD at similar rates.

search/Small Business Technology Transfer (SBIR/STTR)-funded technologies into defense procurement in order to maximize their impact on the warfighter.

Recommendation 7-3: The Department of Defense's (DOD's) Office of the Secretary of Defense Chief Information Officer should conform with the digitization requirements for the Modernization of DOD Business Processes to provide greater fidelity and precision for Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Phase III awards.

Recommendation 7-4: The Office of the Under Secretary of Defense for Research and Engineering should require that all Department of Defense (DOD) Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) applications include Technology Readiness Level data. These data should be included in the award portal, along with data on subsequent procurement of DOD SBIR/STTR-supported technologies.

CHAPTER 8

Finding 8-1: DOD SBIR/STTR firms are more likely than other federal R&D–performing firms to create patented technology and to receive private financing.

Finding 8-2: DOD SBIR/STTR firms with at least five Phase I awards are associated with higher levels of patenting and follow-on financing relative to those with fewer.

Recommendation 8-1: The Office of the Under Secretary of Defense for Research and Engineering should analyze the patent and follow-on investment activities of Department of Defense Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awardees to understand best practices for creating incentives for private-sector investment in defense technologies and defense firms.

(Continued)

BOX S-1
(Continued)

Finding 8-3: DOD SBIR/STTR awardees register a significant rate of knowledge transfer to prime contractors. For example, patents attributed to DOD SBIR/STTR funding are cited nearly three times more often compared with non-SBIR/STTR patents among the same recipients. Additionally, nearly 20 percent of acquisitions of DOD SBIR/STTR-funded firms are by one of the top defense contractors.

Finding 8-4: The lack of data on subcontracting by DOD contractors makes it difficult or impossible to track procurement of DOD SBIR/STTR-supported technologies and to compare it with the procurement of technologies from other firms engaging in federal R&D activities.

CHAPTER 9

Finding 9-1: Performance standards (concerning follow-on funding or transition to Phase II) that potentially limit participation in the SBIR/STTR programs by particular firms, whether by limiting the ability to submit proposals or the number of awards that can be received, add administrative burden and limit the discretion of program executive officers and program managers.

Finding 9-2: DOD SBIR/STTR firms with more than 50 Phase I awards over a 10-year period are more likely to contribute capability and expertise to the defense supply chain and innovation ecosystem than are firms that receive fewer awards.

Finding 9-3: DOD SBIR/STTR firms with more than 50 Phase I awards over a 10-year period often come from states

Recommendation 9-1: Congress should direct the Small Business Administration to revise the Policy Directive restriction on proposal submission by certain applicants that do not meet commercialization or transition benchmarks. Doing so would ensure that the Department of Defense can review and select the best proposals to meet its needs.

Recommendation 9-2: Congress should ensure that program executive officers and program managers have the flexibility to choose among applicants with the best technologies and those that can quickly deliver results for the warfighter. Congress should not mandate strict benchmarks restricting the receipt of awards based simply on the number of previous awards or prior Small Business Innovation Research/Small Business

that receive relatively low levels of venture capital and are outside of those areas of the country perceived as traditional innovation clusters.

Finding 9-4: Excluding federal funding from the commercialization standard disadvantages firms that provide defense-specific technologies.

Technology Transfer (SBIR/STTR) funding received by a small business.

Recommendation 9-3: Congress should include additional federal funding in calculations of commercialization.

1

Introduction[1]

The Small Business Innovation Research (SBIR) program was conceived in the late 1970s and early 1980s to address several related, but distinct, challenges. The focus and purpose of the program, at least as articulated by Congress, have changed over time. The 1982 act creating the program stated that its purposes were to stimulate technological innovation, to use small business to meet federal research and development (R&D) needs, to foster and encourage participation in technological innovation by minority and disadvantaged persons, and to increase private-sector commercialization of innovations derived from federal R&D.[2] The 1992 reauthorization of the program also established the Small Business Technology Transfer (STTR) program, which was intended to improve the commercialization of innovations resulting from federal funding by requiring collaborations between research institutions and small businesses. The 1992 legislation also tweaked the purposes of the SBIR program slightly. The stated purposes of the program were changed to emphasize the goals of increasing private-sector commercialization of technology developed through federal R&D; increasing small business participation in federal R&D; and improving the federal government's dissemination of information concerning the program, particularly with regard to program participation by small businesses owned by women and socially and economically disadvantaged groups.[3] The 1992 act stated that the program had created jobs, but it was not until its 2000 reauthorization that legislative language was added to request that the National Academy of Sciences

[1] Material in this chapter draws from material in Chapter 1 of the National Academies of Sciences, Engineering, and Medicine report *Review of the SBIR and STTR Programs at the Department of Energy* (NASEM, 2020); Chapter 1 of the National Academies report *Assessment of the SBIR and STTR Programs at the National Institutes of Health* (NASEM, 2022a); and Chapter 1 of the National Academies report *Review of the SBIR and STTR Programs at the National Science Foundation* (NASEM, 2023).

[2] U.S. Congress, Small Business Innovation Development Act of 1982, P.L. 97-219, Section 2(b) (July 22, 1982).

[3] U.S. Congress, Small Business Research and Development Enhancement Act, P.L. 102-564, Section 102(b)(2-4) (October 28, 1992).

evaluate the economic and noneconomic benefits of the SBIR and STTR programs.[4]

By statute, participation in the SBIR and STTR programs is determined by the size of an agency's extramural R&D budget. Eleven federal agencies currently participate in the SBIR program, and of these, six participate in the STTR program.[5] The principal budgeting mechanism of the SBIR and STTR programs is a set-aside of each participating agency's extramural federal R&D budget. Over time, the SBIR and STTR programs have enjoyed considerable support within Congress and various administrations, largely on a bipartisan basis. The percent set-aside for each program has increased over time. For fiscal year (FY) 1983, the percentage to be set aside for the SBIR program, based on the original legislation, was no less than 0.2 percent of a participating agency's extramural budget, with this percentage increasing over time to 1.25 percent by FY1986.[6] When the STTR program was established, a set-aside of at least 0.05 percent was required for the program in FY1994, a rate prescribed to increase to 0.15 percent.[7] Subsequent legislation increased these percentages; the FY2011 reauthorization increased the percentage for each program over the ensuing decade, ultimately leading to today's minimum rates of 3.2 percent for SBIR and 0.45 percent for STTR.[8] Combined with increasing agency extramural R&D budgets, the result has been a significant expansion of the programs.

The SBIR program is one of the most emulated government R&D programs in the world (Link, 2024). Countries as diverse as India, New Zealand, South Korea, Taiwan, and Turkey have adopted similar programs to engage small businesses in their national economies more effectively (BIRAC, n.d.a; Link, 2024). In 1998, for example, South Korea established the Korea Small Business Innovation Research (KOSBIR) program, basing it on the U.S. SBIR program (de Souza Lima Júnior et al., 2024). India's Small Business Innovation Research Initiative (SBIRI), established in 2005, provides support for small- and medium-sized enterprises carrying out high-risk R&D in the biotech sector (BIRAC, n.d.b). In an earlier example, Turkey set up the Small and Medium-sized Industry Development Organization (KOSGEB) in 1990, an enterprise similar to SBIR in some aspects (Unsal, 2024).

[4] U.S. Congress, Small Business Reauthorization Act of 2000, HR 5667, P.L. 106-554, Appendix I (December 21, 2000).

[5] At the outset, the legislation governing the SBIR program called for participation by any federal agency with extramural research or an R&D budget in excess of $100 million. U.S. Congress, Small Business Innovation Development Act of 1982, P.L. 97-219, Section 4(f)(1) (July 22, 1982). The STTR program has set a higher threshold, requiring participation by any agency with a research or R&D budget in excess of $1 billion. U.S. Congress, Small Business Research and Development Enhancement Act, P.L. 102-564, Section 202(c)(n)(1) (October 28, 1992). As agency budgets increase, new participants may be, and have been, drawn into the programs.

[6] U.S. Congress, Small Business Innovation Development Act of 1982, P.L. 97-219, Section 4(f)(1) (July 22, 1982).

[7] U.S. Congress, Small Business Research and Development Enhancement Act, P.L. 102-564, Section 202(c)(n)(1) (October 28, 1992).

[8] 15 U.S.C., Section 638(f)(1), and 15 U.S.C., Section 638(n)(1)(B).

THE NATIONAL ACADEMIES STUDY MANDATE

Congress first requested that the National Academies of Sciences, Engineering, and Medicine (the National Academies) undertake a study of the SBIR program as part of the Small Business Reauthorization Act of 2000.[9] This study mandate was expanded in the National Defense Authorization Act for Fiscal Year 2012,[10] wherein Congress directed agencies with SBIR program budgets of more than $50 million to engage with the National Academies to conduct a quadrennial assessment of their SBIR and STTR programs.[11]

The congressional mandate calls for assessments to study "how the SBIR program has stimulated technological innovation and used small businesses to meet federal research and development needs."[12] These assessments are to encompass several specific analyses and evaluations, including the value and quality of the R&D conducted under the programs and the programs' economic and noneconomic benefits. The mandate also includes an analysis of whether federal agencies are making sufficient effort to utilize funded firms to fulfill procurement needs. Since 2011, the legislative mandate has in addition called for a study of how the STTR program has "stimulated technological innovation and technology transfer."[13]

This report is the product of a National Academies study focused on the SBIR and STTR programs at the Department of Defense (DOD). The stated purpose of the study was to examine the economic and noneconomic benefits of the DOD SBIR and STTR programs and the effectiveness of program processes. To carry out the study, the National Academies assembled a committee of experts including academic scholars specializing in innovation and entrepreneurship; former SBIR and STTR awardees; former executive branch and congressional defense experts; and research, engineering, and development experts from defense industries.[14] The committee's formal statement of task is presented in Box 1-1.

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[9] U.S. Congress, Small Business Reauthorization Act of 2000, HR 5667, P.L. 106-554, Appendix I (December 21, 2000).

[10] U.S. Congress, National Defense Authorization Act for 2012, P.L. 112-81, Section 5137 (December 31, 2011).

[11] The National Academies has conducted previous sets of studies in response to the legislative mandate. The first, completed in 2009, included a review of the SBIR programs at DOD, the National Institutes of Health (NIH), the Department of Energy (DOE), the National Aeronautics and Space Administration, and the National Science Foundation (NSF). The second, completed by a separate committee in 2016, included reviews of both the SBIR and STTR programs at those same agencies. More recent National Academies studies have had a stand-alone committee for each participating agency. In 2020, a National Academies committee completed a review of the SBIR and STTR programs at DOE (NASEM, 2020); in 2022, a committee completed a review of the SBIR and STTR programs at NIH (NASEM, 2022a); and most recently, in 2023, a committee completed a review of the SBIR and STTR programs at NSF (NASEM, 2023).

[12] U.S. Congress, Small Business Reauthorization Act of 2000, HR 5667, P.L. 106-554, Appendix I, Section 108(a)(1) (December 21, 2000).

[13] U.S. Congress, National Defense Authorization Act for 2012, P.L. 112-81, Section 5137(e)(1)(B) (December 31, 2011).

[14] Brief biographies of committee members can be found in Appendix B.

BOX 1-1
Statement of Task

In response to a Congressional mandate, an ad hoc committee will conduct a study of the economic and noneconomic benefits of the Small Business Innovation Research and Small Business Technology Transfer programs at the Department of Defense and the effectiveness of the enabling strategies DOD has employed to enhance the programs. Specifically, and to the extent that data are available, the committee will examine:

1. How the SBIR and STTR programs have stimulated technological innovation and engaged small businesses to meet federal research and development needs, including (a) the economic and noneconomic benefits achieved by the SBIR and STTR programs over the life of the programs; (b) the role of the SBIR and STTR programs in meeting DOD procurement needs; (c) challenges to, and opportunities for, the incorporation of SBIR and STTR-supported companies and technologies into DOD programs.
2. The effectiveness of the STTR program in stimulating new collaborations between small businesses and research institutions; potential barriers to the creation of such collaborations, particularly with academic institutions that primarily serve minority populations; and mechanisms to encourage such collaborations.
3. The effectiveness of the STTR program at transferring technology and capabilities developed through federal funding.
4. Challenges to, and the effectiveness of, DOD outreach to potential applicants and assistance to applicants, especially those applying for the first time or from socially and economically disadvantaged groups or underserved states, and an analysis of award levels and outcomes with respect to these demographic groups.[a]
5. A review of application and award procedures and their effectiveness in meeting DOD mission needs and SBIR/STTR legislative objectives.
6. The role and effectiveness of support for awardees, such as Discretionary Technical and Business Assistance and programs to connect small businesses with prime contractors.
7. The impact of statutory changes in the programs' requirements over time, including restrictions on the number of awards and/or award sizes.

The committee will determine appropriate metrics to measure impact in the context of the Department of Defense, given national security considerations and any specific needs of the department. The committee will conduct a public workshop to facilitate the development of recurring, quantifiable metrics for measuring the ability of the SBIR and STTR programs to deliver products and services that meet DOD's mission needs, and a proceedings of this public workshop will be prepared by a designated rapporteur. Based on its analysis of available data, the committee will produce a consensus report with its findings and recommendations.

[a]In view of the executive order, the committee focuses its analysis on new applicants and geographic diversity of applicants.

PROGRAM OPERATIONS

SBIR and STTR program operations are decentralized to agencies and subagencies throughout the federal government, with the Small Business Administration (SBA) playing a broad oversight role. Although specific features of the programs vary significantly across and within agencies, and agencies have engaged in adaptation and experimentation in their programs, the broad structure of the two programs is similar across agencies.

Three Program Phases

SBIR and STTR awards are made on a competitive basis, with each participating agency issuing solicitations—also referred to as funding opportunity announcements—at least once per year. By design in the original Small Business Act, the program funding proceeds in three phases[15]:

- **Phase I:** This is a feasibility demonstration phase to "determine the scientific and technical merit and feasibility of [a] proposed effort and the quality of performance of the [small business] with a relatively small agency investment before consideration of further Federal support in Phase II" (SBA, 2023, p. 18). Award amounts from DOD vary by agency component, averaging $150,000 with a 12-month duration, although the SBA Policy Directive allows Phase I awards to exceed $300,000 (SBA, 2023).
- **Phase II:** This phase is intended to support Phase I projects that have showed positive results and continue to demonstrate scientific and technical merit, along with commercial potential. The typical Phase II award from DOD is $1 million with a 24-month duration, although SBA allows awards of up to nearly $2.1 million.
- **Phase III:** This phase receives no funding from the SBIR/STTR programs. Instead, it entails follow-on funding for "work that derives from, extends, or completes an effort made under prior SBIR/STTR Funding Agreements" (SBA, 2023, p. 25), which may include direct purchase of the product by some SBIR/STTR-participating agencies. Congress's original intent was for this phase to be where "non-federal capital pursues commercial applications of the research or research and development,"[16] or where non-SBIR/STTR federal follow-on funds support "SBIR/STTR-derived

[15] The SBIR and STTR programs consist of the same phases and dollar amounts, but small businesses receiving STTR awards are required to collaborate formally with a research institution (such as a university or federal laboratory) in Phases I and II.
[16] U.S. Congress, Small Business Innovation Development Act of 1982, P.L. 97-219, Section 4(e)(4)C) (July 22, 1982).

> products or services intended for use by the Federal Government" (SBA, 2023, p. 25).

Funds are available for commercialization assistance, and agencies can request and receive approval from SBA to exceed Phase I and Phase II award amounts. Furthermore, in addition to standard Phase I and Phase II awards, some agencies may provide funding either prior to a Phase I or following a Phase II award.

Recent Legislative Changes to the SBIR and STTR Programs

The legislation authorizing the programs has, from its outset, contained sunset provisions; the programs were authorized through September 2025, and reauthorization of the programs is pending in Congress. The programs have experienced changes over time, principally when reauthorized. For instance, in addition to calling for program assessments by the National Academies, the 2000 reauthorization included language around commercialization and specifically mentioned that commercial potential should be used as a criterion for awards. A number of legislative changes accompanied the programs' reauthorizations in 2018 and 2022.[17]

The August 2018 program reauthorization expanded the scope and level of assistance to awardees. It raised the levels of commercialization assistance to $6,500 per Phase I award and up to $50,000 per Phase II award, each raised from the previous limit of $5,000 per awarded project. This assistance, now known as Technical and Business Assistance (TABA), can be used for business or commercialization assistance, such as intellectual property protection, market research and validation, and the development of regulatory and manufacturing plans. At civilian agencies, this assistance is supplemented by the Commercialization Readiness Pilot Program, which provides support to selected prior Phase II awardees for technical assistance not normally covered under Phase II. Established in the December 2011 reauthorization, that program, like the entire SBIR/STTR program, is pending reauthorization.

Other pilot programs extended through 2025 include a 2018 pilot to hasten the award process at DOD; authorization for the National Institutes of Health, Department of Education, and DOD to give Phase II awards to companies that did not receive a Phase I award; and a 2011 pilot allowing agencies to use 3 percent of their SBIR funds to help cover SBIR/STTR oversight and contract processing costs.

The SBIR and STTR Extension Act of 2022, which reauthorized the programs through September 2025, introduced measures designed to address national security concerns. As part of their review of applications, awarding

[17] U.S. Congress, National Defense Authorization Act for 2012, P.L. 112-81 (December 31, 2011); U.S. Congress, John S. McCain National Defense Authorization Act for Fiscal Year 2019, P.L. 115–232 (August 13, 2018); U.S. Congress, SBIR and STTR Extension Act of 2022, P.L. 117-183 (September 30, 2022).

agencies are now required to perform a security risk assessment for all applicants. Applications must disclose any ties with foreign countries—for example, affiliations, participation in talent recruitment programs, contractual or financial obligations, relationships with venture funds, technology licensing arrangements, or any intellectual property sale involving a foreign country.

Performance metrics introduced in the December 2011 reauthorization of the programs were applied to multiple-award recipients with award counts above certain thresholds over set periods of time. The reauthorization required the establishment and administration of standards concerning both a company's track record in progressing from Phase I to Phase II and the extent to which a company has progressed past projects from Phase II toward commercialization. The resulting[18] Transition Rate Benchmark currently applies to companies that have received 21 or more Phase I awards during the past 5 fiscal years, excluding the most recently completed fiscal year, and requires that a company have achieved an average ratio of Phase II's to Phase I's of 0.25.[19] Additionally, the legislation calls for a Commercialization Rate Benchmark that applies to any company having received 16 or more Phase II awards during the past 10 fiscal years, excluding the two most recently completed fiscal years. It requires that a company have achieved an average of $100,000 in sales/investments per Phase II award received during that 10-year period, or have received a number patents equaling or exceeding 15 percent of the number of Phase II awards received over that period.[20] Both provisions went into effect in 2013. Each year, SBA identifies those companies failing to meet the standards, which then become ineligible to apply for a Phase I or Direct to Phase II award for 1 year.

The 2022 reauthorization tightened restrictions on multiple-award recipients by establishing increased performance standards for more experienced firms, both for their transition rate and for commercialization progress. Firms that have received more than 50 Phase I awards over the 5 fiscal years preceding the most recently completed fiscal year must have achieved an average ratio of Phase II's to Phase I's of 0.50, double the Transition Rate Benchmark required for less experienced firms described above. As for the Commercialization Rate Benchmark, the 2022 reauthorization created two tiers of more experienced firms, each with its own standard. Firms that have received more than 50 Phase II awards during the past 10 fiscal years, excluding the two most recently completed fiscal years, must achieve minimum average sales and/or investments of $250,000 per Phase II award received during that period. Firms that have received more than

[18] The current standards are published by SBA on its website. See SBA, "Performance Benchmark Requirements," https://www.sbir.gov/performance-benchmarks.

[19] When calculating the Phase II/Phase I Transition Rate for a company, the measurement period for Phase II's begins and ends 1 year after those years used to calculate the number of Phase I's received by a firm.

[20] Firms report commercialization data via the Company Commercialization Report on the SBA website. Awardees are required to update their report at the end of any Phase II and then annually for at least 5 years. Phase II applicants must update their company's report whenever applying for a new Phase II award.

100 Phase II awards during the same period must achieve minimum average sales and/or investments of $450,000 per Phase II award received during that period. In contrast with the terms of the 2012 reauthorization, sales paid for with federal funds do not count toward these requirements.[21] Any experienced firm, as determined under the provisions of the 2022 reauthorization, that fails to meet either the required transition or commercialization rate cannot receive more than 20 total Phase I and Direct to Phase II awards from each federal agency for a period of 1 year.

The 2022 reauthorization also mandated that agencies offer open topic opportunities for applicants. DOD in particular was mandated to offer at least one open topic announcement at each agency component each fiscal year, the aim being to "increase the transition of commercial technology to the Department of Defense," "expand the small business nontraditional industrial base," "increase commercialization derived from investments of the Department of Defense," and "expand the ability for qualifying small business concerns to propose technology solutions to meet the needs of the Department of Defense."[22]

Tailoring of the SBIR/STTR Programs to DOD

Although Congress charged the SBA administrator with overseeing and coordinating the SBIR/STTR program activities of participating agencies, it also granted each agency latitude in determining how it will operate its SBIR and STTR programs. Specifically, each agency can determine the categories of projects and solicitation topics, issue solicitations, receive and evaluate its own proposals, make final award decisions, and make and manage its own funding agreements.

The DOD SBIR and STTR programs are designed to "encourage domestic small businesses' engagement in research and development, scientific excellence, and technological innovation through federal research fund investment in critical American priorities to build a strong national economy and accelerate Warfighter capabilities (OBSI, para. 2)." The Office of the Under Secretary of Defense for Research and Engineering (OUSD[R&E]) serves as the Office of the Secretary of Defense's point of contact for Congress, SBA, the Government Accountability Office, and the interagency SBIR/STTR community.[23] This SBIR/STTR central oversight and policy organization also cultivates technology partnerships within DOD and other federal agencies.

The DOD SBIR/STTR program leaders must balance multiple objectives while aligning implementation with their component's unique mission needs. As

[21] Also, in contrast with the standards established in response to the 2011 reauthorization, there is no provision for patents to meet the commercialization standard for firms that have received more than 50 Phase II awards during the period specified in the 2022 reauthorization.

[22] U.S. Congress, SBIR and STTR Extension Act of 2022, P.L. 117-183, Section 7(a)(2) (September 30, 2022).

[23] USD(R&E) is tasked with leading the program by DOD Directive 5137.02 (https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/DODd/513702p.pdf).

a result, the program operates with considerable variation across the services and components that make up DOD. To accommodate this heterogeneity, since FY2022, DOD has issued three prescheduled Broad Agency Announcements (BAAs) in addition to Annual BAAs to give the Departments' components flexibility to release topics throughout the year.

As noted above, Phase I award amounts from DOD vary by component; they have averaged $150,000 with a 12-month duration, although the SBA Policy Directive allows Phase I awards to exceed $300,000. The typical Phase II award amount from DOD is $1 million with a 24-month duration, although SBA allows awards of up to nearly $2.1 million. Each DOD component slightly modifies award amounts and time limits to meet its organizational needs. DOD offers additional funding opportunities to help small businesses commercialize the results of their SBIR/STTR awards.

STUDY METHODOLOGY AND LIMITATIONS

The committee based its review on a wide range of evidence, including descriptive and qualitative evidence regarding department- and service/component-level outcomes; quantitative data on patterns in the landscape of awards, firms, and related geographic characteristics; and qualitative evidence concerning the administration of the programs from the perspective of the department and its personnel. The committee also used descriptive evidence regarding program impacts with respect to collaborations, firm structure/orientation, and other system-level outcomes that cannot easily be determined using standard econometric techniques. Finally, the committee considered causal evidence of direct and indirect effects of the programs on innovation and commercialization and agency transition.

The committee gathered quantitative data from (1) SBA's SBIR/STTR Company and Award Listing, (2) DOD (application data), (3) SBA Dynamic Small Business Search, (4) the U.S. General Services Administration's System for Award Management, (5) USASpending, (6) the U.S. Economic Development Administration's Cluster Map, (7) the Federal Procurement Data System, (8) publication data in Web of Science, (9) patent data in PatentsView, (10) venture capital funding and initial public offering/acquisition outcome data in PitchBook and Crunchbase, and (11) firm-level data in the National Establishment Time-Series database. Data from these sources were compiled, matched, and verified to provide the empirical basis for this study.

Sources of qualitative data include presentations by DOD SBIR/STTR personnel; archival data available from the DOD SBIR/STTR website, such as webinars, publicly available documents, and solicitations; and presentations from DOD SBIR/STTR awardees.

ORGANIZATION OF THIS REPORT

The remainder of this report contains detailed information on the SBIR/STTR programs, describes the study methodology and results, and presents the committee's findings and recommendations.

Chapter 2 describes the role of small business in defense innovation technology, while Chapter 3 provides an overview of the DOD SBIR and STTR program funding and awardees. A description of the organization and administration of the DOD SBIR/STTR programs, including processes for outreach, review of applicants, and selection of and commercialization support for awardees, follows in Chapter 4. Chapter 5 presents an analysis of application and award data for DOD, focused mainly on SBIR, and Chapter 6 takes a deeper look at those data for DOD's STTR program. Chapters 7 and 8 focus on program impact—first on agency mission and then on innovation more broadly. Finally, Chapter 9 looks at the impact of firms with multiple SBIR/STTR awards on agency mission and the potential impact of greater restrictions on their participation introduced in the most recent reauthorization of the programs.

The body of the report is followed by a list of references, agendas for meetings of the committee, brief biographies of committee members, and chapter annexes.

2

The Role of Small Business in Defense Technology Innovation: An Overview of DOD's SBIR/STTR Programs

Innovation is a cornerstone of national security, providing a strategic advantage for U.S. military operations. The private sector has been pivotal in the rapid development, procurement, and deployment of innovative technologies to support national defense—technologies that enable effective responses to emerging threats and the capacity to maintain robust defense operations. From the creation of the internet to advances in GPS and aerospace technologies, innovations that originated to address military needs have been adapted for civilian markets, enhanced productivity, and spurred new industries. Since the nation's earliest days, the Department of Defense (DOD) and its predecessor organizations have maintained a vital partnership with small businesses, recognizing their essential role in bringing innovation to the forefront of national security. Today, the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs serve as critical components of this partnership. This chapter provides a framework for understanding the multifaceted nature of the SBIR and STTR programs at DOD. As context for the committee's analysis of the programs, the chapter provides an overview of DOD's historical engagement with small business; this chapter also describes the interplay of the SBIR/STTR programs with the current defense innovation ecosystem and some advantages of SBIR/STTR in supporting and transitioning defense technology innovation.

A BRIEF HISTORY OF AMERICAN DEFENSE INNOVATION

Throughout the nation's history, private firms have been instrumental in developing critical technologies that have significantly enhanced the capabilities of the U.S. military. From the early days of the Revolutionary War, when small arms manufacturers provided the Continental Army with weapons (Schakenbach Regele, 2019), to the development of advanced communication systems and cyber

technologies in recent decades (Bonvillian and Singer, 2018), small businesses have consistently demonstrated their capacity to meet DOD's dynamic and complex needs.

Since its earliest days, the U.S. government has also been funding research to improve its military capabilities, a long-standing collaboration with industry that has not only fueled technological advances but also provided a strategic advantage in various conflicts and wars. During the Civil War, rifles produced by small arms manufacturers, located principally in a Connecticut small arms cluster (Ford and Schakenbach Regele, 2024), proved critical to the war effort. The creation of the National Research Council during World War I formalized the relationship between private industry and universities and catalyzed the growth of Army Aviation in the interwar years (McBride, 1992). During this same period, Thomas Edison worked with the Department of the Navy to establish the Naval Research Laboratory (McKinney, 2012), and during World War II, the Office of Scientific Research and Development (OSRD) spearheaded the Manhattan Project, the Penicillin Project, the invention of radar and sonar, and advances in aviation that helped secure Allied victory (Gross and Sampat, 2023a). Small firms were often pivotal in the rapid development, procurement, and deployment of such cutting-edge technologies (Nelson and Wright, 1992).

Demonstration of the importance of scientific innovation to military prowess during World War II served as a strong motivation for Vannevar Bush, the founder of Raytheon and first OSRD director, to lead a postwar movement advocating for increased government support for science (Gross and Sampat, 2023b). This movement would eventually lead to the creation of the National Science Foundation and establish the framework for the current structure of federal support for science connected to designated agency missions, such as that of DOD. Indeed, the postwar years were marked by the creation of the Service research laboratories and Federally Funded Research and Development Centers (FFRDCs), which serve as key organizations for DOD's science and technology activities aimed at delivering advanced warfighting technical capabilities to provide overmatch for U.S. forces on any battlefield (Gross and Sampat, 2023a).

Similarly, the Cold War era, and the implied threats of the Sputnik launch, led to the establishment of the Defense Advanced Research Projects Agency (DARPA), which enlisted world-class scientists and engineers to lead high-risk, high-payoff research efforts focused on the development of groundbreaking military capabilities, such as GPS, stealth technology, and the internet (Azoulay et al., 2019). Throughout the Cold War, newly created technology firms pioneered advances in aerospace, electronics, and computer technologies that played a crucial role in maintaining the United States's competitive edge (Gross and Sampat, 2023a; Roberts, 1991).

Regardless of the geopolitical era or the needs of the military at the time, small firms have served not only to address critical requirements but also to diversify the supplier base on which DOD relies to perform its mission. Simply put, small and innovative enterprises, such as Qualcomm, BBN Technologies, and Anduril, have played a crucial role in providing technological innovations that

serve the warfighter and support DOD's mission to defend and protect the nation; in turn, the SBIR/STTR programs have played an important role in the early success of these companies.

Today, with the emergence of the People's Republic of China as a technologically advanced strategic adversary, the continued presence of Russia as a technically capable adversary, and increased geopolitical tensions around the world overall, the United States faces new strategic challenges (Fuchs, 2010). Against this backdrop, new scientific advances—in such areas as robotics, space, artificial intelligence (AI), biology, and quantum computing—present new opportunities for innovation and for research investments. The SBIR/STTR programs are positioned to contribute to the achievement of DOD's goals in these and other areas, helping to augment the nation's military capabilities and bolster America's national security. Small firms—especially startups—can improve the speed of the development, production, and deployment of new defense capabilities; expand the defense industrial base and the national security innovation base; and foster and promote the development of innovative defense capabilities (Congressional Budget Office, 2020).

THE SBIR/STTR PROGRAMS AT DOD

As discussed in Chapter 1, the SBIR program was established in 1982 as a competitive program aimed at promoting the translation of the scientific findings and engineering achievements of small businesses into technology developments and innovation activities. The STTR program was established in 1992 with the requirement that a small business awardee partner with a college, university, FFRDC, or qualified nonprofit research institution on a cooperative research/research and development (R&D) project to help promote the technology transfer and commercialization of research collaborations between those parties. Since the SBIR program's establishment in 1982, more than 13,400 unique firms have received SBIR/STTR awards from DOD.

DOD is a complex organization comprising service branches, such as the Army, Navy, and Air Force; defense agencies such as DARPA and the Defense Threat Reduction Agency (DTRA); and combatant commands such as the United States Special Operations Command (USSOCOM)—each with unique geographic or functional mission field activities. In all, today, 14 services and components within DOD execute SBIR/STTR programs.[1] Each service and component has a distinct mission, budget, and organizational structure. Their organizational structures have evolved over time to address emerging threats and to adapt to changing national security priorities—for example, the creation of the United States Cyber Command (CYBERCOM), the Defense Innovation Unit (DIU), and the Space Force.

[1] The different services and components are discussed in greater detail in Chapter 4; including the Under Secretary of Defense for Research and Engineering, there are 15 services and components.

DOD operates command and field activities that execute specific R&D missions. As noted previously, for example, DARPA funds high-risk, high-payoff science and technology programs aimed at achieving technological advantages over adversaries. Agencies such as DTRA and the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) fund research designed to address threats resulting from weapons of mass destruction. DIU funds research and prototyping activities aimed at leveraging commercial technologies for military uses. These agencies fund small business research performers, using both SBIR/STTR funds and other research, development, test, and evaluation (RDT&E) funds.

As a defense mission agency, DOD performs a range of operations—including installation management, the provision of educational services, health care management, policy development and execution, and even R&D—but each of these operations is carried out only in service to the Department's defense mission. Even a multi-hundred-billion-dollar procurement enterprise is ancillary to daily global military operational activities and the training, equipping, and fielding of military capabilities globally to support the execution of national defense missions, such as power projection, homeland defense, humanitarian assistance, and deterrence of future conflicts. In fiscal year (FY) 2023, DOD's total budget was $894.2 billion, including supplemental appropriations; this budget funds all DOD activities, including personnel, operations, and maintenance of forces and systems, as well as procurement. In the FY2023 budget, $145 billion was allocated to RDT&E, covering activities from foundational scientific research to the prototyping and testing of military weapons and equipment. Funding for the earlier-stage accounts—Basic Research, Applied Research, and Advanced Technology Development—was about $22 billion. DOD's SBIR program for FY2023 was nearly $3 billion.[2]

DOD RDT&E FUNDING

DOD's budget originates in the president's annual budget request to Congress. Final funding levels are determined in the annual Department of Defense Appropriations Act, which supports DOD's full range of activities, based on authorizations in the National Defense Authorization Act, which falls under the jurisdiction of the House Committee on Armed Services and the Senate Committee on Armed Services. Reauthorization of the SBIR and STTR programs is under the jurisdiction of the House Committee on Small Business and the Senate Committee on Small Business and Entrepreneurship. RDT&E is one of DOD's five major appropriation categories, and SBIR and STTR are funded through a small set-aside of extramural RDT&E funds. At times, Congress also provides additional DOD RDT&E funding through supplemental appropriations acts. The DOD RDT&E budget is managed primarily by the military services,

[2] Presentation to the committee by Marcy E. Gallo, Congressional Research Service, April 18, 2024, Washington, DC.

which use the funding mainly to develop technologies, systems, and capabilities to meet their unique service operational requirements. Each service and component has its own science and technology budget. That budget funds basic and applied research and technology development with the aim of transitioning technologies to what are known in DOD as acquisition programs of record, which develop, deliver, and maintain operational defense systems and warfighter capabilities. The services' and components' SBIR/STTR programs often operate in parallel with rather than being integrated into these science and technology activities.

Because they operate as a set-aside, the SBIR/STTR programs are neither included in the annual DOD budget request nor specifically appropriated by the Appropriations Act. The DOD comptroller transfers the program funds from DOD's RDT&E accounts according to statutory guidance, under the authority of and consistent with the levels required by the Small Business Act. Roughly, each participating component allocates 3.2 percent of its extramural R&D portion of the RDT&E budget (as calculated per SBA and DOD guidance) to the SBIR program, and 0.45 percent to the STTR program. However, in the committee's view, the DOD budget materials provided to Congress provide little information on the SBIR/STTR programs and their activities, significantly less information than what is provided for other RDT&E activities.

DOD's RDT&E budget funds research, development, test, and evaluation efforts of both contractors and government installations toward the development of equipment, material, or software. DOD R&D activities overall are categorized according to eight RDT&E Budget Activities, shown in Figure 2-1, which collectively represent DOD's efforts to use R&D programs to mature technologies and systems for eventual procurement for operational use. Figure 2-1 shows how this budget structure for RDT&E activities maps to Office of Management and Budget categories.

DOD's RDT&E funding for FY2023 totaled $145 billion, representing about 16.4 percent of the Department's overall budget in that fiscal year (Gallo, 2024b). DOD examines the share of its overall RDT&E funding that is distributed extramurally to determine the annual funding for the Department's SBIR/STTR programs (that share is set at 3.2 percent for SBIR[3] and 0.45 percent for STTR[4]). For FY2023, the total amount allocated to the SBIR/STTR programs was nearly $2.9 billion, or about 11 percent of DOD's budget for "science and technology activities," which are budget activities 1-3 (Gallo, 2024b) (see Figure 2-1). While spending on SBIR/STTR makes up a substantial portion of DOD's science and technology budget, it represents only about 2 percent of the Department's overall RDT&E funding and about 0.3 percent of its total spending (Gallo, 2024b). The remaining RDT&E budget can be allocated to intramural and extramural

[3] 15 U.S.C., Section 638(f)(1).
[4] 15 U.S.C., Section 638(n)(1)(B).

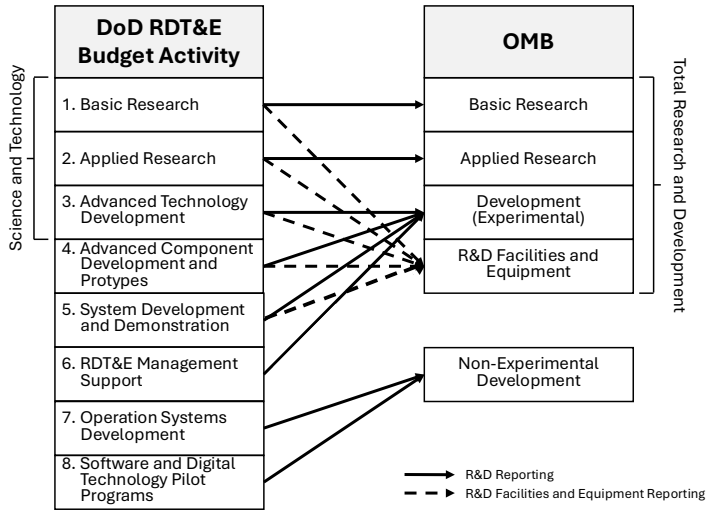

FIGURE 2-1 Research, development, test, and evaluation (RDT&E) programs.
NOTE: OMB = Office of Management and Budget; R&D = research and development.
SOURCE: Adapted from a presentation to the committee by Marcy E. Gallo, Congressional Research Service, April 18, 2024, Washington, DC.

organizations to advance technology using contracts outside of the SBIR/STTR programs. Budget activities 4 and 5, for example (shown in Figure 2-1), are used for subsequent development, demonstration, and piloting of technologies toward greater levels of technology readiness, leading to procurement and deployment.

DOD's extramural research programs, including SBIR/STTR activities, are managed by civilian and military personnel within government program offices and executed primarily by private-sector performers, including large and small defense contractors and universities. RDT&E activities are also executed internally through a network of more than 55 service laboratories and test ranges. In addition, DOD funds a set of FFRDCs and University Affiliated Research Centers that carry out additional R&D activities.

THE DEFENSE INNOVATION ECOSYSTEM

The U.S. defense innovation ecosystem comprises multiple key participants that contribute to both its effectiveness and its complexity (Figure 2-2). Because SBIR/STTR is just one small share of the activities within this ecosystem, it is difficult to identify the specific role of the programs in isolation. The broader ecosystem includes organizations and individuals that act as funders of R&D activities, including DOD organizations in the services and defense agencies, as well as private-sector organizations in the defense industry. Funding

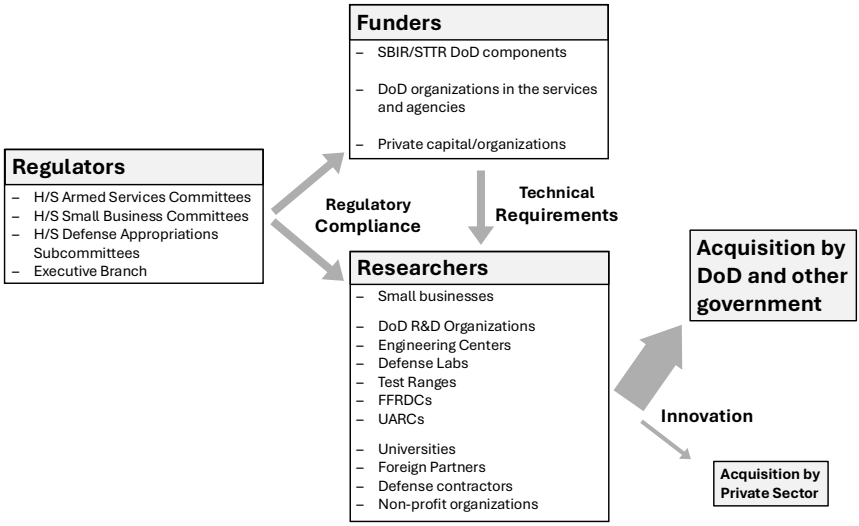

FIGURE 2-2 The defense innovation ecosystem.
NOTE: FFRDC = Federally Funded Research and Development Center; H/S = House and Senate; R&D = research and development; UARC = University Affiliated Research Center.

for the private sector has come from contracting with the defense agencies, as well as internal R&D investments and, more recently, an increasing number of private venture capital sources. In contrast to idealized markets that include multiple buyers and suppliers, the defense market is highly concentrated.

For a host of defense technologies in the United States, DOD is the only customer that procures and uses final systems, goods, or services, a market described by economists as a monopsony, although some emerging technologies, such as AI, machine learning, and autonomous systems, originated in the civilian sector and are dual-use (Center for Strategic and International Studies, 2025). This situation complicates procurement activities because of the paucity of competition and comparable contracts. As a result, market competition for DOD products is typically oriented primarily toward meeting technical requirements and achieving regulatory compliance instead of toward price. Innovation still occurs—including remarkable advances in science, technology, and military platforms and other equipment—giving the United States the world's leading national security capabilities. Some of these innovations subsequently transfer to the commercial sector. Further complicating the investigation of SBIR/STTR innovation pathways, DOD funding may go to controlled or classified projects, and information on those projects may not be available for security reasons.

In addition to all of the funders and performers of research and technical work for DOD is a set of policy makers and regulatory organizations. These include Congress, whose oversight and appropriations committees pass laws, provide funding, and perform oversight over the SBIR/STTR programs.

Committees with principal jurisdiction include the House and Senate Small Business Committees, as well as the House Science Committee, the House and Senate Armed Services Committees, and the House and Senate Defense Appropriations subcommittees. Within the executive branch, oversight, funding decisions, and policy and regulatory activity stem from the White House; the Small Business Administration (SBA); and many offices within DOD, including the Office of the Secretary of Defense, the military services, and agency components. Because SBIR and STTR bridge funding and policy issues in sectors ranging from science and technology to acquisition to small business policy, and because the statutorily mandated goals of the programs are in tension with each other, the regulatory environment is particularly complex and involves competing priorities and incentives (NASEM, 2020).

The subsections that follow describe some of the major players in this ecosystem.

The Defense Prime Contractors

Prime defense contractors, commonly referred to as primes, are large companies that engage in direct contractual arrangements with DOD (Table 2-1). Since the 1990s, following significant consolidation in the defense industry, a small number of firms have become increasingly dominant (Amara and Franck, 2021; Chang and Chakrabarti, 2023). These prime contractors are responsible for integrating complex technologies into operational systems, managing vast supply chains, and ensuring that systems meet stringent performance and reliability standards. Primes, in turn, rely on networks of subcontractors, including firms participating in the SBIR/STTR programs. This subcontracting, although difficult to observe and measure, allows primes to incorporate innovative technologies developed by small businesses into larger defense systems. Additionally, primes may acquire small firms to integrate their technologies and expertise directly, further blurring the lines between the contributions of small and large defense contractors.

TABLE 2-1 Defense Prime Contractors: Five Largest by Obligations (Fiscal Year 2023)

Company	Obligations (billions of dollars)
Lockheed Martin Corporation	68.6
Raytheon Technologies Corporation	27.8
General Dynamics Corporation	23.0
The Boeing Company	21.8
Northrop Grumman Corporation	15.1

NOTE: Raytheon Technologies Corporation is now known as RTX Corporation.
SOURCE: Forecast International, 2024.

Subcontractors

Subcontractors are integral to the defense innovation ecosystem, providing specialized components, services, and expertise that support the large-scale projects managed by prime contractors. While subcontracting theoretically offers opportunities for firms of all sizes, in practice, many of the most significant subcontractors are themselves large or even very large companies. This is due in part to the complexity and scale of defense projects, which often require the substantial resources and established research, engineering, and manufacturing capabilities that larger firms possess. As a result, incorporating young and small firms into the subcontracting process has historically been a challenge. To become successful subcontractors, these smaller firms face such barriers as stringent qualification requirements; limited visibility into and from the final government customer; and difficulties navigating DOD's procurement system, securing funding, and establishing credibility within a traditionally risk-averse environment—all of which can limit their participation and the infusion of innovative solutions into defense projects. Furthermore, and perhaps surprisingly, DOD, as the final customer for defense products and services, has limited visibility into the subcontracting arrangements made by the prime contractors and limited tools for supporting subcontractors.

Small Firm DOD Contractors

Incorporating small firms into the defense sector diversifies the supplier base, reducing reliance on a few large contractors and enhancing the resilience of supply chains, as outlined in DOD's (2023c) *Small Business Strategy*. Small firms are pivotal contributors to the defense innovation ecosystem. Known as nontraditional defense contractors in the defense ecosphere, these firms can bring new skills, innovative capabilities, and even new resources to bear in support of the national security innovation base. Their smaller size and less bureaucratic structures enable them to adapt quickly to new information, changing requirements, and technological advances. In addition, many small firms focus on niche areas, providing specialized skills and trying out innovative approaches. Their agility, specialized expertise, and capacity for rapid innovation can position them to develop cutting-edge technologies to address DOD's dynamic and complex needs. These firms sometimes operate at the forefront of emerging technologies, such as AI, cybersecurity, biotechnology, and autonomous systems. By introducing novel solutions and fostering competition, they can help foster a culture of innovation and risk taking and drive technological advances to enhance national security.

The advantages of small firms have been highlighted by analyses of the role of technological innovation and small businesses in defense strategy. The *2022 National Defense Strategy* (*NDS*), for example, states that "the United States' technological edge has long been a foundation of our military advantage,"

highlighting the importance of emerging technologies and innovation to national defense (DOD, 2022, p. 19). Furthermore, the *NDS* identified a goal to "Adapt and Fortify Our Defense Ecosystem," stating that "we will bolster support for our unparalleled network of research institutions . . . as well as small businesses and innovative technology firms" (DOD, 2022, p. 20).[5]

Small firms have a variety of motives for applying to the SBIR/STTR programs. Some apply to receive nondilutive (equity-free) investment. These firms are engaged in developing technologies, and DOD, having the largest federal SBIR program, provides an attractive funding vehicle. In addition, securing a Phase III contract provides the firm with a reliable first-use customer. SBIR also helps the firm develop a product or process that can serve a larger commercial market. For example, the startup firm Compound Eye received one SBIR Direct to Phase II award from the U.S. Air Force and one SBIR Catalyst Award from the Army to develop advanced sensing and perception technologies for defense operations. The technology is applicable to all types of autonomous vehicles and is a component that fits into a product platform. Thus, the company is developing a potential dual-use technology.

Another type of SBIR-funded firm develops platform technologies that scale innovation. Anduril, for example, used DOD SBIR funding to develop a dual-use strategy, based on vertically integrated products that could be delivered as complete, end-to-end solutions. The company was founded in 2017 and currently has a market valuation of more than $14 billion (Tarr, 2024). Backed by venture capital investment, Anduril is discussing plans for an initial public offering, which is the gold standard for a startup company. Known in the investment world as unicorns, these types of companies are rare indeed.

Another type of SBIR awardee firm is a specialized R&D organization. Firms of this type use SBIR funding to advance their technologies, which frequently involve components of larger systems that serve the warfighter. These firms often work closely with the DOD service branches, form long-term trusted partnerships, and provide complex critical technologies that have limited commercial potential. NAVSYS, for example, a company that develops positioning, navigation, and timing technology, was founded in 1986 and received its first SBIR award in 1988. NAVSYS was selected as the Top Satellite Solutions

[5] Two high-level documents that flow from the *NDS*—the 2023 *National Defense Industrial Strategy* (*NDIS*) (DOD, 2023d) and the *National Defense Science & Technology Strategy 2023* (*NDSTS*) (DOD, 2023a)—similarly reiterate those themes and further highlight the value of funding R&D and working with small businesses to achieve stated goals. The *NDIS* states that "the Department will explore opportunities to expand programs that mitigate costs of entry for promising, small and non-traditional businesses that improve DOD's technology edge and capabilities" (DOD, 2023d, p. 20). The *NDSTS* states that "the DOD will tap into the innovation potential of our nation's small businesses by expanding engagements with and investments into this community to support their ability to prototype and scale their products into production" (DOD, 2023a, p. 6). Countless statements by DOD's senior military and civilian leaders, policy and strategic documents, technology strategies, and congressional testimony are consistent with these themes. These policy goals are also mirrored by statements made by congressional leadership in legislation, reports, hearings, and floor speeches, as well as by White House officials in speeches, executive orders, and other communication.

Provider of 2024 by *Aerospace and Defense Review* for improving satellite technologies to address GPS challenges ("NAVSYS Corporation: Offering PNT for a resilient future," n.d.). Other successful SBIR firms are examples of the more traditional type of SBIR awardee that serves an essential niche defense market and has limited appeal to private investors.

Private Capital

Private capital and the firms it supports play an important role in the defense innovation ecosystem. Recent years have seen a notable rise in venture capital (VC)-backed defense tech startups—notably Anduril Industries, Palantir Technologies, and SpaceX—and of private equity firms making investments in the defense supply chain. These firms exemplify how startups can leverage private investment to accelerate growth and innovation in the defense sector. VC firms provide substantial funding that enables startups to invest heavily in R&D, scale their operations, and bring advanced technologies to market more quickly. These firms often pursue ambitious projects aimed at disrupting traditional defense paradigms, introducing such innovative solutions as autonomous systems, advanced sensors, and data analytics platforms. VC-backed startups frequently operate at the intersection of commercial and defense markets, facilitating the transfer of cutting-edge commercial technologies to military applications.

However, tensions can arise between private capital objectives and DOD requirements. Venture capitalists typically seek profitable exits within a relatively short timeframe, while DOD requires dependable, long-term partnerships with suppliers for critical technologies. These rapid-growth expectations of VC-backed firms may not align with the slower pace of defense procurement and acquisition processes. Also, firms that focus on defense technologies often have limited potential to scale their technologies to mass markets to meet VC expectations. Defense-focused firms are often required to adopt practices that are not conducive to competing in commercial markets. These constraints are due to unique defense requirements; the security environment of the defense sector, including export controls and classification systems; and unique auditing and reporting requirements that drive up administrative overhead. On the other hand, venture capitalists may view a company's receipt of SBIR/STTR funding as a certification of quality and follow-on procurement, potentially making such firms attractive for private investment (Feldman and Kelley, 2006; Lanahan and Armanios, 2018).

Overall, the rise of VC-backed defense tech firms highlights the increasing interest of private investment in national security and the potential to inject new energy and innovation into the defense sector. Their contributions complement those of other small and young firms, as well as traditional technology developers represented by the defense industry and government labs, collectively enhancing the technological capabilities of the U.S. military.

Recent Initiatives to Support Research and Innovation

Since the SBIR program's establishment in 1982, DOD has experimented with other funding programs offering nondilutive capital. Designed to address shortfalls in private funding, these programs complement and extend the impact of the SBIR/STTR programs by providing additional funding opportunities beyond the R&D funding provided under DOD's mainstream science and technology and R&D programs. These initiatives have formed part of the defense ecosystem, and they reflect DOD's strategy over the years to increase the speed of innovation and address a lack of available private capital.

Several new initiatives over the past 15 years are worthy of note. First, DOD's Rapid Innovation Fund (RIF), established in 2011, was designed to accelerate the adoption of innovative technologies. From 2011 to 2016, RIF made 670 awards totaling $1.4 billion, with 88 percent of the awards being made to small businesses (DOD, 2020). The program was never included in any President's Budget Request, so it had to be supported completely by congressional earmarks, the last of which was in 2020.

Second, the Defense Innovation Unit (DIU), established in 2015, has been called "the Pentagon's innovation experiment" (Kaplan, 2016). The organization is headquartered in Silicon Valley, with additional offices in Austin, Boston, Chicago, and Washington, DC. DIU operates in six critical areas of national security: AI/machine learning, autonomous systems, cyber, human systems, energy, and space. Its objective is to identify a problem, prototype a commercial solution, and then implement it in the field in under 2 years—a highly targeted and problem-focused orientation. To address a lack of private investment in hardware (Lerner and Nanda, 2020), DIU initiated the National Security Innovation Capital program in 2021, specifically to enable hardware startups to advance toward key milestones in their product development.

In addition, the SBIR and STTR programs have recently been augmented by two programs operated by AFWERX, a research funding organization within the Department of the Air Force. The Strategic Funding Increase Program (known as STRATFI) began in 2020 and the Tactical Funding Increase Program (known as TACFI) in 2021. These programs are available to small businesses that have been awarded an SBIR or STTR Phase II contract within the previous 2 years. The programs require matching funding either from a DOD office or from industry or a VC investor; they provide much-needed capital to advance a project toward procurement and commercialization.

The Rapid Defense Experimentation Reserve was initiated in 2021 to accelerate the development pipeline from prototypes to validated military capabilities, working directly with the services, combatant commands, the Joint Staff, and industry partners. The focus is on iterative feedback loops between warfighters and technologists throughout the testing and experimentation phases, and often on tailoring of commercially available components for military-specific use.

The Accelerate the Procurement and Fielding of Innovative Technologies pilot program, known as APFIT, was initiated in FY2022. Through this program, funding amounts in the range of $10 million–$50 million are awarded "to projects with small business or non-traditional performers to accelerate initial production and reduce the overall procurement timeline" (APFIT, n.d., para. 2). Awardees are selected each year by the Office of the Under Secretary of Defense for Research & Engineering, with projects being evaluated based on impact to the warfighter, sustainment support, and applicability to the broader DOD technology portfolio.

Finally, the Office of Strategic Capital, initiated in late 2022, provides financing tools such as direct loans and loan guarantees to boost tech firms focusing on dual-use technologies with applications beyond the military. Priority investment areas include space technologies, AI, cybersecurity, energy storage, semiconductors, autonomous systems, biotechnology, quantum computing, and advanced materials.[6]

In sum, the DOD innovation ecosystem has evolved and has recently included several new programs, oriented toward bridging the "valley of death"—a metaphor for the lack of funding for firms to move technologies forward toward DOD procurement. In this way, these programs are different from SBIR/STTR, which focus more on lower–Technology Readiness Level (TRL) projects. DOD funding is explored in more depth in the next section.

CONSIDERATIONS FOR THE COMMITTEE'S ANALYSIS OF THE SBIR/STTR PROGRAMS

Five considerations informed the committee's overall approach to its assessment of DOD's SBIR/STTR programs. The first is a central paradox: DOD's SBIR/STTR programs are critically important for small business innovators working on defense-related technologies and indeed account for well over half of total federal SBIR/STTR funding; that said, the programs are relatively small within the operations of DOD. Practically speaking, DOD's RDT&E budgets are the largest single source of innovation funding for advanced defense technologies in the world. And similarly, DOD's SBIR/STTR programs are the world's largest programs dedicated to small business defense innovation technology. In context, however, DOD's SBIR/STTR programs represent only a small share of DOD's extramural RDT&E budget (and an even smaller fraction of the overall DOD budget).

Second, in the above context, it is particularly important to consider how the SBIR/STTR programs can offer DOD distinctive strategic advantages. Consistent with oft-stated DOD goals, these programs diversify DOD's industrial, innovation, and supplier bases by enabling small firms to compete for research funding, decreasing reliance on the small number of large defense prime

[6] See https://www.cto.mil/osc.

contractors. The SBIR/STTR programs allow technology experimentation to inform the technological frontier of DOD initiatives by providing access to a variety of ideas and perspectives.

Third, firms have multiple motivations and incentives for applying for and receiving SBIR/STTR funding. One is the opportunity to receive nondilutive funding (i.e., funding received without having to give up equity in the company) with which to scale up product development and delivery and refine business operations without a specific defense orientation. Housing the largest federal SBIR/STTR programs, DOD provides an attractive funding target for firms developing new technologies. Other firms use SBIR/STTR funding to advance technologies that provide components for integration into larger defense systems that serve the warfighter. The different approaches pursued by small businesses require adaptable program management on the part of DOD to optimize program results and return to the taxpayer. In both cases, securing a Phase III contract provides a firm with a reliable first-use customer. The SBIR/STTR programs thus serve as a gateway to the broader set of DOD research, development, and acquisition activities for nontraditional defense contractors, and potentially as way for small businesses to engage with prime contractors, acquisition program managers, and operational units.

Fourth, innovation is realized via multifaceted pathways within the DOD ecosystem, which is marked by a large and complex departmental organizational infrastructure and acquisition system and a competitive environment among DOD contractors. Any assessment of the SBIR/STTR programs must account for the circuitous route by which technology transitions into defense acquisition programs and operational use over long periods of time, sometimes including integration into complex weapons systems. Such an assessment must also account for the different pathways a technology may take for commercialization outside of DOD or for dual commercial–military uses. The SBIR/STTR programs impact DOD acquisition and procurement activities; benefit both participating firms and large defense primes; and affect state and local economies and the supply of science, technology, engineering, and mathematics talent. These diverse impacts create a challenge for assessing the programs or choosing one or two metrics to apply in that assessment.

Finally, DOD's SBIR/STTR programs operate in the context of the government-wide SBIR/STTR programs, creating challenges that cover a range of administrative, operational, and evaluation concerns. The DOD programs must be responsive to guidance from the White House to remain consistent with appropriate interagency initiatives and comply with SBA's Policy Directive, which governs the SBIR/STTR programs. The programs must also be executed in a manner consistent with the Small Business Act, including provisions that may not be easily adaptable to DOD's unique organizational structure and mission needs related to promoting the interest of the warfighter. Reconciling the statutorily mandated goals of the SBIR/STTR programs with the more DOD-specific goals included in other legislation, such as the National Defense

Authorization Act, or in DOD's internal strategies and goals for its research and acquisition activities, requires attention.

The federated nature of DOD means that each SBIR/STTR program is executed differently throughout the Department. Each subagency that operates these programs must remain simultaneously responsive to SBA directives and to high-level DOD officials in the Office of the Secretary of Defense, as well as the leadership of the military service or defense agency or organization where the individual SBIR/STTR program resides. Each branch or organization within DOD has significant autonomy in administering its programs and defining its portfolio of projects, tailored to meet specific defense needs. This decentralized approach presents challenges in evaluating DOD's SBIR/STTR programs. There are, in reality, numerous unique program implementations across the various branches and agencies, each reflecting different strategic priorities and technological focuses.

Given the federated nature of program management, the diversity of program goals, and a lack of consistent attention from leadership within DOD, those operating the programs face considerable challenges in shaping program activities to accord with institutional goals and strategies. Moreover, the guidance and any prioritized metrics for judging program outcomes from leadership (in each of the executing agencies and subagencies; in the defense acquisition programs intended as "customers" of transition SBIR projects; and in SBA, the White House, or Congress) are often in tension, if not contradictory.

The committee attempted to consider and balance these elements to analyze the interplay between the SBIR/STTR programs and the defense innovation ecosystem.

THE ROLE OF SBIR/STTR IN ACHIEVING DEFENSE MODERNIZATION GOALS

The SBIR/STTR programs are intricately connected to DOD's broader modernization goals, providing a flexible mechanism for the development of technologies that align with the Department's needs, from basic research to full-scale deployment. Indeed, one of the programs' key features is their ability to fund early-stage research that can eventually transition to Phase III R&D or procurement awards on a sole source basis, at which point technologies are integrated into defense platforms. The programs are uniquely positioned in terms of scale and impact—small in the context of DOD but large in their impact on small business. They benefit from a flexible structure not subject to some of the strictures faced by other defense programs and thereby have an outsized potential to achieve defense modernization.

Despite the fact that the DOD SBIR/STTR programs make up a small portion of the overall DOD budget, their importance to the U.S. small business ecosystem has several strategic implications. Despite their small size within DOD, the programs have the potential to "punch above their weight" by acting as

catalysts for innovation and risk taking. DOD's significant share of overall federal SBIR/STTR funding means that the DOD programs have the potential to influence the direction of small business activity nationally. While this is particularly important for defense-related areas, DOD also funds research in such areas as health topics related to trauma and battlefield recovery; environmental topics related to remediation and safety monitoring; and emerging technology topics related to national security, such as AI and cybersecurity. DOD research funding helps define opportunities for small business that affect the lives of every citizen. Several specific benefits of DOD's SBIR/STTR programs are detailed below.

Strategic Funding Flexibility

As the United States seeks to compete with China and other global security and economic peers, as well as to keep up with the accelerating pace of commercial technological change that is increasingly likely to result in threats to the national security, DOD needs to make more efficient use of all programs and activities that can support the rapid development and delivery of new technology-based defense capabilities. Larger concerns about the DOD procurement system that are beyond the scope of this report affect the ability of SBIR/STTR firms to get their technologies into the formal acquisition program that has been approved and funded by DOD programs of record.

The SBIR/STTR programs have several advantages over many traditional DOD RDT&E activities in terms of speed of execution. Many of these advantages stem from the programs' unique budgeting and program execution authorities and practices. For one thing, the SBIR/STTR programs are not beholden to the traditional DOD planning, programming, budgeting, and execution (PPBE) process. SBIR/STTR program funding is therefore not included in the annual DOD Budget Request, nor is it specifically appropriated in the annual Defense Appropriations Act (Commission on PPBE Reform, 2024). As a result, DOD SBIR/STTR administrators can avoid lengthy processes associated with those activities and instead focus its management attention on program execution. In theory, program officials could move much more rapidly from becoming aware of a promising research or technology development opportunity to obligating and delivering funds to small business performers of the work, especially as compared with traditional RDT&E programs. In fact, program officials are not even required to present program funding plans to Congress as part of the Budget Request, providing flexibility that is unheard of relative to DOD's traditional programs and activities.

The SBIR/STTR programs can proceed with solicitations and awards even when other DOD programs are delayed by budget uncertainties. Currently, DOD executes its SBIR/STTR programs so that they are still affected by continuing resolutions, which have become a familiar part of the federal budget cycle and interrupt program processes, including soliciting proposals, selecting awardees, and awarding contracts and expending funds. Allowing the programs

to continue even when the government was operating under a continuing resolution would be valuable for officials responsible for RDT&E activities, who are often forced to pause many planned traditional RDT&E programs during the early quarters of new fiscal years while waiting for final appropriations acts to be passed by Congress and signed into law. The flexibility of the SBIR/STTR programs has the potential to make them a significant tool for rapidly initiating high-priority modernization efforts despite a traditional appropriations process that can be a lagging indicator of DOD's needs and priorities.

Indeed, the SBIR/STTR programs, for the most part, operate outside of traditional DOD RDT&E financial management policies and procedures. Most important, the programs' funds are not tied to any specific "budget activity" or TRL in either law or policy directives (see Box 2-1 and Tables 2-2 and 2-3). In fact, the funds can be used flexibly to invest in activities that move technologies seamlessly and rapidly from basic research to applied research and prototyping and even to limited initial production of test systems, all without requiring new requests of funds from Congress or senior DOD leaders. For traditional RDT&E programs, the need to move program support through a spectrum of funding streams ("colors of money" in DOD parlance)—many of which are controlled and overseen by various offices within DOD and by Congress—results in delays for both program managers and the larger defense industry, slowing the pace of technological advancement. Simplified procedures and support services can further help new firms navigate the complexities of defense contracting.

Flexibility in Transitioning Technology

Technologies typically require extensive further development or modification between initial discovery and readiness for deployment at any scale.

TABLE 2-2 Technology Readiness Level Definitions for Hardware

Level	Definition
1	Basic principles observed and reported
2	Technology concept and/or application formulated
3	Analytical and experimental critical function and/or characteristic proof-of-concept
4	Component and/or breadboard validation in laboratory environment
5	Component and/or breadboard validation in relevant environment
6	System/subsystem model or prototype demonstration in a relevant environment
7	System prototype demonstration in an operational environment
8	Actual system completed and qualified through test and demonstration
9	Actual system proven through successful mission operations

SOURCE: DOD, 2025c.

BOX 2-1

Technology Readiness Levels and the DOD SBIR/STTR Programs

DOD budget activities can be mapped to Technology Readiness Level (TRL) (Héder, 2017; Mankins, 2009), which is a technology measurement system used extensively within DOD and the National Aeronautics and Space Administration (NASA) to assess the maturity level of a particular technology (see Table 2-3). TRL is a simple scale ranging from 1 (idea) to 9 (successful implementation) for technology-agnostic evaluation. Generally, at DOD a technology must reach TRL 6 before it can be incorporated into systems acquisition programs. TRL is an important term in discussing how innovations reach the warfighter; for instance, the time and resources required to increase TRLs for critical technologies can severely impact scheduled deliveries for weapons systems (Katz et al., 2015). It has been estimated that advancing a single unit on the TRL scale can take about 20 months for small components and 50 months for a large system (Alexander, 2018).

A rough relationship exists between TRL and DOD research, development, test, and evaluation appropriations codes that could be better used to track SBIR/STTR awardee progress toward technology readiness. SBIR/STTR activity, generally conducted under DOD budget activities 1–3, correspond roughly to TRLs up to 6. Advancing technology after TRL 6 becomes more expensive. For example, using Navy SBIR data, Hay and colleagues (2013) estimated that SBIR firms advance the earliest TRLs (e.g., 2–3 or 3–4) at lower costs than their larger counterparts, but this advantage vanishes at higher TRLs. In their analysis of NASA SBIR/STTR proposals, Terrile and colleagues (2014) suggested that advancing from TRL 5 to 6 is about three times more expensive than advancing to TRL 5.

There are no legal or policy constraints on the TRLs that are appropriate for SBIR/STTR projects. Within DOD, different services and centers work at different points on the TRL scale. For example, the Army Research Office and DARPA's Defense Science Office fund activities at lower TRLs. Programs such as the Office of Naval Research and Air Force Research Laboratory fund activities at higher TRLs. Within DOD, SBIR/STTR programs typically operate in accordance with the general funding culture of the service or center. In almost all cases, the overall goal of DOD's research efforts is to advance TRLs so that capabilities can be eventually transitioned into acquisition programs. The scale of the SBIR/STTR funding—$1 million–$2 million in optimal cases—suggest that a single award could advance only component-level technologies (Alexander, 2018). Firms with more complex or integrating technologies might require multiple SBIR/STTR awards to advance them satisfactorily. Notably, the NASA program employs TRL information in SBIR/STTR selection (Belz et al., 2021).

The SBIR/STTR Policy Directive describes "work that derives from, extends, or completes an effort made under prior SBIR/STTR Funding Agreements, but is funded by sources other than the SBIR/STTR programs" as Phase III program funding (SBA, 2023, p. 25). In contrast with the standardized competitions of Phases I and II, SBA does not impose a cap on Phase III. The Policy Directive

TABLE 2-3 Technology Readiness Levels and Their Relation to DOD Funding Programs

Technology Readiness Level								
1	2	3	4	5	6	7	8	9
RDT&E Budget Activity and Other Funding Types								
6.1		6.2	6.2–6.3	6.2–6.3	6.3–6.4	6.4	6.5–6.7	6.5–6.7, Procurement, Operation & Maintenance
Acquisition Life Cycle Phase								
Technology Maturation and Risk Reduction					Engineering & Manufacturing Development			Production, Deployment, and Sustainment
Science and Technology Programs					Acquisition Programs			
	Traditional SBIR Activities							

NOTE: RDT&E = research, development, test, and evaluation; SBIR = Small Business Innovation Research.
SOURCE: Derived from Defense Acquisition University (DAU), n.d.d.

indicates that it is "typically oriented towards Commercialization of SBIR/STTR research or technology, including through further R/R&D work" (SBA, 2023, p. 25). While SBA collects data on SBIR/STTR Phase I and Phase II awards, tracking the transition to Phase III has been more difficult because of the multiple pathways available for transitioning technologies. Still, the evidence reviewed by the committee suggests high rates of continued activity from SBIR/STTR awardees.

The ability to award noncompetitive Phase III contracts and other awards to successful small businesses creates the potential for the more rapid development of prototypes, test and evaluation programs, and production of promising systems and capabilities. Enhanced use of this authority could allow DOD to increase the number of small businesses it works with in its broader set of research, development, and acquisition programs, and even the number of small businesses to which it awards procurement contracts for goods and services. Additionally, the programs have the full authority and ability to make use of the most responsive contract type needed to best support "speed of delivery." This latitude includes the use of both Federal Acquisition Regulation (FAR)–type and non-FAR-type contracts (such as Other Transaction Agreements), cooperative agreements, purchase order agreements, technology prizes, and indefinite delivery/indefinite quantity and consortia awards, among many other options. All these contracting options enable program officials to reduce or even eliminate the traditional slowness of contracting processes and tailor agreements to best suit the needs of both DOD as a customer and small businesses, especially during technology transition activities.

Any agency or military service within DOD may award a Phase III contract to follow an SBIR/STTR award from a different part of DOD or even

another federal agency. Although Phase III has been viewed as the final objective of a proposing firm (Bhattacharya, 2021), as it represents an extended purchase of goods and services, the ultimate goal for any technology is to become part of a defense program of record, namely as an explicitly identified item in the defense budget (Hernández-Rivera, 2023). In other words, Phase III may mark an important part of any technology's funding genealogy, but the technology has ultimately demonstrated value to the military if it becomes or is incorporated into a program of record.

In fact, better tracking of Phase III and DOD's enhanced ability to identify contracts that are funding Phase III activities represents one of the best ways for DOD, industry, Congress, and the public to monitor technology transition in the defense research enterprise. Although SBA is required to collect these data, they have "limited use in providing information regarding the commercialization success" (Gallo, 2020, footnote 72). This data gap is also a problem for other federal science and technology programs that have yet to initiate such a systematic and transparent way of tracking the progress of research investments through commercialization and ultimately, in the case of DOD, to practical incorporation into the defense acquisition system to serve the warfighter. Of the five federal agencies with large extramural R&D budgets, only DOD and the National Aeronautics and Space Administration have extensive procurement that can be linked to their SBIR/STTR programs.

Expansion of the National Security Innovation and Industrial Base

Senior DOD and congressional officials often cite the need to expand the base of companies participating in the development, production, and delivery of new technologies, systems, and services to support defense capabilities, often lamenting that DOD works with an increasingly smaller share of the total population of commercial companies with defense-relevant technological innovation and production capabilities. As a result of inherent advantages, the SBIR/STTR programs can be used to strengthen and expand the defense industrial base and national security innovation base.

First, SBIR/STTR program funding is limited to U.S.-owned small businesses. Program funding therefore inherently strengthens domestic innovation and manufacturing firms working in the defense sector, consistent with many stated domestic economic growth policies, security requirements, and political considerations. The strengthening of U.S. technology-oriented small businesses is widely viewed as consistent with job growth, global competitiveness, and enhancement of technological innovation.

The STTR program funds are mandated to be used to strengthen partnerships between two sectors generally viewed as sources of technological innovation—small businesses and not-for-profit research institutions and universities. The dedicated funding for these partnerships under the STTR program is well aligned with the goals of speeding the transition of useful intellectual property to technologies and systems for both defense and commercial

markets, creating the technological workforce needed to support the private sector, and enhancing the quality of academic research through more direct connection to and inspiration from real-world technological and operational challenges.

The flexibility of the SBIR/STTR programs also allows DOD to invest in early-stage niche defense capabilities, extend and modify commercial technologies to evaluate their possible defense applications, and invest in transitioning promising academic research—all of which serve to expand the nation's defense industrial and innovation bases. Importantly, the programs do not consider past performance as part of the source selection process, making them an ideal entry point into the defense industrial base for new small businesses. The programs have the authority to make the entry of small businesses into the sometimes complex procedures of defense acquisition more attractive and manageable, including special authorities to protect the intellectual property generated under program activities; the potential to use simplified procedures for requesting and auditing contract costs[7]; and assistance for companies in maturing their businesses and enhancing their ability to access defense customers and markets under Commercial Assistance Programs, APEX Accelerators, Mentor-Protégé programs, and other efforts.

Driving Innovation in Critical Technology Areas

DOD's SBIR/STTR programs are additionally well placed to support strategic efforts toward the development of innovative defense capabilities in high-priority areas, ranging from AI to biotechnology to hypersonics and directed energy. As fixed percentages of extramural R&D, rather than line-item appropriations, the programs are a reliable and flexible source of funding for DOD priorities. DOD has the authority to shape SBIR/STTR topics and award contracts in areas of the highest priority, including by increasing or decreasing awards made in various areas as priorities change or even using open topics when considered advantageous; program managers need not set topic areas and activities years in advance of appropriations, since the programs stand outside of traditional Pentagon programming and budgeting activities. Uniquely, the programs are not subject to changes through congressional budget cuts or earmarks, which routinely adjust the course of other Pentagon R&D programs, sometimes in unanticipated ways. The approximate overall program size, including at the subagency level, is known well in advance, allowing DOD leaders to plan for the integration of program activities with other science and technology, acquisition, and procurement activities. The programs' structure and regulations allow DOD to support promising efforts and companies, including while waiting for additional funding to be programmed using the traditional PPBE process

[7] U.S. Congress, National Defense Authorization Act for Fiscal Year 2016, P.L. 114-92, Section 873 (as amended) (November 25, 2015).

(Commission on PPBE Reform, 2024). In addition, the programs are not subject to congressional marks during the appropriations process, which may facilitate advancing emerging technologies (Commission on PPBE Reform, 2024). DOD can use simplified and flexible contracting procedures, thereby reducing bureaucratic delays in supporting projects; Phase III awards can also be used to provide bridge funding prior to transition of an SBIR/STTR project into a program of record. By supporting small businesses and fostering partnerships with research institutions, DOD's SBIR/STTR programs enhance domestic innovation and facilitate the transfer of technology out of labs and universities. The programs' flexibility allows DOD to invest in early-stage niche defense capabilities, extend and modify commercial technologies to evaluate their possible defense applications, pull new companies into the defense innovation ecosphere, and invest in transitioning promising academic research—all of which serve to expand the nation's defense industrial and innovation bases.

By providing funding and support to small businesses at the earliest stages of the innovation process, DOD's SBIR/STTR programs have the potential to encourage the development of cutting-edge technologies that address the Department's evolving requirements, and they serve as critical mechanisms for ensuring that DOD continues to benefit from the specialized expertise of small businesses. The programs offer a pipeline of innovation that is essential for maintaining national security and technological superiority, with secondary effects such as generating patents, funding award-winning research, training a science and engineering workforce, and potentially leading to development of successful commercial technologies and systems.

Given their potential strategic benefits, assessment of DOD's SBIR and STTR programs is usefully informed by an in-depth qualitative and quantitative analysis of the degree to which the programs—in whole or in part—realize these strategic objectives over time. Specifically, with this discussion of the role of the SBIR and STTR programs in the context of the defense innovation ecosystem as a backdrop, this report now turns first to the landscape of DOD SBIR/STTR awards and an in-depth analysis of the process by which DOD's SBIR and STTR programs operate, and then to an assessment of the impact of those awards and awardees both within DOD and in the broader commercial marketplace.

FINDING

Finding 2-1: SBIR/STTR firms bring distinct capabilities to advance the U.S. defense innovation system.

3

The Landscape of DOD SBIR/STTR Awardees

This chapter focuses on the landscape of funding and awardees for the Department of Defense's (DOD's) Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. The objective is to provide descriptive data with which to answer basic questions about the characteristics and geographic locations of firms receiving DOD SBIR/STTR awards. Analysis of the distribution of funding and awards covers the fiscal year (FY) 2012–2023 timeframe. The chapter reviews the distribution of awards across the different components and services within DOD and the geographic distribution of awards across states, drawing comparisons with other DOD spending and venture capital funding.

METHODOLOGY AND SAMPLING

The principal source for this chapter is award data accessed through the Small Business Administration (SBA) website,[1] supplemented by data from the National Center for Science and Engineering Statistics's Survey of Federal Funds for Research and Development, data from USASpending.gov, and data on private-sector funding from Crunchbase and Pitchbook. The focus is on the FY2012–2023 timeframe to take into account changes following the 2011 reauthorization of the SBIR/STTR programs[2] and to cover a long enough period to show trends.

DOD made a total of 34,704 SBIR/STTR awards to 6,093 small businesses during the FY2012–2023 timeframe, including Phase I and Phase II awards, Fast-Track awards, Direct to Phase II awards, and Phase IIB awards. The total amount awarded was $17.7 billion over the 12-year period in nominal dollars, or $20.7 billion in 2023 inflation-adjusted dollars. Ending the analysis at FY2023 enabled the committee to consider certain subsequent award outcomes, such as follow-on funding from DOD sources and from angel and venture capital.

[1] https://www.sbir.gov/awards.
[2] U.S Congress, National Defense Authorization Act for 2012, P.L. 112-81 (December 31, 2011).

Unfortunately, the SBA award database does not definitively connect later-phase awards with those made earlier to the same company for the same project, which inhibited the committee's ability to determine the cumulative effects of program funding. Complicating the ability of the committee to match Phase I awards and Phase II awards is the lack of consistent identifiers between Phase I and Phase II awards. Additionally, the titles of the Phase I award and its associated Phase II may differ, and DOD has Direct to Phase II awards, which do not have an associated Phase I award.

PROGRAM STRUCTURE AND PARTICIPATION

SBA oversees the SBIR/STTR programs and provides overall guidelines for implementing the programs across 11 federal agencies. DOD accounts for the largest SBIR/STTR programs, at $2.3 billion, with the next largest being those of the Department of Health and Human Services, at $1.2 billion.[3] The SBIR/STTR programs are congressionally mandated set-asides that currently allocate 3.2 percent of a participating agency's extramural research and development (R&D) budget to SBIR and 0.45 percent to STTR. These percentages represent an increase from the FY2012 allocations of 2.6 percent for SBIR and from 0.35 percent for STTR (see Table 3-1).

DOD's SBIR and STTR programs are designed to "encourage domestic small businesses' engagement in research and development, scientific excellence, and technological innovation through federal research fund investment in critical American priorities to build a strong national economy and accelerate Warfighter capabilities" (OSBI, n.d., para. 2). The Office of the Under Secretary of Defense for Research and Engineering (OUSD[R&E]) serves as the Secretary of Defense's point of contact for Congress, SBA, the Government Accountability Office, and the interagency SBIR/STTR community.[4] This SBIR/STTR central oversight and policy organization also seeks technology partnerships within DOD and other federal agencies.

TABLE 3-1 Required Minimum SBIR/STTR Expenditures for Participating Agencies as a Percentage of Agency Extramural Budgets for Research or Research and Development (Fiscal Years 2012–2017)

	Fiscal Year					
	2012	2013	2014	2015	2016	2017
SBIR	2.6	2.7	2.8	2.9	3.0	3.2
STTR	0.35	0.35	0.40	0.40	0.45	0.45

NOTE: Minimum expenditures for subsequent years remain at fiscal year 2017 levels.
SOURCE: 15 U.S.C., Section 638(f)(1), and 15 U.S.C., Section 638(n)(1)(B).

[3] See https://www.sbir.gov/participating-agencies.
[4] USD(R&E) is tasked with leading the program by DOD directive (USD[R&E], 2020).

SBIR and STTR are competitive award programs that typically operate in three phases (SBA, 2023). Phase I awards provide funding for researching the scientific and technical merit, as well as the feasibility, of an idea; this phase is also known as proof of concept. Award amounts vary by agency component, averaging $150,000 with a 12-month duration, although the SBA (2023) Policy Directive currently allows for Phase I awards that exceed $300,000.[5] The SBIR Phase I program is highly competitive, with approximately 20 percent of applications receiving funding.[6] While venture capital investors operate with far greater selectivity than the SBIR program—screening hundreds of potential opportunities for every investment—firms that apply for DOD SBIR funding must first satisfy statutory eligibility criteria, have the internal capabilities to perform early-stage R&D for defense needs, and in most cases be able to respond to a specific DOD solicitation. This means that the applicant pool is drawn from a substantially narrower, more self-selected set of technology-oriented firms than the population of ventures encountered by venture capital firms.[7]

Phase II allows successful Phase I awardees to receive further funding for the development, testing, and validation of their innovation. The typical amount of Phase II awards is $1 million, with a 24-month duration, although SBA currently allows for awards up to nearly $2.1 million.[8] Many DOD components slightly modify this typical program structure to meet organizational needs; as an example, Figure 3-1 provides an overview of the OUSD(R&E) SBIR/STTR application and award process.

The final phase of the SBIR/STTR programs is Phase III. Phase III activities are not funded with SBIR/STTR funds. Instead, agency components and services or private-sector entities seeking to use the technology developed in earlier phases fund its further development and implementation to address their needs. The transition to Phase III can vary in style and speed and is not guaranteed. A benefit to companies funded by DOD's SBIR/STTR programs is that if a DOD service or component needs the technology, the company can transition it directly to DOD without competition, saving several months typically spent on

[5] AFWERX currently limits Phase I open topic awards to $75,000. SBA reported that in FY2022, DOD as a whole had 1,172 new Phase I SBIR awards with an obligation of $185,784,181, which corresponds to an average award of $159,000.

[6] SBA's *SBIR/STTR Annual Report for Fiscal Year 2022* shows a DOD SBIR Phase I selection rate of 18 percent for DOD as a whole, varying from 9 percent (Army) to 27 percent (other defense agencies) (see SBA, 2022, Table 6, p. 16).

[7] The SBIR award rate is comparable to many of the most prestigious and competitive mechanisms in U.S. science funding. In the past decade, R01 grants from the National Institutes of Health typically have had around 20 percent success rates, and the National Science Foundation's overall proposal success rate ranged between 24 and 26 percent. Though the missions differ, these programs are widely viewed as highly selective. See https://report.nih.gov/nihdatabook/category/10 and https://tableau.external.nsf.gov/views/NSFbyNumbers/Trends?%3AisGuestRedirectFromVizportal=y&%3Aembed=y&%3Alinktarget=_blank&%3Atoolbar=top.

[8] SBA's *SBIR/STTR Annual Report for Fiscal Year 2022* shows a Phase II SBIR success rate of 28 percent with 1,334 awards and total obligations of $1,709,252,049, corresponding to an average award of $1.3 million (see SBA, 2022, Table 6, p. 16).

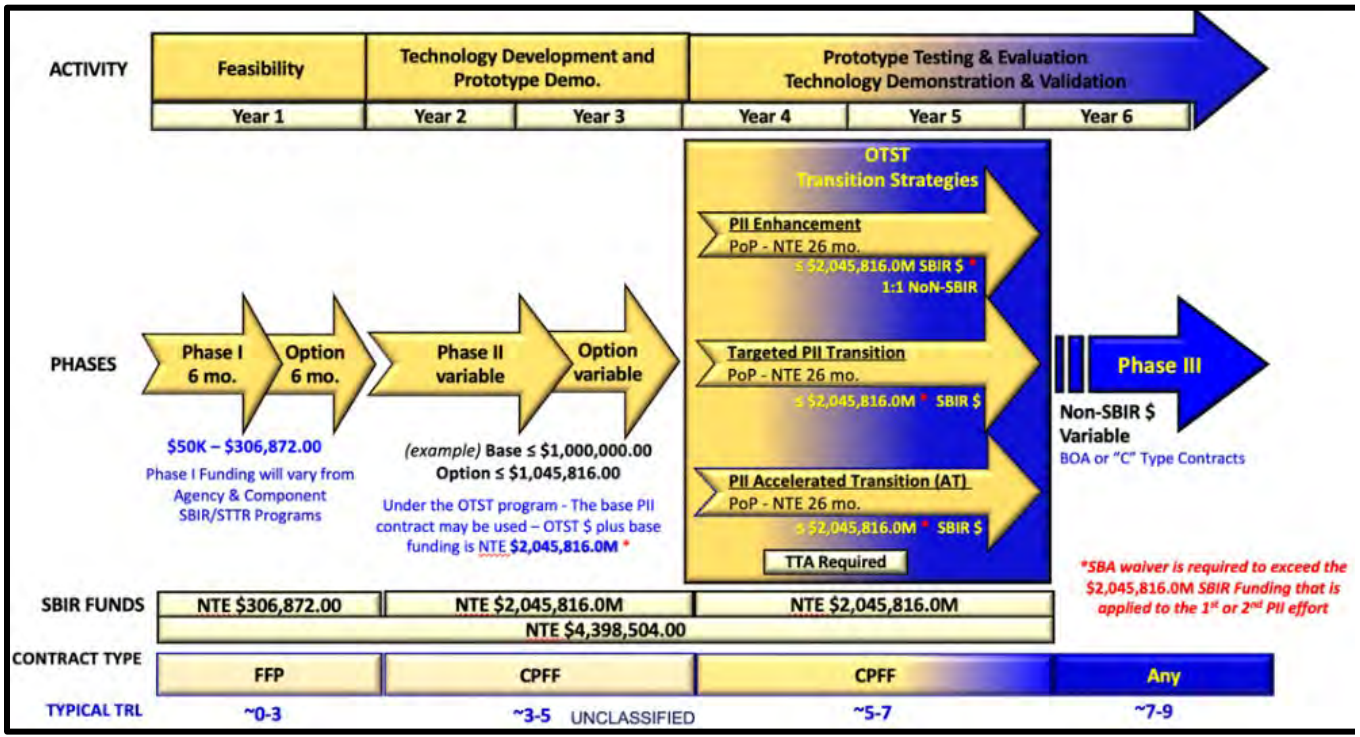

FIGURE 3-1 Office of the Under Secretary of Defense for Research and Engineering SBIR/STTR award structure.
NOTE: Contract Types: CPFF = cost-plus-fixed-fee contract; FFP = Firm Fixed Price. OTST = Office of the Secretary of Defense Transitions SBIR/STTR Technologies Program. TRL=Technology Readiness Level.
SOURCE: Presentation to the committee by Matthew Williams, Department of Defense, December 6, 2023, Washington, DC.

proposal writing and source selection processes. Tracking the transition to Phase III awards is complicated given the many ways in which Phase I/II innovations can mature within the defense acquisition system, including through follow-on R&D awards, contracts for procurement of products or services, subcontracting activity executed by defense prime contractors, or direct commercial-sector investment.[9] These Phase III awards, especially those resulting from subcontracting and direct commercial investment, are not easily tracked using current government data sources and reporting systems.

Table 3-2 provides detail on each of the DOD services and components that offered Phase I and II SBIR/STTR awards in FY2023, including the number of awards, the service's or component's articulated mission, and the amount of money associated with the awards.[10] As discussed above, SBIR and STTR budgets are a percentage of extramural R&D. Detail on DOD R&D funding is shown in Figure 3-2.

Award Amounts

Each DOD service and component participating in the SBIR/STTR programs provides its own guidance on maximum award amounts within the maximum amounts established by SBA based on congressional legislation. SBA allows Phase II awards to exceed the maximum amounts by 50 percent without a waiver. From 2011 to 2021, most of DOD's Phase I funding amounts were either $100,000 or $150,000,[11] and most Phase II awards hovered around $1 million, with smaller peaks at around $1.5 million and above, indicating some variation in funding amounts. Looking at specific DOD services and components, the Assistant Secretary of the Army (Acquisition, Logistics and Technology) SBIR program, for example, issues Phase I awards with amounts up to $250,000 and Phase II awards up to $2 million (U.S. Army, n.d., para 2), whereas the Missile Defense Agency, a component much smaller than the Army, advertises lower maximum award amounts of $100,000 for Phase I and $1 million for Phase II (MDA, 2017). Until recently, AFWERX Phase I open topic proposals were limited to $50,000 (now $75,000) and its specified topics are eligible for Phase I awards of up to $150,000 (2F, 2022). In general, the majority of awards issued by DOD SBIR/STTR programs have been below the SBA threshold. As shown in Figures 3-3 and 3-4, the median award (indicated by the solid black line within each shaded rectangle) in many years is far below the maximum award size

[9] See Chapter 8 for additional discussion.
[10] Because the SBA database does not distinguish between Air Force and Space Force awards, these services are combined in the table. Additionally, the Office of Strategic Capital within OUSD(R&E) has recently started making awards.
[11] The SBIR/STTR Reauthorization Act of 2011 increased the limit on Phase I awards from $100,000 to $150,000 and on Phase II awards from $750,000 to $1,000,0000, indexed annually for inflation. As of October 2024, the adjusted amounts were up to $314,363 for Phase I awards and $2,095,748 for Phase II awards (including modifications) without a waiver being required (SBA, n.d., para 3).

TABLE 3-2 Overview of DOD Services and Components (Fiscal Year 2023)

Service/Component	Mission	SBIR/STTR Spending	Count of Phase I SBIR/STTR Awards	Count of Phase II SBIR/STTR Awards
Air Force (including Space Force)	To defend the United States and protect its interests through air and space power.	$1,198,302,906	997	669
Army	To deploy, fight, and win our nation's wars by providing ready, prompt, and sustained land dominance by Army forces across the full spectrum of conflict as part of the joint force.	$277,905,174	175	159
Navy	To maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas.	$255,349,990	412	200
Defense Advanced Research Projects Agency (DARPA)	To make pivotal investments in breakthrough technologies for national security.	$170,941,959	7	105
Missile Defense Agency	To develop and deploy a layered Missile Defense System to defend the United States, its deployed forces, allies, and friends from missile attacks in all phases of flight.	$84,731,009	37	52
Defense Health Program	To develop future technologies to improve warfighter health and survival.	$64,186,240	20	47
Special Operations Command	To provide rapid and focused acquisition, technology, and acquisition logistics support to Special Operations Forces Warfighters.	$43,231,780	23	26
Defense Logistics Agency	To drive and sustain Warfighter readiness by delivering unmatched global support as the Nation's Logistics Combat Support Agency.	$37,715,626	40	33

Office of the Secretary of Defense (OSD)	The OSD Transitions SBIR/STTR Technologies Program (OTST) may fund Phase II awards from other components.	$15,453,510	9	13
Defense Threat Reduction Agency	To deter strategic attack against the United States and its allies; to prevent, reduce, and counter weapons of mass destruction (WMD) and emerging threats; and to prevail against WMD-armed adversaries in crisis and conflict.	$13,832,899	24	9
Office for Chemical and Biological Defense	To anticipate and deter future threats by developing and delivering timely chemical and biological (CB) defense capabilities that enable a resilient Joint Force to prevail in CB-contested environments and protect the nation.	$13,830,926	19	18
National Geospatial-Intelligence Agency	To provide geospatial intelligence in support of national security objectives.	$7,868,511	0	7
Defense Microelectronics Activity	To deliver microelectronics solutions to meet DOD needs.	$7,588,105	12	4
Unlisted		$28,305,922	0	23
Total		$2,219,244,557	1,775	1,365

SOURCE: SBIR/STTR spending and counts from U.S. Small Business Association's SBIR/STTR Awards database (SBIR.gov).

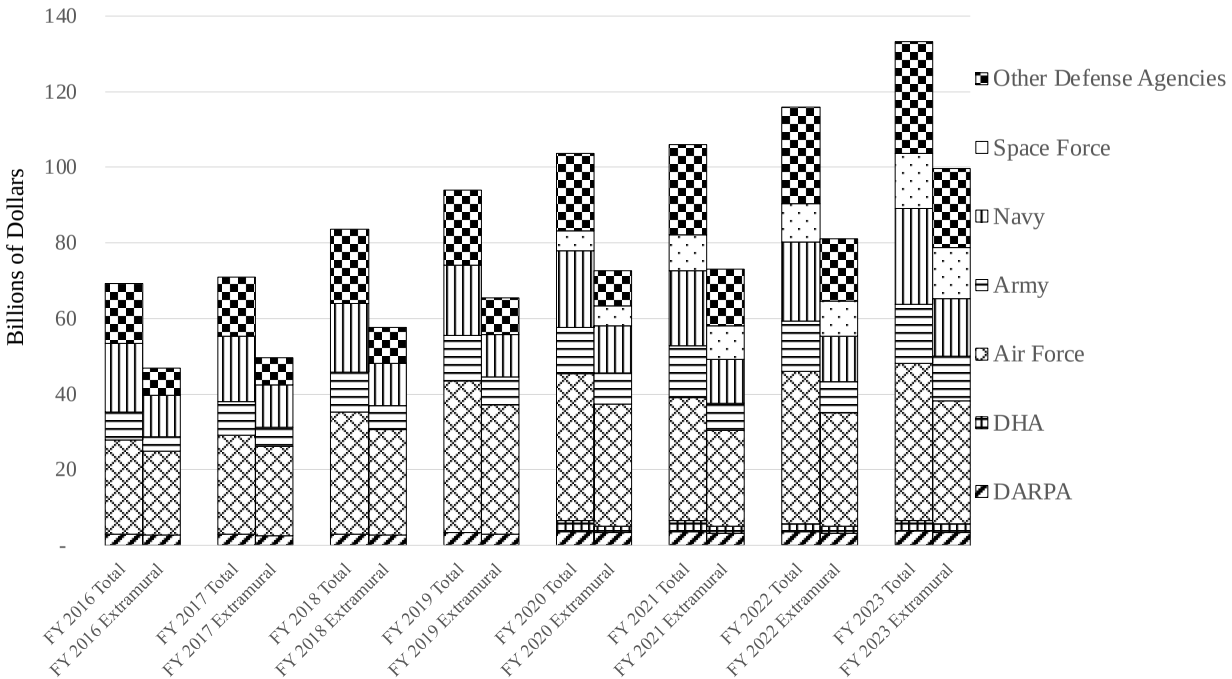

FIGURE 3-2 Defense total extramural research, development, test, and evaluation (fiscal years [FY] 2016–2023).
NOTES: The Space Force was established in December 2019. DARPA = Defense Advanced Research Projects Agency; DHA = Defense Health Agency.
SOURCE: Based on data from National Science Foundation, National Center for Science and Engineering Statistics. Survey of Federal Funds for Research and Development. See https://ncses.nsf.gov/surveys/federal-funds-research-development.

(indicated by the dashed red line) allowed by SBA without a waiver (programs are eligible to ask for a waiver from the SBA maximum). Award amounts have shown more variation in recent years, indicating tailoring of award sizes to actual small business and project requirements.

Contract Types

Different DOD services and components use different cost-based or fixed-price contract types but not other mechanisms, such as cooperative agreements and grants, for their SBIR/STTR awards (Figure 3-5). Each service uses a primary contract type for SBIR/STTR awards. In FY2021, for example, the Air Force used primarily cost-plus-fixed-fee contracts (79 percent of SBIR/STTR awards) to fund SBIR/STTR awards. The Army used cost-plus-fixed-fee (47 percent) and firm-fixed-price contracts (27 percent), while the Navy used cost-plus-incentive-fee contracts (64 percent). Some components, such as the Defense Threat Reduction Agency (DTRA), use purchase orders for Phase I awards to speed up the process. The Defense Advanced Research Projects Agency (DARPA) plans to adopt this practice as well. Figure 3-5 aggregates the data for all services and components and shows the variety of contract types used to fund SBIR/STTR awards.

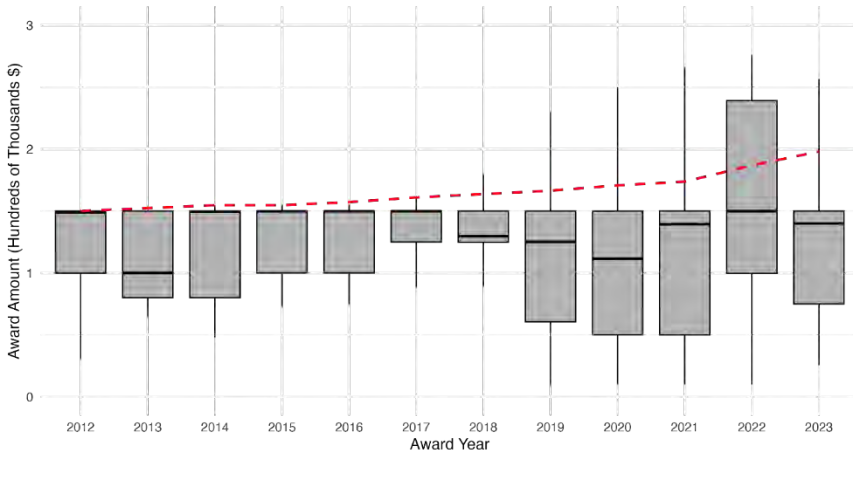

FIGURE 3-3 DOD SBIR/STTR Phase I award amounts, by year (fiscal years 2012–2023).
NOTES: Boxes depict the 25th–75th percentiles; solid line indicates the median; whiskers show 1.5x the interquartile range. Red dashed line depicts the maximum award amounts.
SOURCES: Committee calculations based on U.S. Small Business Association's (SBA's) SBIR/STTR Awards database (SBIR.gov). Maximum award amounts from SBA, SBIR/STTR policy directives (SBA, 2023, and earlier).

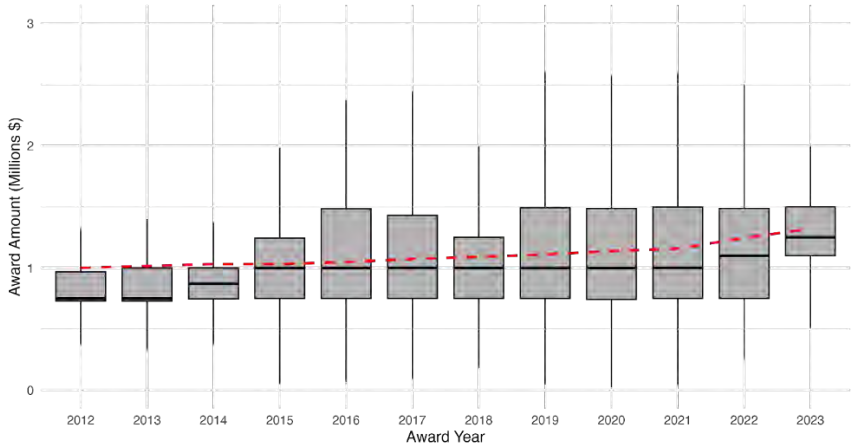

FIGURE 3-4 DOD SBIR/STTR Phase II award amounts, by year (fiscal years 2012–2023).
NOTES: Boxes depict the 25th–75th percentiles; solid line indicates the median; whiskers show 1.5x the interquartile range. Red dashed line depicts the maximum award amounts.
SOURCES: Committee calculations based on U.S. Small Business Association's (SBA's) SBIR/STTR Awards database (SBIR.gov). Maximum award amounts from SBA, SBIR/STTR policy directives (SBA, 2023, and earlier).

Cost contracts are typically used when the technical risk for contractors and project uncertainty and complexity are higher. Fixed-price contracts are more typically used when the scope and complexity of the work are well understood, and both the government and the contractor have a clear understanding of expectations and deliverables. Because typical Phase I and Phase II awards are limited in size and less complex than large defense systems acquisition programs, the reason for such frequent use of cost contracting methods is unclear, especially given the additional bureaucratic burden such contracts can create related to the delivery of cost and price data to the government, and the auditing of contractor activities. DOD, like most federal agencies, is congressionally mandated to issue awards no more than 180 days after the proposal submission deadline. The complexity of contracting may be limiting participation by small businesses that lack the dedicated staff to deal with the data reporting associated with federal contracts or limiting participation by research institutions that are more accustomed to paperwork involved with government grants.

DISTRIBUTION OF SBIR/STTR FUNDING AND AWARDS

Figure 3-6 shows SBIR/STTR spending for the five largest DOD services or components for the period FY2012–2023. The percentage set-asides

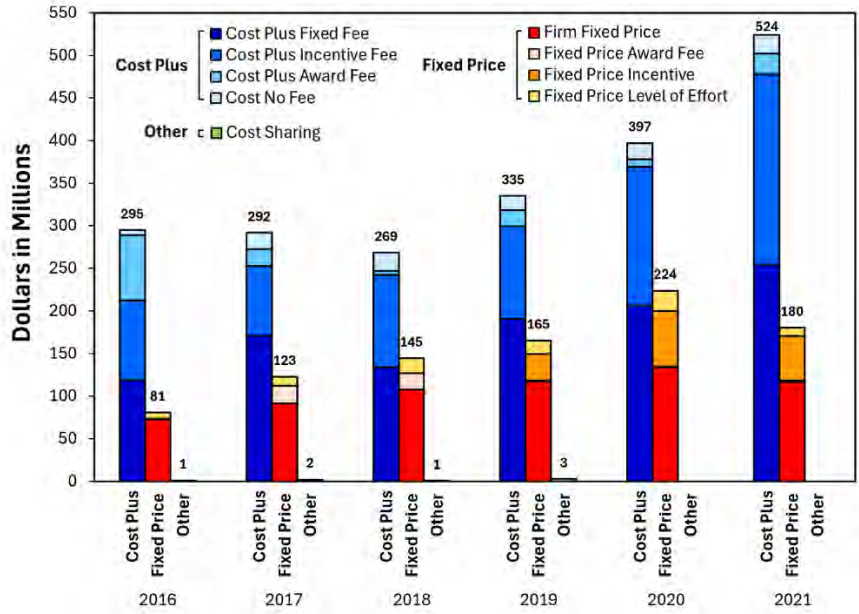

FIGURE 3-5 DOD SBIR/STTR awards, by contract type and by amount and year (fiscal years 2016–2021).
SOURCE: Committee calculations based on Federal Procurement Data System data (accessed via USASpending.gov).

have remained the same since FY2017, but increases or decreases in extramural R&D budgets have led to changes in spending on SBIR/STTR awards. The upward trend for the Air Force after FY2019 can be attributed in part to the creation of the Space Force, which SBA does not distinguish from the Air Force, and in part to increases in the Air Force's R&D budget; however, the committee was unable to determine whether the increase in FY2019 and decrease in FY2020 were due to a timing issue, a data integrity issue between DOD and SBA, or some other cause.

In FY2023, the Air Force and Space Force combined accounted for 54 percent of the total DOD SBIR/STTR funding, and the Army and Navy accounted for 12.5 percent and 11.5 percent, respectively (see Figure 3-7). DARPA represented another 7.7 percent and the MDA 3.8 percent, with the other DOD components collectively accounting for 10.5 percent.[12] Although DARPA has a

[12] According to DOD's SBIR/STTR website, 12 DOD services and components participate in the SBIR/STTR programs. In addition to the five mentioned, they are the Defense Health Agency, United States Special Operations Command, Defense Logistics Agency, Chemical and Biological Defense, Defense Microelectronics Activity, DTRA, and Office of the Secretary of Defense. See

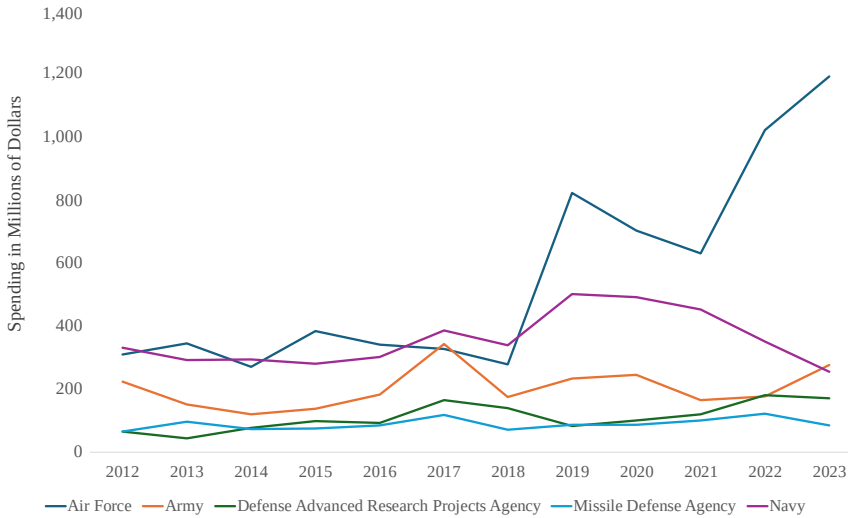

FIGURE 3-6 SBIR/STTR spending, by DOD service/component (fiscal years 2012–2023).
NOTE: All dollar amounts are adjusted to 2023 dollars using the Consumer Price Index (https://www.bls.gov/cpi/).
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov).

relatively small overall budget compared with the three services (Army, Navy, and Air Force), the bulk (90 percent) of its spending was dedicated to extramural R&D, which is the basis for the SBIR/STTR spending allocation (Gallo, 2021).

Figure 3-8 shows the distribution of Phase I and Phase II awards across DOD services and components for FY2023. The Air Force accounts for the largest share of awards, issuing approximately 1,000 Phase I and more than 650 Phase II awards during that year. The Navy and Army follow, though at a substantially lower scale, with each issuing fewer than half the number of Phase I awards issued by the Air Force. Other DOD agencies, including DARPA, MDA, and the Defense Health Program, account for a much smaller share of total awards, each issuing fewer than 150 Phase I awards and proportionally fewer Phase II awards.

https://www.defensesbirsttr.mil/About-Us/History/#Components. Application data from DOD also includes applications from National Geospatial-Intelligence Agency and the Office of Strategic Capital as well as applications to Space Force.

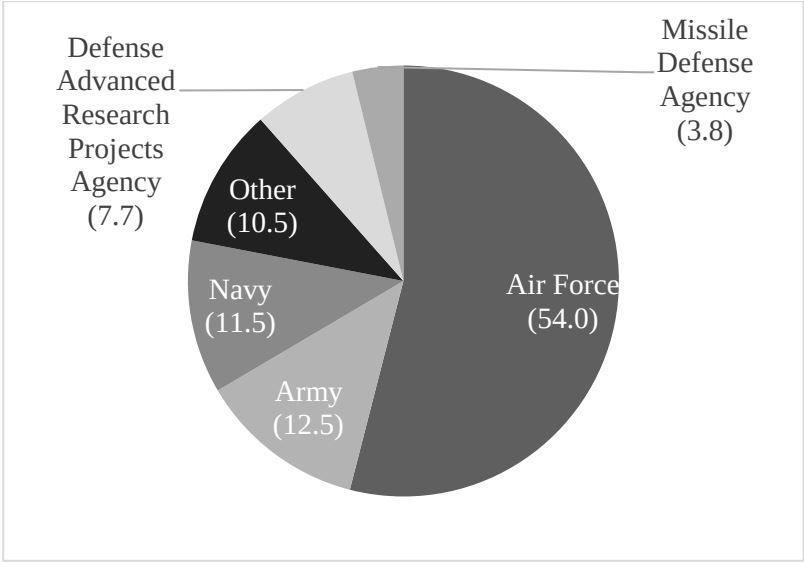

FIGURE 3-7 Percentage of total DOD SBIR/STTR funding, by service/component (fiscal year 2023).
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov).

Because of the size of the Air Force SBIR/STTR program and recent programmatic changes favoring open topics, Figures 3-9 and 3-10 take a close look at the Air Force programs, presenting trends in award amounts and number of awards over the FY2012–2023 period. As shown in Figure 3-9, Air Force Phase I funding ranged from $109.5 million in FY2012 to $75.3 million in FY2023. In FY2019, Phase I funding increased to $112.5 million, while Phase II funding rose sharply, from $251.6 million in FY2018 to $802.8 million in FY2019. Phase II funding eventually climbed to $995.6 million in FY2023.

Figure 3-10 presents the number of Phase I and Phase II awards in the Air Force SBIR/STTR programs during the FY2012–2023 period. Although the number of awards remained relatively stable between FY2012 and FY2018—with Phase I awards outnumbering Phase II awards—there was a sharp inflection point in FY2019. The Air Force introduced an open topic model for Phase I awards in FY2018, with small (originally $50,000 and now $75,000) awards. This change corresponded to a substantial increase in the number of Phase I awards offered by the Air Force and a decrease in the share of the Air Force's total SBIR/STTR spending going to Phase I awards. Phase I awards surged to 1,047 in FY2019, nearly tripling over the previous year. Although the number of Phase I awards declined somewhat in subsequent years, it remained high from FY2020 through FY2023. Phase II awards also increased, rising from 221 in FY2018 to 586 by FY2023.

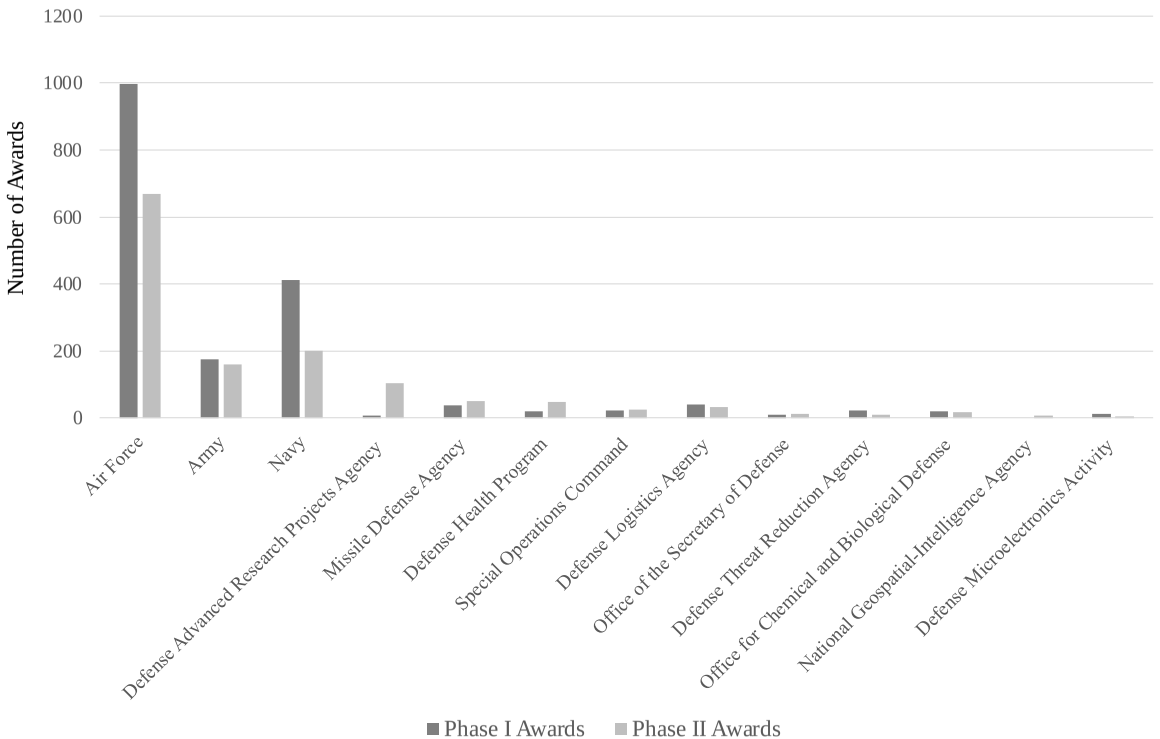

FIGURE 3-8 Number of DOD SBIR/STTR awards, by service/component (fiscal year 2023).
NOTE: Air Force includes Space Force awards.
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov).

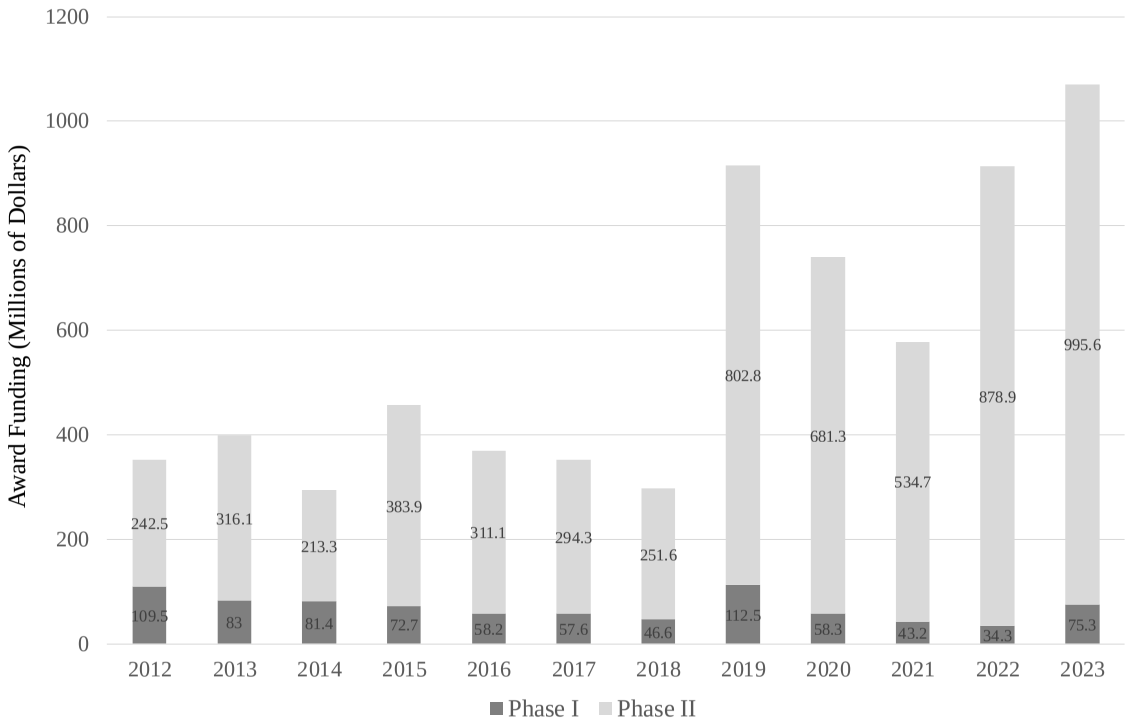

FIGURE 3-9 Air Force SBIR/STTR funding, by phase (fiscal years 2012–2023).
NOTE: All dollar amounts are adjusted to 2023 dollars using the Consumer Price Index (https://www.bls.gov/cpi/).
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov).

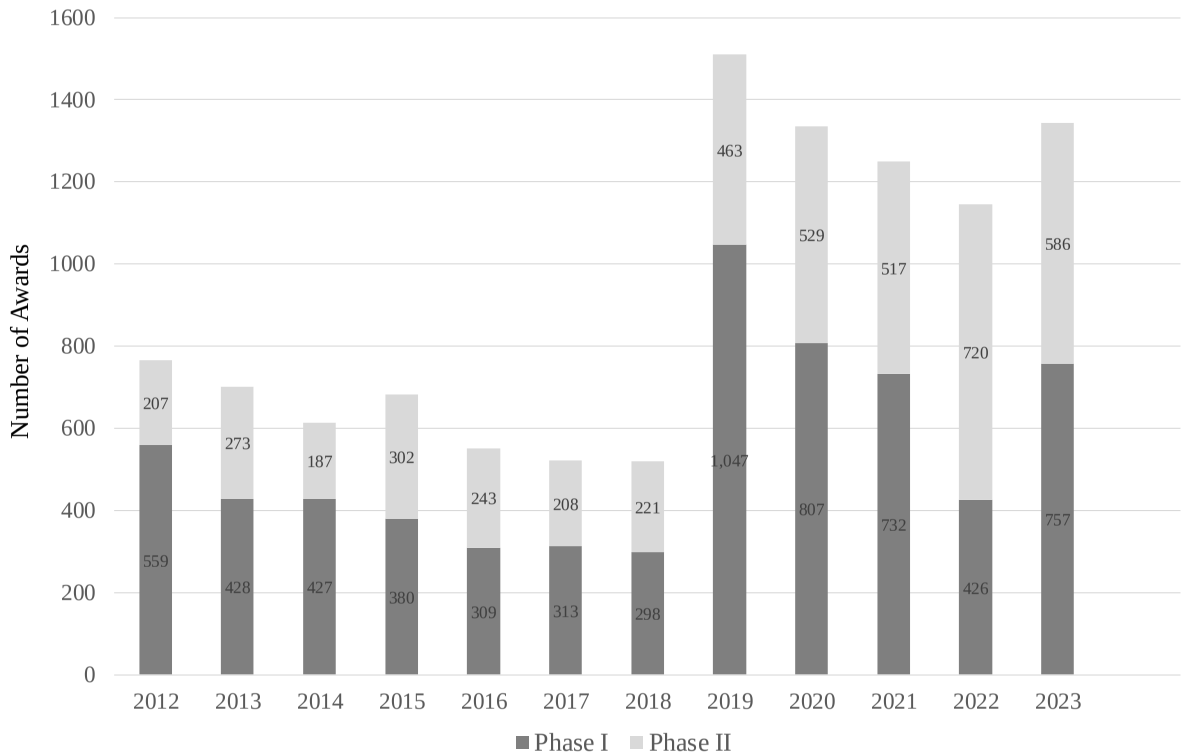

FIGURE 3-10 Number of Air Force SBIR/STTR awards, by phase (fiscal years 2012–2023).
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov).

Together, Figures 3-9 and 3-10 show a clear divergence: while the number of Phase I awards rose substantially after FY2018, Phase I funding remained low or declined, reflecting the Air Force's decision to issue a higher number of smaller, early-stage awards. In contrast, the number and total funding of Phase II awards both increased, signaling a growing emphasis on advancing selected technologies toward later-stage development. These trends reflect the Air Force's strategic pivot toward later-stage technology maturation and follow-on development, especially after the open topic Phase I solicitation model was introduced in FY2018. The result has been a declining proportion of total SBIR/STTR funds allocated to Phase I despite a high number of Phase I awards, signaling a reorientation of the program toward scaling promising innovations rather than expanding early-stage feasibility testing.

NEW ENTRANTS TO THE DOD SBIR/STTR PROGRAMS

New entrants to the SBIR/STTR programs play a critical role in introducing fresh ideas and novel approaches to government-sponsored innovation efforts. The committee examined differences across the largest SBIR/STTR programs within DOD to learn about their funding of firms and principal investigators that are new to the programs. The distinction between new firms and new principal investigators in the SBIR/STTR programs reflects the difference between organizational and individual entry into the innovation ecosystem. A *new firm* refers to a business that is funded by the program for the first time. These entrants are important for expanding the pool of innovative small businesses and enhancing competition within the program. In contrast, a *new principal investigator* is an individual—typically a scientist, engineer, or entrepreneur—who is serving as the lead on a proposal for the first time, even if the firm with which they are affiliated has participated in the program previously. New principal investigators bring fresh technical perspectives and help cultivate the next generation of R&D leadership. Importantly, a firm can be experienced while the principal investigator is new, and vice versa. Understanding this distinction is essential for evaluating how the program supports both organizational innovation and individual researcher development, and for designing policies that broaden participation at both levels.

Summary data for FY2012–2023 are presented in Table 3-3. The Air Force's movement to making a larger number of smaller Phase I awards has led to a substantial share of firms being first-time SBIR/STTR awardees over this period. For all the components included in the table, the percentage of first-time principal investigators was much higher than the corresponding percentage of new awardees. In the Navy's SBIR/STTR programs, for instance, only a small share (8 percent) of awardee firms were new to the programs, compared with more than one-third of principal investigators.

TABLE 3-3 New Entrants in the DOD SBIR/STTR Programs, by Service/Component (Fiscal Years 2012–2023)

Service/Component	Percentage of SBIR/STTR Awardee Firms That Were First-Time Awardees	Percentage of Principal Investigators That Were First-Time Participants in SBIR/STTR
Navy	8.2	34.4
Missile Defense Agency	5.4	28.0
Defense Advanced Research Projects Agency	19.7	43.6
Army	10.4	35.2
Air Force	22.4	41.6
Average	13.2	36.6

NOTE: Data are based on the first time that a firm or individual received any SBIR/STTR funding.
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov).

GEOGRAPHIC DISTRIBUTION OF AWARDEES

Analyzing the geographic distribution of SBIR/STTR spending is important because it provides insight into whether the programs are broadening access to federal innovation funding beyond traditional innovation hubs. Unlike other DOD contracts, which often are concentrated in established defense regions, or venture capital financing, which is heavily skewed toward coastal urban centers, SBIR/STTR programs are explicitly designed to support small businesses across the country. By comparing SBIR/STTR funding patterns with those of other DOD contracts and private venture capital, the committee could assess whether the SBIR/STTR programs are helping to reduce geographic disparities in innovation opportunity, fostering innovation capacity in underrepresented states and regions, and ensuring that national security R&D benefits from a more diverse and distributed supplier base.

Data for the top 10 states receiving DOD SBIR/STTR funding are reported in Figure 3-11, which compares the average annual percentage of total funding allocated to each state across three categories: SBIR/STTR funding, DOD R&D contracts and grants, and venture capital financing. California leads across all three categories, receiving more than 20 percent of SBIR/STTR and DOD R&D funding, and an even higher share of venture capital investment, underscoring its dominance in both public and private innovation financing. Massachusetts and Virginia also receive substantial shares of SBIR/STTR and DOD R&D funding, though their venture capital shares (particularly that of Virginia) are comparatively lower. Notably, states such as Ohio, Maryland, and Colorado receive a greater proportion of SBIR/STTR funding relative to their

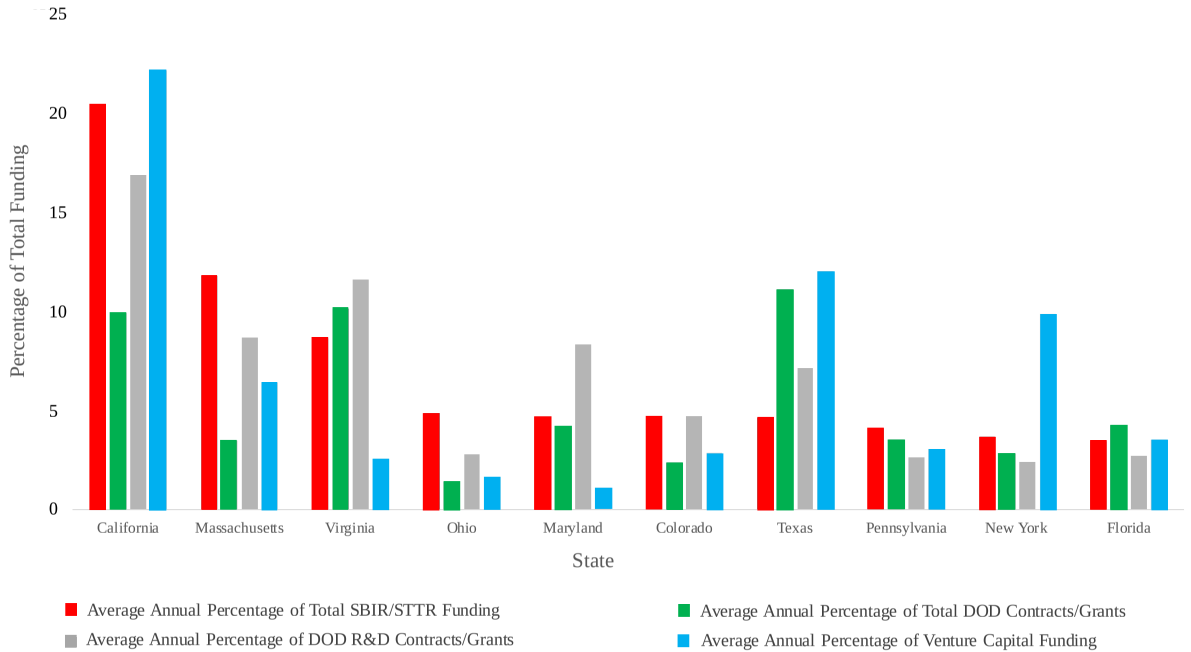

FIGURE 3-11 Impact of DOD's SBIR/STTR programs on geographic diversity of funding (fiscal years 2012–2023).
NOTE: All dollar amounts are adjusted to 2023 dollars using the Consumer Price Index (https://www.bls.gov/cpi/). R&D = research and development.
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov), matched by firm with data from USASpending.gov and Crunchbase.

share of venture capital investment, suggesting that SBIR/STTR may play a compensatory role in regions underrepresented in private capital markets. Conversely, states such as New York and Florida receive a larger share of venture capital funding than of federal R&D support. Overall, the figure suggests that while SBIR/STTR funding is still concentrated in leading innovation states, it is more geographically distributed than venture capital and may help fill funding gaps in states less dominant in defense contracting or private investment.

DOD's Office of Local Defense Community Cooperation produces an annual report highlighting spending in each state, but this report (*Annual Defense Spending by State*) does not break down SBIR/STTR spending in each state. The analysis done by the committee is based on the SBA dataset of awardees and does not reflect any subcontracting or research partnering by SBIR/STTR firms (in other words, the entirety of the SBIR/STTR award is attributed to the state in which the small business has an address). A more comprehensive picture of SBIR/STTR funding would more fully illustrate the geographic diversity of SBIR/STTR funding relative to other DOD funding or venture capital funding.

Table 3-4 presents an overview of the distribution of Phase I and initial Phase II SBIR/STTR awards and funding across U.S. states, normalized by population to reveal the relative intensity of support. Per capita metrics are especially useful for comparing innovation intensity across regions, revealing undertapped areas with potential for greater engagement in federal R&D initiatives. Nationally, nearly 30,000 Phase I and Phase II SBIR and more than 5,500 STTR awards were made, amounting to more than $1.8 billion and $2.6 billion, respectively, in 2023 inflation-adjusted dollars. On a per capita basis, this translates to about 8.7 SBIR awards and 1.6 STTR awards per 100,000 residents.

At the state level, Massachusetts was the leader by nearly every metric during the FY2012–2023 period. It had 47.4 SBIR and 8.6 STTR awards per 100,000 residents and demonstrated an extraordinarily dense concentration of federal innovation funding. Colorado, Virginia, Maryland, and New Hampshire also ranked highly on both absolute and per capita measures, reflecting strong DOD research and innovation ecosystems.

New Hampshire, despite its small size, had 34 SBIR awards per 100,000 residents—four times the national average—pointing to a highly competitive innovation sector relative to its population. In contrast, states such as Mississippi, North Dakota, and Iowa received notably fewer awards and less funding per capita. For example, Mississippi had just 0.7 SBIR and 0 STTR awards per 100,000 people, well below national averages.

Some small states and territories, such as Hawaii, Delaware, and Washington, DC, received disproportionately high levels of SBIR/STTR investment relative to their populations. For example, Washington, DC, received more than 20 SBIR awards and 2.5 STTR awards per 100,000 residents, placing it among the highest in the country on this measure.

TABLE 3-4 State Distribution of DOD SBIR and STTR Awards and Funds (Fiscal Years 2012–2023)

	2023 Population	Total Number of DOD Awards		Total DOD Award Dollars		Number of DOD Awards Per 100,000 Capita		Total DOD Award Dollars Per Capita	
State		SBIR	STTR	SBIR	STTR	SBIR	STTR	SBIR	STTR
AK	736,510	8	4	3,653,350	1,444,174	1.1	0.5	5.0	2.0
AL	5,117,673	860	200	539,686,119	97,306,784	16.8	3.9	105.5	19.0
AR	3,069,463	36	13	21,658,125	4,871,818	1.2	0.4	7.1	1.6
AZ	7,473,027	543	134	320,350,958	58,009,929	7.3	1.8	42.9	7.8
CA	39,198,693	6,083	887	3,804,154,455	441,183,181	15.5	2.3	97.0	11.3
CO	5,901,339	1,392	235	872,271,979	109,845,687	23.6	4.0	147.8	18.6
CT	3,643,023	287	44	167,846,158	19,545,992	7.9	1.2	46.1	5.4
DC	687,324	139	17	80,425,018	6,104,338	20.2	2.5	117.0	8.9
DE	1,036,423	129	38	76,651,429	18,654,476	12.4	3.7	74.0	18.0
FL	22,904,868	1,078	190	645,574,117	81,662,469	4.7	0.8	28.2	3.6
GA	11,064,432	279	74	233,227,704	32,627,931	2.5	0.7	21.1	2.9
HI	1,441,387	256	34	197,158,749	17,289,846	17.8	2.4	136.8	12.0
IA	3,218,414	27	7	16,122,626	2,528,028	0.8	0.2	5.0	0.8
ID	1,971,122	65	12	31,750,813	4,158,256	3.3	0.6	16.1	2.1
IL	12,642,259	405	140	237,710,591	72,119,853	3.2	1.1	18.8	5.7
IN	6,880,131	219	54	142,182,184	24,905,708	3.2	0.8	20.7	3.6

(Continued)

TABLE 3-4 Continued

State	2023 Population	Total Number of DOD Awards		Total DOD Award Dollars		Number of DOD Awards Per 100,000 Capita		Total DOD Award Dollars Per Capita	
		SBIR	STTR	SBIR	STTR	SBIR	STTR	SBIR	STTR
KS	2,951,500	62	27	34,258,138	11,381,774	2.1	0.9	11.6	3.9
KY	4,550,595	83	33	32,668,168	16,214,651	1.8	0.7	7.2	3.6
LA	4,588,071	85	25	75,841,671	5,553,798	1.9	0.5	16.5	1.2
MA	7,066,568	3,349	608	2,144,618,237	303,433,417	47.4	8.6	303.5	42.9
MD	6,217,062	1,398	290	811,023,321	136,422,260	22.5	4.7	130.5	21.9
ME	1,399,646	29	4	21,738,892	514,270	2.1	0.3	15.5	0.4
MI	10,083,356	621	117	371,314,850	61,815,518	6.2	1.2	36.8	6.1
MN	5,753,048	238	36	136,727,268	14,990,500	4.1	0.6	23.8	2.6
MO	6,208,038	118	17	67,798,870	10,932,380	1.9	0.3	10.9	1.8
MS	2,943,172	22	0	11,138,080	0	0.7	0.0	3.8	0.0
MT	1,131,302	62	15	39,710,671	7,506,769	5.5	1.3	35.1	6.6
NC	10,881,189	528	103	329,105,648	52,577,445	4.9	0.9	30.2	4.8
ND	789,047	4	2	1,526,124	1,073,214	0.5	0.3	1.9	1.4
NE	1,987,864	31	5	26,118,868	3,020,741	1.6	0.3	13.1	1.5
NH	1,402,199	477	74	296,531,299	35,383,144	34.0	5.3	211.5	25.2
NJ	9,379,642	615	119	369,315,900	47,076,647	6.6	1.3	39.4	5.0
NM	2,121,164	401	102	250,519,511	54,835,752	18.9	4.8	118.1	25.9
NV	3,214,363	83	16	45,117,759	9,741,571	2.6	0.5	14.0	3.0
NY	19,737,367	1,075	219	652,211,410	113,930,138	5.4	1.1	33.0	5.8

OH	11,824,034	1,420	389	861,872,858	158,293,755	12.0	3.3	72.9	13.4
OK	4,063,882	88	38	47,564,447	13,347,672	2.2	0.9	11.7	3.3
OR	4,253,653	206	35	134,153,754	18,176,674	4.8	0.8	31.5	4.3
PA	13,017,721	1,112	170	794,586,511	72,517,884	8.5	1.3	61.0	5.6
RI	1,103,429	133	20	77,873,455	7,823,612	12.1	1.8	70.6	7.1
SC	5,387,830	74	12	42,969,669	5,661,795	1.4	0.2	8.0	1.1
SD	918,305	24	17	14,859,974	6,498,166	2.6	1.9	16.2	7.1
TN	7,148,304	156	43	87,212,668	17,269,771	2.2	0.6	12.2	2.4
TX	30,727,890	1,566	329	837,270,105	145,952,008	5.1	1.1	27.2	4.7
UT	3,443,222	296	59	230,441,826	26,731,793	8.6	1.7	66.9	7.8
VA	8,734,685	2,415	423	1,605,364,238	197,129,039	27.6	4.8	183.8	22.6
VT	648,708	56	8	38,207,934	4,986,500	8.6	1.2	58.9	7.7
WA	7,857,320	342	57	188,578,746	33,182,977	4.4	0.7	24.0	4.2
WI	5,930,405	77	34	42,783,592	19,268,693	1.3	0.6	7.2	3.2
WV	1,770,495	45	17	31,348,420	5,318,187	2.5	1.0	17.7	3.0
WY	585,067	49	7	30,314,579	2,998,159	8.4	1.2	51.8	5.1
National	336,806,231	29,146	5,553	18,173,111,835	2,613,819,142	8.7	1.6	54.0	7.8

NOTES: Both Phase I and Phase II SBIR and STTR awards are included. All dollar values adjusted for inflation, with 2023 as base year (https://www.bls.gov/data/inflation_calculator.htm).
SOURCES: Committee calculations based on award data from SBA's SBIR/STTR Awards database (SBIR.gov). Population data are drawn from U.S. Census Bureau projections for 2020–2024 (https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-total.html).

For further perspective, Figure 3-12 compares average DOD SBIR/STTR funding per capita and average venture capital funding per capita across U.S. states for FY2012–2023. Because California, New York, and Massachusetts had high levels of venture capital funding and received many DOD SBIR/STTR awards, they are omitted from the chart to show detailed information for the remaining states.

The diagonal line in Figure 3-12 serves as a reference indicating the trend relationship between venture capital and DOD SBIR/STTR funding. This line reveals a general correlation: states with higher venture capital funding per capita also tend to receive more SBIR/STTR funding per capita. This trend suggests that these programs are complementary rather than substitutes. It is likely that underlying conditions that make a state able to succeed in attracting public funding for R&D, such as having a strong science and engineering workforce or high-quality research institutions, are likely to make the state attractive to private-sector innovation funding as well. Moreover, while this analysis points out only the positive relationship between public and private innovation funding, previous research has shown that public funding can create large innovation spillovers that lead to new firm formation and growth; this, in turn, can attract follow-on private-sector investments (Gross and Sampat, 2023a).

However, this upward trend is not uniform. States above this line, such as New Hampshire, Virginia, and Maryland, receive high SBIR/STTR funding despite modest venture capital investment, suggesting that federal programs may play a more significant role in supporting innovation in those states. Conversely, states such as Connecticut and Nevada exhibit relatively high venture capital funding but lower SBIR/STTR participation. Notably, Washington, DC, stands out with both the highest per capita venture capital and SBIR/STTR funding, reflecting its high density of federal defense contractors. Overall, the figure underscores the complementary yet uneven roles of public and private capital in regional innovation systems.

Some states are clustered in the bottom left corner of Figure 3-12. These states, such as Mississippi, Arkansas, and West Virginia, receive relatively little funding from either source, highlighting persistent regional disparities in innovation finance. Others, such as Ohio and Rhode Island, stand out well above the trend line, indicating that they receive disproportionately high levels of SBIR/STTR funding relative to their venture capital funding. Similarly, Wyoming and South Dakota also perform well in terms of federal support, despite limited venture capital presence. In contrast, states such as Georgia and Minnesota fall below the line, receiving less SBIR/STTR funding than might be expected given their venture capital activity. These regional disparities in SBIR/STTR funding across states could be addressed by focusing on building capacity, improving access, and targeting support to underrepresented regions.

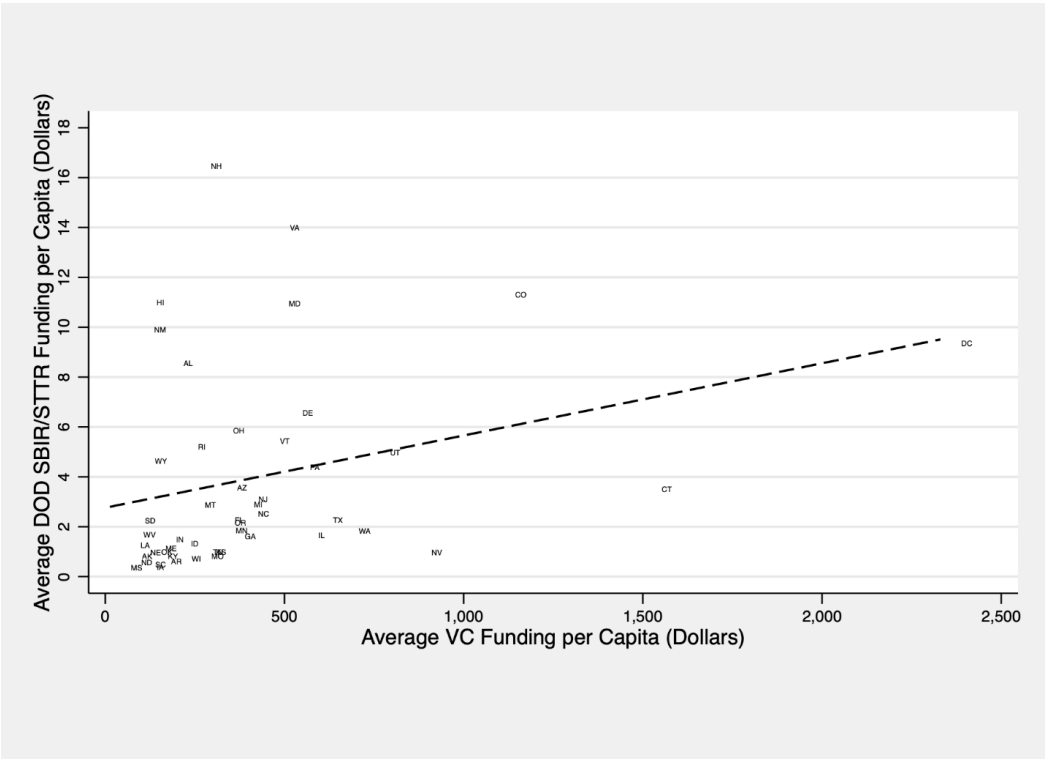

FIGURE 3-12 Relative levels of venture capital (VC) and DOD SBIR/STTR funding, by state (fiscal years 2012–2023).
NOTES: Includes trend line. Chart excludes California, New York, and Massachusetts.
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov), matched by firm with data from Pitchbook.

SUMMARY

DOD's SBIR and STTR programs show evidence of bringing new entrants into the defense innovation system. Notably the Air Force and Space Force combined now account for more than half of DOD's SBIR/STTR awards, and the large number of smaller Phase I awards offered by the Air Force and Space Force has increased the number of small businesses that are new to the programs. At the same time, the other services and DARPA are awarding SBIR/STTR contracts to a large proportion of principal investigators that are new to the programs, although they may be working in more experienced small businesses.

DOD's SBIR/STTR programs do appear to help diversify the geographic base of the defense innovation ecosystem, although more transparency in reporting would help policy makers fully understand the impact of the programs in their state. Importantly, the positive relationship between per capita venture capital funding and per capita DOD SBIR/STTR funding indicates that these programs are complementary. At the same time, the committee's analysis showed that DOD's SBIR/STTR programs do help diversify the defense innovation ecosystem. Some states, such as Ohio, receive a relatively large share of DOD SBIR/STTR funding compared with their share of other DOD R&D funding or venture capital funding. Additionally, states such as Maryland, Virginia, and New Hampshire, which do not receive a large share of venture capital funding, do receive a larger share of DOD SBIR/STTR funding.

FINDINGS AND RECOMMENDATIONS

Finding 3-1: It is difficult to link Phase I and Phase II awards because DOD SBIR/STTR award data available through the Small Business Administration database do not provide consistent identifiers for projects across the phases.

Finding 3-2: DOD's SBIR/STTR programs improve the geographic diversity of the defense supply chain, but more could be done to understand and diversify the geographic reach of the programs.

Finding 3-3: States underserved by venture capital markets benefit from the DOD SBIR/STTR programs.

Recommendation 3-1: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering, working with the Under Secretary of Defense (Comptroller), should develop information systems to provide greater fidelity and precision for the tracking of DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards, and a single, public portal to access and sort this information. This portal should link awards from Phase I to

Phase II to Phase III in a consistent, clear format. These actions would provide the foundation for improving the programs' effectiveness and efficiency, as well as communicating the value of DOD SBIR/STTR awards.

Recommendation 3-2: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering, working with the Under Secretary of Defense (Comptroller), should ensure that the DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards database includes subcontracting activity to SBIR/STTR awardees, whether from prime contractors or defense subcontractors.

4

DOD's SBIR/STTR Processes

This chapter reviews the Department of Defense's (DOD's) processes for executing the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs, including such activities as proposal solicitation, outreach, selection of awardees, and support for awardees during their participation in the programs across the military services and component agencies that administer the awards.[1] The chapter provides a detailed assessment of the overall application and award process. This description includes a comparison of internal topic development and recent initiatives (most notably at the Air Force) to introduce an open topics approach for a subset of awards. As well, the chapter describes some key domains in which opportunities for change might be efficacious, particularly with regard to administrative burdens associated with Foreign Influence Due Diligence, enhanced scrutiny of experienced firms, and issues related to contract types and strictures concerning both minimum and maximum award sizes for both Phase I and Phase II awards.

The principal sources of data for this chapter were discussions between committee members and SBIR/STTR program managers and staff from each of the DOD services and components that issue SBIR/STTR awards, based on a list of program managers for each military service or component provided by the DOD Office of Small Business Programs. A list of interviewees and their offices is provided in Appendix C of this report. These program managers oversee the processes and procedures in the programs and rely on technical experts within each service or component to determine specific research topics and monitor the small businesses' performance. Each discussion followed a similar protocol (also

[1] As of 2025, 15 military services and component agencies offer SBIR/STTR awards (Air Force, Space Force, Army, Navy, Defense Advanced Research Projects Agency, Missile Defense Agency, Defense Health Agency, United States Special Operations Command, Defense Logistics Agency, Defense Threat Reduction Agency, Chemical and Biological Defense Command, National Geospatial-Intelligence Agency, Defense Microelectronics Activity, and Office of Strategic Capital, as well as the Office of the Secretary of Defense). However, this chapter focuses on the 10 services/components listed in Appendix C of this report.

found in Appendix C) and lasted approximately 60–90 minutes. Additional data and background information were obtained from the DOD websites, from discussions with the Office of the Under Secretary for Research and Engineering (OUSD[R&E]), former DOD procurement and technical points of contact, SBIR and STTR awardees, prime contractors, investors, and other entrepreneurs (see, e.g., NASEM, 2024). The committee acknowledges that DOD's SBIR/STTR processes and procedures may have changed during the course of this study. For example, program solicitations are offered monthly as of fiscal year (FY) 2025, and the central SBIR/STTR oversight office has been rebranded as the Office for Small Business Innovation.

A central finding of the chapter is that, although many broad rules and policies apply across the different DOD services and components, each has substantial autonomy (and initiative) in program emphasis and administrative orientation to best serve its mission. For example, program officers vary significantly as to whether they prioritize enhancing the resilience and capabilities of the defense industrial base versus enabling the introduction of novel technologies, whether they seek to leverage SBIR/STTR as an opportunity within their component to support agency modernization goals, and whether they are concerned primarily with satisfying their SBIR/STTR obligations in a compliant and responsible manner. These differences in program emphasis and administrative orientation offer insight into the types of outputs resulting from the programs across the different services/components, and they also provide a sense of the breadth of management styles and practices that are possible within the programs under current statute, regulation, policy, and practices.

ORGANIZATION OF DOD'S SBIR AND STTR PROGRAMS

Figure 4-1 is an organizational chart for DOD's SBIR/STTR programs. While the autonomy and variation among services/components noted above is substantial, the OUSD(R&E) SBIR/STTR Office oversees and coordinates aspects of the programs across DOD. Specifically, that office oversees the DOD SBIR and STTR programs through the following activities:

- Serves as the primary contact for Congress, the Small Business Administration (SBA), the Government Accountability Office (GAO), and the interagency SBIR/STTR community.
- Publishes SBIR/STTR topics from across DOD through Broad Agency Announcements (BAAs) and Commercial Solutions Openings (CSOs).
- Oversees the development, maintenance, and enhancement of the Defense SBIR/STTR Innovation Portal in collaboration with the participating DOD services/components.
- Establishes and maintains a web presence where DOD and other government, industry, and academic personnel can find useful and relevant information about DOD's SBIR/STTR programs.

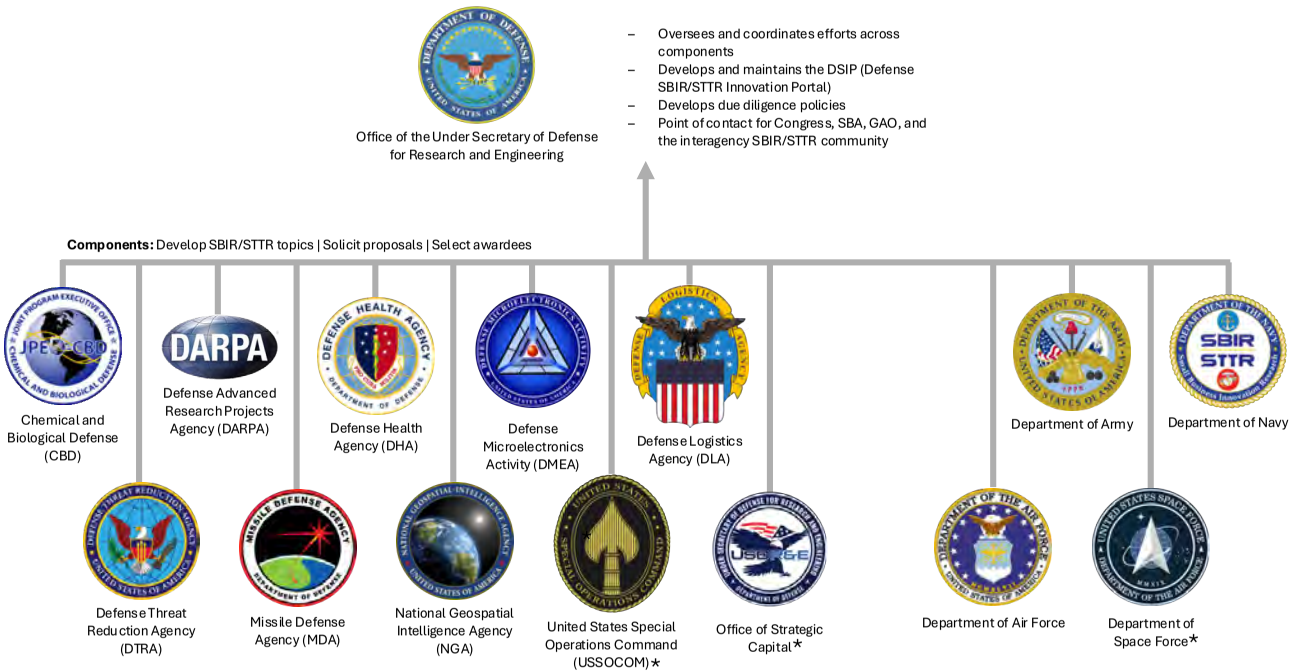

FIGURE 4-1 DOD SBIR/STTR program organizational chart.
NOTE: Asterisks identify services and components that did not have a representative meet with the committee. GAO = Government Accountability Office; SBA = Small Business Administration.

- Prepares the policy and guidance documents resulting from new mandates in legislation, such as the annual National Defense Authorization Act and the 2022 SBIR/STTR Extension Act. These documents include guidance on foreign risk management, open topics, increased minimum performance standards for experienced firms, multiple-award recipients, and more.
- Meets regularly with SBIR/STTR program managers in the services and components to share challenges and ideas. In discussions with the committee, some service/component representatives mentioned holding monthly meetings to discuss challenges.
- Coordinates with services and components to conduct program outreach and inreach across DOD, in addition to the outreach conducted by the individual programs. One DOD component representative described OUSD(R&E)'s outreach to traditional venues while that component focused on nontraditional venues.
- Manages the Office of the Secretary of Defense (OSD)–level Transition and Commercialization Program.
- Manages the execution of OSD's SBIR/STTR extramural and administrative budgets.

Beyond these functions of the OUSD(R&E) SBIR/STTR Office, DOD's SBIR/STTR programs are executed by individual offices and personnel across each of the services and components.

Many but not all DOD services/components participate in the SBIR/STTR programs. For example, agencies within the Intelligence Community (IC)[2] are exempt from mandatory participation in the programs (see Box 4-1).[3] The National Geospatial-Intelligence Agency (NGA) is the only IC member that participates in the programs, finding them valuable enough to warrant voluntary participation.[4]

Given the myriad objectives of DOD's SBIR/STTR programs—enhancing the nation's defense capability through innovation, building the defense–industrial complex, enhancing warfighting capabilities, increasing private–sector commercialization of federal research and development (R&D), and leveraging the inventiveness of the entrepreneurial ecosystem—the SBIR/STTR program managers must balance (and resolve conflicts between) these objectives. Specifically, as described in more detail below, in the process of implementing the SBIR/STTR programs, DOD executive officers and program managers orient implementation of the SBIR/STTR programs in the manner they deem best suited to their service's/component's unique mission and needs. The

[2] See https://www.dni.gov/index.php/what-we-do/members-of-the-ic.
[3] The Intelligence Community is considered exempted from the requirement to execute SBIR/STTR programs under 15 U.S.C., Section 638(e)(2).
[4] See https://media.defense.gov/2023/Aug/22/2003285640/-1/-1/0/OSD-NGA_SBIR_233.PDF.

BOX 4-1
Extending DOD's SBIR/STTR Programs to Intelligence Agencies and National Nuclear Security Administration

The National Geospatial-Intelligence Agency (NGA) is currently the only intelligence agency with dedicated SBIR/STTR programs, funding Phase I awards. The Office of the Under Secretary of Defense for Research and Engineering (OUSD[R&E]) provides the necessary funding for NGA Phase II awards. However, it is noteworthy that the Department of Energy's National Nuclear Security Administration (NNSA), funded largely by DOD, as well as other intelligence agencies, including those within DOD, receive waivers from participation in the SBIR/STTR programs.

As the landscape of intelligence and nuclear security continues to evolve, shaped by emerging threats and cutting-edge technologies, small businesses in the commercial sector are increasingly at the forefront of innovation in this domain. An illustrative example is Sandia National Laboratories, a government-owned, contractor-operated entity under the Department of Energy that has become a significant recipient of DOD STTR funding, while also receiving extensive noncompetitively awarded funding from many organizations within DOD and the Intelligence Community (IC). This example underscores the overlapping missions of the DOD SBIR/STTR programs and the IC and NNSA.

Small businesses often have the agility and cost-effectiveness to deliver innovative capabilities more efficiently and at significantly lower cost compared with national laboratories and large defense contractors. Given that DOD is successfully using the SBIR/STTR programs to tap into small business innovation to support broad defense missions, it stands to reason that similar opportunities could be explored for intelligence and nuclear missions.

result is the differences in how the programs operate noted earlier. Some DOD SBIR/STTR programs operate at early-stage research levels (Technology Readiness Levels [TRLs] 1–3), while others operate at the levels of applied R&D (TRLs 4–6). Most of the programs manage portfolios with a range of readiness levels.

Program managers can be critical to the success of small businesses participating in the SBIR/STTR programs. Program managers come from a variety of educational backgrounds, although, unlike other federal agencies, DOD SBIR/STTR program managers do not have tend to have advanced technical degrees (only one program manager had a PhD in engineering). Instead, most have some management education; at the same time, there appears to be a lack of hands-on expertise with startups. This gap can result in limitations on the kinds of support program managers can provide for small businesses as they participate in the SBIR/STTR programs.

There appears also to be no standardized training for SBIR/STTR program managers across the services and components. Some services/components have thorough training for their program managers, while others have none, potentially contributing to inconsistent support for small

businesses. Given the inexperience of SBIR/STTR program managers in working with small businesses, implementing standardized DOD training and sharing best practices focused on the needs of small businesses could enhance the overall effectiveness of the programs, equipping program managers with the skills necessary to better address small business concerns.

DOD'S SBIR/STTR APPLICATION AND AWARD PROCESS

To understand how DOD services/components implement the SBIR/STTR programs and how differences manifest across components, it is useful first to understand the overall process by which applications are solicited, the award process, and the potential for "transition" and follow-on funding and development. The committee's analysis uncovered important differences in these processes across the DOD services/components.

Topic Development

The first step in the overall SBIR/STTR process is developing the topics that form the basis of the program's solicitations. In most cases, a technical point of contact (TPOC) leads the development of an SBIR/STTR-specific topic and implementation of the solicitation, source selection, and program execution processes. The specific terminology for these processes varies across programs; in the Army, for example, topics are called projects, and technology broker teams lead their development, selection, and implementation.

Topic development typically involves contributions from military and civilian employees, who are encouraged to submit suggestions and ideas. In some instances, programs may seek input from other DOD agencies. Prioritization of these topics occurs through collaborative discussions within and across programs.

Topic development practices vary among participating DOD services/components. For example, the Defense Health Agency (DHA) actively solicits feedback from at least one military service. Representatives of several services/components, such as the Air Force and Missile Defense Agency (MDA), mentioned inviting prime contractors to provide input on potential topics. The Defense Advanced Research Projects Agency's (DARPA's) topic approval process involves discussions with peers and approval by DARPA's deputy director.

While DOD laboratories are actively engaged in brainstorming ideas for DOD SBIR/STTR topics, other federal labs, such as those of the National Aeronautics and Space Administration (NASA), the National Institute of Standards and Technology, and the Department of Energy, are typically not included in the topic development process. Similarly, DOD labs are not asked to provide input into the topic selection of other agencies, even though they employ the largest federal technical workforce, have significant technical and engineering expertise, and possess a strong knowledge of potential military applications of commercial technologies.

The nature of topics can vary significantly. Some are highly specific and designed with acquisition in mind, targeting defined customers, with the intent of seamlessly funding projects from Phase I into Phase II and subsequent follow-on. MDA, for example, focuses on identifying mission capability gaps or technological needs. In contrast, the Defense Logistics Agency (DLA) derives its topics from immediate needs expressed by DLA personnel in the field, reflecting a more urgent acquisition focus on addressing current operational needs. Other topics are broader, aimed at exploration and learning, leading to numerous Phase I awards with less concern for direct transition into acquisition programs or operational use.

Topic development typically takes from 2 months for small organizations, such as the Chemical and Biological Defense Command (CBD) and Defense Threat Reduction Agency, to 3–4 months for larger services and components. The SBIR topic development cycle occurs every year, while the STTR cycle takes place every other year for some components, such as CBD.

While topic development has mostly followed the process described above, in June 2018 the Air Force's innovation arm, AFWERX, began an initiative to experiment with an alternative approach to attracting proposals: open topics. Open topics are intended to solicit R&D proposals submitted by companies that address a critical technology area, instead of requiring companies to propose projects in response to technology-specific or mission area–specific topic areas developed by DOD services/components. According to the committee's discussions with program personnel, the process was designed to

- attract new small businesses,
- deliver technology solutions faster,
- give companies more flexibility in proposing solutions,
- accelerate R&D, and
- showcase commercial products that could be adapted for DOD.

Within the Air Force, the open topics process has largely replaced that service's conventional approach of identifying specific problems and mission needs as the basis for solicitations.

One rationale cited for the use of open topics is to increase the number of new firms submitting SBIR/STTR proposals to DOD. Howell and colleagues (2025) found that the use of open topics in the Air Force increased the adoption of new technologies and attracted new firms to the defense industrial base. In its report *AFWERX 2.0*, the Air Force states that it added "more than 2,200 new companies to the AFWERX portfolio since the Open Topic approach launched" (AFWERX, 2022, p. 8).

Given the perceived salutary impact of open topics within AFWERX, Congress mandated in 2022 that SBIR/STTR programs at all federal agencies conduct at least one open topics competition annually. This requirement appears in Section 7 of the SBIR and STTR Extension Act of 2022 and was implemented

in FY2023 for all DOD SBIR/STTR programs. The DOD-issued BAA notes that small businesses may submit only one proposal under each open topic solicitation (SBIR Program, 2024, p. 7). OUSD(R&E) created and disseminated guidance on SBIR/STTR open topics to provide a framework for meeting the intent of the statutory requirement while allowing flexibility for each service and component to structure its open topic process in a streamlined manner.[5]

The committee specifically considered the open topics approach first pioneered within AFWERX and expanded across other services/components. In response to the open topics mandate and OUSD(R&E) guidance, each service and component uses a different approach to implementing the program. Larger organizations, such as the Air Force's AFWERX, reported significant benefits in identifying and using dual-use technologies to benefit the warfighter (Howell et al., 2025), and AFWERX has increased the number of open topic solicitations each year, now issuing four—two for SBIR and two for STTR. Midsize programs, such as that of MDA, say that using open topics causes some difficulty, but provides the benefit of encouraging more nontraditional (to DOD) small companies to apply. One smaller component (CBD) had similar experience in attracting a broader range of firms applying to the program, and it received a number of proposals similar to that for traditional topics (12–30 proposals). As a result, it held two open topic competitions in 2024.

Smaller components raised concern that the number of proposals received in response to open topic solicitations exceeded their capacity to review and evaluate them. They noted significant challenges with the open topic mandate, including having difficulty finding technical evaluators for the proposals, receiving a large number of proposals that are difficult to evaluate, or receiving large numbers of proposals incompatible with their organizational requirements and technology needs. Since proposals submitted under open topic solicitations are not always naturally aligned with an existing defense technology gap or mission need, and therefore not naturally aligned with a transition partner, these programs may be challenged to gain traction in transitioning efforts from SBIR/STTR into their broader science and technology or acquisition programs. As a result, some components, such as DARPA, indicated a need to provide "tailored" open topics to limit the number of proposals, find appropriate reviewers, and meet agency needs.

In summary, open topics have the potential to increase the number of new SBIR/STTR firms submitting proposals to DOD's SBIR/STTR programs. These solicitations appear to work better in the larger DOD participating services/components, such as the Air Force. For smaller and more specialized agencies, the number and type of proposals can create a significant administrative burden for processing and review while not yielding the required specialized capacity.

[5] Presentation to the committee by Matthew Williams, Department of Defense, on December 6, 2023, Washington, DC.

Outreach to Applicants

Whether a service or component uses a conventional topic or open topics approach, the ultimate impact of the SBIR/STTR programs depends on attracting high-quality applicants. Additionally, an explicit objective of the SBIR/STTR programs is fostering and encouraging participation in technological innovation by socially and economically disadvantaged small businesses and those that are 51 percent owned and controlled by women. Similarly, DOD has a stated goal of expanding its small business, nontraditional defense industrial base.[6]

Outreach within the DOD SBIR/STTR programs occurs on both the external and internal fronts; some examples are presented in Box 4-2. External outreach efforts focus on seeking new applicants—particularly small, innovative companies that may not be aware of the SBIR/STTR programs—with the aim of educating potential future applicants about the opportunities available to them. Internally, outreach is directed at identifying customers that can champion topics and facilitate the transition of Phase II awards into Phase III contracts. This internal effort demands persistence, strong networking, and in-depth knowledge of the programs and defense mission requirements.

The current approach to outreach of DOD's SBIR/STTR programs can be seen as a dual strategy: a "pull" mechanism that gathers more proposals and a "push" aspect that emphasizes the importance of transitioning technologies to benefit the warfighter. An ongoing discussion is whether the pull should outweigh the push, and whether dedicated personnel to support transition activities are necessary to streamline and improve these efforts.

Personnel often attend both traditional and nontraditional events to connect with potential applicants. Events such as South by Southwest and TechConnect, alongside specialized gatherings for Special Operations Forces, highlight the diverse events that can be leveraged for outreach. Additionally, well-established events such as SBA Road Tours and various conferences provide channels for agencies to promote their programs.

The extent of outreach activity largely depends on the service's or component's budget and staffing capabilities. Some centralize their outreach within offices, such as the OUSD(R&E) SBIR/STTR office, or within organizations such as AFWERX. MDA collaborates with AFWERX and Space Ventures in replying to applicants because of overlapping mission areas and common technical interests. Some components refer first-time small business applicants to private-sector accelerators for support, although some accelerators take a percentage of the company's equity.

Outreach and administration of the programs are currently funded in part by a pilot program originally authorized in the SBIR/STTR Reauthorization Act

[6] 15 U.S.C., Section 638(ww)(1)(B).

BOX 4-2
Examples of SBIR/STTR Outreach Strategies and Activities

ARMY

As an element of its overall program, the Army's SBIR/STTR program has undertaken initiatives (xTECH and Reverse Pitch Day) to attract potential applicants for its SBIR/STTR programs (Volkwine, 2024). Designed as a prize competition portfolio, xTECH aims to widen the pool of participants, with an impressive 70 percent of the competing companies having never before collaborated with the government. By partnering with venture capital firms, accelerators, and various organizations, the Army is tapping into broader networks of small businesses. This approach lowers the barrier to entry, allowing new businesses to engage effortlessly, such as by submitting a straightforward one-page white paper. The range of participants in these prize competitions extends across various demographics, including historically Black colleges and universities, minority-serving institutions, and international small businesses, among others.

The unique structure of xTech prize competitions encourages collaboration between the Army and nontraditional innovators, but also offers incentives such as nondilutive cash prizes, educational resources, mentorship opportunities, and networking prospects with Army customers. Notably, recipients gain access to potential follow-on contracts, including Phase I or Phase II SBIR/STTR awards, to develop viable technology solutions for Army challenges.

In addition to xTECH, the Army has undertaken other outreach initiatives, such as the Reverse Pitch Day organized with Plug and Play, which attracted 600–700 companies in August 2024. This event provided a platform for Army customers and their programs to communicate directly about the solutions they seek. Furthermore, the Army is making concerted efforts to engage the clean tech sector, using a blend of in-person, hybrid, and virtual formats to maximize outreach efficiency with minimal staffing resources. Collaborations extend to organizations such as the Women's Chamber of Commerce in North Carolina and Georgia. Industry days facilitated by the Army Applications Laboratory, a component of the Army Futures Command, further promote interaction with nontraditional startups. The Army is also expanding its social media presence across platforms such as LinkedIn, X, and Facebook to broaden its outreach.

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY (NGA)

Agencies with specific program requirements appear to limit their outreach to known partners and events. For example, NGA uses tech days to engage with internal customers, occasionally including universities through their academic research programs.

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA)

DARPA focuses on outreach to seek nontraditional applicants and new program managers. In addition, it has an extensive online outreach platform, DARPA Connect, aimed at fostering global outreach by supporting opportunities that allow users to engage with others participating in the program. This platform offers training modules on subjects such as DARPA 101 and SBIR 101, alongside resources such as the Connect Corner, which features coaching, office hours, monthly webinars, and opportunities for real-time

interaction through "ask me anything" sessions. The DARPA Connect Team actively participates in trade shows and events to bolster its presence, aiming to broaden its network and strengthen its outreach initiatives. The SBIR/STTR team in the Office of the Under Secretary of Defense for Research and Enterprise is interested in expanding activities modeled on DARPA Connect across all DOD SBIR/STTR programs.

DARPA has also established a robust system of communication through weekly newsletters. These newsletters keep all stakeholders—past and present—aware of important updates, including upcoming events, solicitation release dates, and training opportunities, while also requesting insights about the transition of their SBIR/STTR projects.

DOD-WIDE

DOD's Office of Small Business Programs administers the Rapid Integrated Scalable Enterprise (RISE) program, which provides a collaborative vehicle for small businesses. RISE is designed to provide DOD with innovative technologies that can be rapidly inserted into acquisition programs that meet specific defense needs.

of 2011, which allows agencies to allocate 3 percent of their SBIR/STTR budgets for purposes of administering the programs.[7] This funding addresses a chronic issue within the programs' original authorized structure, under which no funds allocated for the programs could be used for their administration—in contrast with the vast preponderance of other R&D programs within the federal government.

Since the administrative funding pilot program was established across all SBIR/STTR federal agencies, some agencies have used this funding to facilitate faster proposal processing and commercialization of projects, and to enhance outreach activities such as site visits, conferences, and connection with underrepresented businesses, some of which are described in more detail below. Within DOD's SBIR/STTR programs, these funds are used broadly for any administration costs associated with running the programs. The pilot program appears to have had a positive impact on outreach overall.

Solicitation of Proposals

The conventional and open topics developed by the participating DOD services/components are included in one or more solicitations using either a BAA or CSO, depending on program needs and desired outcomes (DAU, n.d.a, n.d.b). CSOs are typically used to acquire innovative commercial items, technologies, or services that directly meet program requirements, whereas BAAs are generally restricted to basic and applied research activities (DAU, n.d.c).

[7] U.S. Congress, National Defense Authorization Act for Fiscal Year 2012, P.L. 112–81, Section 5141 (December 31, 2011) and subsequent legislation, which extended the provision.

Evaluating Proposals and Making Awards

Selecting and awarding funding to DOD SBIR/STTR applicants involves several important steps, including reviewing and ranking proposals, as well as attempting to prevent foreign influence among program participants. In contrast with most DOD source selection processes, past performance does not appear to be a major factor in proposal evaluation. Unless specified otherwise in the instructions specific to a service or component, each proposal is evaluated based on three main criteria—technical merit, team qualifications, and commercialization potential.[8] There are differences across services and components in how scoring is applied or in the use of consensus or review panels to make recommendations for funding. Final decisions are made by designated authorities, often after reviews and evaluations consistent with their respective ranking frameworks.

Applicants submit a seven-part proposal in accordance with precise guidelines that vary somewhat by service/component. Submissions include technical matters such as problem identification, statement of work, commercialization strategy, and key personnel, as well as discussion of project cost issues, letters of support, and disclosures of foreign affiliations. Many of these elements are similar to those that small businesses would include in proposals for other DOD R&D programs.

Once proposals have been submitted and have undergone an administrative check for completeness, they move through a review process that is generally similar across DOD services and components, although each implements the review process differently according to its needs. Subcriteria are tailored to each topic and subtopic listed in the solicitation. In general, the technical point of contact (TPOC) or project director makes the final proposal recommendations to the SBIR/STTR program manager or designated source selection authority. Key elements of the review process and example review criteria are shown in Box 4-3 and Table 4-1.

The review in Phase II is similar to that in Phase I, with more emphasis on commercialization or transition potential. Phase II approval is based on the proposal's merits (using the above criteria established in the solicitation announcement), Phase I accomplishments, and TPOC feedback. Recommendations are made to the source selection authority, who can delegate authority to expedite the approval process as needed.

Foreign Influence Due Diligence

In 2022, the SBIR and STTR Extension Act established a due diligence program to enhance the security of proposals submitted by small businesses seeking DOD awards. This program officially took effect on June 14, 2023, prompting DOD to communicate requirements to small businesses through

[8] See https://www.defensesbirsttr.mil/SBIR-STTR/#Structure.

various channels, including Listserv, the Defense SBIR/STTR Innovation Portal banner, the program's official website,[9] and social media platforms.

Reflecting this program guidance, DOD officials indicated to the committee that they conduct thorough reviews of all proposals in response to SBIR/STTR solicitations, focusing on assessing any security risks associated with these small businesses. A critical aspect of this review process involves the

BOX 4-3
Key Elements of Phase I Review Process

Key elements of the Phase I review process include the following:

- Reviewer selection: This process may include both internal government and external contractor personnel who are subject matter experts.
- Evaluation criteria: Overall elements include technology feasibility, team qualifications, and commercialization plans, although weighting of these elements varies. Subcriteria vary by topic.
- Tools and automation: Some services/components use tools such as the Army's Valid Eval to streamline the process and provide feedback.
- Decision authority: Recommendations often progress through multiple levels of review, including portfolio managers and source selection authorities.
- Transparency: Services/components provide feedback to firms, with a goal of making the process more defensible and unbiased.

Proposals are reviewed using the proposal evaluation criteria described in the solicitation, although services and components are allowed to specify different evaluation criteria.[a] The evaluation factors for Phase I proposals in a recent Broad Agency Announcement are listed below, in a descending order of importance (DOD, 2025a, p. 19):

- The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.
- The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include the ability to perform the proposed R&D and commercialize the results.
- The potential for commercial (government or private-sector) application and the expected benefits of this commercialization.

[a] For example, the Army's Phase I evaluation criteria (and their relative importance) are Army benefits (15%), technical approach (35%), programmatic potential (20%), commercial potential (25%), and proposal quality (2%) (Army Evaluation Criteria, Appendixes A–C). Similarly, the Air Force lists (in descending order of importance) defense need, technical approach, and commercialization potential as its evaluation criteria for open topic proposals in the Commercial Solutions Opening. (See DAF, 2025).

[9] https://www.defensesbirsttr.mil.

TABLE 4-1 Key Elements of the Review Process, by Service/Component

Service/Component	Reviewers	Evaluation Criteria
Air Force (AFWERX)	• Minimum of 3 reviewers • Internal to Air and Space Force • Open topic reviewers are best-matched from pool of reviewers	• 3 DOD evaluation criteria plus defense need • Reviewer scores are added • Conventional topic proposal reviewers adjust weighting of evaluation criteria • Open topic proposal reviewers use equal weighting of evaluation criteria
Navy	• Minimum of 2 reviewers, preferably 3 • Topic author is a reviewer	• 3 DOD evaluation criteria plus defense need • Reviewers use panel consensus rather than scores • TPOC makes final decisions in their topic areas
Army	• Minimum of 3 reviewers, preferably 5 • Broad range of SMEs from Army labs and special operations	• 3 DOD evaluation criteria plus 7 formally defined Army-specific subelements with more under those[a] • Uses Valid Eval (evaluation software) • Scores in four categories from unsatisfactory to superior • Panel discussions determine proposal recommendations using technical reviewer and Valid Eval scores
Missile Defense Agency (MDA)	• Minimum of 2 reviewers • Technology area leads and SMEs • Mostly MDA personnel supplemented by Federally Funded Research and Development Center employees	• 3 DOD evaluation criteria plus transition potential and interest from other entities • Top proposals are presented to MDA Research Council for endorsement • Source selection authority considers transition potential and interest from other entities for final decisions
Defense Advanced Research Projects Agency (DARPA)	• No formal reviewer structure • Program manager evaluates with input from other DARPA program directors	• 3 DOD evaluation criteria • Recommendations from program manager after concurrence from Technical Office deputy director

Chemical and Biological Defense Program	• No minimum number of reviewers • TPOC creates technical team to evaluate proposals • Reviewers can include anyone across DOD	• 3 DOD evaluation criteria • Division chiefs make funding decisions based on alignment with technology portfolio
Defense Health Agency	• Minimum of 3 reviewers • 2 technical evaluators plus topic author • Topic author assembles reviewers of internal SMEs • Do not use external reviewers	• 3 DOD evaluation criteria • Only fund proposals that align with their listed priority areas
Defense Logistics Agency	• No minimum number of reviewers • Generally the project managers serve as reviewers • Will use internal and external end-users as reviewers	• 3 DOD evaluation criteria • Review process differs between conventional and open topics • Scores based on overall topic criteria, then ranked by summary score • Scores in 4 categories from unsatisfactory to superior
Defense Threat Reduction Agency (DTRA)	• No minimum number of reviewers • Topic author is generally the only reviewer, though sometimes another SME is added	• 3 DOD evaluation criteria plus DTRA-specific standard scoring sheet • Additional security evaluations needed due to high-risk nature of DTRA's work

(Continued)

TABLE 4-1 Continued

Service/Component	Reviewers	Evaluation Criteria
National Geospatial-Intelligence Agency (NGA)	• No minimum number of reviewers, preferably 2 • Not uncommon for topic author or SME to be only reviewer • All reviewers internal to NGA • Technical evaluators must get permission to review proposals in DSIP	• 3 DOD evaluation criteria • Use source selection panel for evaluation proposals

[a] DOD, 2024.

NOTE: DSIP = Defense SBIR/STTR Innovation Portal; SME = subject matter expert; TPOC = technical point of contact.

SOURCE: Committee conversations with DOD SBIR/STTR program managers.

information provided by small businesses regarding their foreign affiliations or relationships with foreign countries. The reviews encompass an analysis of cybersecurity practices, patents, employee backgrounds, and potential foreign ownership. Additionally, they involve examining financial ties and obligations to foreign entities, including any surety, equity, and debt commitments.

In using advanced analytical tools and open-source analysis, DOD aims to improve the efficiency and effectiveness of its due diligence assessments that were mandated by the SBIR and STTR Extension Act of 2022. The SBIR/STTR Office within OUSD(R&E) works to apply the due diligence program consistently across all DOD services and components. Furthermore, OUSD(R&E) is preparing a course designed to help small businesses understand the implications of foreign ownership, control, or influence. More recently the Department implemented a standard common risk matrix and tried to reduce the administrative burden for both the small businesses and the government.

At the same time, the DOD SBIR/STTR programs are under intense scrutiny from Congress, particularly regarding the timeliness of awards. Even minor delays, such as waiting a couple of days for a waiver decision, can adversely affect the timeliness data, which are actively monitored by GAO.

To streamline the process for DOD's participating services and components, the Air Force Office of Commercial and Economic Analysis (OCEA) is tasked with conducting reviews of foreign ownership, control, or influence (DOD, 2024). OCEA is an Air Force–led office that performs assessments and analyses in support of efforts to protect DOD and its activities and services/components from commercial and economic risks. This office evaluates proposals and categorizes them as low, medium, or high risk; mitigation measures could be pursued for those deemed high risk by the relevant service or component. This mitigation process in smaller SBIR/STTR programs is challenging, time consuming, and complicated.

Keeping a database of previous due diligence investigations and ensuring that program managers have access to the database and are trained in its use is one way of reducing the burden of this due diligence, especially for those smaller DOD components. Additionally, creating a database of high-risk actors would reduce the time burden associated with this mandate. The 2022 SBIR and STTR Extension Act allows for flexibility in how DOD conducts foreign influence due diligence. Currently, all proposals are evaluated, which wastes resources given that most proposals will not be funded. It might therefore be more efficient to conduct due diligence at a later stage, especially if there are no issues with finding proposal reviewers. The Environmental Protection Agency, National Science Foundation, and National Institutes of Health conduct due diligence reviews only on applications being considered for awards and require disclosures only from those applicants (GAO, 2024). If DOD were to adopt the practice of conducting due diligence only for applicants being considered for awards, disclosure forms could still be submitted with the application in order to protect the timeliness of the selection process.

Still, due diligence restrictions at the time of a firm's application for funding may not reveal security concerns that may emerge later. For example, supplemental funding from venture capital may cause concerns about foreign influence, control, or influence because venture capital funds often include foreign investors. Moreover, venture capitalists may require small firms to expand into new and global markets, which may include sales to international rivals.

MULTIPLE-AWARD RECIPIENTS

There has been growing concern about the subset of SBIR/STTR firms that are selected for and receive large numbers of awards within the programs. This concern has led to increased scrutiny and oversight by Congress and GAO. For example, the 2022 SBIR/STTR reauthorization included specific language that established increased minimum performance standards aimed at certain multiple-award recipients. Current legislation that has been introduced is also intended to address perceived problems resulting from the activities of multiple-award recipients. Analysis of these experienced firms is discussed in more detail in Chapter 9.

As part of its data collection, the committee sought to understand the prevalence of multiple-award recipients across programs and the extent to which program managers were concerned about either overreliance on known performers or barriers preventing them from achieving the goal of expanding the supply base.

The SBIR/STTR program managers from the services and components varied in their responses as to whether multiple-award recipients were common within their program and whether they had any concerns about multiple-award recipients as a potential issue or problem for the DOD SBIR/STTR programs overall. About half of the program managers noted that although multiple-award recipients did exist, they were relatively rare in the pool of companies funded through their program. DARPA, for example, given its focus on early-stage technology development, has awarded very few firms multiple awards. These program managers saw multiple-award recipients as a nonissue. The remaining program managers acknowledged the presence of multiple-award recipients but had mixed opinions or were neutral as to whether this was a concern or not, elaborating on both the pros and cons of this practice.

On the positive side, several program managers noted that repeat awardees had the benefit of experience and often were funded because they had the technical knowledge necessary to advance existing projects through sequential Phase II awards. Services and components that require an assured supply chain of specific or high-demand technologies rely on recipients of multiple awards for a variety of reasons: because trust has already been built, program managers believe this to be the fastest way to get required work completed, or these firms can initiate productive work more quickly given their experience working with the agency and its processes. Others acknowledged that this familiarity might lead to a

selection bias on the part of government officials, given past experiences and an expectation of benefits from the ability to achieve program outcomes.

Furthermore, although multiple awards are associated with a single company, that company may include new researchers on the project team, effectively bringing additional performers with new ideas and capabilities into the mix. On the negative side, a few of the interviewees expressed concern that the repeat funding of previous awardees may effectively be crowding out new applicants, as often occurs in federal university research programs and traditional defense contracting activities, thus undercutting the SBIR/STTR programs' ability to expand the national security industrial and innovation base. On the other hand, representatives of SBIR/STTR programs, even those in smaller services and components, acknowledged that the open topic solicitations have broadened the applicant pool, altering the mix of applicants.

Most program managers said that multiple-award recipients are subject to the same level of scrutiny as first-time awardees. Per SBIR/STTR evaluation guidelines, past performance is not a criterion for selecting firms for SBIR/STTR awards. A few SBIR/STTR program managers implied that the standard was effectively higher for previous awardees, which had to meet minimum performance benchmark requirements to be eligible to apply for a new Phase I or Direct to Phase II award.

It is interesting to note that no other defense science and technology program or other federal agency research program has subjected multiple federal award recipients to the level of scrutiny to which small businesses have been subjected under the SBIR/STTR programs—this despite the fact that Federally Funded Research and Development Centers (FFRDCs), including Department of Energy laboratories, universities, and large defense contractors (from both the traditional defense industry and the commercial sector), are all repeat recipients of multiple awards, including much larger awards than those of the SBIR/STTR programs. Yet those other programs have experienced no similar controversy and have had no better metrics for assessing the benefits to taxpayers or federal missions.

POSTAWARD IMPACT: PHASE III, TECHNOLOGY TRANSITION, AND FOLLOW-ON CONTRACTING

The third and final phase of the SBIR/STTR programs is known as Phase III. A Phase III award supports work that "derives from, extends, or completes work under a prior SBIR/STTR Funding Agreement, but is funded by sources other than the SBIR/STTR programs" (SBA, 2023, p. 25). SBIR/STTR awardees, including those that receive Phase III awards, also receive certain data rights (see Box 4-4). The goal of a Phase III award is to facilitate the process of developing and delivering "products, processes, technologies, or services for sale to or use by

the federal government or commercial"[10] sector through the funding of further R&D to mature technologies or through procurement of technologies, goods, or services. For DOD, this typically implies transition into mainstream R&D programs for eventual incorporation into larger acquisition programs, production, and operational fielding and use. SBIR/STTR awards offer several benefits to the awardee, including the right to sole source Phase III contracts, exemptions from SBA size standards for contracts, and the retention of SBIR/STTR data rights. In almost all cases, transitioning to a Phase III award is viewed as the ultimate goal for SBIR/STTR programs by both the small business contractors and DOD program managers.

Transition rates to Phase III are not carefully measured and are therefore difficult to quantify and analyze accurately. These rates likely depend on the agency's mission and research focus. For example, DARPA and DHA focus on earlier-stage technologies (with a higher ex ante likelihood of technical failure and more lengthy transition and commercialization timeframes) relative to services and components such as the Army or Navy, with an extensive set of acquisition activities and mission requirements with which their SBIR/STTR programs must align for the purposes of transition. It is reasonable to expect mission differences to affect transition rates for reasons unrelated to program management quality.

BOX 4-4
Management of Data Rights

A benefit to SBIR/STTR companies is ownership of data rights resulting from their awards. Contractors in the SBIR/STTR programs are considered to have more data rights than is the case in other federal research programs. SBIR/STTR program data rights typically provide proprietary protection of the technical data for a period of 20 years, although data rights do not apply to nontechnical data.

The difference in data rights policy between SBIR/STTR and other DOD research activities does create concern for some defense officials, who are also responsible for supporting DOD's efforts to maintain access to technical data rights for technologies throughout the acquisition life cycle. For example, DOD believes it needs technical data rights to technologies as they mature to support integration with other systems and to preserve the ability to create more competition in the defense industrial base. DOD also believes it needs technical data rights for technologies as they are used operationally—for example, to perform required system maintenance and upgrade activities.

Representatives of at least one component, National Geospatial-Intelligence Agency (NGA), discussed how they strategically decide which companies to work with through SBIR/STTR contracts or traditional contracts. If NGA wants a company to make its technology or product available for an extended period, it funds the company through an SBIR/STTR contract; but if NGA wants to control the technology, it funds the company through a traditional DOD contract.

[10] 15 U.S.C., Section 638(e)(10)(B).

The transition rate is also significantly affected by the complexity of the defense acquisition process, which has created a commonly observed "valley of death"—where a promising technology fails to transition from a Phase II prototype to a Phase III contract or commercialization—for many research activities, frustrating both government program managers and contractors.[11] These transition challenges are faced routinely by the mainstream science and technology activities of each of the services and components that executes the DOD SBIR/STTR programs, as well as other agencies, such as the Defense Innovation Unit and the Strategic Capabilities Office. It is not to be expected that SBIR/STTR program managers and their awardee firms will have any greater success in addressing these intrinsic and embedded technology transition challenges that face all defense research and innovation efforts. As discussed further in Chapter 7, the programs' primary success is in helping small firms secure larger R&D contracts, but DOD could enhance pathways to procurement by helping to build collaborations with prime contractors.

While transition to Phase III is an important milestone and metric, SBIR/STTR projects can support an agency's mission even without a successful transition. On the one hand, program managers made frequent reference in their interviews to the valley of death. On the other hand, they emphasized that an SBIR/STTR project can reveal useful information—about failed attempts or infeasible technological approaches—even without a Phase III transition. This observation is not generally aligned with the business interests of a small business that is seeking to continue and expand defense contracting activities and sales through larger R&D and procurement awards. However, the multiple channels for mission value are important to keep in mind when evaluating transition rate statistics.

Some program managers track whether their Phase I and II awardees transition to Phase III; examples include annual reports from AFWERX and the Navy. Many smaller programs, however, do not systematically track transitions to Phase III, and their representatives stated that they lack the resources to do so. A centralized DOD-wide database linking Phase I projects to subsequent Phase II and Phase III awards does not exist. In principle, such information could be used to track and evaluate "within-program" changes in transition rates following the introduction of new commercialization initiatives or practices. As discussed in Chapter 7, transition from Phase II directly into procurement appears to be relatively rare. Many contracts or other defense awards that would legally be considered Phase III activities are not coded as such in any database by program officials, which is understandable given that program managers for Phase III projects are not connected to the original SBIR/STTR programs in most cases and have no incentive for being consistent with this reporting. As discussed in Chapter 7, Phase III's are more likely to be for follow-on research funding, perhaps reflecting the lower starting Technical Readiness Levels (TRLs) of the projects,

[11] See, for example, Specht and O'Halloran (2023).

but there currently is no way to assess this more comprehensively across the SBIR/STTR programs or other defense research activities since TRLs are not routinely collected for DOD. The only other agency with procurement activity operating SBIR/STTR programs, NASA, does collect TRL information on projects.

Services/components and program managers have additional means of progressing or driving the transition of SBIR/STTR projects. Supplemental funding opportunities are available to Phase II awardees through sequential Phase II and subsequent Phase II awards. These awards, explained below, are funded through SBIR/STTR budgets and thus are not considered "transitions" per se. They may, however, enable Phase II awardees to develop their work further in ways that increase the odds of a successful transition. Awardees may receive a total of two Phase II awards per topic from either the original or another awarding agency.

Sequential Phase II awards were introduced in the SBIR/STTR Reauthorization Act of 2011. They provide an additional government-requested Phase II contract for the same topic to the same small business for the same project. The funds enable the awardee to continue work on the initial Phase II project; thus, the work must be within the scope of the initial Phase II award. Sequential Phase II awards are awarded without competition, with a guideline amount of $1 million and a limit of $1.5 million. A Phase II awardee can receive only one sequential Phase II award per project.

More recently, the 2020 SBIR/STTR Program Directive (SBA, 2020, p. 24) provided separate authority for small businesses that receive a Phase I award from one federal agency to receive a subsequent Phase II award from another agency on the same topic (Navy SBIR, 2022). *Subsequent Phase II awards* are solicited, evaluated, and awarded on an ongoing basis. Like sequential Phase II awards, they are initiated at the request of the government, but unlike sequential Phase II's, subsequent Phase II's typically are used to fund Phase I proposals that did not receive a Phase II award from the original topic sponsor or agency. The original topic sponsor or agency must grant permission for a subsequent Phase II award on the same topic to be considered. This authority is particularly useful for SBIR/STTR projects with the potential to meet the needs of multiple agencies, which thus have multiple potential pathways for transition.

The DOD services and components have many approaches to transition. Some, especially the smaller ones, are not involved in efforts to support it, often because they lack the necessary programmatic and personnel resources, whereas others have more extensive and integrated practices and formalized transition efforts and programs. Examples of proactive practices include those of MDA, which "designs in" DOD-wide priorities at Phase I through technology leads, research council input, and the proactive development of relationships with program managers at services and components with complementary missions (e.g., Air Force, Space Force, DARPA). Incentivizing technology leads who work in targeted transition activities to connect with program managers at services and components with shared interests (e.g., in developing hypersonic defense

systems) also helps identify opportunities for sequential Phase II awards and new transition pathways.

Four years ago, the Army restructured its SBIR/STTR programs and created transition broker teams. These teams are tasked with bringing more of an acquisition mindset to topic selection and evaluation of early-stage SBIR/STTR projects. A program manager interviewed by the committee highlighted that this approach allows the transition broker teams to understand the program managers' goals before a topic is approved.

Table 4-2 describes the established programs, many of which are new or recent DOD initiatives, aimed at facilitating the transition of products resulting from SBIR/STTR activities.

VARIATION IN PROGRAM EMPHASIS AND ADMINISTRATIVE ORIENTATION

It is useful to note that while there is considerable uniformity in the management and processes for DOD SBIR/STTR programs across the services and components, conversations with SBIR/STTR program managers uncovered significant variation in the details of how the programs are implemented. Specifically, as illustrated in Figure 4-2, the committee found it useful to examine two key dimensions of this variation: (1) the program emphasis and (2) the administrative orientation. This flexibility in implementation is useful and important as it allows the programs to adapt to different needs and missions.

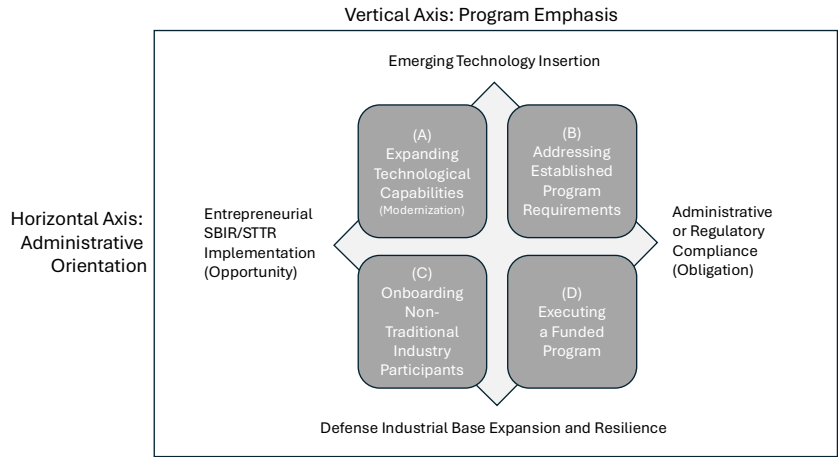

FIGURE 4-2 Two-dimensional typology of alternative approaches to viewing and implementing the SBIR/STTR program within the DOD services and components.

TABLE 4-2 Examples of DOD Programs Aimed at Facilitating the Successful Transition of SBIR/STTR-Funded Technologies into Military Acquisition Programs, Commercial Markets, or Both

Agency and Program Link	Description and Eligibility	Year Introduced and Funding Enhancement
AirForce AFWERX Ventures: Strategic Funding Increase (STRATFI) Program[a]	A collaboration between AFWERX and SpaceWERX, the innovation arms of the Department of the Air Force and the U.S. Space Force. Aims to help transition SBIR/STTR projects through added funding and exposure. Eligibility: Must have been awarded a Phase II contract within the last 2 years. Various levels of matching funding and avenues for Defense and/or industry matching, depending on the program sought.	2020 $3M to $15M for up to 48 months
AirForce AFWERX Ventures: Tactical Funding Increase (TACFI) Program[b]	Similar to STRATFI but Air Force only, with a shorter time horizon and smaller funding enhancements. Eligibility: Similar to STRATFI.	2021 $375k to $1.9M for up to 24 months
Army: Army SBIR Catalyst Program[c]	Aims to unite the Army, integrators, and small businesses to create innovative technologies—propelling concepts to transition and commercialization. Provides contracts up to 8x larger than typical SBIR awards. Eligibility: Awards CATALYST Phase II Enhancement funds only following a successful base performance and if the Army transition partner and integrator have available funding.	2023 Up to $7M

Navy: SBIR/STTR Transition Program[d]	An 11-month program that provides business mentoring, education, and networking opportunities. Eligibility: Must have an active Navy-funded Phase II.	1999 Funding n/a (services only)
All agencies: Technical and Business Assistance[e]	Provides additional funding to SBIR/STTR awardees for commercialization and business assistance expenses; allows awardees to select their own commercialization services provider or use services provided by an agency-selected vendor; can be used to cover expenses that are not included in the SBIR/STTR budget or proposal. Eligibility: Phase I & Phase II awardees.	2019 Up to $6.5k for Phase I; up to $50k for Phase II

[a] https://afwerx.com/divisions/ventures/stratfi-tacfi/.
[b] https://afwerx.com/divisions/ventures/stratfi-tacfi/.
[c] https://armysbir.army.mil/catalyst/.
[d] https://navystp.com/.
[e] https://legacy.www.sbir.gov/node/2088581.

Program emphasis denotes whether the service or component focuses on either developing emerging technologies or expanding the defense industrial base and building supply chain resilience. In some cases, the technical capabilities that are needed are well understood and the goal is finding the best solution; in other cases, exploration of the technological frontier is required to imagine novel ways of accomplishing mission goals. A core difference between these approaches is whether the emphasis is on transitioning technologies to acquisition programs in order to meet current military requirements, strengthening the base of suppliers for defense materials and equipment, or developing disruptive technologies and warfighting capabilities.

The *administrative orientation* refers to whether the SBIR/STTR programs are viewed as merely a legal mandate with an administrative obligation that must be fulfilled or as a unique and valuable opportunity to support efforts to accomplish service and component missions.

- Services and components that view the programs as an opportunity are entrepreneurial in expanding the program boundaries by using alternative transaction authorities, seeking additional funding, and building partnerships and coalitions beyond the SBIR/STTR office.
- Services and components that view the program as an obligation tend to emphasize following its rules and attempting to incorporate it into ongoing contracting and programmatic activities. This view generally applies to agencies with lower research budgets and hence, fewer resources to allocate to the SBIR/STTR programs.

As illustrated in Figure 4-2, considering these two dimensions simultaneously creates a four-quadrant space defining alternative approaches to the SBIR/STTR programs within DOD. The approaches of the services and components participating in the programs do not necessarily fit exclusively into one quadrant. For example, those services/components that view the SBIR/STTR programs as an opportunity must still comply with the programs' administrative and regulatory guidance and policies. And the SBIR/STTR programs that primarily identify innovative solutions must also attract new and diverse companies to increase the numbers of exceptional innovators working in defense. Instead, the quadrants provide a language and typology that allows discussion of reasonable and useful variation in how the different DOD participants in the SBIR/STTR programs execute their mandate. The typology highlights what works well and sheds light on opportunities for centralization or improvement. The dimensions and quadrants also give program managers a language for developing a strategic approach to their SBIR/STTR programs.

Applying the Framework

The two dimensions and associated quadrants described above imply distinct program philosophies that manifest in how the DOD SBIR/STTR

programs are implemented. In this section, that framework is used to consider systematically some tactical differences observed across the services and components. The distinct program elements are first introduced and then supported with a few examples of how they vary according to program emphasis and administrative orientation. Table 4-3 provides a summary of how specific implementation areas vary according to this framework.

The SBIR/STTR programs within the services and components make more or less use of the array of adjacent programs and resources, including supplementary funding, training and outreach programs, and centralized infrastructure. However, some important themes emerged in discussion with program managers who wanted additional support or resources, as did numerous exciting and innovative initiatives in outreach.

Open Topics in This Framework

Enthusiasm for open topics varies across services and components. While some of this variation can be explained by differences in size and resources, it also appears to be driven by the underlying program philosophy. Programs with broader or more entrepreneurial orientations—ones that are either seeking novel technologies from the commercial market or aggressively attempting to expand the supply base see more readily the benefits of interacting with unknown performers, whereas programs with more clearly defined missions or specific technology transition needs have less incentive to solicit ideas broadly from industry.

The underlying program philosophy, as defined by the four quadrants in Figure 4-2, helps explain some of the differences in the leadership of the topic development process, the personnel participating in topic development, the breadth of the topics' scope, and the perceived utility of open topics:

- Programs that are focused on broadly expanding technological capabilities rely heavily on scientists and engineers working on novel technologies. These programs tend to be enthusiastic about open topics as a vehicle for exploration.
- Programs that are focused on addressing established program requirements involve a broad array of stakeholders, including subject matter experts and end users within services/components, as well as prime contractors. For these kinds of programs, broad involvement increases the likelihood that the topics will meet current military requirements and support existing acquisition programs. For these kinds of programs, open topics are less useful, as service/component and program needs are well specified.
- Programs focused on onboarding nontraditional industry participants rely on small business advocates. Open topics can be helpful in connecting unknown performers, but direct outreach to new suppliers is more effective.

TABLE 4-3 Translating the Two-dimensional Typology into Implementation

Quadrant	A	B	C	D
Description	Expanding Technological Capabilities (Modernization)	Addressing Established Program Requirements	Onboarding Nontraditional Industry Participants	Executing a Funded Program
Lay Person Description	Exploring unknown horizons	Fulfilling known program needs	Identifying and vetting new suppliers	Running a mandated program
Advocates	Research and development program managers	Acquisition program managers and program executive officers	Acquisition personnel and small business advocates	Legal and compliance officers
Topic Development Objective	Developing and delivering disruptive and innovative defense capabilities	Meeting current military requirements and supporting acquisition programs	Broad topics to increase participation by new entrants	Execute a smooth process
Enthusiasm for Open Topics	High	Low to neutral	Neutral	Low
Importance of Multiple-Award Recipients	Low–high—interested in engaging young companies and nontraditional defense contractors	High—relies on a network of "known performers"	Medium—values "known performers," but also wants to expand the base	Neutral—following the mandate
Transition Focus	Experimentation oriented; tolerance for failure	Engage end users at the start of topic selection	Providing resources and support for novice partners to be performers	Transition is for use by other services and components
Outcome Metrics	Leveraging private funding, patents, publications	Transition to acquisition programs	Broader supply base	Compliance with policy directives and other program requirements

- Programs that are simply executing a mandated funded program are concerned about efficiency and want to manage a predictable schedule of topic releases, as opposed to using the releases opportunistically. They also tend to view open topics as creating an additional administrative burden for overworked and understaffed program offices.

Multiple-Award Recipients in This Framework

Similar to the responses to open topics, these variations help explain whether multiple-award recipients are viewed positively or negatively:

- Programs that are focused on expanding technological capabilities are eager to tap into exciting young companies and actively work to seek out firms that are working at the cutting edge.
- Programs that are focused on addressing established program requirements tend to rely on a network of known performers who have demonstrated their capacity to meet known needs.
- Programs focused on onboarding nontraditional industry participants are open to new businesses but also want to support and advocate for existing disadvantaged businesses.
- Programs that are executing a mandated funded program follow the rules as imposed without taking a stance on the pros or cons.

Phase III and Transitions in This Framework

The typology of program philosophies in Figure 4-2 helps explain some of the variations in emphasis on transition. It also points to other kinds of outcomes that could be tracked or evaluated. The following are examples:

- Programs that are focused on expanding technological capabilities can use the SBIR/STTR programs for experimentation purposes. Early-stage scientific and technological experimentation entails a high likelihood of failure, but learning comes from these failures. Under this approach, therefore, a much lower emphasis on transition, as well as lower transition rates, would be expected. Other outcomes that would demonstrate the value of the SBIR/STTR investment would be patents or publications.
- For programs focused on the commercial technological frontier or dual-use technologies, the value of SBIR/STTR investments could be seen in company growth, valuation, or private capital investments.
- Programs focused on addressing established program requirements should have a relatively high transition rate. If the program runs well, the path to transition has been set in advance and should result in identifiable follow-on SBIR/STTR funding as well as procurement contracts.
- Programs focused on onboarding nontraditional industry participants are likely to have mixed success in achieving transition as new performers

may or may not be able to meet DOD's stringent requirements. It would be important to compare the transition rates for first-time awardees and multiple-award recipients, and to attend to differences by race, gender, veteran status, and geography.

- Programs that are executing a mandated funded program are unlikely to be concerned with what happens to grantees once they leave the SBIR/STTR programs.

SUMMARY

This chapter has presented an overview of the administration of the SBIR/STTR programs at DOD. The committee's discussions with program managers for the SBIR/STTR services and components revealed that while many broad rules and policies apply, each service or component exhibits substantial autonomy (and initiative) in program emphasis and administrative orientation. These variations reflect differences among the services and components and offer insight into the types of outputs resulting from the programs across the different services and components. They also offer a sense of the breadth of management styles and practices possible within the programs under current statute, regulation, policy, and practice. Given that the different services and components of DOD's SBIR/STTR programs differ greatly in size and mission, these varying approaches to running the programs can be beneficial.

Caution is necessary in reforming the programs. For example, the introduction of open topics was embraced by some of the services and components, and was observed to bring in more new small businesses that may expand the defense supply base. At the same time, less targeted solicitations were found to increase the workload of program managers substantially, especially for smaller and more specialized services and components. For them, processing and reviewing the number and type of proposals garnered from an open topics solicitation can create a significant administrative burden while failing to yield the required specialized capacity. More targeted open topic solicitations, adopting an approach similar to the National Science Foundation's project pitch, or requiring letters of intent might be beneficial, especially for smaller components, to mitigate this burden.

The services and components also differ in their view of making awards to experienced firms. At least one component's representatives mentioned redacting company names on applications before sending them out for review. The committee notes that this technique may help address unfair selection bias due solely to familiarity with proposing companies. Redacting company names would be a better alternative to limiting experienced firms from submitting proposals, which would likely limit the technical options available to program managers for meeting technical mission goals.

The flexibility to implement their programs differently helps services and components use the programs to advance their missions; however, the committee found that some functions could be centralized to help reduce

administrative burden. Specifically, the OUSD(R&E) SBIR/STTR Office could further facilitate coordination across the services and components beyond the monthly meetings and facilitate sharing of innovative practices. For example, the quality of proposals could be improved through a more robust applicant assistance program, which would be especially helpful for small businesses that are new to submitting SBIR/STTR proposals. DOD could also enhance pathways from prototyping to fielded solutions through bridging programs or deeper collaboration with prime contractors. Additionally, to aid in the transition to procurement, new or refined solicitations might offer more guidance to SBIR/STTR awardees seeking to move from proof-of-concept innovations into full-scale acquisitions. More centralization of the due diligence process would be valuable to the smaller services and components as well. While the current process calls for the Air Force's OCEA office to conduct these reviews, the smaller services and components find the process complicated and time consuming, especially for those proposals classified as high risk. In addition, the OUSD(R&E) SBIR/STTR Office could facilitate the sharing of knowledge about experimentation with initiatives that could be implemented across all parts of DOD, such as the Navy's SBIR/STTR Transition Program, AFVentures Strategic Funding Increase (STRATFI) and Tactical Funding Increase (TACFI), the Army's Catalyst, and the Army's xTech prize competition to identify potential SBIR/STTR applicants.

All participating organizations aim to avoid contract award delays. DOD, like most agencies, is congressionally mandated to issue awards no more than 180 days after the proposal submission deadline. Centralization of some functions, such as the due diligence process, could help with streamlining the selection process.

Increased educational opportunities for SBIR/STTR program managers would help improve their ability to assist companies—especially first-time applicants—as well as their ability to administer the programs in a timely and effective manner. These opportunities could be provided through the Defense Acquisition University. While program managers are well versed in the SBIR/STTR legislation, policies, and guidance, they appeared to be less informed about the variety of contract types, cooperative agreements, and grants.

Currently, only up to 3 percent of funds allocated for the SBIR/STTR programs can be used for program outreach and administration. For larger services and components, the amount of money available to run the programs may be sufficient, but smaller services and components cannot take advantage of scale economies. DOD could consider allocating funding to support these programs or provide centralized support.

Finally, including SBIR/STTR in key strategy documents such as the annual Defense Spending by State report or the Defense Planning Guidance might help highlight the value of these programs to DOD leadership, Congress, and the general public. While topic development, evaluation, and selection processes vary across the services and components, they share common goals of fairness,

thoroughness, and a commitment to supporting innovative solutions that benefit both the military and the broader commercial sector.

FINDINGS AND RECOMMENDATIONS

Finding 4-1: DOD's SBIR/STTR programs vary in terms of size, mission, and operational approaches. Codifying and communicating best practices would help all DOD organizations improve their SBIR/STTR programs.

Finding 4-2: Certain activities related to the implementation of DOD's SBIR/STTR programs, such as due diligence, application assistance, and commercialization assistance, create an administrative burden for smaller DOD services/components.

Finding 4-3: Open topics help bring into DOD's SBIR/STTR programs a broader range of firms that could reduce the concentration of awards, but the use of open topics is administratively burdensome for smaller DOD services/components.

Finding 4-4: Opinions vary across the military services (e.g., Army, Navy, Air Force, and Space Force) and components (e.g., Defense Advanced Research Projects Agency, Missile Defense Agency) with regard to the impact of SBIR/STTR open topics, and some services/components find them far more useful than do others.

Finding 4-5: DOD's SBIR/STTR program managers often lack sufficient expertise concerning the needs of startups and entrepreneurs or the commercialization of outcomes from DOD-funded research and development (R&D).

Finding 4-6: Input from industry stakeholders (for example, Tier 1 contractors/system integrators) on topic selection or transition to procurement could lead to more robust incorporation of SBIR/STTR-supported technologies into products and services for the warfighter.

Finding 4-7: The frequent use of cost contracting methods for DOD SBIR/STTR awards increases the bureaucratic burden on both DOD and awardee firms, creates contracting delays, and may limit participation by those small businesses without dedicated staff to deal with the data reporting requirements associated with these contracts.

Finding 4-8: Citing the SBIR/STTR programs in key strategy documents would elevate the programs' importance and utility within DOD and help in providing implementation guidance.

Recommendation 4-1: The Department of Defense's (DOD's) Under Secretary of Defense for Policy should include in Defense Planning Guidance that the DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs should be used as a mechanism for strengthening and broadening the defense industrial system, and direct the Department's services and components to promote the transition of SBIR/STTR-generated technologies into mainstream science and technology and acquisition programs.

Recommendation 4-2: The Department of Defense's (DOD's) Under Secretary of Defense for Policy should include the DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs in the current planning, programming, budgeting, and execution processes, or in the proposed Guidance Document, as a mechanism for strengthening the defense industrial base, alongside metrics provided to DOD leadership to measure the strength, resilience, and diversity of the defense innovation system.

Recommendation 4-3: The Department of Defense's (DOD's) Office of Local Defense Community Cooperation should include DOD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards in its annual Defense Spending by State report.

Recommendation 4-4: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering (OUSD[R&E]), which is the DOD office of primary responsibility for the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs, should codify and communicate best practices, such as those for integrating the SBIR/STTR awardees into programs of record or improving outreach to new small businesses. In addition, OUSD(R&E) should incentivize early collaborations across services and components for projects with potential multimission transition pathways.

Recommendation 4-5: Congress should allow but not require the use of Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) open topics. Congress should encourage more flexibility for the Department of Defense's services and components to experiment with approaches that help broaden their supply base.

Recommendation 4-6: Department of Defense Small Business Innovation Research/Small Business Technology Transfer

(SBIR/STTR) program officials, including contracting officers, should encourage the use of fixed-price contracts for Phase I and II awards.

Recommendation 4-7: The Department of Defense's Office of the Under Secretary of Defense for Research and Engineering should request and Congress should consider appropriating funds for entrepreneurial training for Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program managers, perhaps by having the National Defense University and Defense Acquisition University develop training modules and a certification for these program managers.

Recommendation 4-8: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering should request and Congress should consider requiring and appropriating funds to provide the requisite tailored training to DOD acquisition officials, through the Defense Acquisition University, on contracting and budget flexibilities available under the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs.

Recommendation 4-9: The Department of Defense's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program Office should streamline the due diligence process by creating a centralized database for firms that fail to meet the due diligence requirements, and make the initial due diligence/denial process automated within the Defense SBIR/STTR Innovation Portal.

Recommendation 4-10: The Department of Defense's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program Office should prioritize due diligence reviews for proposals that are being seriously considered for funding.

Recommendation 4-11: The Department of Defense's (DOD's) Office of the Under Secretary of Defense for Research and Engineering should revise DOD's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) instructions, regulations, and guidance to acknowledge program risk. This guidance should take into account the potential for transformational innovation and take into consideration the different needs, strengths, and challenges of large versus small services and components within the Department.

5

Who Applies and Who Gets Funded

A foundational element of any evaluation of DOD's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs is gaining an understanding of who is applying to the programs and who among them is successful in receiving program funding. The committee was able to analyze trends in applications and awards, as well as examine the geographic diversity of the applications and awards of recent years. This information enabled the committee to consider the impact of DOD's outreach efforts and to understand the variation in funding rates of applicants to the different services and components and from different states and congressional districts. The focus of this chapter is on SBIR program applications and awards; data relating to the STTR program are presented for purposes of comparison (see Chapter 6 for additional detail on the STTR program).

DATA SOURCES

This chapter draws on DOD-provided data on SBIR/STTR applications filed for the fiscal year (FY) 2019–2023 time period; these data include measures of race, ethnicity, and sex for firm owners for both funded and unfunded applications.

It should be noted that the application data received from DOD were incomplete at the time that the committee received it, and award totals differ from those reported in the Small Business Administration (SBA) SBIR/STTR award database, which was used for other chapters in the report. The total number of applications and the award status are known, but data are lacking on other variables. For example, among SBIR applications, the phase for which the firm applied was missing in about 14 percent of cases. However, the data do not reflect any systematic bias, and for completeness, the chapter reports cases of missing data. Given the limited number of years of data available for analysis in this chapter, moreover, it was not possible to identify long-term trends; however, these

data and the committee's analysis do provide an important baseline for future research when additional years of data become available.

APPLICANTS TO THE SBIR PROGRAM

DOD's SBIR/STTR programs received 71,146 applications during FY2019–2023 (see Table 5-1). The majority of these applications—86.6 percent (61,580)—were for the SBIR program, while more than 13 percent (9,566) were for the STTR program.

Table 5-1 shows the numbers of applications by fiscal year. These data reveal that the total annual number of applications fluctuated over the period, with growth in the number of SBIR applications increasing in FY2019–2021, followed by smaller numbers of applications. Indeed, the overall number of SBIR and STTR applications fell by 11.6 percent between FY2021 and FY2023. It is notable that the significant decline in SBIR applications after FY2021 coincides with the most recent reauthorization, which introduced new regulations regarding international ownership and limits on the number of applications per firm, and took place in the context of a lengthy reauthorization debate. This decline, however, is not reflected in the data for STTR.

While the STTR program is significantly smaller than SBIR, as indicated by the application numbers, it has a higher rate of funding (Table 5-1). The 5-year average funding rate for SBIR applicants was 22.1 percent, compared with 32.4 percent for the STTR program (Table 5-1). Indeed, STTR consistently has had a higher annual percentage of funded applications. This differential may reflect the collaborative nature of relations between small businesses and research institution partners and, relatedly, the skill and experience of these STTR partners in assisting small business partners in preparing program applications.

Table 5-2 breaks down annual application and award data by phase for the SBIR program and reports cases in which award phase information was not reported. Across the 5-year analysis period, more than 61,580 total applications were submitted. Of this total, 8,093 Phase I awards were granted, for an average funding rate of 17.8 percent. DOD's SBIR Phase I funding rates declined over the period, dropping from 20.5 percent in FY2019 to 12.1 percent in FY2023. This decline reflects both an initial, modest rise in applications and a reduction in the number of awards over the period, particularly in the most recent year. Phase II applications were fewer in number, reflecting a more selective stage of the funding process, while funding rates were higher. Of 7,346 Phase II applications submitted during the period, 3,799 were funded, for an average funding rate of 51.7 percent. Funding rates for Phase II varied by year, peaking at 59.6 percent in FY2019 and falling to 37.4 percent by FY2023.

A notable feature of these data is the growing number of applications with missing phase information, particularly from FY2021 onward. In FY2021, nearly 2,000 applications were missing phase designation, followed by 3,509 in

TABLE 5-1 DOD SBIR and STTR Applications and Awards (Fiscal Years 2019–2023)

	SBIR			STTR			
Fiscal Year	Number of Applications	Number of Awards	Awards as a Percentage of Applications	Number of Applications	Number of Awards	Awards as a Percentage of Applications	Total Number of SBIR/STTR Applications
2019	12,201	3,241	26.6	1,220	432	35.4	13,421
2020	11,668	3,016	25.8	1,825	757	41.5	13,493
2021	14,130	2,895	20.5	1,977	710	35.9	16,107
2022	11,501	2,584	22.5	2,385	696	29.2	13,886
2023	12,080	1,863	15.4	2,159	502	23.3	14,239
	61,580	13,599	22.1	9,566	3,097	32.4	71,146

SOURCE: Committee calculations based on application data provided by DOD.

TABLE 5-2 DOD SBIR Applications and Awards, by Phase (Fiscal Years 2019–2023)

		Phase I			Phase II			Missing Phase Information	
Fiscal Year	Total Number of Applications	Number of Applications	Number of Awards	Awards as a Percentage of Applications	Number of Applications	Number of Awards	Awards as a Percentage of Applications	Number of Applications	Number of Funded Applications
2019	12,201	9,896	2,030	20.5	1,855	1,105	59.6	450	106
2020	11,668	9,613	1,932	20.1	2,054	1,083	52.7	1	1
2021	14,130	10,908	1,895	17.4	1,277	582	45.6	1,945	418
2022	11,501	6,795	1,229	18.1	1,197	669	55.9	3,509	686
2023	12,080	8,338	1,007	12.1	963	360	37.4	2,779	496
Total	61,580	45,550	8,093	17.8	7,346	3,799	51.7	8,684	1,707

SOURCE: Committee calculations based on application data provided by DOD.

FY2022 and 2,779 in FY2023. Of the 8,684 total applications with missing phase information between FY2019 and FY2023, 1,707 received funding—2.8 percent of all applications over the period. These gaps in reporting complicate efforts to fully assess the distribution and success rates of applications by phase and underscore the need for improved data tracking and consistency in program reporting. Additional analysis of the data shows that most of the missing data were from the Air Force, accounting for almost three-quarters of those data.

Table 5-3 shows SBIR application data broken down by service/component for FY2019–2023. The Air Force has the largest program, accounting for 44.6 percent of all applications over this 5-year period. When combined with the Navy and Army, these three services account for 83.6 percent of DOD's SBIR applications during the period. All three services—and the Space Development Agency—have many more applications for Phase I awards than for Phase II awards. Smaller services and components receive a smaller number of applications. Of the three major military services, the Navy had the highest funding rates for Phase II proposals (79.7 percent)—perhaps reflecting the Navy's requirement that applicants identify potential use cases and customers by connecting with operations. Most of the smaller services and components, such as the Defense Threat Reduction Agency and the Defense Health Agency, have lower Phase I funding rates but higher Phase II funding rates.

DATA ON SBIR APPLICANTS

The legal entity of record for any SBIR and STTR application is a firm with under 500 employees. During the analysis period, 11,609 unique firms applied to the SBIR program. Of these, 4,865 (41.9 percent) applied to the program once, and 6,744 (58.1 percent) applied more than once. The median number of applications per firm was 2, and the mean number of applications per firm was 6.1. Reflecting the well-known skew in the distribution of SBIR awards (Feldman et al., 2022), the maximum number of applications by a single firm was 809.[1]

Each of the 61,580 SBIR applications had a principal investigator, the project leader. Among these applications, principal investigator information was not recorded for 1,006 (1.4 percent). Approximately 21,543 unique principal investigators applied to the SBIR program over the analysis period.[2] The median number of applications per principal investigator was 2, and the mean number of applications per principal investigator was 3.3. Once again, the number of applications is skewed: the maximum number of applications from one principal investigator was 251. Unfortunately, demographic data on the principal investigators were not collected.

[1] See Chapter 9 for a more detailed review of firms receiving multiple awards.
[2] SBA.gov does not provide unique principal investigator identifiers. The committee's analysis relies on name disambiguation.

TABLE 5-3 SBIR Applications, by DOD Service/Component (Fiscal Years 2019–2023)

Component	Number of Applications	Share of DOD Applications (%)	Number of Phase I Applications	Percentage of Phase I Applications Awarded	Number of Phase II Applications	Percentage of Phase II Applications Awarded	Phase Unknown (Number of Applications)	Phase Unknown (Percentage Awarded)
Air Force	27,459	44.6	17,693	21.9	3,355	46.2	6,411	19.7
Navy	13,186	21.4	11,682	16.4	1,230	79.7	274	18.2
Army	10,837	17.6	8,901	13.0	1,259	36.9	677	13.7
Special Operations Command	1,581	2.6	1,107	9.9	140	48.6	334	12.9
Defense Logistics Agency	1,542	2.5	1,294	16.1	170	70.6	78	39.7
Missile Defense Agency	1,500	2.4	993	24.0	363	45.2	144	26.4
Defense Advanced Research Projects Agency	1,318	2.1	726	17.2	229	68.1	363	25.3
Defense Health Agency	1,283	2.1	994	18.3	200	58.5	89	46.1

Office of the Secretary of Defense	748	1.2	486	5.8	119	23.5	143	9.8
National Geospatial-Intelligence Agency	621	1.0	487	13.6	70	45.7	64	12.5
Defense Threat Reduction Agency	575	0.9	502	12.2	70	60.0	3	66.7
Chemical and Biological Defense	540	0.9	425	18.6	101	59.4	14	71.4
Space Development Agency	162	0.3	125	13.6	3	33.3	34	29.4
Defense Microelectronics Activity	158	0.3	113	25.7	32	34.4	13	46.2
Strategic Capabilities Office	70	0.1	22	13.6	5	100.0	43	18.6

SOURCE: Committee calculations based on application data provided by DOD.

More data were available for the firms that applied for SBIR awards. The average firm size of SBIR applicants was 21.5 employees. Half of the firms applying had fewer than 5 employees, while 5 percent had more than 100 employees, still well below SBA's criterion for the size of a small firm.

Applicants varied in terms of prior experience with the DOD SBIR program. The Air Force stands out, with more than half of the funded Phase I awards being made to first-time SBIR awardees. This relatively high percentage reflects the Air Force's adoption of an open topic model, which prioritizes exploratory innovation by issuing many small Phase I awards. The Defense Advanced Research Projects Agency (DARPA) also had a high rate of funding firms that were new to the program. Notably, DARPA's mission differs from that of the services, and the agency has only a small internal procurement function relative to the services and compared to what it spends on research and development (R&D).

The committee's analysis showed that funding rates increased with experience in submitting Phase I applications. Of course, it is reasonable that the likelihood of having an application funded depends on the number of applications submitted, given that as the number of applications increases, the likelihood that at least one will be funded rises. An experience factor also comes into play, in that firms may get better at writing proposals the more they do it or may even be able to have a dedicated grant-writing staff.

Geographic Distribution of Applications

The committee explored the geographic distribution of SBIR and STTR awards by the total number of applications and by the percentage of total awards for Phases I and II. The geographic distribution of SBIR awards is important because it reflects the extent to which the program meets its statutory objectives of promoting innovation and supporting technology-based economic development across all regions of the United States. As articulated in the Small Business Innovation Development Act of 1982[3] and reaffirmed in subsequent reauthorizations—including the SBIR/STTR Reauthorization Act of 2011[4]—one of the program's core purposes is to foster and encourage participation by socially and economically disadvantaged small business concerns and by small business concerns that are at a disadvantage in obtaining R&D funds. The geographic distribution of SBIR awards helps achieve this mandate by broadening access to federal R&D funding beyond historically dominant innovation hubs such as Silicon Valley and the Boston–Cambridge corridor. Table 5-4 presents the number of SBIR and STTR applications received, by state, in total and then normalized by the state's total population.

[3] U.S. Congress, Small Business Innovation Development Act of 1982, P.L. 97-219 (July 22, 1982).
[4] U.S. Congress, National Defense Authorization Act for 2012, P.L. 112-81, Sections 5001–5168 (December 31, 2011).

TABLE 5-4 Distribution of DOD SBIR/STTR Applications and Awards across States (Fiscal Years 2019–2023)

State	State Code	Total Applications (2019–2023)	Total Awards (2019–2023)	2023 Population	Awards per 100,000 Capita	Applications per 100,000 Capita
Alabama	AL	2,073	498	5,117,673	10	40.5
Alaska	AK	27	7	736,510	1	3.7
Arizona	AZ	1,314	295	7,473,027	4	17.6
Arkansas	AR	148	27	3,069,463	1	4.8
California	CA	14,043	3,342	39,198,692	9	35.8
Colorado	CO	3,074	830	5,901,339	14	52.1
Connecticut	CT	954	161	3,643,023	4	26.2
Delaware	DE	411	82	1,036,423	8	39.7
District of Columbia	DC	547	113	687,324	16	79.6
Florida	FL	3,446	643	22,904,868	3	15.0
Georgia	GA	962	211	11,064,432	2	8.7
Hawaii	HI	596	125	1,441,387	9	41.3
Idaho	ID	202	47	1,971,122	2	10.2
Illinois	IL	1,054	250	12,642,259	2	8.3
Indiana	IN	649	161	6,880,131	2	9.4
Iowa	IA	63	10	3,218,414	0	2.0
Kansas	KS	294	58	2,951,500	2	10.0
Kentucky	KY	273	48	4,550,595	1	6.0

(Continued)

TABLE 5-4 Continued

State	State Code	Total Applications (2019–2023)	Total Awards (2019–2023)	2023 Population	Awards per 100,000 Capita	Applications per 100,000 Capita
Louisiana	LA	416	85	4,588,071	2	9.1
Maine	ME	64	13	1,399,646	1	4.6
Maryland	MD	3,272	644	6,217,062	10	52.6
Massachusetts	MA	6,030	1,730	7,066,568	25	85.3
Michigan	MI	1,389	311	10,083,356	3	13.8
Minnesota	MN	469	110	5,753,048	2	8.2
Mississippi	MS	43	6	2,943,172	0	1.5
Missouri	MO	330	71	6,208,038	1	5.3
Montana	MT	126	30	1,131,302	3	11.1
Nebraska	NE	131	20	1,987,864	1	6.6
Nevada	NV	267	51	3,214,363	2	8.3
New Hampshire	NH	753	222	1,402,199	16	53.7
New Jersey	NJ	1,400	309	9,379,642	3	14.9
New Mexico	NM	763	201	2,121,164	10	36.0
New York	NY	2,802	628	19,737,368	3	14.2
North Carolina	NC	1,424	360	10,881,189	3	13.1
North Dakota	ND	36	3	789,047	0	4.6
Ohio	OH	3,951	928	11,824,034	8	33.4
Oklahoma	OK	393	85	4,063,882	2	9.7

Oregon	OR	452	115	4,253,653	3	10.6
Pennsylvania	PA	2,258	581	13,017,721	5	17.3
Rhode Island	RI	295	75	1,103,429	7	26.7
South Carolina	SC	288	50	5,387,830	1	5.3
South Dakota	SD	134	26	918,305	3	14.6
Tennessee	TN	514	123	7,148,304	2	7.2
Texas	TX	4,781	1,042	30,727,890	3	15.6
Utah	UT	793	180	3,443,222	5	23.0
Vermont	VT	166	30	648,708	5	25.6
Virginia	VA	5,555	1,388	8,734,685	16	63.6
Washington	WA	1,009	225	7,857,320	3	12.8
West Virginia	WV	170	32	1,770,495	2	9.6
Wisconsin	WI	298	63	5,930,405	1	5.0
Wyoming	WY	215	48	585,067	8	36.7

SOURCE: Committee calculations based on application data provided by DOD and population data from the U.S. Census Bureau.

The distribution of DOD SBIR/STTR applications follows a pattern of regional high concentration, with most applications coming from a small number of states. States such as California, Massachusetts, and Virginia dominate in total applications, accounting for a significant proportion of submissions. Remarkably, as Table 5-4 shows, nearly 70 percent of the total is concentrated in just 20 percent of states. Most of those states are in the Northeast (e.g., Massachusetts, New York, Pennsylvania) and the eastern United States (e.g., Ohio, Maryland, Virginia, Florida, Alabama). The West accounts for fewer states with high application rates, with the notable exceptions of California, Texas, and Colorado. This geographic disparity highlights the uneven distribution of innovation infrastructure and resources across different regions of the country (Boschma et al., 2025; Feldman and Florida, 1994).

Geographic Distribution of SBIR Applications and Funding Rates by Phase

Next, the committee examines separately the geographic distribution of DOD SBIR Phase I and Phase II applications and funding rates. The two phases serve distinct purposes and reflect different dynamics in the innovation pipeline. Phase I awards are designed to support feasibility studies, providing small businesses with early-stage funding to explore the scientific and technical merit of a proposed innovation. These awards typically have lower barriers to entry and attract a broader and more geographically dispersed applicant pool—including first-time participants, startups, and firms in emerging or less-developed innovation regions.

In contrast, Phase II awards are significantly larger and intended to support the continued development and commercialization of technologies initiated in Phase I. Because they require prior Phase I success and often involve stronger commercialization plans, Phase II awards are more likely to go to firms with existing infrastructure, experienced management, and access to follow-on capital—factors that tend to be concentrated in established innovation clusters such as Silicon Valley, Boston, and the DC metro area (Wallsten, 2000).

By analyzing the two phases separately, policy makers and researchers can assess whether the SBIR program is successfully fulfilling its mandate to broaden geographic participation. A relatively inclusive distribution of Phase I awards could indicate progress in reaching new regions and firms, while a narrower Phase II distribution could reveal persistent challenges in scaling innovations from underrepresented areas. This distinction is crucial for designing interventions—such as technical assistance, mentorship, or regional commercialization support—that can help firms in underserved regions transition from Phase I to Phase II, ultimately improving the effectiveness of the SBIR program (Lanahan and Feldman, 2015, 2018).

The acceptance rates for Phase I and Phase II suggest disparities in regional innovation ecosystems and the ability of firms operating in different

geographic areas to transition projects through funding phases. States in the East and Northeast, along with selected states in the West, such as Colorado, perform well in Phase I, while smaller and less populous states, such as Wyoming and Rhode Island, are among those that excel in transitioning to Phase II. Unfortunately, of the total number of awards reviewed for the committee's analysis, 8,684 cannot be clearly assigned to a specific phase. Appendix D of this report provides detail on DOD SBIR applications and funded awards by phase for every congressional district.

As reflected in Table 5-5, the distribution of Phase I funding rates shows great variation across states, with some Eastern states and a few Western states achieving notably high success rates. Eastern states such as Massachusetts (23 percent) and New Hampshire (21 percent) have some of the highest acceptance rates, benefiting from robust innovation ecosystems supported by world-class universities and research institutions. Colorado in the West also achieves a high acceptance rate of 21 percent, reflecting the region's growing focus on technology and innovation hubs. In contrast, states such as Nebraska (10 percent) and South Dakota (11 percent) show much lower funding rates, potentially because of fewer resources for fostering early-stage innovation or a lack of established innovation networks. Surprisingly, some smaller states, such as Rhode Island (21 percent), perform well despite their smaller application pools.

Phase II funding rates (Table 5-6) also show clear regional patterns, with the highest rates often seen in smaller or less populous states across the country. Western states such as Wyoming (with an 85 percent acceptance rate) and Arkansas in the South Central region (69 percent) lead the way in transitioning Phase I projects into funded Phase II awards, indicating strong support in these states for follow-up efforts and commercialization readiness. Similarly, New Hampshire in the East (56 percent) and Indiana in the Midwest (57 percent) perform well, likely because of effective infrastructure for advancing early-stage innovations. On the other hand, some states, such as South Dakota and Mississippi, have relatively low funding rates, with 32 and 22 percent of Phase I projects transitioning to Phase II, respectively. These regional differences suggest the importance of localized innovation ecosystems, as well as the need for tailored strategies to support proposals through both phases of the innovation pipeline.

FINDING

Finding 5-1: DOD's SBIR/STTR programs employ competitive application processes. The applicant and awardee pools span the country, but there are significant differences in funding rates among and within states.

TABLE 5-5 Difference in Funded SBIR Phase I Applications, by State (Fiscal Years 2019–2023)

State	Number of Applications	Average Annual Percentage Funded	State	Number of Applications	Average Annual Percentage Funded
Alaska	17	27	Kansas	173	16
Massachusetts	3,890	23	Arizona	853	16
Colorado	1,876	21	Oklahoma	238	16
Rhode Island	202	21	Hawaii	400	15
New Hampshire	438	21	Louisiana	232	15
Idaho	130	20	Maine	45	15
North Carolina	891	20	Wisconsin	210	15
Wyoming	154	19	Utah	516	15
Oregon	302	19	Delaware	261	15
Minnesota	289	19	Maryland	2,154	14
District of Columbia	332	19	Connecticut	603	14
California	9,058	19	Georgia	568	14
Pennsylvania	1,438	19	Florida	2,327	14
New Mexico	466	18	New Jersey	969	14
Virginia	3,569	18	Kentucky	188	13
Indiana	389	18	Vermont	114	13
Alabama	1,295	18	South Dakota	80	11

Missouri	221	18	Iowa	50	11
Tennessee	335	17	Montana	87	11
Texas	3,113	17	South Carolina	204	11
Nevada	183	17	Arkansas	97	10
Washington	632	17	Nebraska	91	10
Ohio	2,370	17	Mississippi	29	10
New York	1,772	17	West Virginia	107	7
Illinois	620	17	Puerto Rico	16	7
Michigan	925	17	North Dakota	27	4

SOURCE: Committee calculations based on application data provided by DOD.

TABLE 5-6 Difference in Funded SBIR Phase II Applications, by State (Fiscal Years 2019–2023)

State	Number of Applications	Average Annual Percentage Funded	State	Number of Applications	Average Annual Percentage Funded
Alaska	1	100.00	North Carolina	178	49.70
Wyoming	13	85.00	Louisiana	26	49.20
Arkansas	8	75.00	California	1,528	48.50
Rhode Island	32	63.00	Oregon	46	48.00
Indiana	61	61.60	New York	250	47.90
New Hampshire	118	60.40	Michigan	153	47.70
South Carolina	20	60.30	Wisconsin	23	47.50
Delaware	31	58.90	Washington	99	47.30
Utah	89	57.90	Idaho	16	47.30
Hawaii	64	56.20	West Virginia	13	47.00
Arizona	130	55.90	District of Columbia	44	46.50
Pennsylvania	253	55.50	Ohio	389	45.80
New Jersey	152	54.70	Nevada	19	45.60
Georgia	86	54.70	Texas	437	45.20
Tennessee	45	54.20	Kentucky	22	45.10
Massachusetts	765	53.50	Vermont	12	45.00
Kansas	15	53.30	Minnesota	57	44.90

Alabama	205	53.00	Illinois	96	44.10
Connecticut	66	52.90	Oklahoma	31	42.80
Colorado	381	52.20	Maryland	318	42.60
Virginia	607	52.10	Missouri	30	42.10
New Mexico	89	51.10	Mississippi	5	22.20
Nebraska	10	50.00	South Dakota	7	20.80
Montana	7	50.00	Maine	6	12.50
Iowa	4	50.00	Puerto Rico	1	0.00
Florida	288	49.70			

SOURCE: Committee calculations based on application data provided by DOD.

6

The STTR Program and DOD

The Department of Defense's (DOD's) Small Business Technology Transfer (STTR) program was established in 1992 with the aim of fostering innovation by facilitating collaboration between small businesses and research institutions. By leveraging the agility of small enterprises and the research capabilities of research institutions such as universities and federal laboratories, the STTR program is aimed at meeting DOD's mission-critical needs through technological advances. This chapter explores the unique characteristics of DOD's STTR program, examining its rationale, funding landscape, competitiveness, and obstacles, and concludes by synthesizing some key findings and recommendations.

STTR'S DISTINCTIVE RATIONALE AND STRUCTURE

The STTR program was established to address specific needs not fully met by the existing Small Business Innovation Research (SBIR) program. While both programs aim to stimulate technological innovation and enhance the role of small businesses in federal research and development (R&D), the STTR program is uniquely designed to foster formal collaborations between small businesses and research institutions, such as universities and federal laboratories.

The rationale for a separate STTR program lies in its potential ability to bridge the gap between fundamental research, often conducted within universities and federal laboratories, and practical application. While small and young businesses often possess agility and entrepreneurial drive, they may lack access to the specialized research facilities and expertise within universities, nonprofit research institutions, and Federally Funded Research and Development Centers (FFRDCs). Because it requires collaboration between small businesses and these research institutions, the STTR program has the potential to leverage those institutions' capabilities and tools. This collaborative approach may be particularly valuable for DOD, which faces increasingly complex technological challenges and is particularly focused on realizing its mission.

The distinct rationale of the STTR program is reflected in its unique structural requirements, setting it apart from the SBIR program. Central to the STTR program is the mandatory collaboration between a small business and a U.S.-based research institution. This formal partnership is not merely encouraged but is a condition of eligibility, ensuring that both entities are actively involved in the R&D process. The small business must perform at least 40 percent of the R&D activities, while its research institution partner is required to carry out a minimum of 30 percent. The remaining 30 percent can be allocated flexibly based on the project's specific needs.[1] This structure ensures a significant commitment from both parties and promotes a balanced partnership in which the strengths of each can be effectively utilized. The partners must also establish a cooperative research agreement that outlines the terms of collaboration, including intellectual property rights, proprietary information, and commercialization plans. The SBIR program, on the other hand, permits but does not require collaboration agreements, and a certain percentage of the overall effort must be undertaken by the small business awardee, thereby capping the amount that can be undertaken by a research partner: in the case of Phase I SBIR awards at least two-thirds of the overall effort must be undertaken by the small business awardee, and for Phase II that figure drops to one-half (SBA, 2023).

THE STTR FUNDING LANDSCAPE

To assess the effectiveness and impact of DOD's STTR program, it is useful to begin with an overview of STTR awards, including the funding rates for Phase I and Phase II applications, the distribution of awards across different services/components and states, and other characteristics.

Figure 6-1 shows DOD's expenditures on the STTR program and how they have evolved over time. The past decade has seen significant growth in the overall inflation-adjusted level of funding through the program, reflecting three interrelated developments. First, with the 2011 SBIR/STTR reauthorization, the statutory level of funding for STTR was gradually increased (from 0.3 percent to 0.45 percent of extramural R&D funding). Second, starting in 2017, there was a sizeable increase in the size of DOD's extramural research expenditures, which led to an increase in the level of STTR expenditures. There was a further increase in this trajectory with the onset of the COVID-19 pandemic, with significant increases in overall federal research funding.

Despite this increase in expenditures, there has been a more muted (and recent) decrease in the number of actual awards (Figure 6-2). From fiscal year (FY) 2012 through 2019, the number of Phase I and Phase II STTR awards

[1] The U.S. Small Business Administration's 2023 SBIR/STTR Policy Directive indicates that "an agency can measure this research or analytical effort using the total award dollars or labor hours, and must explain to the small business in the solicitation how it will be measured" (SBA, 2023, p. 34). The *DOD STTR 25.D Annual Program Broad Agency Announcement* indicated that "the percentage of work is measured by both direct and indirect costs" (DOD, 2025b, p. 2).

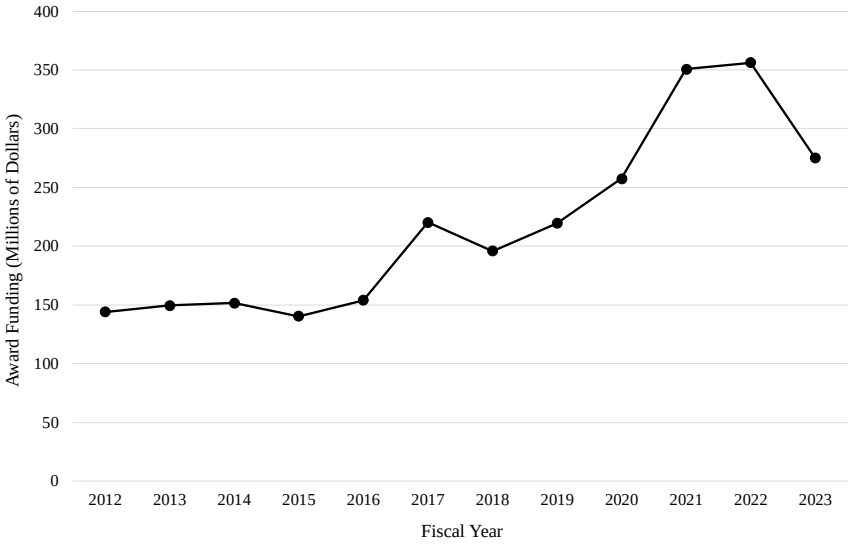

FIGURE 6-1 DOD's STTR expenditures (fiscal years 2012–2023).
NOTE: All values adjusted for inflation with 2023 as base year (https://www.bls.gov/data/inflation_calculator.htm).
SOURCE: Committee calculations based on the U.S. Small Business Association's SBIR/STTR Awards database (SBIR.gov).

supported by DOD each remained at a roughly similar level, as illustrated in Figure 6-2. In other words, the overall number of awards remained (roughly) constant over this period, reflecting increased average award sizes from $299,000 to $415,000 in FY2019. In the most recent period (FY2019–2022), however, there was a sizeable increase in the number of awards, concentrated in Phase I awards.

Awardee Characteristics

An analysis of DOD's STTR program over the period FY2012–2023 reveals notable trends in the characteristics of participating firms. The STTR program exhibits a relatively low fraction of first-time awardees and a high fraction of multiple-award recipients. Only 13.4 percent of STTR recipients were first-time awardees. Conversely, 32.2 percent of DOD's Phase I STTR awardees received 15 or more Phase I SBIR or STTR awards from any federal agency within a 5-year period, a common characterization of multiple-award recipients, seen in previous scholarship (NASEM, 2020). The committee also calculated proportions of STTR awards made to higher-volume participants using the congressional performance benchmark of 51+ Phase I awards within 5 years from any federal agency, which are defined as "experienced firms" in the 2022 reauthorization of the SBIR/STTR programs (see the extended discussion in

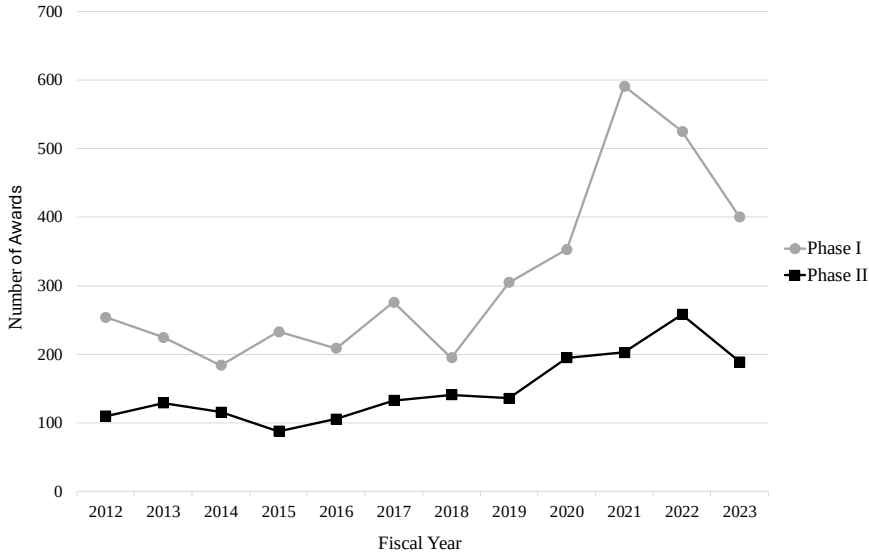

FIGURE 6-2 Number of DOD STTR Phase I and Phase II awards (fiscal years 2012–2023).
NOTE: All values adjusted for inflation with 2023 as base year (https://www.bls.gov/data/inflation_calculator.htm).
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

Chapter 9).[2] Using this measure, only 11.9 percent of DOD STTR awards went to experienced firms during fiscal years 2012–2023 (see Table 6-1).

The relatively low proportion of awards going to firms new to the program suggests that new firms may face greater barriers to entry compared with experienced firms. For instance, established firms may be more adept at navigating the program's requirements. As noted, multiple-award recipients include those receiving multiple awards from DOD and those securing awards from multiple federal agencies. The prevalence of such firms indicates a concentration of awards among a subset of businesses with prior experience and success within federal R&D programs, possibly suggesting that academics in highly ranked universities may be selective in choosing the small firms with which they want to work as partners.

Further examination by DOD service/component, as detailed in Table 6-2, shows that this trend is particularly pronounced within the Navy, Army, and Missile Defense Agency (MDA), which have an even lower fraction of first-time awardees and a higher fraction of multiple-award recipients compared with the

[2] U.S. Congress, SBIR and STTR Extension Act of 2022, P.L. 117-183 (September 30, 2022). See Section 8, "Increased Minimum Performance Standards for Experienced Firms."

TABLE 6-1 STTR Awardee Characteristics Across Participating Federal Agencies (Fiscal Years 2012–2023)

		Percentage of Phase I STTR Awards to Firms			
Federal Agency	Percentage of First-Time Awardees	With 15+ Phase I SBIR/STTR Awards from Any Federal Agency	With 15+ Phase I SBIR/STTR Awards from DOD	With 51+ Phase I SBIR/STTR Awards from Any Federal Agency	With 51+ Phase I SBIR/STTR Awards from DOD
Department of Defense	13.4	32.2	24.5	11.9	7.2
Department of Energy	22.7	17.0	3.4	4.6	1.4
Department of Health and Human Services	45.4	3.3	0.3	0.4	0.0
National Aeronautics and Space Administration	13.6	35.5	12.9	13.3	1.9
National Science Foundation	71.1	0.7	0.1	0.1	0.0
Average	33.2	17.7	8.2	6.1	2.1

NOTE: Experience is first calculated as the proportion of awards (Phase I STTR only) from an agency to firms that have accumulated at least 15 other Phase I SBIR or STTR awards from any federal agency in the previous 0–5 years. The committee also calculated figures using the 51+ Phase I award threshold for "experienced firms" per the provisions of the SBIR and STTR Extension Act of 2022 (P.L. 117-183) and as outlined by the Small Business Administration (SBA). See "Performance Benchmark Requirements" at https://www.sbir.gov/performance-benchmarks. For comparison, the table includes two columns with measures that restrict these underlying definitions to include only DOD SBIR/STTR awards.
SOURCE: Committee calculations based on SBA's SBIR/STTR Awards database (SBIR.gov).

TABLE 6-2 STTR Awardee Characteristics Across Top Five DOD Divisions (Fiscal Years 2012–2023)

		Percentage of Phase I STTR Awards to Firms			
Service/Component	Percentage of First-Time Awardees	With 15+ Phase I SBIR/STTR Awards from Any Federal Agency	With 15+ Phase I SBIR/STTR Awards from DOD	With 51+ Phase I SBIR/STTR Awards from Any Federal Agency	With 51+ Phase I SBIR/STTR Awards from DOD
Air Force	17.5	24.0	17.6	7.2	4.2
Army	11.9	36.4	26.9	18.2	11.9
Defense Advanced Research Projects Agency	17.6	29.4	22.9	12.4	7.2
Missile Defense Agency	6.6	43.7	35.4	16.6	12.7
Navy	7.0	40.6	32.3	14.6	9.0
Average	12.1	34.8	27.0	13.8	9.0

NOTE: Experience is first calculated as the proportion of awards (Phase I STTR only) from an agency to firms that have accumulated at least 15 other Phase I SBIR or STTR awards from any federal agency in the previous 0–5 years. The committee also calculated figures using the 51+ Phase I award threshold per the provisions of the SBIR and STTR Extension Act of 2022 (P.L. 117-183). For comparison, the table includes two columns with measures that restrict these underlying definitions to include only DOD SBIR/STTR awards.
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

overall STTR program averages. In contrast, data on the Air Force and the Defense Advanced Research Projects Agency (DARPA) reveal relatively higher participation from first-time awardees and a lower proportion of multiple-award recipients.

This variance is especially significant given that the period of analysis includes the Air Force's introduction of the open topics solicitation program, which offers many small Phase I awards.[3] This initiative was designed in part to expand the small (or nontraditional) business base.[4] The data suggest that the open topics program was effective in increasing the engagement of first-time awardees within the Air Force's STTR program.

Geographic Distribution of Awards

An analysis of the geographic distribution of DOD STTR awards reveals significant variations in award intensity across various states. As illustrated in Figure 6-3, the relative intensity of STTR awards per capita is particularly high in

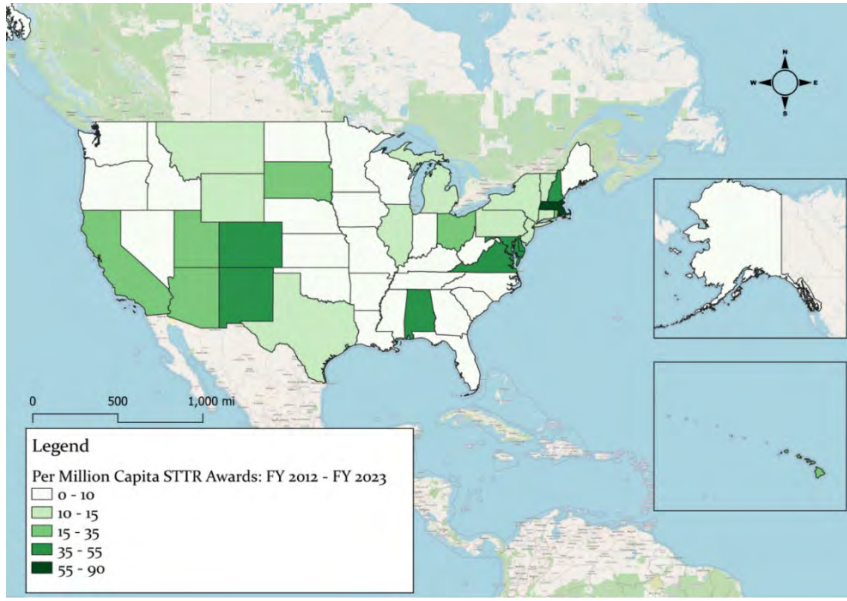

FIGURE 6-3 Geographic distribution of DOD STTR awards per million capita (fiscal years [FY] 2012–2023).
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

[3] STTR and SBIR open topics Phase I awards were originally offered for a shorter period of time (up to 3 months) and a maximum dollar value of $50,000. Currently, STTR Phase I open topics awards are for up to $110,000 (while SBIR Phase I open topic awards are for up to $75,000) for a 3-month period of performance.
[4] 15 U.S.C., Section 638(ww)(1)(B).

Massachusetts, Colorado, New Mexico, Alabama, New Hampshire, Virgina, Maryland, and Delaware. When one examines just Phase I awards (see Figure 6-4), these states are joined by Ohio. The location of DOD research laboratories and facilities may impact levels of STTR activity in those states or regions. Finally, looking just at Phase II STTR awards (see Figure 6-5), a pronounced concentration of awards is seen in Massachusetts, Virginia, and New Mexico. This higher concentration may reflect the presence of robust support systems, infrastructure, and resources necessary to advance projects to more complex development stages.

Table 6-3 presents STTR versus SBIR funding by state. Overall, STTR funding constitutes about 12.7 percent of the combined SBIR/STTR funding within the states. This ratio holds true for states such as California, Massachusetts, and Colorado, among others, suggesting a balanced engagement with both programs. Notably, certain Midwestern states with large, research-intensive public university systems—including Wisconsin, Illinois, and Ohio—exhibit a relative strength in STTR funding compared with SBIR funding. This pattern may be attributable to the strong collaborative relationships between small businesses and universities in these states, leveraging academic research capabilities to drive innovation through the STTR program. The geographic patterns observed

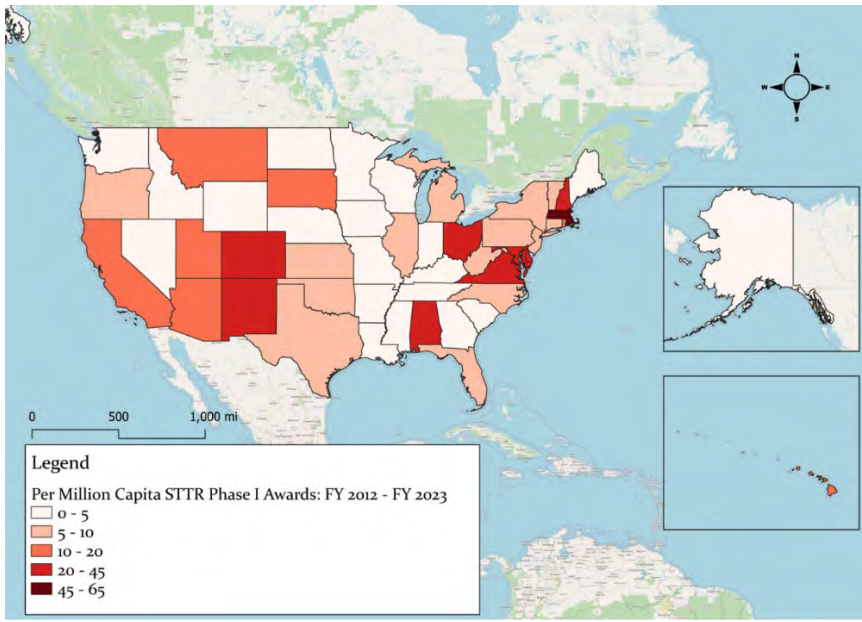

FIGURE 6-4 Geographic distribution of DOD Phase I STTR awards per million capita (fiscal years [FY] 2012–2023).
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

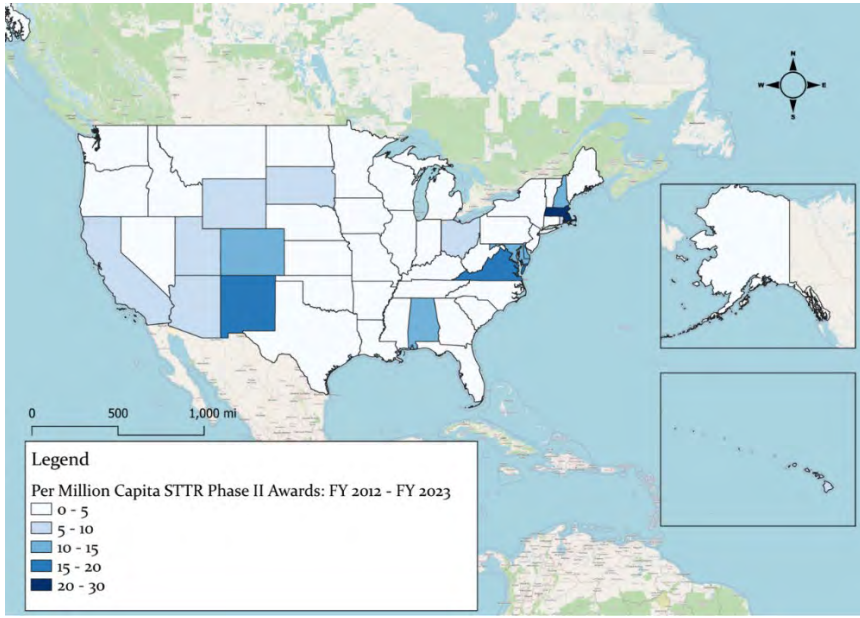

FIGURE 6-5 Geographic distribution of DOD Phase II STTR awards per million capita (fiscal years [FY] 2012–2023).
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

highlight the significant role played by DOD facilities and research institutions in the distribution of STTR awards. States that host major DOD laboratories and have universities with robust research programs tend to secure a higher number of awards, particularly at the more competitive Phase II level. This suggests that proximity to DOD resources and the presence of strong academic–industry partnerships are influential factors in the success of STTR initiatives.

Leading STTR Partner Institutions

Table 6-4 shows the top research institutions participating as firm partners in the STTR program. Many of the nation's leading universities are actively engaged in collaborations with small businesses to advance defense-related technologies. Institutions such as the Massachusetts Institute of Technology, The Ohio State University, The Pennsylvania State University, Purdue University, and the Georgia Institute of Technology rank highly in terms of both funding amounts received and the number of STTR contracts awarded. Their significant involvement highlights the importance of academic expertise and resources in driving innovation within DOD. Institutions such as North Carolina State University (#3) and the University of Central Florida (#14, not

TABLE 6-3 Total DOD SBIR/STTR Program Funding, by State (Fiscal Years 2012–2023)

State	Total SBIR Funding	Total STTR Funding	STTR Percentage of Total
Alabama	539,686,119	97,306,784	15.3
Alaska	3,653,350	1,444,174	28.3
Arizona	320,350,958	58,009,929	15.3
Arkansas	21,658,125	4,871,818	18.4
California	3,803,759,090	441,183,181	10.4
Colorado	872,271,979	109,845,687	11.2
Connecticut	167,846,158	19,545,992	10.4
Delaware	76,651,429	18,654,476	19.6
Florida	645,574,117	81,662,469	11.2
Georgia	233,227,704	32,627,931	12.3
Hawaii	197,158,749	17,289,846	8.1
Idaho	31,750,813	4,158,256	11.6
Illinois	237,710,591	72,119,853	23.3
Indiana	142,182,184	24,905,708	14.9
Iowa	16,122,626	2,528,028	13.6
Kansas	34,258,138	11,381,774	24.9
Kentucky	32,668,168	16,214,651	33.2
Louisiana	75,841,671	5,553,798	6.8
Maine	21,738,892	514,270	2.3
Maryland	811,023,321	136,422,260	14.4
Massachusetts	2,144,618,237	303,433,417	12.4
Michigan	371,314,850	61,815,518	14.3
Minnesota	136,727,268	14,990,500	9.9
Mississippi	11,138,080		0.0
Missouri	67,798,870	10,932,380	13.9
Montana	39,710,671	7,506,769	15.9
Nebraska	26,118,868	3,020,741	10.4
Nevada	45,117,759	9,741,571	17.8
New Hampshire	296,531,299	35,383,144	10.7
New Jersey	369,315,900	47,076,647	11.3
New Mexico	250,519,511	54,835,752	18.0
New York	652,211,410	113,930,138	14.9
North Carolina	329,105,648	52,577,445	13.8
North Dakota	1,526,124	1,073,214	41.3
Not Found	861,872,858	158,293,755	15.5

Ohio	47,564,447	13,347,672	21.9
Oklahoma	134,153,754	18,176,674	11.9
Oregon	794,586,511	72,517,884	8.4
Pennsylvania	77,873,455	7,823,612	9.1
Rhode Island	42,969,669	5,661,795	11.6
South Carolina	14,859,974	6,498,166	30.4
South Dakota	87,212,668	17,269,771	16.5
Tennessee	837,270,105	145,952,008	14.8
Texas	230,441,826	26,731,793	10.4
Utah	38,207,934	4,986,500	11.5
Virginia	1,605,364,238	197,129,039	10.9
Vermont	188,578,746	33,182,977	15.0
Washington	80,425,018	6,104,338	7.1
West Virginia	31,348,420	5,318,187	14.5
Wisconsin	42,783,592	19,268,693	31.1
Wyoming	30,314,579	2,998,159	9.0
Total	15,925,252,117	2,318,099,457	12.7

NOTE: All values adjusted for inflation with 2023 as base year (https://www.bls.gov/data/inflation_calculator.htm).
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

TABLE 6-4 Top DOD STTR Research Institution Partners (Fiscal Years 2012–2023)

Institution	Number of STTR Awards	Total STTR Funding (Dollars)
Purdue University	103	47,725,376
The Ohio State University	114	47,536,274
North Carolina State University	92	47,299,123
Southwest Research Institute	58	35,131,684
Georgia Institute of Technology	69	33,169,748
University of Maryland	64	33,112,349
Massachusetts Institute of Technology	69	31,674,482
University of Arizona	47	31,156,951
Sandia National Laboratories	54	30,796,209
University of Michigan	56	29,512,895

NOTE: All values adjusted for inflation with 2023 as base year (https://www.bls.gov/data/inflation_calculator.htm).
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

shown) also feature prominently, indicating that partnerships are not limited to the most prestigious universities but include a diverse range of institutions with specialized expertise or strong industry ties.

Notably, some top-tier universities renowned for their engineering and science programs, such as the University of California, Berkeley and the University of Illinois Urbana-Champaign are conspicuously absent from the list of leading STTR participants. This absence may stem from various factors, including an institutional focus on fundamental over applied research, differing collaboration policies, or lower levels of engagement with the STTR program. It suggests that while institutional prestige is significant, the effectiveness of the STTR program depends more on the strength and productivity of the collaborations between small businesses and research partners.

STTR Awards to Minority-Serving Institutions (MSIs)

The committee's statement of task[5] includes examining the STTR program's effectiveness in fostering research collaborations and identifying potential barriers, particularly for institutions serving minority populations. Table 6-5 illustrates MSI participation in the STTR program, and Figure 6-6 further breaks down trends in MSI STTR activity at DOD over the period FY2012–2023. The data reveal both challenges and opportunities for improvement.

TABLE 6-5 Top DOD STTR Research Institution Partners Among Minority-Serving Institutions (Fiscal Years 2012–2023)

Institution	Number of STTR Awards	Total STTR Funding (Dollars)
University of Arizona	47	31,156,951
University of Central Florida	50	25,406,904
George Mason University	38	15,836,623
The University of Texas at Austin	33	15,243,675
University of California, San Diego	28	14,541,934
Colorado State University	24	11,593,570
University of California, Santa Barbara	17	9,194,638
University of Houston	17	6,732,505
University of North Texas	13	5,198,622
Florida International University	15	2,064,287

NOTE: All values adjusted for inflation with 2023 as base year (https://www.bls.gov/data/inflation_calculator.htm). Minority-serving institutions drawn from Rutgers University's 2024 published list based on Department of Education data (https://cmsi.gse.rutgers.edu/msi-directory).
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

[5] The committee's Statement of Task can be found in Chapter 1.

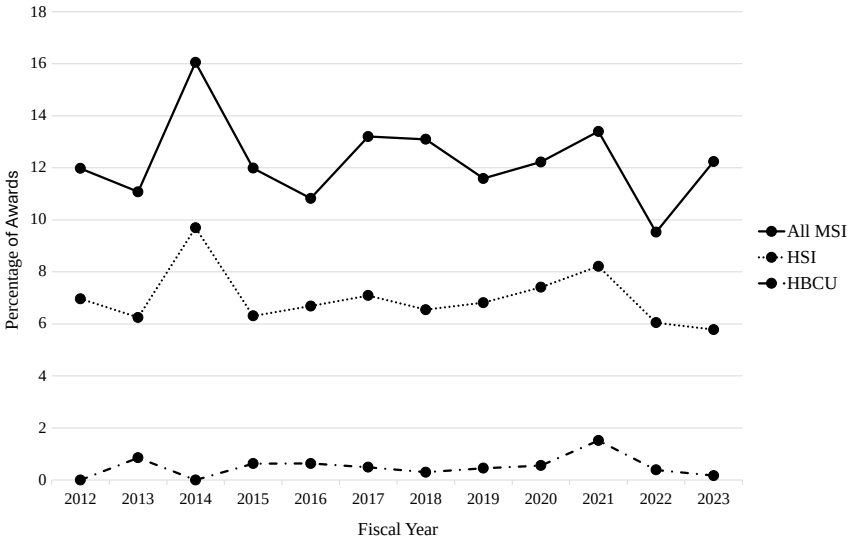

FIGURE 6-6 Percentage of total DOD STTR awards going to minority-serving institution (MSI) partners (fiscal years 2012–2023).
NOTE: All values adjusted for inflation with 2023 as base year (https://www.bls.gov/data/inflation_calculator.htm); MSIs drawn from Rutgers University 2024 published list based on Department of Education data, including subgroup analysis for historically Black colleges and universities (HBCUs) and Hispanic-serving institutions (HSIs) (https://cmsi.gse.rutgers.edu/msi-directory).
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

While some MSIs have achieved notable success in establishing STTR partnerships—with institutions such as the University of Central Florida (50 awards, $25.4 million) and George Mason University (38 awards, $15.8 million) establishing a substantial number of these partnerships—the overall trends shown in Figure 6-5 suggest persistent barriers to broader participation. The fact that MSI participation has declined from its 2014 peak of about 16 percent to recent levels of around 12 percent, dropping to just under 10 percent in FY2022, indicates challenges in creating and sustaining these collaborative relationships.

Moreover, the consistent underrepresentation of historically Black colleges and universities (HBCUs), with participation remaining below 2 percent throughout the study period, suggests significant structural barriers to creating these collaborations. While Hispanic-serving institutions (HSIs) have maintained higher participation rates (generally 2–6 percent of total awards), their representation still lags significantly behind that of non-MSI institutions.

Several potential barriers to collaboration emerge from this analysis. First, the concentration of awards among a small number of established research institutions suggests that institutional experience and infrastructure play a crucial

role in STTR success. The gap between top performers such as The Ohio State University (114 awards) and even the most successful MSIs indicates potential barriers to developing this institutional capacity. Second, the persistent disparity between HSI and HBCU participation rates suggests that different MSIs may face distinct challenges in establishing small business partnerships. This variance merits further investigation to understand the specific obstacles facing different types of institutions. Finally, the recent decline in overall MSI participation, particularly the sharp drop in FY2022, raises concern about whether current program structures adequately support sustained collaboration with MSIs.

These observations point to several potential mechanisms that could encourage such collaborations. The success of certain MSIs in establishing significant STTR portfolios suggests that targeted support for developing institutional capacity and partnership networks could help broaden participation. Additionally, the varying patterns of participation among different types of MSIs indicate that customized approaches may be needed to address the specific challenges facing different institutional categories.

The data strongly suggest that fostering broader collaboration, particularly with MSIs, will require focused attention to reducing barriers and developing supportive mechanisms. The current patterns of participation indicate that while the STTR program has created some successful partnerships with MSIs, significant work remains to stimulate broad-based research collaboration.

STTR, Federal R&D, and Technology Transfer

The committee analyzed funding patterns for research institutions to assess the STTR program's effectiveness at transferring technology and capabilities developed through federal funding. Data from the National Science Foundation's (NSF's) National Center for Science and Engineering Statistics on institutional funding for federal R&D across all agencies, and DOD in particular, reveal a positive relationship between overall R&D expenditures and STTR participation that has significant implications for technology transfer outcomes.

A striking observation emerges when one compares institutions' overall DOD R&D funding with their STTR participation. While Johns Hopkins University led significantly in DOD's R&D expenditures ($8 billion) in FY2023, its STTR engagement was relatively modest ($1.7 million). Conversely, The Ohio State University, ranked 36th in DOD R&D funding ($47.4 million), showed the highest STTR expenditures ($9.5 million) among all institutions. This disparity suggests that high levels of DOD funding do not automatically translate into effective technology transfer through the STTR program.

The data also reveal potential challenges in the program's technology transfer mission. Some major research universities with substantial DOD funding show limited STTR engagement. There is significant variation in STTR participation among institutions with similar levels of DOD funding, indicating the potential impact of institutional factors beyond research capacity. Indeed, the concentration of participation as partners among certain institutions suggests that effective technology transfer mechanisms may not be widely distributed across

the research institution landscape. These patterns suggest that while the STTR program has created effective pathways for technology transfer at certain institutions, its effectiveness varies significantly across the research institution landscape. The data indicate that technology transfer through STTR may depend more on institutional expertise in commercial translation and small business partnerships and the incentive structure within individual universities rather than on overall DOD research funding levels.

CHALLENGES TO STTR EFFECTIVENESS

The STTR program uniquely requires small businesses to collaborate with universities or federal laboratories, with at least 30 percent of the work being conducted by the research institution and 40 percent by the small business. This structure leverages the advanced research capabilities of academia and the agility of small businesses, fostering the development of cutting-edge technologies in such areas as quantum computing and advanced materials. However, this requirement also introduces complexities, such as the need for up-front negotiation of intellectual property agreements and potential misalignment between academic research objectives and DOD operational needs. These factors can impede the efficient transition of technologies to practical use within DOD, potentially leading to longer development timelines compared with the SBIR program. Other issues, discussed below, impact the potential effectiveness of the program.

Funding levels: The levels of Phase I and Phase II STTR funding have not kept pace with inflation, and the program, and its resulting collaborations, may benefit from additional flexibility in appropriate funding sizes, for both Phase I and Phase II projects. There may be cases in which smaller Phase I award sizes may be appropriate and other cases in which the optimum Phase II award size may be significantly larger than the current threshold. In areas such as artificial intelligence (AI), data science, and machine learning, the current salaries range from $150,000/year to $300,000/year (Sternlicht, 2025).[6] Given that as little as 30 percent of the Phase I and Phase II award funding goes to a research partner, the actual amounts available to universities are not commensurate with the level of effort needed from professors and their graduate students or postdocs to participate in an STTR project. The stipends of graduate students in engineering are typically in the range of $40,000–$50,000/year,[7] and postdoc salaries in the range of $75,000–$90,000/year (Sainburg, 2023). Given the low levels of funding, a typical STTR effort has a senior company employee or university faculty member serving as the principal investigator, with someone more junior doing most of the work. This being the case, STTR projects can often serve as a training ground for young employees.

[6] See also https://aipaygrad.es.
[7] See http://phdstipends.com.

Attracting more first-time awardees: As noted previously, the Navy, Army, and MDA exhibit particularly low fractions of first-time awardees and higher concentrations of multiple-award recipients. In contrast, the Air Force and DARPA have higher participation rates from first-time awardees. The Air Force's implementation of the open topics program, which simplifies the application process, appears to have effectively increased engagement from new firms, which suggests that specific initiatives and solicitation strategies can reduce barriers to program entry. This observation is particularly important with respect to attracting junior researchers working in cutting-edge technical areas such as AI and quantum. The STTR program provides a distinctive and critical pipeline to encourage more junior researchers to continue work (e.g., during a thesis or postdoc) while also engaging with the defense innovation system.

Data sensitivity: More and more STTR projects may need a controlled unclassified information (CUI) clause. Many universities view this provision as an impediment, given that a significant number of graduate students in science and engineering are international students, who cannot access CUI information. As these students are well trained in AI, data science, and machine learning, if CUI provisions are enforced, the small companies will be unable to attract them, and they may eventually join large companies such as Meta, Google, or Apple.[8]

DOD bureaucracy: Many small business owners double as their company's contract officers. STTR contract negotiations involve such issues as intellectual property rights, publication of results, and technology transfer between companies and universities. Issues such as getting paid on time and any gap in funding between Phase I and Phase II could discourage small businesses.

FINDINGS AND RECOMMENDATIONS

Finding 6-1: The STTR program requirement to collaborate with a research institution is both a significant strength and a source of challenges.

Finding 6-2: The participation rate of first-time firms in DOD's STTR program is low, indicating potential barriers to entry.

Finding 6-3: DOD STTR awardees are geographically concentrated in states with major DOD research facilities and strong academic–industry partnerships, potentially limiting nationwide contributions to innovation.

Recommendation 6-1: Department of Defense Small Business Technology Transfer (STTR) program managers should prioritize and experiment with new means of targeted outreach and support for new firms and those from historically underutilized parts of the country in order to enrich the innovation ecosystem.

[8] For a discussion of CUI and the challenges it poses for some researchers, see NASEM, 2022.

Recommendation 6-2: Department of Defense Small Business Technology Transfer (STTR) program managers should streamline collaboration requirements and provide support for negotiating intellectual property agreements to reduce complexities and expedite technology transitions.

7

Impact of SBIR/STTR Awards on the DOD Mission

This chapter examines the observable impact of the Department of Defense's (DOD's) Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) programs. This analysis is based on metrics capturing the role of firms participating in these programs on the defense innovation ecosystem and industrial base. Because one of the four central objectives of the SBIR/STTR programs is to use small business to meet federal research and development (R&D) needs, assessment of the impact of the SBIR/STTR programs in meeting their legislative objectives must account for whether the programs are successful in accomplishing this objective. Most prior SBIR/STTR evaluation and assessment studies, particularly those addressing the programs at other agencies, have tended to focus on technology transfer, whereby federally funded technologies and know-how migrate to private markets and provide benefits to the recipient firms (Howell, 2017; Lanahan and Armanios, 2018; Lerner, 1999; NASEM, 2022a, 2023), or on spillovers to other private firms (Myers and Lanahan, 2022; NASEM, 2020). Less attention has been paid to the impact of the SBIR/STTR programs on meeting the R&D needs of the government agencies that are funding the programs.

LIMITATIONS AND METHODOLOGY OF THE ANALYSIS

As emphasized in Chapter 2, DOD's SBIR/STTR programs are fundamentally different from SBIR/STTR programs in federal agencies such as the National Institutes of Health and National Science Foundation (NSF) because of DOD's emphasis on procurement and incorporation of funded technologies for the warfighter. Most civilian agencies with SBIR/STTR programs, in which the federal agencies are not the ultimate customers for the innovations, are more concerned with providing public benefits beyond the direct funding of firms, and

each agency interprets this mission differently.[1] DOD's enduring mission is to develop technologies for the combat-ready military forces needed to deter war and protect the security of the nation. It is therefore nontrivial when the *National Defense Science & Technology Strategy 2023* calls for the DOD research enterprise to focus on "create[ing] and field[ing] capabilities at speed and scale" (DOD, 2023a, p. 1). The purpose of this chapter is to examine, to the extent possible, whether the SBIR/STTR programs contribute to achieving this goal.

Before turning to the substance of the analysis, it is useful to reinforce that, in most cases, the scale and timing associated with defense procurement are beyond the capacities of an individual small firm. While critical elements of technology that ultimately serves the warfighter may originate within an SBIR/STTR contract, development of the technology itself may entail partnerships with defense prime contractors and subcontractors and may involve combining multiple technological innovations into a multicomponent product, service, or platform. Also, the learning absorbed within DOD and by other players within the defense innovation ecosystem may lead to the application of advances first developed under an SBIR/STTR contract for purposes well outside the initial focus area. Accordingly, the pathway from an initial SBIR/STTR contract to the deployment of a technology that ultimately serves the warfighter is both multistage and nonlinear, and often involves much larger players, such as primes.

This "technology infusion" process (i.e., the process by which SBIR/STTR-funded technologies are ultimately introduced into DOD products, services, and platforms) is therefore complex, making assessment of the impact of the SBIR/STTR programs on the warfighter challenging. Ideally, one would quantitatively value the full range of impacts of SBIR/STTR-originated technologies on defense across the ecosystem. As noted, however, technology infusion most often takes place through trajectories that not only are difficult to observe but also involve a long and variable time lag between the initial R&D investment and the ultimate impact of the technology.

Moreover, deployment of a technological innovation originally developed under an SBIR/STTR contract in fielded military systems most often involves either the SBIR/STTR firm (or a follow-on entity) serving as a subcontractor (or even deeper in the supply chain) to defense prime contractors, and the subaward details are often neither transparent nor consistently captured. As well, there are many cases in which the SBIR/STTR-funded innovation may enter the defense supply chain via a corporate transaction, such as a merger or acquisition, or through a license to use a private patent, which also is not easily observed. A project that is deemed a technical failure also serves the purpose of redirecting or terminating DOD research pathways, in the process saving

[1] For example, NSF focuses on basic science, and its SBIR/STTR programs generate national impact to align with the American Innovation and Competitiveness Act of 2017, primarily by focusing on startups as a strategic objective (Lanahan and Feldman, 2018). Alternatively, the National Aeronautics and Space Administration's SBIR/STTR programs develop technologies that may be deployed on robotic space science missions, and a small firm may still be able to produces parts for these space missions in the relatively small volumes needed (Giga et al., 2022).

resources and shaping future DOD technology strategies and initiatives. Finally, the value of the SBIR/STTR-funded technology or innovation cannot easily be stated in financial terms, since the technological superiority of the U.S. military over those of U.S. adversaries ultimately safeguards the national security, enhances the safety of the warfighter (leading to reduced casualties), and has a deterrence effect that ultimately reinforces both national security and warfighter safety. From the perspective of the empirical assessment in this chapter, each of these factors makes it likely that observable impacts based on the available data will both undercount incidences of the impact of the SBIR/STTR programs and undercount the likely impact of the programs on broader national security and warfighter safety objectives.[2]

Despite these limitations, the committee undertook an analysis of publicly available data to describe broadly ways in which DOD's SBIR/STTR programs are effective in enabling DOD to expand both the defense innovation ecosystem and the broader defense industrial base. To this end, the committee built on a recent body of academic and policy research (Bhattacharya, 2021; Howell et al., 2025) examining elements of technology infusion to consider both how to measure and how to assess the incidence of follow-on activity between SBIR/STTR performers and DOD.

The next section describes the challenge of measuring the impact of SBIR/STTR awards and performers on the DOD innovation ecosystem and defense industrial base. Specifically, this chapter highlights both the potential and challenges of using measures related to an explicit Phase III designation or the use of Technology Readiness Levels (TRLs). The committee then evaluates a new measure of follow-on DOD funding, which provides a proxy for Phase III–type activities both in research, development, test, and evaluation (RDT&E) and in follow-on procurement of technologies directly serving the warfighter. The committee next examines this measure for various types of awardees, different firm-owner demographics, and number of awards received. The discussion concludes with the committee's assessment of how SBIR/STTR-awarded firms contribute to the DOD mission.

SUMMARY OF THE ASSESSMENT

The committee's analysis suggests that DOD's SBIR/STTR programs promote the advancement of SBIR/STTR-funded small businesses into the broader DOD innovation ecosystem in four interrelated ways.

First, for the vast majority of firms that ever receive DOD SBIR/STTR funding, DOD's SBIR/STTR programs are the first point of contact with DOD.

[2] On a related note, recent scholarship has begun to track the indirect returns of government investments, reporting knowledge and innovation returns as large as three times the initial investment (Myers and Lanahan, 2022). Currently, no research systematically captures the indirect returns to the defense innovation ecosystem, though one can expect that related mechanisms drive this effect, yielding a larger return.

Thus, the programs serve as a distinct gateway to DOD—a critical on-ramp and not simply one of many funding sources.

Second, firms that receive DOD SBIR/STTR funding have a significantly higher rate of receiving additional funding from DOD, particularly in the domain of R&D projects. In other words, DOD SBIR/STTR funding represents an important entryway for small (and young) R&D-intensive firms to enter the DOD innovation ecosystem, and there is demand from other parts of DOD (beyond simply more SBIR/STTR contracts) for the services of those DOD SBIR/STTR-funded firms. This represents an expansion of DOD's innovation base and potentially leads to the expansion of the defense production base. Moreover, although important differences exist among DOD services and components and among different types of firms receiving awards (e.g., based on their age and level of experience with the SBIR/STTR programs), the positive association between SBIR/STTR contracts and the receipt of other DOD funding is robust across many different slices of the data.

Third, the level of additional federal non-SBIR/STTR funding for small businesses that have received DOD SBIR/STTR funding is significant: for every federal dollar allocated to firms under the SBIR/STTR programs, those firms receive (on average) more than 4 dollars of observable additional DOD funding. This funding ratio has been increasing over time and is particularly striking given that much of the impact of SBIR/STTR-funded small businesses cannot be directly observed in the available data (e.g., technology that serves the warfighter subsequent to an acquisition by a prime or major subcontractor). No similar ratio has been observed for other DOD research or innovation activities.

Finally, DOD's SBIR/STTR programs are associated with expansion of the defense innovation industrial base. By 2020, firms participating in DOD SBIR/STTR programs accounted for nearly one-third of all firms receiving DOD R&D funding and were awarded more than 10 percent of annual DOD R&D expenditures. These ratios are particularly striking given that the SBIR/STTR programs serve as the gateway to further DOD funding for the vast majority of small businesses that ever participate in the programs, and that these measured impacts to DOD are likely an underestimate of the overall impact of the programs in light of the complex nature (and data limitations) associated with tracking or measuring the impact of these firms on ultimate national defense goods and services.[3]

MEASURING THE IMPACT OF DOD'S SBIR/STTR PROGRAMS ON THE DOD INNOVATION ECOSYSTEM AND INDUSTRIAL BASE

To assess the incidence and impact of technology infusion from DOD's SBIR/STTR programs, it is necessary to construct a consistent measure of the ways in which funds from the programs are ultimately linked to follow-on

[3] Specifically, the committee had access only to public records. Hence, data on classified activity were not available.

activities within DOD that are *not* funded directly through the DOD SBIR/STTR programs. The committee considered a wide range of alternatives, building both on a burgeoning academic and policy literature assessing the impact of the SBIR/STTR programs and other DOD innovation programs (Bhattacharya, 2021; Bresler and Bresler, 2023; Howell et al., 2025), and on insights drawn from the committee's examination of the processes by which DOD's SBIR/STTR programs operate (discussed in detail in Chapter 4).

Measuring how DOD's SBIR/STTR programs contribute to the broader DOD mission requires examining how technologies initially funded by those programs move further in the defense acquisition process and eventually are incorporated into operational systems. One official mechanism for capturing one part of this transition pathway is the Phase III designation (see Box 7-1), which identifies follow-on contracts for SBIR/STTR-derived technologies that are funded from sources outside the SBIR/STTR programs. Phase III awards are meant to provide a seamless path for SBIR/STTR technologies to be further developed and incorporated into federal acquisitions. The committee found that, despite directives aimed at tracking the transition to Phase III, actual implementation of those tracking mechanisms across the various services and components and contracting platforms remains sporadic. DOD has no systematic way of tracking Phase III funding, which is challenging in any case since Phase III funding occurs in many different ways. It is important to note, however, that despite the limitations, the SBIR/STTR programs' tracking of Phase III awards represents the best and largest effort to measure technology transition in the defense research enterprise directly.

A second way of gauging impact involves TRLs, which track how a technology matures over time (see Box 7-2). TRLs are used extensively in defense acquisition programs, as well as by other agencies, such as the National Aeronautics and Space Administration for its SBIR/STTR projects. However, DOD does not collect or update TRL data on SBIR/STTR projects in a single, uniform system, and cross-service/component TRL analyses are thus challenging to perform. While limited studies, such as those conducted by the Navy, highlight the potential of a TRL-based evaluation of SBIR/STTR contributions, it remains impractical to rely on TRLs alone as a broad measure of the programs' ability to aid in the accomplishment of DOD's mission (Belz et al., 2021; Hay et al., 2013).

Faced with these limitations, the committee adopted a broader measure, motivated in part by recent scholarly work such as that of Bhattacharya (2021) and Howell and colleagues (2025), which relies on follow-on DOD contracts as an indicator of successful transition. In line with these studies, the committee focused on non-SBIR/STTR DOD funding received by firms that have, at some point, received an SBIR/STTR award. This firm-level linkage captures a wide range of funding pathways, including subcontracts and other avenues that may not be explicitly labeled as Phase III. Although this approach has its own limitations—it does not, for instance, reveal the precise technological maturity of a given

BOX 7-1
The Phase III Program and Designation

Under the SBIR/STTR Policy Directive, a Phase III contract is defined as "work that derives from, extends, or completes an effort made under prior SBIR/STTR Funding Agreements, but is funded by sources other than the SBIR/STTR programs" (SBA, 2023, p. 25). This structure is designed to enable the continued development of a technology following the foundational work of Phase I and Phase II, thereby facilitating the technology's transition into use by DOD or other federal agencies.

Phase III contracts offer several benefits:

- **SBIR/STTR status and data rights:** A Phase III award, by its nature, retains SBIR/STTR status and carries SBIR/STTR data rights protection.
- **No limits on number, size, or timing:** There is no cap on the number, duration, type, or dollar value of Phase III awards. In addition, there are no time constraints on when a Phase III award may be made relative to earlier phases.
- **Flexible contracting pathways:** A subcontract to a prime contractor can count as a Phase III, and any federal agency—not just the one that funded the original Phase I/II—can award a Phase III.
- **Exemption from size limits:** Unlike Phase I and II awards, Phase III awards are not subject to small business size requirements. A Phase III may follow the original awardee or a successor entity, even after an acquisition or substantial growth in size.
- **Sole source authority:** Because Phases I and II are awarded under competitive procedures, any follow-on Phase III may be awarded on a noncompetitive, sole source basis under specific conditions.
- **Breadth of activities:** Phase III can fund additional research, product development, production, or any combination thereof, allowing a small business to continue iterating on an SBIR/STTR-originated technology without recompeting for a new contract.

These features make Phase III contracts especially appealing to small businesses, which can outgrow the size standards of the SBIR/STTR programs or undergo ownership changes while still maintaining the thread of their original research and development. From DOD's perspective, Phase III provides a convenient mechanism for extending promising SBIR/STTR work into more advanced, mission-relevant applications.

Tracking Phase III activity, however, is challenging. Unlike Phase I and II awards, which rely on dedicated SBIR/STTR set-asides and are tracked by the Small Business Administration, Phase III contracts are funded through general DOD (or other federal) budgets. Definitions of Phase III and coding procedures also vary among DOD services and components. In many cases, *Phase III* may appear only in the contract's description or an internal note, rather than in a standardized field. As a result, systematically identifying Phase III awards across multiple contracting databases is extremely difficult. This gap in consistent labeling and record keeping means that relying solely on officially labeled Phase III awards substantially undercounts SBIR/STTR-related technology transitions.

BOX 7-2
Technology Readiness Levels

As an intermediate step in measuring technological value, it would be useful to understand whether a DOD SBIR/STTR-funded technology advances in readiness for deployment, and how far. For instance, as described in Chapter 2, Technology Readiness Level (TRL) is a key metric used throughout the aerospace and defense industries to assess advancements and estimate funding outcomes. TRLs range from 1 (idea) to 9 (used successfully) (Mankins, 2009) and are one of two significant elements used to conduct Technology Readiness Assessments (TRAs) for defense acquisition programs (DOD, 2023b). Indeed, TRAs—and the associated TRL evaluation—are required both by law and by DOD policy for technology acquisition.

Similar policies exist at the National Aeronautics and Space Administration (NASA, 2020), where a technology must reach TRL 6 to qualify for insertion into a flight mission. Terrile and colleagues (2014) attempted to value this impact to evaluate NASA's SBIR/STTR portfolio, but an equivalent effort has not taken place at DOD. For approximately 15 years, NASA has collected the principal investigator's initial TRL estimate in SBIR/STTR proposals and assigned its own estimate of the final TRL at the project's conclusion. Belz and colleagues (2021) demonstrate that TRL is a key indicator in Phase II project selection and that the program largely funds technology advancement from TRL 3 to 6 (specifically, approximately 70 percent of the NASA portfolio advances from initial TRL values of 3–4 to the final stages of TRL 4–6), in agreement with an early-stage emphasis.

Unfortunately, the committee was unable to conduct such an analysis with the available DOD data, as TRLs are not recorded systematically across the agency's SBIR/STTR projects. One estimate does exist for the Navy portfolio: Hay and colleagues (2013) determined that Navy SBIR/STTR awardees achieve the earliest TRL advances (e.g., 2–3 or 3–4) at lower cost compared with larger companies; however, this distinction vanishes at higher TRLs.

In principle, the goal of any defense technology development effort is insertion into a fielded capability, and the budget would then be allocated as a program of record. Developing even a component technology from TRL 3 to 6 probably takes about $20 million and 5 years (Alexander, 2018), and thus is out of reach for a single SBIR/STTR award. An intermediate step to value creation and fielded capabilities is to enable small firms to address research and development needs, the second SBIR/STTR program objective.

project—it offers a more complete perspective on how successfully SBIR/STTR-funded small businesses integrate into the DOD innovation ecosystem.

By examining where DOD dollars flow after an SBIR/STTR contract, the committee was able to capture an expansive view of the role of the SBIR/STTR programs in introducing new technologies, firms, and capabilities into DOD. In addition, this strategy avoids the pitfalls of relying solely on official Phase III labels or TRL metrics, both of which are documented sporadically and therefore incomplete. In this way, the analysis provides clearer evidence of the SBIR/STTR programs' function as a gateway for innovative small businesses to

work with DOD. Ultimately, this approach aids in assessing how effectively the programs are contributing to meeting DOD's R&D and operational needs. The committee notes that this measure may underestimate the impact of SBIR/STTR-funded firms that work with subcontractors rather than prime contractors because those interactions are incomplete in publicly available data.

Specifically, the committee created three proxies for Phase III activity that occur after a prior SBIR/STTR contract: one that looks only at DOD procurement activity, one that looks at DOD R&D awards greater than $1.5 million, and one that includes all DOD funding (the sum of the first two proxy measures). The amount of $1.5 million was chosen to represent a significant commitment that was larger than the Phase II award during the sample period and to reflect the median Phase III amount found in publicly available data. Thus, the committee incorporated an implied DOD Phase III proxy in its analysis to determine the extent of the impact of SBIR/STTR-funded small businesses on the broader DOD mission.

DOD'S SBIR/STTR PROGRAMS AS A GATEWAY TO DOD R&D AND PROCUREMENT

A central question in assessing the impact of the SBIR/STTR programs is whether they help small businesses enter the broader DOD innovation ecosystem. To address this question, the committee used public records to identify 5,919 firms that received at least one DOD SBIR/STTR award between 2012 and 2020. The committee then linked these firms to additional federal non-DOD SBIR/STTR funding during the same period. The committee limited the non-SBIR/STTR funding to amounts that were at least $1.5 million, classifying these non-SBIR/STTR awards as either research or procurement.

Among these DOD SBIR/STTR-awardee firms, 63 percent eventually received additional federal funding outside of the SBIR/STTR programs. This follow-on rate aligns closely with that of Hernández-Rivera (2023), who reported a 65 percent rate based on surveys of 1,681 SBIR awardees. Looking only at subsequent DOD funding shows that more than half of these firms received their follow-on funding from DOD.

Importantly, 85 percent of the DOD SBIR/STTR-funded firms that also received non-SBIR/STTR support from DOD engaged in research-related (R&D or special-studies) contracts rather than procurement. Of note, the vast majority (92 percent) of these firms received their SBIR/STTR award prior to non-SBIR/STTR support of more than $1.5 million from DOD. Very few (15 percent) of DOD SBIR/STTR-funded firms received procurement contracts.

Although the data show fewer firms moving directly to procurement, this does not necessarily indicate a failure in transitioning SBIR/STTR technologies. Defense procurement typically requires a multistage maturation process, often involving prime contractors and extended testing and evaluation. The fact that most SBIR/STTR-funded firms continue to pursue R&D with DOD (rather than

progressing straight into large-scale procurement) may reflect the longer trajectory needed to field defense-ready solutions.

Taken together, these findings suggest a logical, temporal flow in the way firms move through DOD contracting. The SBIR/STTR programs provide an important on-ramp to DOD research, introducing innovative, often early-stage companies to defense agencies. Once inside the system and armed with a proven technology concept, these firms are then positioned to pursue additional R&D contracts, which may eventually culminate in procurement—albeit often through complex pathways that may not be fully visible in the data. This progression underscores SBIR/STTR's vital role in forging the early relationships and technology demonstrations that underpin the DOD's broader modernization and readiness objectives.

To assess whether DOD's SBIR/STTR programs provide a distinct advantage for small businesses seeking subsequent non-SBIR/STTR defense contracts, the committee compared DOD SBIR/STTR awardees with a control group of small firms that also engaged in research for the federal government without receiving a DOD SBIR/STTR award. More specifically, this control group consisted of companies appearing in USASpending.gov with Product or Service Codes indicative of R&D (codes beginning with "A" or "B") without receiving DOD SBIR/STTR funding between 2012 and 2020. By following both sets of firms forward in time, the committee measured their respective propensities to secure non-SBIR/STTR DOD contracts. This control group consisted of more than 34,000 firms reported in USASpending.gov with R&D activity (but critically, not SBIR/STTR activity) during the 2012 to 2020 period. The firms in this control group represent a group of firms with a demonstrated record of interest in performing R&D with the federal government. These firms are likely to be very interested in having DOD as a customer given that it is the largest federal funder of R&D. The committee's analysis does reveal differences between DOD SBIR/STTR-funded firms and other firms that engage in R&D in the federal government. Namely, DOD SBIR/STTR firms tend to be younger; more likely to be in California and Massachusetts; more likely to specialize in research and testing, computer and data processing, or engineering and architectural services; more likely to patent; and more likely to engage in private financing and get acquired.

While this analysis reveals correlation rather than causation, a key insight emerges from this comparison. Specifically, receiving a DOD SBIR/STTR award correlates with roughly a 20-percentage-point higher likelihood of contracting with DOD relative to firms in the control group. Looking only at additional R&D awards, SBIR/STTR-awardee firms were 28 percentage points more likely to receive follow-on funding from DOD compared with those firms that did not receive a DOD SBIR/STTR award during the 2012–2020 period.

Examining results across DOD services and components, the Army and Navy generally show the strongest positive associations between SBIR/STTR participation and additional DOD contracting (Figure 7-1). In all cases, however, SBIR/STTR support correlates more robustly with R&D follow-on contracts than

with procurement—a finding consistent with SBIR/STTR's emphasis on early-stage technology development rather than immediate production.

Assessment of Multiple-Award Recipients

In discussing the effectiveness of the SBIR/STTR program, policy makers have sometimes voiced concern about so-called SBIR/STTR "mills"—firms that appear to specialize in securing multiple awards without ultimately transitioning technologies into the marketplace. On the other hand, some practitioners argue that a series of awards is precisely how many cutting-edge R&D firms build enough momentum (and DOD-specific expertise) to produce deployable innovations. The committee found that firms that received only one or two Phase I DOD SBIR/STTR awards (with or without subsequent Phase II awards) showed only modest gains in additional DOD contracts compared with otherwise similar, federal R&D contractors who did not receive DOD SBIR/STTR funding. As shown in Figure 7-2, however, once firms obtained five or more Phase I DOD SBIR/STTR awards, they exhibited a marked jump in non-SBIR/STTR DOD funding, especially in R&D contracts.

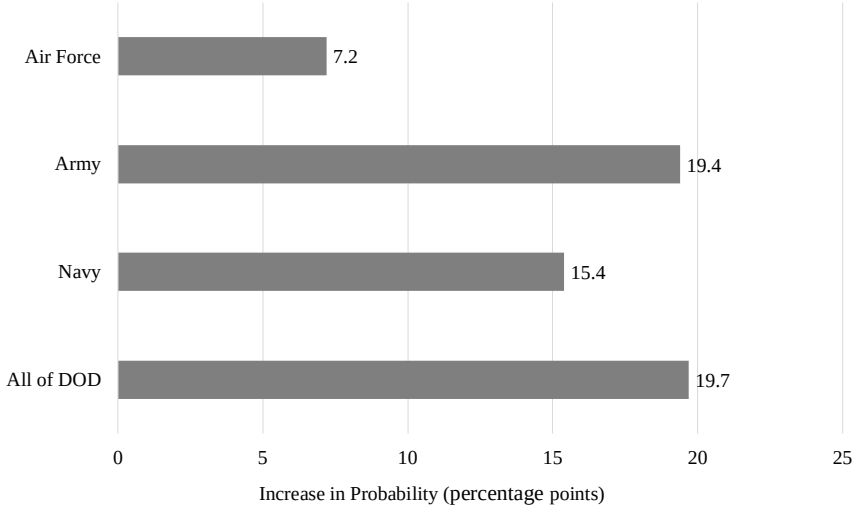

FIGURE 7-1 Increase in likelihood of a firm receiving DOD funding outside of SBIR/STTR for DOD SBIR/STTR firms versus non-DOD SBIR/STTR-funded firms across service branches and all of DOD (2012–2020).
NOTE: Statistical significance of $p < 0.01$ in each case. These results are based on a predictive econometric model that controls for the average likelihood of funding in a given year as well as time-varying and time-invariant differences among firms.
SOURCE: Committee calculations based on USASpending.gov data.

This threshold effect suggests that multiple SBIR/STTR engagements can create the deeper technical credibility; programmatic and transition partner relationships with industry and government organizations; and familiarity with defense acquisition, security, and contracting processes needed to secure DOD contracts beyond the SBIR/STTR programs. While each additional SBIR/STTR award may raise concern about overreliance on government R&D subsidies, these findings imply that repeat participation can also yield significant longer-term benefits—both for the participating firms, which become more integrated in DOD's innovation pipeline, and for DOD itself, which gains continued access to specialized technical expertise. In other words, firms experienced with DOD's SBIR/STTR programs that cross the five-award Phase I threshold are, on average, the same firms that make the most demonstrable leap to securing larger-scale, non-SBIR/STTR DOD contracts. Standing in direct contrast to historical critiques of the programs, this evidence suggests that a history of multiple SBIR/STTR awards may often be a stepping stone, rather than a stagnant endpoint as firms contribute to the defense innovation ecosystem.

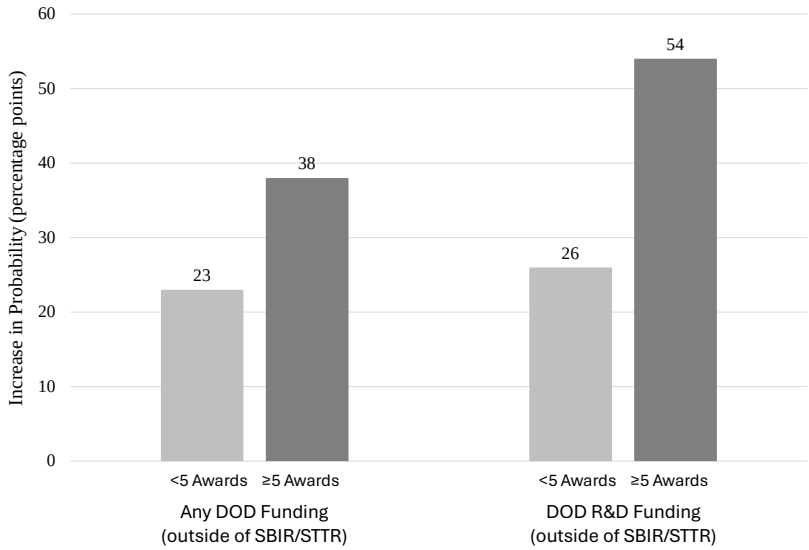

FIGURE 7-2 Increase in likelihood of a firm receiving DOD funding outside of SBIR/STTR for DOD SBIR/STTR firms versus non-DOD SBIR/STTR-funded firms based on award count and type of DOD funding (2012–2020).
NOTE: Statistical significance of $p < 0.01$ in each case. Both groups are compared with similar non-SBIR/STTR firms in the DOD funding ecosystem. These results are based on a predictive econometric model that adjusts for firm differences and includes time and firm-level fixed effects.
SOURCE: Committee calculations based on USASpending.gov data.

These results suggest that cumulative engagement with SBIR/STTR may be crucial for building technical credibility, DOD-specific expertise, and stakeholder relationships that lead to follow-on non-SBIR/STTR federal funding. A firm that completes multiple projects through SBIR/STTR is more likely to have demonstrated consistent performance on DOD-funded R&D; developed a network of DOD program managers and technical points of contact, including in organizations responsible for transitioning technologies into acquisition programs and operational use; and navigated DOD's contracting and compliance processes multiple times. This repeated engagement lowers administrative barriers for future awards. In other words, while an initial SBIR/STTR award may open the door to DOD, securing five or more awards appears to embed a firm in the defense innovation ecosystem to a degree that yields larger-scale opportunities beyond the SBIR/STTR pipeline.

Assessment of Additional Heterogeneity by Various Firm Features

Subgroup analyses revealed that this overarching pattern—strong gains in R&D, comparatively weak movement into direct procurement, and threshold-based benefits—persists across various firm types. Woman-owned firms, minority-owned firms, and startups (firms less than 5 years old) all show similar outcomes. Although procurement transitions remain less frequent, the SBIR/STTR programs are a valuable on-ramp to DOD's research-intensive contracting environment for all these demographic subsets (Figure 7-3).

In summary, a central takeaway across these various assessments is that the SBIR/STTR programs serve as a significant on-ramp to DOD contracting. Firms with only a handful of awards see modest gains compared with the control group, whereas those surpassing five awards experience a marked increase—on the order of 20 percentage points—in the likelihood of securing non-SBIR/STTR defense work. This analysis underscores that DOD's investments via SBIR/STTR are not all equally transformative; repeat awards often signal deeper partnerships, more advanced technology development, and a strong foothold in DOD research efforts. This is logical given that the repeat awards are the result of government processes for selection of program managers, which entail assessing the awards' technical merit and potential contribution to overall agency missions and represent a prioritized allocation of limited program resources over competing proposals and activities.

DOD SBIR/STTR PERFORMERS ATTRACT SIGNIFICANT FOLLOW-ON DOD RESEARCH AND PROCUREMENT EXPENDITURES

Between 2012 and 2020, DOD invested $13.5 billion in Phase I and Phase II SBIR/STTR awards. Over the same period, the firms that received these awards obtained $59.2 billion in additional (non-SBIR/STTR) DOD contracts. As noted previously, this translates to more than 4 dollars of additional DOD

expenditures for every 1 dollar of SBIR/STTR funding—a testament to how SBIR/STTR can help small research-oriented companies become integral parts of the DOD innovation ecosystem (Figure 7-4). No similar data-based measurement of follow-on award activity has been demonstrated for any other defense research or innovation programs.

It is crucial to note, however, that this ratio should not be interpreted as a return on investment (ROI) from DOD's standpoint. The figure of $59.2 billion represents incremental government expenditures beyond the initial SBIR/STTR outlay—money that DOD chose to spend because it deemed further development or procurement of these technologies to be worthwhile. This is not revenue flowing back to DOD, but additional DOD costs directed toward the same SBIR/STTR-performing firms. Nonetheless, the mere fact that DOD allocated its limited and often oversubscribed RDT&E and procurement dollars to these small firms at such a high multiple implies that DOD decision makers recognized value in the technologies and capabilities offered by SBIR/STTR participants.

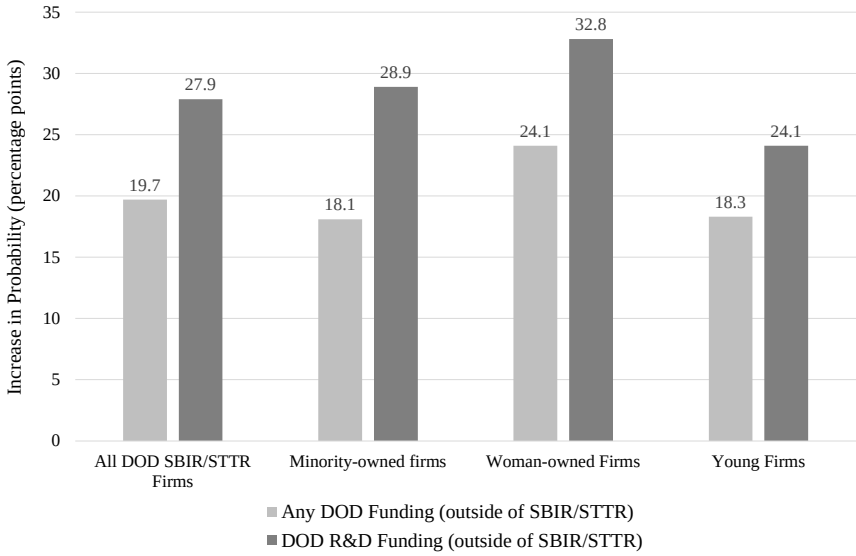

FIGURE 7-3 Increase in likelihood of a firm receiving DOD funding outside of SBIR/STTR for DOD SBIR/STTR firms versus non-DOD SBIR/STTR-funded firms based on firm type and type of DOD funding (2012–2020).
NOTE: Statistical significance of $p < 0.01$ in each case. All firms are compared with similar non-SBIR/STTR firms in the DOD funding ecosystem. These results are based on a predictive econometric model that adjusts for firm differences and includes time and firm-level fixed effects.
SOURCE: Committee calculations based on USASpending.gov data.

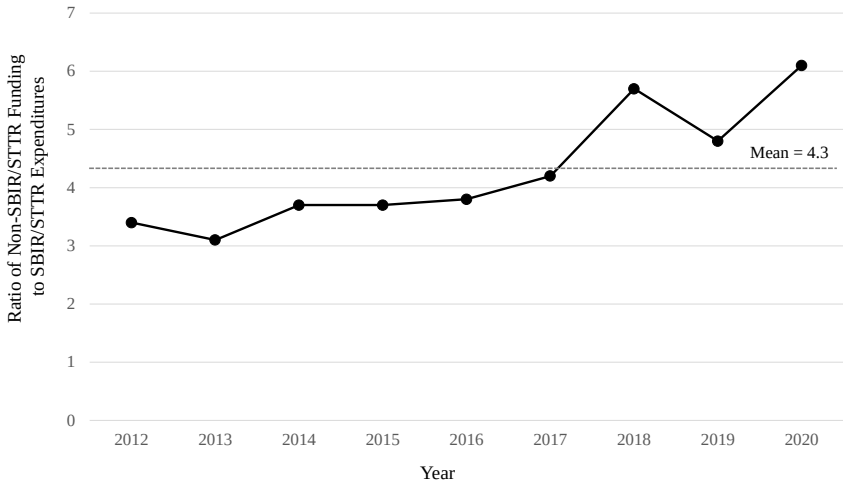

FIGURE 7-4 Non-SBIR/STTR DOD expenditures going to DOD SBIR/STTR awardees for every dollar of DOD SBIR/STTR expenditures (2012–2020).
SOURCE: Committee calculations based on USASpending.gov data.

In this sense, the 4-to-1 ratio signals leverage. The additional funding demonstrates that major DOD entities—beyond the SBIR/STTR program itself—deem these firms worthy of continued investment. That willingness to pay for additional development or procurement indicates how effectively the SBIR/STTR programs identify and nurture specialized technologies aligned with DOD priorities. Ultimately, these efforts strengthen the defense industrial base and promote innovation within the broader national security ecosystem.

FRACTION OF THE DOD INNOVATION ECOSYSTEM AND DEFENSE INDUSTRIAL BASE REPRESENTED BY SBIR/STTR PERFORMERS

An important metric of the SBIR/STTR programs' influence is the extent to which participating firms meet DOD's broader research needs, including larger-scale R&D efforts. Although DOD SBIR/STTR awardees typically do not develop fully scaled solutions destined for immediate procurement, many undertake sizable research contracts that feed into DOD's overall technology pipeline. To gauge just how much of DOD's R&D portfolio relies on SBIR/STTR performers, the committee created a measure termed the SBIR/STTR Firm Research Share. This indicator captures two dimensions of SBIR/STTR participation within

DOD's non-SBIR/STTR R&D contracting:

- the fraction of total R&D dollars awarded to SBIR/STTR-awardee firms, and
- the fraction of all R&D awardee firms accounted for by SBIR/STTR awardees.

Both of these dimensions illuminate the portion of the defense innovation ecosystem represented by SBIR/STTR awardees. In essence, SBIR/STTR Firm Research Share assesses how much of DOD's R&D enterprise depends on SBIR/STTR-funded companies—both in total money spent on R&D and number of contractors engaged.

Analysis of these dimensions reveals that firms that have ever received a DOD SBIR/STTR award represent roughly one-third of all firms receiving DOD R&D funding, a substantial figure in a defense industrial base historically dominated by large prime contractors. Even more notable, these SBIR/STTR performers capture slightly more than 10 percent of DOD's total R&D dollars (Figure 7-5). Although 10 percent may sound modest in some contexts, it is in fact quite significant given the degree to which DOD's top-tier procurement and R&D spending is highly concentrated among a small group of major prime contractors.

Notably, both the number and dollar shares of SBIR/STTR awardees in DOD's R&D portfolio have been growing over the past decade. This trend indicates that SBIR/STTR firms have become an increasingly integral source of new technologies and capabilities for DOD. Although each individual SBIR/STTR project may remain relatively small compared with the marquee programs funded by large defense primes, the collective presence of these smaller, research-intensive firms constitutes an expanding facet of the defense industrial base and national security innovation base. The SBIR/STTR programs continue to serve as a powerful mechanism for expanding DOD's sources of innovation and deepening its overall R&D capacity.

SUMMARY

Drawing on a comprehensive set of public records and prior literature, the committee's analysis shows that DOD's SBIR/STTR programs function effectively as both a gateway and a catalyst for broader DOD engagement. Firms that receive even a single SBIR/STTR award are substantially more likely to secure follow-on R&D contracts, establishing a logical, temporal flow from early-stage technology development to deeper involvement in DOD-sponsored research. Although transitions to large-scale procurement are less frequent, multiple SBIR/STTR awards appear to strengthen a firm's foothold in the defense innovation ecosystem, suggesting that repeated engagement builds the capabilities, networks, and credibility necessary for further DOD investment.

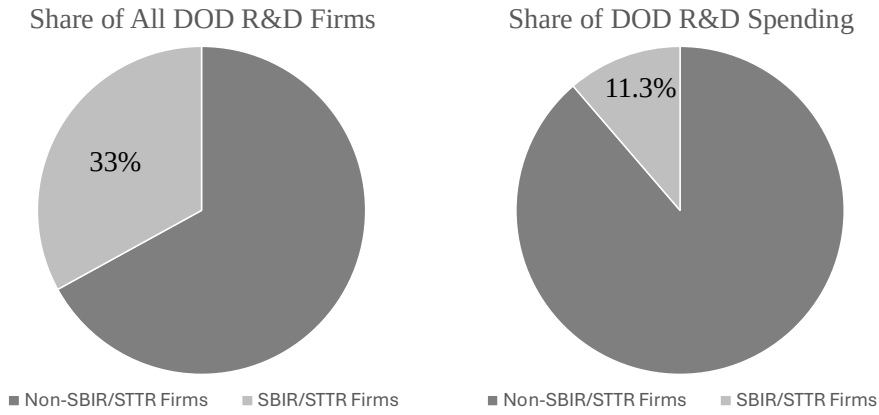

FIGURE 7-5 DOD SBIR/STTR firm share of the defense innovation ecosystem (2012–2020).
SOURCE: Committee calculations based on USASpending.gov data.

Moreover, SBIR/STTR participants represent an important and growing share of the defense industrial base. They now account for roughly one-third of DOD R&D contractors, and while their share of total R&D funding is more modest, it is nonetheless significant in the context of DOD's historically prime-contractor-dominated expenditures. Finally, the ratio of additional DOD funding to SBIR/STTR dollars of more than 4 to 1 (although, to reiterate, not a traditional ROI metric) highlights the extent to which DOD's operational units and program offices are willing to invest further in SBIR/STTR-originated technologies. Taken together, these patterns indicate that the SBIR/STTR programs successfully identify and elevate a wide range of emerging firms and relevant ideas, encouraging technical disruption and innovation and expanding overall capacity within DOD's research portfolio.

Overall, the evidence strongly supports the conclusion that SBIR/STTR awardees—especially those with multiple awards—enjoy a clear, measurable advantage in obtaining follow-on DOD contracts compared with otherwise similar federal R&D contractors.

FINDINGS AND RECOMMENDATIONS

Finding 7-1: DOD's SBIR/STTR programs serve as a gateway for small firms to enter the defense innovation ecosystem and receive subsequent R&D funding from DOD, consistent with their role in expanding the defense industrial base.

Finding 7-2: Firms that receive more than five DOD SBIR/STTR Phase I awards are more likely to become part of the broader defense innovation ecosystem than are firms that receive fewer.

Finding 7-3: Available data indicate that DOD contracts for additional R&D from DOD SBIR/STTR-funded firms, instead of procuring goods and other services.

Finding 7-4: Data on defense subcontracting are not always transparent, nor are they consistently captured in publicly available data; thus, it is difficult to determine the full extent of subcontracting by prime contractors or defense subcontractors to SBIR/STTR awardee firms in defense procurement.

Finding 7-5: Firms that have participated in DOD's SBIR/STTR programs ultimately meet a significant and growing fraction of DOD's extramural R&D needs and represent nearly one-third of participants in the defense R&D base.

Finding 7-6: DOD SBIR/STTR firms ultimately attract more than 4 dollars in non-SBIR/STTR funding from DOD for each dollar of DOD SBIR/STTR funding.

Finding 7-7: Both startups (firms less than 5 years old) and older firms that participate in DOD's SBIR/STTR programs receive follow-on R&D funding from DOD at similar rates.

Recommendation 7-1: Given the demonstrated impacts of the Department of Defense's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs on the development and fielding of new defense systems and capabilities, as well as on the defense innovation ecosystem and defense research and development industrial base, Congress should make the SBIR/STTR programs permanent.

Recommendation 7-2: The Secretary of Defense should initiate a rigorous study on ways to encourage the timely transition of Department of Defense Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR)-funded technologies into defense procurement in order to maximize their impact on the warfighter.

Recommendation 7-3: The Department of Defense's (DOD's) Office of the Secretary of Defense Chief Information Officer should conform with the digitization requirements for the Modernization

of DOD Business Processes to provide greater fidelity and precision for Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Phase III awards.

Recommendation 7-4: The Office of the Under Secretary of Defense for Research and Engineering should require that all Department of Defense (DOD) Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) applications include Technology Readiness Level data. These data should be included in the award portal, along with data on subsequent procurement of DOD SBIR/STTR-supported technologies.

8

Impact of DOD's SBIR/STTR Programs: Innovation and Additional Private-Sector Funding

This chapter examines the observable impact of the Department of Defense's (DOD's) Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs by looking at key indicators of innovation and commercialization, including external venture funding, company acquisitions, and patenting activity. Although it is challenging to determine whether SBIR/STTR funding directly increases a firm's capacity to produce innovative products, the committee's analysis indicates that DOD SBIR/STTR awardees consistently display stronger outcomes on these external measures relative to comparable firms that receive federal funding but not DOD SBIR/STTR support. By examining these metrics, the committee assessed the extent to which DOD SBIR/STTR awardees either develop or attract additional resources for technologies beyond the realm of federal contracting or even beyond DOD. This analysis helped the committee determine how DOD SBIR/STTR firms fulfill two of the legislative purposes of the programs: (1) to stimulate technological innovation, and (2) to increase private-sector commercialization of innovations derived from federal research and development (R&D).[1]

As in the previous chapter, it is important to underscore that these analyses cannot definitively establish a causal effect of SBIR/STTR awards. Because DOD may target firms already possessing strong potential, the favorable outcomes observed might arise from both the selection process and any gains produced by SBIR/STTR support. Nevertheless, by comparing these firms with a control group of other federally funded R&D small business contractors that did not participate in DOD's SBIR/STTR programs, one can gauge the degree to which SBIR/STTR awardees stand out on the key indicators of external innovation. Moreover, as discussed in Chapter 2, DOD funding may go to controlled or classified projects, and information on those projects may not be available for security reasons. Because patents covering classified information are

[1] U.S. Congress, Small Business Innovation Development Act of 1982, P.L. 97-219, Section 2(b) (July 22, 1982).

not public, the analysis may undercount the number of patents produced by some firms.

DEFINING COMMERCIALIZATION

As a preliminary matter, it is important to situate the term *commercialization* within the SBIR/STTR context. Although the SBIR/STTR Policy Directive (SBA, 2023) and academic literature both emphasize the transition of federally funded research into marketable products or services, there is no single, universally accepted definition of *commercialization*. In practice, the concept can encompass sales to federal or nonfederal customers, licensing arrangements, or simply attracting follow-on funding to develop a technology further. While commercialization can overlap with transition to military programs, not every SBIR/STTR-funded firm follows the same path. Box 8-1 explores the various definitions of commercialization that appear in earlier studies, clarifying the scope and limitations of the indicators used in this chapter.

The committee's empirical approach parallels the methodology in Chapter 7. The committee identified 5,919 firms that received at least one DOD SBIR/STTR award between 2012 and 2020 and a much larger set—34,351 firms—that served as a comparison group of R&D contractors that did not participate in DOD's SBIR/STTR programs during the same period. Both sets of companies were then linked to multiple external data sources, including Crunchbase records on private financing, the U.S. Patent and Trademark Office patent database, the System for Award Management and USASpending.gov for ownership and demographic information, and the National Establishment Time-Series Database for firm age. By examining outcomes such as external funding, acquisition activity, and patenting, this approach illuminates whether DOD SBIR/STTR awardees show different patterns of commercial innovation after controlling for attributes such as firm age, size, location, and industry.

PRIVATE FINANCING, VENTURE CAPITAL, AND ACQUISITIONS

An important question in assessing the broader effectiveness of DOD's SBIR/STTR program is whether awardee firms attract additional private-sector investment. Prior studies have suggested that SBIR/STTR's R&D support complements venture capital: Gans and Stern (2003) reported that SBIR/STTR awards fund a broader range of industries and technologies compared with venture investors, while Lerner (2000) showed that SBIR-funded companies experienced stronger sales growth if they were located in regions with robust venture capital ecosystems. Howell (2017) further demonstrated that certain recipients of Department of Energy SBIR/STTR awards between 1983 and 2013 were nearly twice as likely to secure venture capital as comparable firms that narrowly missed out on SBIR/STTR funding. Lanahan and Armanios (2018) found that SBIR/STTR funding across multiple federal agencies generally increases a firm's

BOX 8-1
Defining Commercialization

Multiple definitions of *commercialization* exist in the SBIR/STTR ecosystem, reflecting the variety of ways in which a technology can mature beyond early-stage research.

- **SBIR/STTR Policy Directive:** The SBIR/STTR Policy Directive broadly defines commercialization as "the process of developing products, processes, technologies, or services and the production and delivery (whether by the originating party or others) of the products, processes, technologies, or services for sale to or use by the Federal Government or commercial markets" (SBA, 2023, p. 7). This language encompasses both private markets and federal buyers, but it does not specify a clear threshold at which an R&D effort becomes a commercial product.
- **Self-reported sales surveys:** Many agencies, including DOD, have historically relied on surveys that ask whether a firm has generated any sales—products, processes, or services—incorporating the funded technology. While this method can help measure realized market impact, there is often a substantial lag between initial R&D and the revenue stream arising from it, and many firms prefer not to share proprietary sales data.
- **Transition within DOD:** In defense contexts, some researchers and program offices use *commercialization* to indicate Phase III or other post-SBIR/STTR funding that extends the technology's development under DOD budgets. This narrower lens underscores that sales or deployments within DOD also represent a form of commercial success, albeit in a specialized government market.
- **Academic scholarship:** A series of academic studies focuses on broader market outcomes, such as patenting, licensing, or venture investment. These metrics are more readily observed in public data, but they may only approximate commercial progress. A firm might patent heavily with no eventual market success, or it might raise outside capital without ever fielding a product.

Because of these varied definitions, no single data source or metric can perfectly capture the commercial trajectory of SBIR/STTR-funded research. This chapter's approach, like that of many academic and policy studies, focuses on intermediate indicators of technological advancement—particularly patents and private capital—rather than on sales figures or final deployment. While this approach provides tangible insights into the innovation potential of SBIR/STTR firms, the discussion should be read with an understanding that commercialization is a nuanced concept, the realization of which often spans multiple funding stages and organizational arrangements.

ability to acquire private financing, while additional awards from a single agency decrease a firm's ability to acquire private financing. More recently, Howell and colleagues (2025) reported that firms receiving DOD SBIR/STTR open topic contracts from the Air Force attracted greater private investment relative to peers funded through conventional SBIR/STTR channels, highlighting the interplay between public R&D support and private capital markets.

Building on this body of work, the committee examined whether DOD SBIR/STTR awardees from 2012 to 2020 garnered additional financing or were acquired by other firms. Drawing on Crunchbase, a leading database for publicly disclosed investment deals, the committee focused on venture capital but also tracked angel funding and crowdfunding. While Crunchbase likely underestimates the true incidence of private financing (because it documents only announced deals), false positives are rare, making it a credible source for identifying significant private investment events.

The analysis indicates that 18 percent of DOD SBIR/STTR awardees reported at least one external financing round, compared with just 6 percent of non-DOD SBIR/STTR awardees. Even after controlling for firm age, size, location, and other attributes, DOD SBIR/STTR funding correlates with a 9-percentage-point higher probability of raising private investment. Although this association is not strictly causal—DOD may well be selecting firms with exceptional growth potential—it is robust across multiple services, with the Army showing the strongest relationship. Figure 8-1 illustrates these differences and displays how the boost in external financing is distributed among larger DOD

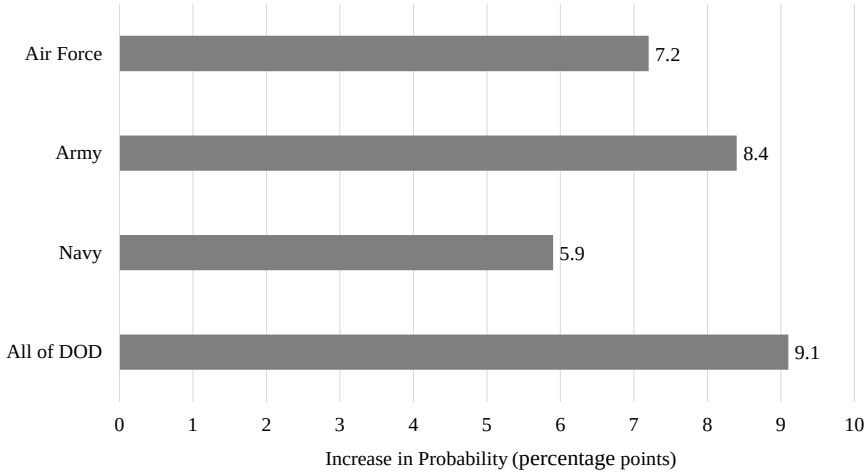

FIGURE 8-1 Increase in probability of additional private investment: DOD SBIR/STTR-funded firms vs. non-DOD SBIR/STTR-funded firms (2012–2020).
NOTE: Statistical significance of $p < 0.01$ in each case. These results are based on a predictive econometric model that adjusts for firm differences and includes time and firm-level fixed effects.
SOURCE: Committee calculations based on data from the Small Business Administration's SBIR/STTR Award database (SBIR.gov), Crunchbase, and USASpending.gov.

SBIR/STTR funding organizations (military services) and for DOD as a whole. The committee also looked at whether startups perform differently from the control group. Young firms (those less than 5 years old) that received DOD SBIR/STTR awards had a 9.7-percentage-point higher probability of raising private investment than the control group, which is slightly higher than the figure for all of DOD.

A further indicator of commercial validation is the acquisition of SBIR/STTR-funded companies by larger enterprises. In contexts such as defense, where significant costs and long lead times can complicate commercialization, acquisitions can integrate promising R&D into established manufacturing and distribution networks, thereby creating efficiencies and spurring greater innovation overall. Looking at the full set of DOD SBIR/STTR awardees (1983–2022), the committee identified 567 of those awardees that were acquired between 1990 and 2022, representing about 4 percent of all DOD SBIR/STTR-funded firms. Looking more specifically at acquisitions by major defense contractors, the committee found that 95 DOD SBIR/STTR firms were eventually acquired by these companies, almost 20 percent of those acquisitions. Although Lockheed Martin, General Dynamics, and Raytheon did acquire some DOD SBIR/STTR awardees, such as Voyager Space Holdings, the acquisition of some DOD SBIR/STTR awardees by 3M, Hewlett Packard, and Merck illustrate the diversity of acquiring firms and the range of technological domains in which DOD SBIR/STTR-funded small businesses can excel.

The committee also looked at acquisition comparisons in the 2012–2020 time period between DOD SBIR/STTR firms and the control group of firms that did not receive DOD SBIR/STTR funding. In that period, the committee found that DOD SBIR/STTR firms were twice as likely to be acquired compared with the control group, and that difference was statistically significant. While acquisitions can reflect broader industry consolidation, the higher prevalence among DOD SBIR/STTR awardees underscores the perceived value of these firms' intellectual property, personnel, and long-term potential, as well as the sole source contracting benefits of receiving an SBIR/STTR contract. Acquisition activity among DOD SBIR/STTR firms has grown over time, reflecting overall trends in the economy—acquisitions have become a well-adopted corporate strategy and have increased over time—and consolidation in the defense industry. But the fact that SBIR/STTR firms are acquired at a higher rate than the matched sample indicates the perceived value of the program.

INNOVATION: PATENTING RATES BY DOD SBIR/STTR FIRMS

Patents are a widely used indicator of technological creativity, offering a standardized but inherently imperfect measure of new knowledge production. During the 2012–2020 time period, more than one-third (34 percent) of DOD SBIR/STTR awardees held at least one patent, a figure that stands in sharp contrast to 7 percent among the control group of firms that did not receive a DOD

SBIR/STTR award. When the committee adjusted for the underlying differences between these groups—recognizing that DOD SBIR/STTR firms tend to be younger, more technology focused, and more often located in technology clusters such as California or Massachusetts—a pronounced gap in patenting remained. As illustrated in Figure 8-2, controlling for differences in firm characteristics confirms that DOD SBIR/STTR funding is associated with a roughly 23-percentage-point increase in the probability of obtaining a patent. This pattern holds across services, though the Army exhibits a slightly stronger relationship. Across DOD a whole, young firms, or startups, that received DOD SBIR/STTR awards had a nearly 23-percentage-point higher probability, similar to the figure for all of DOD.

Although DOD SBIR/STTR firms clearly patent at higher rates, the committee also investigated whether their patents receive more forward citations—a standard proxy for patent quality or influence. Forward citations are the number of subsequent patents that cite a given patent as prior art in the invention. Comparing DOD SBIR/STTR-funded firms with the control group did not provide insight into the quality of these patents, likely because the analysis

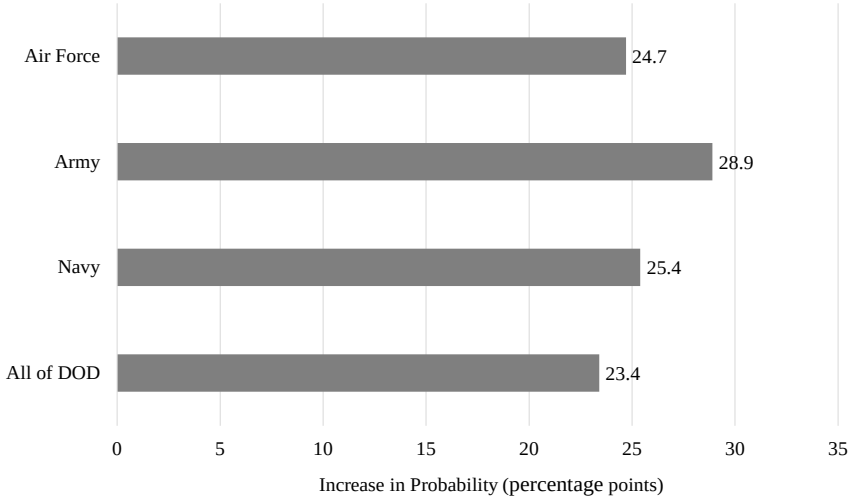

FIGURE 8-2 Increase in probability of patenting activity: DOD SBIR/STTR-funded firms vs. non-DOD SBIR/STTR-funded firms (2012–2020).
NOTE: Statistical significance of $p < 0.01$ in each case. These results are based on a predictive econometric model that adjusts for firm differences and includes time and firm-level fixed effects.
SOURCE: Committee calculations based on data from the Small Business Administration's SBIR/STTR Awards database (SBIR.gov), the United States Patent and Trademark Office, and USASpending.gov.

analyzed patents and forward citations only during the 2012–2020 time period. Citation-based measures often take considerable time to mature, and patents originating from newly established or specialized technologies may not accumulate many citations in the early years. A relatively short observation window can further obscure the long-term impact of patents by DOD SBIR/STTR-funded firms.

The committee took a closer look at patents produced by DOD SBIR/STTR awardees to determine whether these firms generate economic value through the flow of knowledge to other defense contractors, particularly the large prime contractors.[2] To examine this issue, the committee assembled data on 5,278 companies that received Phase II DOD SBIR/STTR awards between 2012 and 2020. These firms produced 17,001 patents after receiving their DOD SBIR/STTR contract during that period.[3] Among these, 995 (18.9 percent) produced at least one "government interest" patent by 2021, totaling 2,820 such patents. *Government interest patents* are inventions that were supported by federal funding, and inventors are required to disclose this support by including government interest statements in their patent applications. Of these government interest patents, 271 patents from 254 firms were tagged as having been specifically funded through the DOD SBIR/STTR programs.

Of the total 271 patents that included DOD SBIR/STTR funding in their government interest statement, 8.5 percent were cited by one or more defense contractors. During the same period, these DOD SBIR/STTR-funded companies also generated 14,181 patents without government interest markers; only 3 percent were cited by the same set of defense companies.

Table 8-1 presents these citation patterns. The data suggest that the defense contractors reference ideas emerging from SBIR/STTR-funded research and that knowledge explicitly tied to SBIR/STTR funding—evidenced by government interest patents—disseminates more readily into the R&D portfolios of major defense firms. In other words, patents attributed to DOD SBIR/STTR awards are cited nearly three times more often than non-SBIR/STTR patents among the same recipients, underscoring the potential for DOD SBIR/STTR-funded innovations to transition into acquisition programs and operational use.

MULTIPLE-AWARD RECIPIENTS

As in Chapter 7, the committee explored whether the intensity of a firm's SBIR/STTR participation shapes its external outcomes. While all DOD

[2] The committee looked at the top 50 arms-producing and military services companies in the world, and found that only seven contractors (RTX Corporation, BAE Systems, Honeywell, Boeing, Northrop Grumman, Naval Group, and General Electric) cited patents produced by SBIR/STTR-funded firms with a government interest statement acknowledging SBIR/STTR funding.

[3] Because the committee looked at patents issued post–SBIR/STTR award, the time period for collecting patent information extended to 2021.

TABLE 8-1 Patenting by DOD SBIR/STTR Awardees (2012–2020) and Forward Citations

Postfunding	SBIR/STTR Government Interest Patents	Non-SBIR/STTR Government Interest Patents	Non–Government Interest Patents
Patent count of SBIR/STTR Phase II Awardees	271	2,549	14,181
Total number of forward citations	1,118	6,924	50,022
Percentage of patents with at least one forward citation	47.6%	45.2%	44.5%
Number of forward citations by top 50 defense contractors	552	1,501	5,537
Percent of patents with at least one forward citation by a defense contractor	8.5%	5.7%	3.0%
Percentage of forward citations by top 50 defense contractors	49.4%	21.7%	11.1%

NOTE: Table data include patents received by 2021.
SOURCE: Committee calculations based on United States Patent and Trademark Office patent data, accessed via Patentsview, and USASpending.gov data; SBIR/STTR firms from the Small Business Administration's SBIR/STTR Awards database (SBIR.gov); and prime contractors from the top 50 firms listed in Stockholm International Peace Research Institute (Liang et al., 2023).

SBIR/STTR awardees see higher patenting and private financing rates, there is a clear threshold effect once companies surpass five awards. The estimated increase in the probability of patenting nearly doubles when moving from fewer than five to five or more DOD SBIR/STTR awards, suggesting that multiple SBIR/STTR projects may confer deeper technical expertise and visibility. On the financing side, the positive association grows more pronounced—though sometimes failing to reach statistical significance—for firms that hold 40 or more awards (Figure 8-3). This threshold phenomenon indicates that repeated engagement with DOD SBIR/STTR can reinforce a firm's innovation capabilities and market appeal.

DIFFERENCES BETWEEN SBIR AND STTR

Although the above analyses frequently group DOD SBIR and STTR awards together, the committee also examined the two programs separately. Overall, both show positive and statistically significant results for patenting and private investment, but the effects are generally larger and more precisely estimated for SBIR awardees (Figure 8-4). STTR participants, which typically

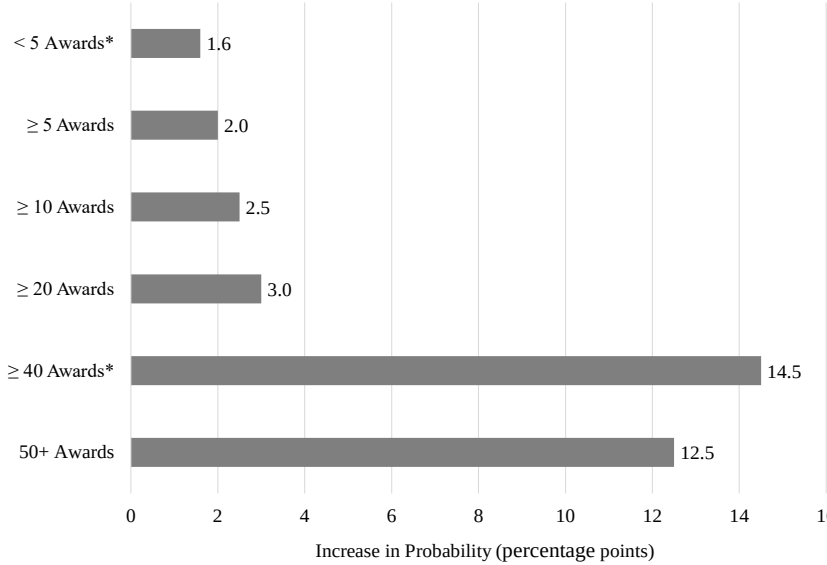

FIGURE 8-3 Increase in probability of additional private investment: DOD SBIR/STTR-funded firms vs. non-DOD SBIR/STTR-funded firms (2012–2020).
NOTE: *Only the (< 5 Awards) and (≥ 40 Awards) categories show statistically significant effects ($p < 0.05$). These results are based on a predictive econometric model that adjusts for firm differences and includes time and firm-level fixed effects.
SOURCE: Committee calculations based on data from the Small Business Administration's SBIR/STTR Awards database (SBIR.gov), Crunchbase, and USASpending.gov.

partner with a university or other nonprofit research institution, may be working on earlier-stage ideas that take longer to yield patentable or market-ready technology. That extended timeline may in turn make it more difficult to detect robust short-term differences in the data, which focus on the 2012–2020 period.

SUMMARY

Taken together, the findings reported in this chapter reinforce the notion that DOD SBIR/STTR awardees occupy an important position in the broader innovation ecosystem, not only within federal contracting but also in private markets. Firms that participate in DOD's SBIR/STTR programs show higher rates of patenting, are more likely to attract external funding, and often become acquisition targets for larger companies seeking to capitalize on new technologies, when compared with a group of R&D contractors who did not participate in DOD's SBIR/STTR programs during the same period of analysis. While the direction of causality remains difficult to pin down—these firms may possess

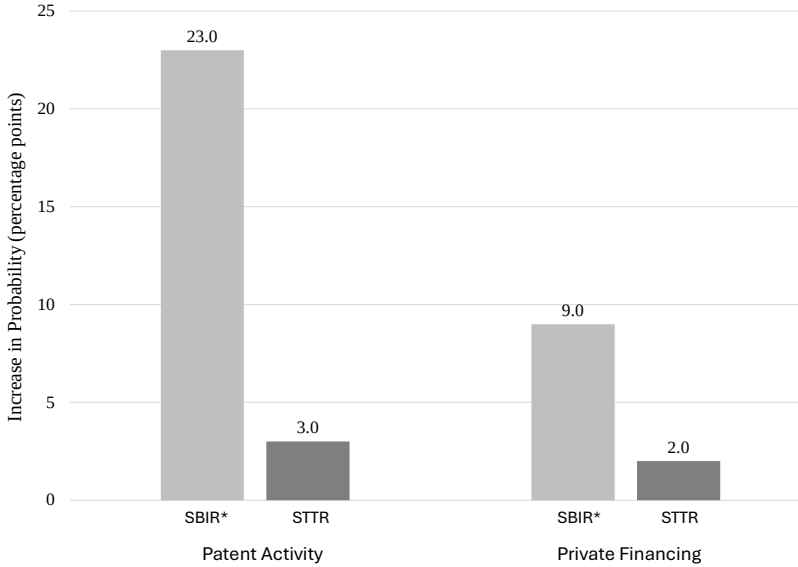

FIGURE 8-4 Increase in probability of patenting activity and private investment: DOD SBIR/STTR-funded firms vs. non-DOD SBIR/STTR-funded firms (2012–2020).

NOTE: *Only the SBIR categories show statistically significant effects ($p < 0.01$). These results are based on a predictive econometric model that adjusts for firm differences and includes time and firm-level fixed effects.

SOURCE: Committee calculations based on data from the Small Business Administration's SBIR/STTR Awards database, the United States Patent and Trademark Office, Crunchbase, and USASpending.gov.

intrinsic capabilities that led DOD to select them in the first place (reflective of an informed and effective award selection process)—the correlations are both sizable and consistent across different metrics, time periods, and services.

In broad terms, the results of the committee's analyses suggest that DOD SBIR/STTR awards often identify or catalyze promising small businesses that go on to achieve stronger innovation outcomes relative to other R&D-focused federal contractors. This finding echoes the core policy rationale behind the SBIR/STTR programs of fostering high-potential firms and helping them develop commercially viable technologies that can ultimately serve defense needs. Just as with DOD-centered follow-on funding, there remain gaps—particularly in measuring the downstream quality of patents and in understanding why STTR effects appear smaller than those of SBIR—but overall, the evidence points to an SBIR/STTR-driven ecosystem of technologically active and investor-backed small companies that extends well beyond purely military applications.

FINDINGS AND RECOMMENDATION

Finding 8-1: DOD SBIR/STTR firms are more likely than other federal R&D–performing firms to create patented technology and to receive private financing.

Finding 8-2: DOD SBIR/STTR firms with at least five Phase I awards are associated with higher levels of patenting and follow-on financing relative to those with fewer.

Finding 8-3: DOD SBIR/STTR awardees register a significant rate of knowledge transfer to prime contractors. For example, patents attributed to DOD SBIR/STTR funding are cited nearly three times more often compared with non-SBIR/STTR patents among the same recipients. Additionally, nearly 20 percent of acquisitions of DOD SBIR/STTR-funded firms are by one of the top defense contractors.

Finding 8-4: The lack of data on subcontracting by DOD contractors makes it difficult or impossible to track procurement of DOD SBIR/STTR-supported technologies and to compare it with the procurement of technologies from other firms engaging in federal R&D activities.

Recommendation 8-1: The Office of the Under Secretary of Defense for Research and Engineering should analyze the patent and follow-on investment activities of Department of Defense Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awardees to understand best practices for creating incentives for private-sector investment in defense technologies and defense firms.

9

Experienced SBIR/STTR Firms

As part of its assessment, the committee was asked to investigate the impact of statutory changes to the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) program requirements over time, including more stringent standards that may restrict the number of awards or award sizes. The concept of making multiple SBIR awards to the same firm has been controversial since at least the 1992 reauthorization of the program (GAO, 1992).[1] At the 10-year anniversary of the program's establishment, which also marked the introduction of the STTR program, the Government Accountability Office (GAO, 1992) recognized the unevenness in the distribution of SBIR awards by recipient and suggested that frequently awarded firms commercialize products at a significantly lower rate compared with other firms. Many scholars have revisited this issue, offering widely differing conclusions (Howell, 2017; Lanahan and Armanios, 2018; Lerner, 1999; Link and Scott, 2009; NRC, 2008; Tingle, 2016). The 2011 reauthorization of the SBIR/STTR programs introduced Phase I–II transition rate and commercialization performance metrics that, if not met, would impact eligibility to participate in the programs.[2] These benchmark requirements were applied to multiple-award recipients with award counts above certain thresholds over set periods of time (SBA, 2014), and any company that fails to meet either benchmark is ineligible to submit a proposal for a Phase I (or Direct to Phase II) award for a period of 1 year.[3]

The SBIR and STTR Extension Act of 2022 created more stringent transition and commercialization performance requirements for what it defines as *experienced firms*—those receiving more than 50 Phase I or Phase II awards over

[1] U.S. Congress, Small Business Research and Development Enhancement Act, P.L. 102–564 (October 28, 1992).
[2] U.S. Congress, National Defense Authorization Act for Fiscal Year 2012, P.L. 112–81, Section 5165 (December 31, 2011).
[3] See https://www.sbir.gov/performance-benchmarks.

defined periods.[4] These performance requirements, if not met, limit the ability of such a firm to participate in the SBIR/STTR programs in a given year. Specifically, under these additional provisions, any applicant that received more than 50 Phase I awards over the 5 fiscal years preceding the most recently completed fiscal year must progress from Phase I to Phase II at or above a prescribed threshold rate, and any applicant that received more than 50 Phase II awards over the 10-year period preceding the 2 most recently completed fiscal years must achieve a certain average level of aggregate private-sector sales or private-sector investments per Phase II award received during that period. The act includes even higher commercialization standards for applicant firms that received more than 100 awards over that 10-year period. Each year any small business deemed an experienced firm under the terms of the 2022 reauthorization that fails to meet these increased standards is restricted, for a period of 1 year, in the total number of Phase I and Direct to Phase II awards it may receive from each federal agency. These provisions from the 2022 reauthorization went into effect on April 1, 2023.

The purpose of this chapter is to provide an analysis of how these provisions of the SBIR and STTR Extension Act of 2022 might affect the Department of Defense's (DOD's) SBIR/STTR programs and their outcomes. To this end, the extent of the population of firms that would meet these thresholds and might be impacted by these provisions is first characterized. This is followed by an examination of DOD's reliance on these experienced firms over time and by DOD service or component. The chapter draws on the analysis conducted elsewhere in the report (and from external sources) to consider firms' motives for engaging with the SBIR/STTR programs, how the new legislation might affect these different types of firms, and finally the performance of experienced SBIR/STTR firms as compared with other small businesses. The chapter also presents an analysis of the states in which multiple-award recipients are located.

SUMMARY OF FINDINGS

Overall, the committee's analyses highlight three interrelated findings: (1) the 2022 provisions impose a significant administrative burden on the entirety of DOD's SBIR/STTR programs while being applicable only to a very small number of potential firms; (2) the firms that are likely to be deemed experienced according to the 2022 legislation are more likely to achieve certain innovation outcomes than are firms with a smaller number of awards; and (3) the firms that are likely to be deemed experienced according to the 2022 legislation often come from states that receive relatively low levels of venture capital and are outside of traditional innovation clusters. Taken together, the analyses suggest that actions to limit the number of awards to a single firm may be detrimental to the defense innovation ecosystem and defense industrial base.

[4] U.S. Congress, SBIR and STTR Extension Act of 2022, P.L. 117–183, Section 8 (September 30, 2022).

DATA SOURCES

The main source of data for this chapter is the public awards database housed in the Small Business Administration's (SBA's) SBIR.gov portal. The committee's analyses focus on SBIR/STTR award activity from fiscal years (FY) 2012 to 2023. This period followed the major reauthorization in 2011 and captures variation after the 2018 reauthorization.[5] These data are supplemented by additional firm- and project-level records from the Federal Procurement Data System, pulled in October 2024, as well as data from USASpending, Crunchbase, and the United States Patent and Trademark Office.

DISTRIBUTION OF DOD SBIR/STTR AWARDS

The starting point of an analysis of the impact of provisions such as those included in the SBIR and STTR Extension Act of 2022 is to characterize, to the extent possible, the population of firms that could be impacted by such provisions. To do so, the committee first undertook an analysis of the distribution of awards across DOD SBIR/STTR awardees.

Figure 9-1 illustrates the uneven distribution of DOD Phase I SBIR/STTR awards per firm. A total of 5,542 firms received awards from FY2012 to FY2023. Most participating firms (3,028, or 55 percent) received just a single DOD SBIR Phase I award, and an additional 18 percent (978) received just two Phase I awards. Thus, nearly three-quarters of firms received no more than two awards over the entire 12-year span. As the number of awards per firm increases, the number of firms drops off sharply, with only a small minority receiving 10 or more awards. At the extreme, just 17 firms received more than 101 Phase I awards, suggesting that the pattern of repeat participation is concentrated among a small, select group of firms.

Figure 9-2 presents the distribution of DOD Phase II SBIR/STTR awards per firm from FY2012 to FY2023, covering 3,807 unique firms. Similar to the case for Phase I, the distribution is highly skewed: more than half of the firms (1,961, or 52 percent) received one Phase II award, and an additional 725 (19 percent) received exactly two. Thus, roughly 70 percent of all awardees received no more than two Phase II awards over the 12-year period. As the number of awards increases, the number of firms declines sharply. Only a small number of firms consistently received multiple Phase II awards—for example, 25 firms received more than 50 Phase II awards, and only 8 received more than 100.

This pattern suggests that while many companies manage to reach Phase II at least once, a much smaller subset becomes deeply embedded in the program, receiving sustained funding across multiple projects. These high-frequency

[5] U.S. Congress, John S. McCain National Defense Authorization Act for Fiscal Year 2019, P.L. 115–232 (August 13, 2018).

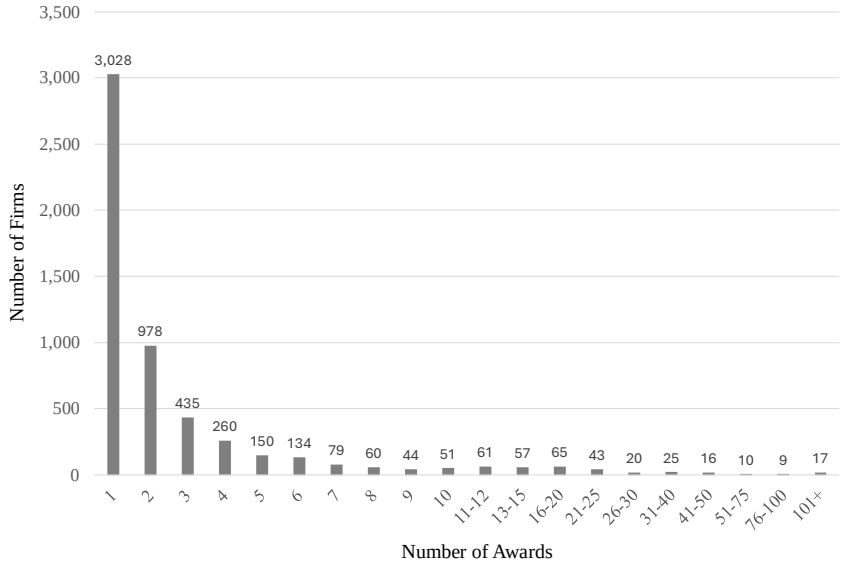

FIGURE 9-1 Distribution of DOD Phase I SBIR/STTR awards per firm (fiscal years 2012–2023).
NOTES: The total number of DOD Phase I awards over this period was 21,219. The total number of companies receiving a Phase I award was 5,542.
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

participants likely have internal capabilities and networks that allow them to align repeatedly with DOD priorities. At the same time, the data underscore a potential barrier to scaling for many firms that successfully complete Phase I but struggle to advance consistently to or through Phase II. Understanding these dynamics could be key to improving the commercialization outcomes of the SBIR/STTR programs and ensuring a more equitable distribution of advanced-stage support.

THE 2022 EXPERIENCED FIRM CRITERION

To get a sense of how the provisions of the 2022 SBIR/STTR reauthorization might impact those companies that receive many awards, the committee undertook an analysis of DOD awards made to firms that would be defined as experienced under the terms of the reauthorization and therefore subject to the additional scrutiny and more stringent performance standards prescribed in that legislation. The increased benchmark for transition from Phase I to Phase II applies to any firm with more than 50 Phase I awards, from

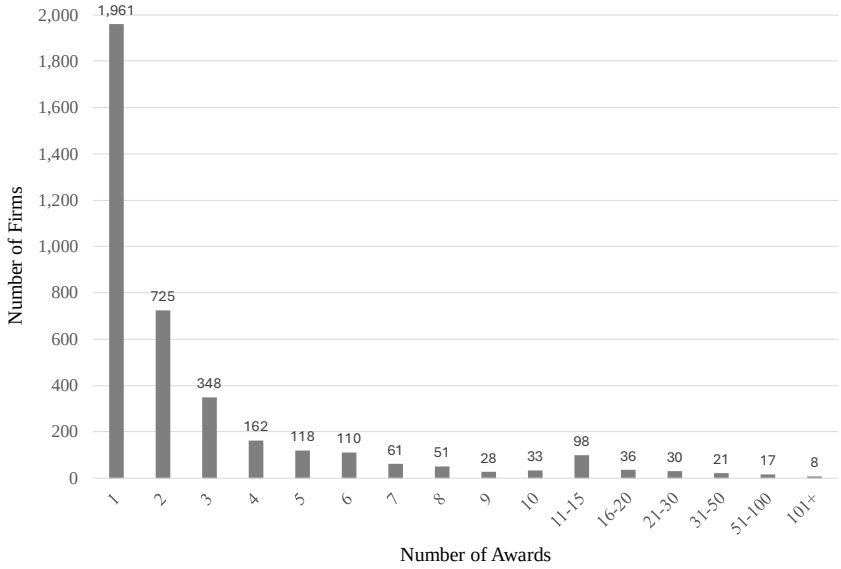

FIGURE 9-2 Distribution of DOD Phase II SBIR/STTR awards per firm (fiscal years 2012–2023).
NOTES: The total number of DOD Phase II awards over this period was 13,484. The total number of companies receiving a Phase II award was 3,807.
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

any federal agency, over the 5 fiscal years preceding the most recently completed fiscal year, and the heightened commercialization benchmark applies to any firm with more than 50 Phase II awards, from any federal agency, over the 10-year period preceding the 2 most recently completed fiscal years. As noted above, an even more stringent commercialization benchmark applies to any firm receiving more than 100 Phase II awards. Figure 9-3 presents the number of unique, experienced firms, as defined by these guidelines, that received DOD SBIR/STTR Phase I or Phase II awards in each fiscal year, 2012–2023.

The number of experienced Phase I firms (black solid line) ranges from a high of 19 in FY2012 to a low of 8 in both FY2015 and FY2023, with relative stability in most other years, hovering around 10–15 firms per year. Phase II experienced firms (gray dashed line) show a smaller but generally increasing presence from 3 firms in FY2012 to a peak of 11 in FY2022.

These firms make up a small share of DOD SBIR/STTR awards, as well as a small share of DOD SBIR/STTR Phase I funding. As shown in Figure 9-4, firms receiving 51 or more Phase I awards within a 5-year period (excluding the

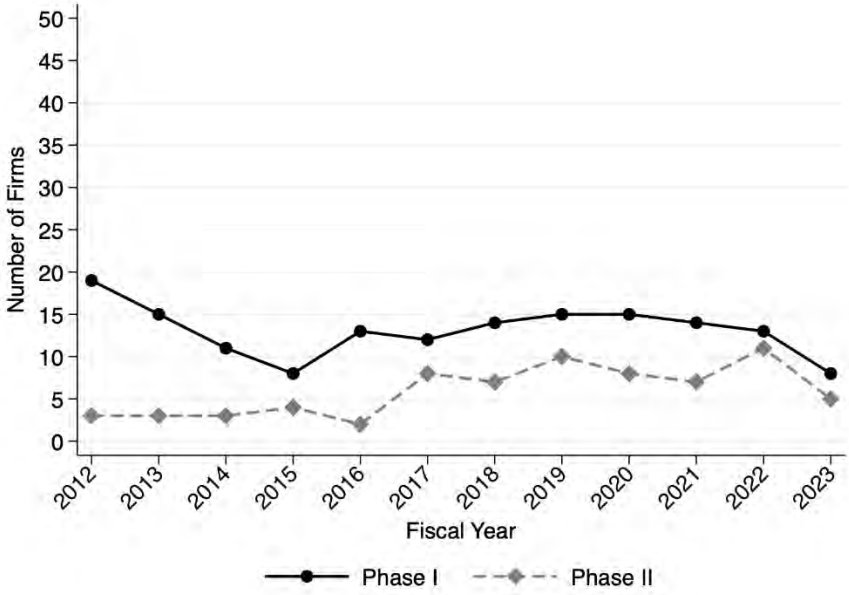

FIGURE 9-3 Number of experienced firms receiving DOD SBIR/STTR awards, by year (fiscal years 2012–2023).
NOTES: For each year, *experienced Phase I firms* are defined as any firm that has received more than 50 Phase I awards, from any federal agency, over the 5 fiscal years preceding the most recently completed fiscal year. *Experienced Phase II firms* are defined as any firm that has received more than 50 Phase II awards, from any federal agency, over the 10-year period preceding the 2 most recently completed fiscal years.
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

most recent fiscal year) during the analysis period received between approximately 5 percent and 9 percent of the total Phase I funding. Firms identified as experienced by the Phase II definition accounted for a much smaller share of the total Phase I funding, generally between 2 percent and 5 percent.

Although experienced firms received a small share of DOD's total SBIR/STTR funds from FY2012 to FY2023, as shown in Figure 9-4, they did capture a larger share of the funding for each phase. Firms with more than 50 Phase I awards over the previous 5 years accounted for 13 percent of all Phase I awards and 14 percent of Phase I funding over the analysis period. Similarly, experienced firms (with more than 50 Phase II awards over a 10-year period)

captured 6 percent of Phase II awards and nearly 6 percent of Phase II funding (see Table 9-1). Thus, a handful of experienced firms do capture a significant share of federal research and development (R&D) investment within DOD's SBIR/STTR programs. Given that the allocated budget for each award reflects DOD's case-by-case assessment of how best to meet its needs, the receipt of an outsized share of funding or awards may reflect the structural advantage these firms have as a result of their cumulative expertise and proven performance.

VARIATION ACROSS DOD SERVICE/COMPONENT AND ACROSS FEDERAL AGENCIES IN AWARDS TO EXPERIENCED FIRMS

Conversations with DOD SBIR/STTR program managers reinforced the committee's interpretation that the trends outlined above stem from a shift toward a more meritocratic, competition-based evaluation system. In at least one DOD service/component, proposal materials are redacted to remove firms' names, addresses, and past award history before review, ensuring that evaluators focus strictly on technical merit and relevance to mission needs.

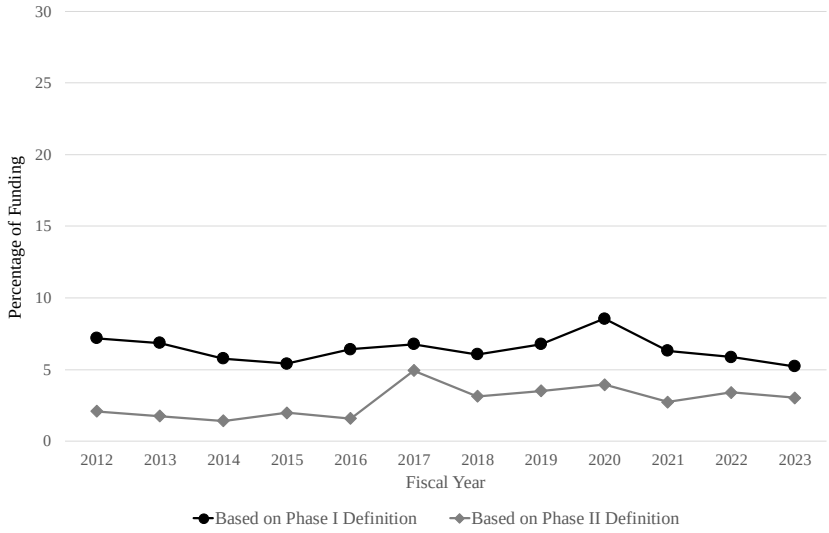

FIGURE 9-4 Percentage of DOD SBIR/STTR Phase I award funding going to experienced firms, by year (fiscal years 2012–2023).
NOTES: For each year, *experienced Phase I firms* are defined as any firm that has received more than 50 Phase I awards, from any federal agency, over the 5 fiscal years preceding the most recently completed fiscal year. *Experienced Phase II firms* are defined as any firm that has received more than 50 Phase II awards, from any federal agency, over the 10-year period preceding the 2 most recently completed fiscal years.
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

TABLE 9-1 Percentage of DOD SBIR/STTR Funding Going to Experienced Firms, by Phase and DOD Service/Component (Fiscal Years 2012–2023)

Branch	Percentage of Phase I Awards	Percentage of Phase I Funding	Percentage of Phase II Awards	Percentage of Phase II Funding
Air Force	8.1	10.4	3.9	3.5
Army	17.4	17.2	8.4	7.9
Navy	15.6	15.6	7.3	7.5
DARPA	12.2	13.0	4.2	4.0
DOD Total	13.0	14.3	6.0	5.7

NOTES: For each year, *experienced Phase I firms* are defined as any firm that has received more than 50 Phase I awards, from any federal agency, over the 5 fiscal years preceding the most recently completed fiscal year. *Experienced Phase II firms* are defined as any firm that has received more than 50 Phase II awards, from any federal agency, over the 10-year period preceding the 2 most recently completed fiscal years. DARPA = Defense Advanced Research Projects Agency.
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

Across services and components, the current system is designed to prioritize fit and quality over familiarity or seniority. Thus, while experienced firms continue to receive a significant share of awards—especially from the Navy and Army—this reflects their ability to succeed in open competition rather than preferential treatment. A declining share of Phase I and Phase II funding to experienced firms in recent years suggests that DOD services and components are increasingly structuring their programs to encourage broader participation and reduce overreliance on incumbent firms.

Table 9-1 presents the share of SBIR/STTR funding, by phase, awarded to experienced firms across four of the largest DOD services and components—Air Force, Army, Navy, and the Defense Advanced Research Projects Agency—over the period FY2012–2023. The Air Force effectuated a sharp reduction in experienced-firm funding over this period, a shift closely tied to its adoption of the open topic model, reducing the share of Phase I awards to experienced firms from 12.7 percent to 6.4 percent and the share of Phase II awards from 3.6 percent to 2.5 percent. This approach prioritizes exploratory innovation by issuing many small Phase I awards, thereby broadening the applicant pool and reducing the proportion of awards going to repeat recipients. In contrast, the Navy continues to allocate a comparatively higher percentage of its SBIR/STTR funding to experienced firms, with 16.5 percent of Phase I awards going to experienced firms and 5.5 percent of Phase II awards going to such firms in FY2023 (although these shares declined from FY2020 when experienced firms captured 21 percent of the Navy's Phase I awards and 11 percent of its Phase II awards). Continued reliance on experienced firms reflects the Navy's long-standing orientation toward using SBIR/STTR as a mechanism to support procurement, which naturally favors firms with demonstrated performance and alignment with naval acquisition needs.

Similarly, the Army has maintained relatively high shares of awards to experienced firms but has shown a gradual reduction in its awards to such firms. Its share of awards to experienced firms for Phase I dropped from 16.7 percent in FY2012 to 9.1 percent in FY2023, and for Phase II from a high of 13.9 percent in FY2019 to 3.1 percent in FY2023.

A comparison of DOD with the other large federal funding agencies reveals that DOD is the largest user of experienced firms in its SBIR/STTR programs, although the National Aeronautics and Space Administration (NASA) also uses a substantial number of such firms. These levels signal moderate institutional reliance on established performers, potentially reflecting a desire for strategic or technical continuity in mission-oriented R&D. In contrast, agencies such as the Department of Health and Human Services (HHS) and the National Science Foundation (NSF) allocate much smaller proportions of awards and funding to experienced firms. Agencies such as DOD and NASA appear to value long-term partnerships with experienced performers as necessary for procurement, whereas HHS and especially NSF may emphasize novelty and diversity in their SBIR/STTR portfolios (NASEM, 2022a, 2023).

PERFORMANCE OF EXPERIENCED FIRMS

Under the provisions of the 2022 reauthorization, as implemented, companies that have received more than 50 Phase I awards over the 5 fiscal years preceding the most recently completed fiscal year must have achieved an average ratio of Phase II's to Phase I's of 0.50 (one Phase II award for every two Phase I awards). This is double the transition rate benchmark required for experienced firms under the 2011 reauthorization.[6] With this in mind and to get some sense of how the transition rates of experienced versus other firms compare, the committee undertook an analysis of the average overall transition rate for firms receiving Phase I awards that would have been subject to the 2022 provisions had those provisions been in place over the period FY2012–2020.

Employing the same 5-year lookback as that called for in the 2022 reauthorization, the committee compared (1) the Phase II transition rates for those firms that would have been categorized as experienced with (2) all other DOD SBIR/STTR Phase I awardees. The results, reported in Figure 9-5, show that these experienced firms outperformed their less experienced counterparts.[7] From

[6] SBA calculates the Phase II/Phase I transition rate for a firm by dividing the number of Phase II awards received by the number of Phase I awards received. The measurement period for the count of Phase II's begins and ends 1 year after the period used to calculate the number of Phase I's received by a given firm. This calculation can be misleading as firms may receive two Phase II awards for the same project, yielding a transition rate >1. See https://www.sbir.gov/performance-benchmarks.

[7] The committee observed the rate at which DOD SBIR/STTR Phase I awards made between FY2012 and FY2020 resulted in Phase II awards made through FY2023. Unlike the practice described by SBA on its website, the committee employed textual analysis of project abstracts to connect specific Phase II awards to specific Phase I awards and allowed additional time for transitioning. SBA bases its calculated transition rates on Phase I and Phase II counts over 5-year periods, offset by 1 year to allow

FY2012 to FY2018, experienced firms maintained an average transition (conversion) rate of around 0.6, while the rate for other firms was 0.45–0.5. However, the trend shifted in FY2019 and FY2020, as both types of awarded firms experienced a marked decline in conversion rates. By FY2020, conversion rates for experienced firms had dropped to about 0.4, while the rate for other firms had fallen below 0.3. It should be noted that this convergence at lower levels may reflect changes in DOD program priorities; increased competition; administrative backlogs; or external shocks such as the COVID-19 pandemic, which disrupted R&D operations and federal contracting timelines.[8]

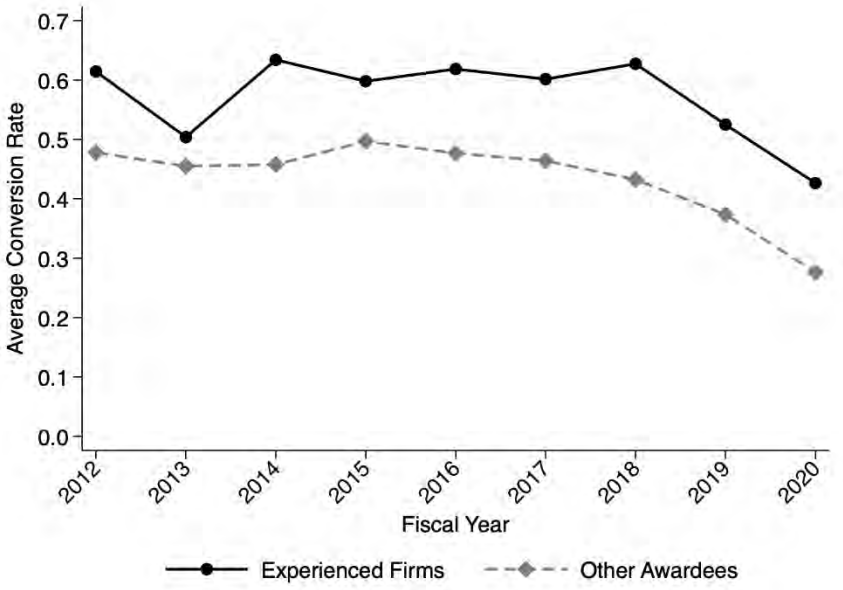

FIGURE 9-5 Phase I to II transition rates of DOD SBIR/STTR Phase I awardees (fiscal years [FY] 2012–2020).
NOTE: For each year, experienced Phase I firms are defined as any firm that has received more than 50 Phase I awards, from any federal agency, over the 5 fiscal years preceding the most recently completed fiscal year. The committee employed textual analysis of project abstracts to connect specific Phase I awards made from FY2012 to FY2020 to specific Phase II awards made through FY2023.
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

for transition, but without connecting the Phase II awards to the Phase I awards included in their counts.
[8] Additionally, it may take longer than the sample period allows to see whether a firm has successfully converted its Phase I award into a Phase II award.

The 2022 SBIR/STTR reauthorization significantly raised commercialization performance standards for firms with a history of frequent participation. The 2022 reauthorization requires that firms that have received more than 50 Phase II awards during the past 10 years, excluding the 2 most recently completed fiscal years, achieve a minimum average of $250,000 in sales and/or investments from the private sector per Phase II award received during that period. Thus, a firm holding 51 Phase II awards would need to achieve at least $12.75 million in total external sales or private-sector investments. The threshold increases further for companies with more than 100 Phase II awards; they must achieve an average of $450,000 per award, translating to more than $45 million for 101 Phase II contracts. This represents a substantial increase from the $100,000 average required of less experienced multiple-award recipients. Importantly, this requirement excludes sales that involve follow-on contracting directly with DOD itself; in other words, firms that succeed in transitioning technology and activities from SBIR/STTR to subsequent research and procurement contracts as part of the defense industrial base would be penalized for this outcome given that the source of these revenues would be federal funds.[9]

Many SBIR-funded innovations are designed for public missions—defense, health, and energy—for which the federal government is the primary customer. By not counting federal sales, the reauthorization reinforces a distorted picture of success, penalizing firms that deliver high-impact technologies to address national needs. This undermines the dual-use purpose of SBIR/STTR, which serves both economic and strategic goals. The 2022 reforms missed a key opportunity to modernize evaluation metrics and recognize the full public value of SBIR/STTR-supported innovation.

Companies oriented toward potential dual-use applications are generally well positioned to meet these thresholds, given their capacity to generate commercial sales and secure private funding. By contrast, specialized R&D firms, which frequently focus on mission-specific defense technologies and may be particularly valuable contributors as specialized firms within the defense industrial base, may struggle to achieve the same benchmarks.

Rigid adherence to these new thresholds, particularly for Phase I-to-Phase II transitions, could unintentionally constrain experimentation. The notion that SBIR/STTR-funded firms advance in a neat, linear progression—Phase I to Phase II to procurement success—oversimplifies the reality of early-stage research. Many companies require multiple Phase I awards to refine an initial concept, and an unsuccessful early attempt may lead a firm to pivot and seek another Phase I award that incorporates new insights. Indeed, the analyses presented in Chapters 7 and 8 show that securing at least five Phase I awards often serves as a practical minimum threshold before most firms can attract either private financing or follow-on DOD funding. Reducing the number of Phase I

[9] Under the terms of the 2011 reauthorization as implemented for less experienced multiple-award recipients, follow-on federal funding or receipt of patents can also be used to meet the commercialization standard. See https://www.sbir.gov/performance-benchmarks.

opportunities in an effort to enforce higher transition rates may thus limit exploratory work, while similarly restricting Phase II awards could leave valuable knowledge underutilized.

Building on the analysis presented in Chapters 7 and 8, the committee examined the performance of SBIR/STTR awardees on a number of indicators, with awardees grouped based on their cumulative number of Phase I awards from FY2012 to FY2022. The committee found that experienced firms were more likely than the comparison group to obtain patents, private investment, and subsequent non-SBIR/STTR R&D funding or non-R&D procurement contracts from DOD. In the case of private capital and the receipt of non-R&D procurement, this likelihood was greater than that for less experienced multiple-award recipients. Especially notable for firms that received more than 50 Phase I awards is that these firms secured non-R&D funding from DOD at higher rates relative to a comparable set of small businesses that did not receive DOD SBIR/STTR funding.

Taken together, these findings suggest that firms that receive many awards have developed technologies that are valued by DOD. Further study is needed to better understand the impact of these awards on the defense supply base, but the evidence is clear: while there is a large variation in outcomes associated with experienced SBIR/STTR firms, the premium enjoyed by DOD SBIR/STTR awardees compared with other firms in the DOD innovation ecosystem mostly increases with higher numbers of awards, and with respect to patenting, private financing, and subsequent contributions to the warfighter through procurement, firms with a higher number of awards do better, on average, than less experienced SBIR/STTR awardees.

LOCATION OF EXPERIENCED FIRMS

Finally, the committee investigated where experienced firms are located, finding that these firms are often located in states that attract less venture capital funding, thus helping to spread DOD R&D funding more broadly across the United States. Figure 9-6 shows the top U.S. states ranked by the percentage of DOD SBIR/STTR Phase I awards that were granted to experienced firms in the FY2019–2020 time period. The top three states—New Hampshire, Massachusetts, and Maryland—stand out for having an exceptionally high concentrations of awards going to experienced firms, accounting for 39.3 percent, 36.6 percent, and 31.9 percent, respectively, of all the SBIR/STTR activity in the state. In each of these states, a small number of firms (one in New Hampshire and Maryland, and five in Massachusetts) were responsible for securing a large share of the state's awards. Alabama and Texas also had notable award shares to experienced firms—19.2 percent and 18.7 percent, respectively—despite having only one or two firms that met the experience threshold. Cutting DOD SBIR/STTR funding to experienced firms would have uneven and potentially severe consequences for many states, particularly those in which one or a few firms dominate the award landscape. In these states, a cut in funding to

experienced firms could directly undermine a major component of the regional innovation economy. These firms often serve as anchors for technical employment, generate local procurement through subcontracting, and contribute significantly to state and local tax bases. A sudden reduction in funding could result in job losses, stalled R&D activities, and weakened innovation infrastructure.

In states with larger and more diverse innovation ecosystems, such as California, Massachusetts, and Virginia, the effects might be more diffuse but still substantial. Experienced firms in these states often lead high-risk, high-impact projects that form the backbone of DOD's early-stage technology pipeline. Curtailing their participation could erode institutional knowledge, reduce economies of scale in proposal development, and ultimately impair the timely delivery of critical technologies to defense users. Moreover, these experienced firms frequently collaborate with universities and smaller businesses, meaning their decline would ripple across the broader ecosystem.

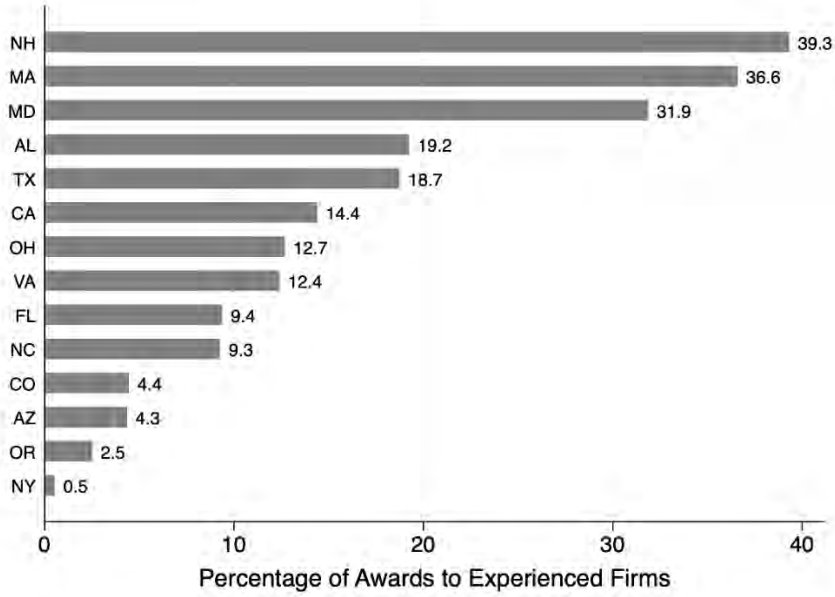

FIGURE 9-6 Top U.S. states by percentage of DOD SBIR/STTR awards going to experienced firms (weighted average for fiscal years [FY] 2019–2020).
NOTE: State is based on location of record. For each year, experienced DOD Phase I firms are defined as any firm that has received more than 50 Phase I awards, from any federal agency, over the 5 fiscal years preceding the most recently completed fiscal year. Analysis limited to states with five or more awards in FY2019–2020.
SOURCE: Committee calculations based on the Small Business Administration's SBIR/STTR Awards database (SBIR.gov).

Restricting funding to experienced firms also risks deepening existing regional disparities in innovation capacity. These firms often emerge in states that lack other federal R&D assets, such as national laboratories or top-tier research universities. In these states, SBIR/STTR funding represents one of the few sustained mechanisms for local firms to engage in high-value technological development. Eliminating that channel would likely shift funding back toward traditional innovation hubs, undercutting national efforts to democratize access to federal R&D support. In sum, a blunt cut to the eligibility of experienced firms would disrupt regional economies and weaken national defense innovation.

EXPERIENCED SBIR/STTR FIRMS AND THE DEFENSE INNOVATION ECOSYSTEM

SBIR/STTR firms typically operate as nonprime contractors within the defense industrial ecosystem, taking on R&D roles that may not align with the scale or scope of large prime contractors. The committee identified several distinct motivations for such firms to apply to SBIR/STTR programs. Some technology-focused companies seek out SBIR/STTR as a source of nondilutive (equity-free) investment to support early-stage product or process development. Because DOD is the largest federal sponsor of SBIR/STTR, it offers a particularly attractive funding vehicle—especially when the possibility of securing a Phase III contract could provide a reliable first-use customer.

For some companies, DOD SBIR funding serves as a springboard to larger commercial markets. For example, the startup Compound Eye received an Air Force Direct to Phase II SBIR award and an Army SBIR Catalyst Award to develop advanced sensing and perception technologies for defense applications. The same core technology designed for autonomous vehicles can be embedded within a broader product platform. In this sense, Compound Eye exemplifies a dual-use approach, leveraging defense R&D funding to develop solutions applicable to both military and civilian markets.[10]

Other firms are more specialized R&D organizations. They rely on SBIR/STTR funding to advance technologies that often form components of larger, warfighter-focused systems (Myers et al., 2025). These firms typically engage in long-term partnerships with DOD services and components and provide specialized prototypes or subsystems critical to mission needs. Although such firms occupy a valuable niche in the defense innovation ecosystem, they may have less appeal for private investors. With limited commercial potential beyond DOD, growth prospects of these firms are constrained, making them less likely candidates for venture capital or other forms of risk capital.

When viewed as a portfolio, these two types of companies—those pursuing dual-use possibilities and those specializing in defense-focused R&D—both serve essential functions. Firms oriented toward dual-use innovation bring

[10] Based on committee discussions with DOD SBIR/STTR program managers. See also https://compoundeye.com.

fresh technological perspectives and benefit from DOD's funding and user feedback. Meanwhile, more specialized firms evolve into trusted partners that repeatedly contribute critical expertise. Many SBIR/STTR program officials and administrators interviewed by the committee expressed neutral or positive views regarding so-called experienced firms, describing them as proven performers that accelerate the path to a deployed technology.

Experienced SBIR/STTR awardees can have an outsized impact on the human capital base of the U.S. defense innovation ecosystem. Applying to the SBIR/STTR programs requires a detailed application and thorough knowledge of the application process, filing requirements, and applicable deadlines (see Chapter 4). One SBIR/STTR program manager indicated to the committee that multiple-award recipients provide important proposal and contracting support to researchers who can bring valuable ideas to DOD, but who otherwise might not access the SBIR/STTR programs.[11]

The committee found that firms meeting the criteria for *experienced*—those receiving at least 51 Phase I awards in the previous 5 years or 51 Phase II awards in the previous 10 years—averaged 44 unique principal investigators who received funding from the DOD SBIR/STTR awards. This suggests that such firms operate as organizational platforms, enabling a broad array of researchers to apply for, manage, and execute government-funded R&D projects. Rather than being centered around a single founder or a narrow technical niche, these firms appear to have a dynamic function within the defense innovation ecosystem, with a diverse internal talent base and the organizational capacity to support multiple, simultaneous lines of inquiry. Their ability to attract, retain, and coordinate dozens of specialized principal investigators indicates a level of managerial and technical infrastructure that differentiates them from less experienced or smaller firms.

Moreover, this pool of technical talent positions experienced SBIR/STTR firms as important intermediaries in the broader defense innovation pipeline—not just as recipients of federal funding, but as hubs of capability that can rapidly mobilize expertise in response to shifting national security needs. Feldman and colleagues (2022) emphasized the generative effects of these firms, noting that they often serve as launching pads for new ventures, either through formal spin-offs or as former employees and principal investigators establish their own firms. In this way, experienced SBIR firms contribute not only to the immediate goals of DOD innovation agendas but also to the longer-term development of the entrepreneurial and scientific workforce. They play a dual role—facilitating applied R&D in support of defense priorities while nurturing the professional development of technical talent, thereby reinforcing the resilience and adaptability of the defense-oriented entrepreneurial ecosystem.

The limits on SBIR/STTR awards to single firms that were put in place as part of the 2022 reauthorization can be expected to impact a limited number of firms but may have an outsized impact on the health of the nation's defense

[11] Based on committee discussions with DOD SBIR/STTR program managers.

innovation ecosystem. As noted, firms often require multiple Phase I awards to refine and develop an initial idea, and limiting the number of awards to some multiple-award recipients based on their transition rate to Phase II may encourage less innovative research. Firms with multiple awards tend to employ many principal investigators to manage their SBIR and STTR awards over the course of their involvement in the programs and help some of those researchers access the programs by providing the corporate structure and application expertise some researchers may lack. Therefore, the limits on Phase I and II awards prescribed in the 2022 reauthorization may reduce the number of researchers benefiting from the programs and going on to make other contributions to the nation's defense innovation system. While those limits are intended to curb repeat participation without demonstrated market impact, they risk penalizing firms whose primary customers are federal agencies—a common reality in the national security, energy, and health sectors.

The committee's analysis also revealed that these limits may impact the geographic reach of the programs to parts of the country not typically associated with technology-intensive industries or venture capital investments, where firms with experience in the SBIR/STTR programs can serve as exemplars for other local firms. Importantly, the committee also found that firms at risk of exceeding the 2022 limits are more likely to contribute important capability and expertise to the defense supply chain and innovation ecosystem than are firms that receive fewer awards.

FINDINGS AND RECOMMENDATIONS

Finding 9-1: Performance standards (concerning follow-on funding or transition to Phase II) that potentially limit participation in the SBIR/STTR programs by particular firms, whether by limiting the ability to submit proposals or the number of awards that can be received, add administrative burden and limit the discretion of program executive officers and program managers.

Finding 9-2: DOD SBIR/STTR firms with more than 50 Phase I awards over a 10-year period are more likely to contribute capability and expertise to the defense supply chain and innovation ecosystem than are firms that receive fewer awards.

Finding 9-3: DOD SBIR/STTR firms with more than 50 Phase I awards over a 10-year period often come from states that receive relatively low levels of venture capital and are outside of those areas of the country perceived as traditional innovation clusters.

Finding 9-4: Excluding federal funding from the commercialization standard disadvantages firms that provide defense-specific technologies.

Recommendation 9-1: Congress should direct the Small Business Administration to revise the Policy Directive restriction on proposal submission by certain applicants that do not meet commercialization or transition benchmarks. Doing so would ensure that the Department of Defense can review and select the best proposals to meet its needs.

Recommendation 9-2: Congress should ensure that program executive officers and program managers have the flexibility to choose among applicants with the best technologies and those that can quickly deliver results for the warfighter. Congress should not mandate strict benchmarks restricting the receipt of awards based simply on the number of previous awards or prior Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) funding received by a small business.

Recommendation 9-3: Congress should include additional federal funding in calculations of commercialization.

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Appendix A

Meeting Agendas

1ST MEETING: OCTOBER 26, 2023
VIA ZOOM
All Times U.S. Eastern

THURSDAY, OCTOBER 26, 2023 (CLOSED SESSION: 15:30–18:00)

2ND MEETING: OCTOBER 30, 2023
VIA ZOOM
All Times U.S. Eastern

MONDAY, OCTOBER 30, 2023 (CLOSED SESSION: 13:30–14:00)

3RD MEETING: NOVEMBER 9, 2023
VIA ZOOM
All Times U.S. Eastern

THURSDAY, NOVEMBER 9, 2023 (CLOSED SESSION: 13:30–14:30)

4TH MEETING: NOVEMBER 28, 2023
VIA ZOOM
All Times U.S. Eastern

THURSDAY, NOVEMBER 28, 2023 (CLOSED SESSION: 13:00–13:30)

5TH MEETING: DECEMBER 6, 2023
National Academy of Sciences
2101 Constitution Avenue, NW
Washington, DC 20418
All Times U.S. Eastern

WEDNESDAY, DECEMBER 6, 2023 (CLOSED SESSION: 12:00–13:00)

WEDNESDAY, DECEMBER 6, 2023 (OPEN SESSION)

13:00–13:05 **Welcome**
Maryann Feldman and Scott Stern, co-chairs

13:05–14:15 **Sponsor Perspectives**
Matthew Williams, Department of Defense
Christina Barnhill, Department of Defense

END OF OPEN SESSION

WEDNESDAY, DECEMBER 6, 2023 (CLOSED SESSION: 14:30–20:00)

6TH MEETING: DECEMBER 7–8, 2023
National Academy of Sciences
2101 Constitution Avenue, NW
Washington, DC 20418
All Times U.S. Eastern

THURSDAY, DECEMBER 7, 2023 (OPEN SESSION)

09:00–09:15 **Welcome**
Maryann Feldman and Scott Stern, committee co-chairs

09:15–09:30 **Introductory Remarks**
Jagadeesh Pamulapati, Department of Defense

09:30–10:00 **National Security Considerations in the Study of Entrepreneurship**
Josh Lerner, Harvard University

10:00–10:30 **Break**

10:30–12:30 **Panel 1: Using SBIR and STTR to Achieve DOD Mission and Goals**
Moderator: Arun Seraphin, committee member

Jason Rathje, Department of Defense (virtual)
Devanand Shenoy, Department of Defense
Bruce Jette, Innvistra LLC
Stephen Ouellette, The Institute for Defense Analyses

12:30–13:30 **Working Lunch**

13:30–15:00 **Panel 2: Perspectives on Conventional Innovation and Commercialization Metrics**
Moderator: Kyle Myers, committee member

Amanda Bresler, PW Communications
Ray Friesenhahn, TechLink
Bhaven Sampat, Arizona State University

15:00–15:30 **Break**

15:30–16:30 **Panel 3: New Data and New Metrics for Evaluating Impact**
Moderator: Maryann Feldman, committee co-chair

Alexander Whalley, University of Calgary
Daniel Gross, Duke University

16:30–17:15 **Concluding Thoughts for Day 1**
Moderator: Scott Stern, committee co-chair

Ellen Lord, committee member
Arun Seraphin, committee member
Kyle Myers, committee member
Maryann Feldman, committee co-chair

DAY 1 ADJOURNS

FRIDAY, DECEMBER 8, 2023 (OPEN SESSION)

09:00–10:30 **Panel 4: Perspectives from Small Business Community (I)**
Moderator: Scott Stern, committee co-chair

Alison Brown, NAVSYS
Jay Rozzi, Creare
John Stocker, Lynntech (retired)

10:30–10:45 **Break**

10:45–12:00 **Panel 5: Perspectives from Small Business Community (II)**
Moderator: Warren Katz, committee member

Eric Blatt, Alliance for Commercial Technology in Government
Caleb Carr, Vita Inclinata Technologies, Inc.
Rohit Gupta, Sentenai

12:00–12:05 **Final Thoughts**
Scott Stern, committee co-chair

7TH MEETING: DECEMBER 8, 2023
National Academy of Sciences
2101 Constitution Avenue, NW
Washington, DC 20418
All Times U.S. Eastern

FRIDAY, DECEMBER 8, 2023 (CLOSED SESSION: 13:00–14:30)

8TH MEETING: FEBRUARY 22–23, 2024
Keck Center of the National Academies
500 Fifth, NW
Washington, DC 20001
All Times U.S. Eastern

THURSDAY, FEBRUARY 22, 2024 (CLOSED SESSION: 09:30–13:00)

THURSDAY, FEBRUARY 22, 2024 (OPEN SESSION)

13:00–13:05 **Welcome**
Scott Stern and Maryann Feldman, co-chairs

13:05–14:05 **Sponsor Perspectives**
Regina "Gina" Sims, Director, Defense SBIR/STTR (virtual)

14:05–15:00 **Using SBIR and STTR to Achieve DOD Mission and Goals**
Jason Rathje, Department of Defense

15:00–17:00 **Panel 1: National Security Perspectives**
Moderator: Maryann Feldman, committee co-chair

Gerald Epstein
Ethan Kapstein, Princeton University (virtual)
John Alic
Jerry McGinn, George Mason University

END OF OPEN SESSION

THURSDAY, FEBRUARY 22, 2024 (CLOSED SESSION: 17:00-20:00)

FRIDAY, FEBRUARY 23, 2024 (CLOSED SESSION: 09:00–09:30)

FRIDAY, FEBRUARY 23, 2024 (OPEN SESSION)

09:30–09:35 **Welcome**
Scott Stern and Maryann Feldman, committee co-chairs

09:35–10:30 **Panel 2: Perspectives from Prime Contractors (part 1)**
Moderator: Arun Seraphin, committee member

Lawrence Schuette, Lockheed Martin
Terrell Reid, Northrop Grumman (virtual)

END OF OPEN SESSION

FRIDAY, FEBRUARY 23, 2024 (CLOSED SESSION: 10:30–12:00)

FRIDAY, FEBRUARY 23, 2024 (OPEN SESSION)

12:00–12:05 **Welcome**
Maryann Feldman and Scott Stern, committee co-chairs

12:05–12:45 **Panel 2: Perspectives from Prime Contractors (part 2)**
Moderator: Arun Seraphin, committee member

Michael Winter and Francisco Vasquez, Pratt & Whitney (virtual)

END OF OPEN SESSION

FRIDAY, FEBRUARY 23, 2024 (CLOSED SESSION: 12:45–14:00)

9TH MEETING: APRIL 18-19, 2024
Keck Center of the National Academies
500 Fifth, NW
Washington, DC 20001
All Times U.S. Eastern

THURSDAY, APRIL 18, 2024 (CLOSED SESSION: 09:30–10:00)

THURSDAY, APRIL 18, 2024 (OPEN SESSION)

10:00–10:05 **Welcome**
Scott Stern and Maryann Feldman, co-chairs

10:05–11:00 **An Introduction to the DOD Budget Process**
Marcy E. Gallo, Congressional Research Service

11:00–12:30 **Perspectives from Former Program Executive Officers**
LTG David G. Bassett, US Army, Retired; Principal, Acquisition Insight LLC
Richard R. McNamara, RRM & Associates, LLC

END OF OPEN SESSION

THURSDAY, APRIL 18, 2024 (CLOSED SESSION: 12:45–15:00)

THURSDAY, APRIL 18, 2024 (OPEN SESSION)

15:30–15:35 **Welcome**
Maryann Feldman and Scott Stern, co-chairs

15:35–17:00 **Recent Academic Work**
Sabrina Howell, New York University (virtual)
Vivek Bhattacharya, Northwestern University (virtual)
Erica Fuchs, Carnegie Mellon University (virtual)

END OF OPEN SESSION

THURSDAY, APRIL 18, 2024 (CLOSED SESSION: 17:30–19:30)

FRIDAY, APRIL 19, 2024 (CLOSED SESSION: 09:00–09:10)

FRIDAY, APRIL 19, 2024 (OPEN SESSION)

09:10–09:15 **Welcome**
Scott Stern and Maryann Feldman, committee co-chairs

09:15–10:30 **Perspectives from the Venture Community**
Chris Moran, Lockheed Martin Venture Fund (virtual)
Fiona Murray, MIT

END OF OPEN SESSION

FRIDAY, APRIL 19, 2024 (CLOSED SESSION: 10:30–11:30)

FRIDAY, APRIL 19, 2024 (OPEN SESSION)

11:30–11:35 **Welcome**
Maryann Feldman and Scott Stern, committee co-chairs

11:35–12:00 **Leveraging Small Business to Meet Defense Needs: A View from DARPA**
Stefanie Tompkins, DARPA (virtual)
Jennifer Thabet, DARPA (virtual)

END OF OPEN SESSION

FRIDAY, APRIL 19, 2024 (CLOSED SESSION: 12:15–14:00)

10TH MEETING: MAY 9, 2024
VIA ZOOM
All Times U.S. Eastern

THURSDAY, MAY 9, 2024 (OPEN SESSION)

16:00–16:05 **Welcome and Introductions**
Maryann Feldman and Scott Stern, co-chairs

16:05–17:00 **Committee Discussion with David Metzger**

11TH MEETING: JULY 31–AUGUST 2, 2024
Beckman Center of the National Academies
100 Academy Way
Irvine, CA 92617
All Times U.S. Pacific

WEDNESDAY, JULY 31, 2024 (CLOSED SESSION: 12:30–13:00)

WEDNESDAY, JULY 31, 2024 (OPEN SESSION)

13:00–13:05 **Welcome**
Maryann Feldman and Scott Stern, co-chairs

13:05–13:45 **Alison Brown, NAVSYS Corporation (virtual)**

END OF OPEN SESSION

WEDNESDAY, JULY 31, 2024 (CLOSED SESSION: 13:45–20:00)

THURSDAY, AUGUST 1, 2024 (CLOSED SESSION: 09:00–13:45)

THURSDAY, AUGUST 1, 2024 (OPEN SESSION)

14:00–14:05 **Welcome**
Maryann Feldman and Scott Stern, co-chairs

14:05–14:50 **Lee Steinke, CisLunar Industries**

END OF OPEN SESSION

THURSDAY, AUGUST 1, 2024 (CLOSED SESSION: 15:00–17:00)

FRIDAY, AUGUST 2, 2024 (CLOSED SESSION: 09:00–11:30)

12TH MEETING: NOVEMBER 7–8, 2024
Keck Center of the National Academies
500 Fifth, NW
Washington, DC 20001
All Times U.S. Eastern

THURSDAY, NOVEMBER 7, 2024 (CLOSED SESSION: 09:30–20:00)

FRIDAY, NOVEMBER 8, 2024 (CLOSED SESSION: 09:00–14:30)

13TH MEETING: AUGUST 15, 2025
VIA ZOOM
All Times U.S. Eastern

FRIDAY, AUGUST 15, 2025 (CLOSED SESSION: 11:00–13:00)

Appendix B

Biographies of Committee Members

Maryann P. Feldman (*Co-Chair*) is the Watts professor in the Department of Public Policy at Arizona State University. Feldman was the winner of the Global Award for Entrepreneurship Research for her contributions to the study of the geography of innovation and the role of entrepreneurial activity in the formation of regional industry clusters. Her most recent work explores the emergence of regional entrepreneurial ecosystems. Feldman served as co-chair of the congressionally mandated National Academies of Sciences, Engineering, and Medicine studies of the SBIR and STTR programs at the Department of Energy, National Institutes of Health, and National Science Foundation.

Scott Stern (*Co-Chair*) is the David Sarnoff professor of management at the Massachusetts Institute of Technology (MIT) Sloan School of Management. Stern explores how innovation and entrepreneurship differ from more traditional economic activities and the consequences of these differences for strategy and policy. His research in the economics of innovation and entrepreneurship focuses on entrepreneurial strategy, innovation-driven entrepreneurial ecosystems, and innovation policy and management. Recent studies include the impact of clusters on entrepreneurship, the role of institutions in shaping the accumulation of scientific and technical knowledge, and the drivers and consequences of entrepreneurial strategy. Stern started his career at MIT, where he worked from 1995 to 2001. Before returning to MIT in 2009, he held positions as a professor at the Kellogg School of Management and as a nonresident senior fellow at the Brookings Institution. Stern was the cofounder and director (through 2021) of the Innovation Policy Working Group at the National Bureau of Economic Research. In 2005, he was awarded the Kauffman Prize Medal for Distinguished Research in Entrepreneurship. Stern has served and contributed to a number of National Academies committees and boards, including the Board on Science, Technology, and Economic Policy; The Future of Supercomputing (2004); Copyright in the Digital Era (2013); and An Assessment of ARPA-E (2017). Along with Maryann Feldman, he has also served as co-chair of three consensus committees examining

the SBIR and STTR programs at Department of Energy, National Institutes of Health, and National Science Foundation, respectively. Stern holds a B.A. in economics from New York University and a Ph.D. in economics from Stanford University.

Michael J. Andrews is an associate professor in the Department of Economics at the University of Maryland Baltimore County (UMBC). He studies the economics of innovation with research focusing on the role of public investments in developing local innovation ecosystems and on quantifying how social interactions lead to the generation and diffusion of new ideas. Much of his research uses historical data and settings, especially data on historical patents and the history of U.S. higher education. Andrews' work has received funding from the Kauffman Foundation and a National Science Foundation Doctoral Dissertation Improvement grant. He holds a Ph.D. in economics from the University of Iowa, as well as an M.A. in economics from the University of Iowa and a B.A. in economics and B.S. in supply chain management, both from the University of Maryland. Prior to joining UMBC, he served as a postdoctoral fellow at Northwestern University and at the National Bureau of Economics Research.

Andrea Belz is vice dean of transformative initiatives at the University of Southern California (USC) Viterbi School of Engineering, research director at the Information Sciences Institute, director of translational strategy for California Defense Ready Electronics and Microdevices Superhub (California DREAMS), director of the Center for Research in Space Technologies (CREST), and professor of practice in industrial and systems engineering, where she specializes in engineering policy and technology strategy. She has previously served as a visiting professor of engineering at California Institute of Technology (Caltech). From 2019 to 2022, Belz served as division director at the National Science Foundation, where she oversaw the agency's translational research activities (including the SBIR/STTR programs) and the launch of the Translational Impacts Division in the new Directorate for Technology, Innovation and Partnerships. From 2016 to 2019, she served as the inaugural vice dean of technology innovation and entrepreneurship at USC Viterbi, following her creation of Innovation Node–Los Angeles, a regional center of excellence for the NSF I-Corps program. Previously, Belz spent 10 years serving as a consulting systems engineer at the National Aeronautics and Space Administration Jet Propulsion Laboratory, leading roadmap efforts for the Solar System Exploration Directorate in topics ranging from life detection; electronics for extreme environments; and guidance, navigation, and control systems. Belz has consulted to multiple startups, inventors, and venture capital firms over the years; she served on the board of Caltech spinoff Ondax until its acquisition in 2018. She serves as a senior advisor at the Aerospace Corporation, a Federally Funded Research and Development Center for the United States Air Force. She is president of the IEEE Technology and Engineering Management Society. She holds a Ph.D. in experimental nuclear

physics from Caltech, a B.S. in physics from the University of Maryland at College Park, and an M.B.A. in finance from the Pepperdine Graziadio School of Business.

Janet Bercovitz joined the Leeds School of Business at the University of Colorado Boulder in fall 2017 as professor of strategy and entrepreneurship and was named the Deming professor of entrepreneurship in 2019. She previously taught at the Geis College of Business at the University of Illinois Urbana-Champaign and the Fuqua School of Business at Duke University. Bercovitz's research program consists of two main research streams: the first concentrates on extending understanding of academic entrepreneurship and university–industry technology transfer, and the second stream focuses on issues of organizational structure and interorganizational contractual relationships. Her research has been published in major journals such as *Organization Science*, *Strategic Management Journal*, *Management Science*, *Research Policy*, and the *Journal of Technology Transfer*. Bercovitz currently serves on the editorial review boards of the *Strategic Management Journal*, *Strategy Science*, and *Research Policy*. She served on the 5-year leadership team for the Technology and Innovation Management Division of the Academy of Management, completing her term in August 2023. Bercovitz holds a B.S. in chemistry, and an M.B.A. and Ph.D. in business and public policy from the University of California, Berkeley.

M. Diane Burton is the Joseph R. Rich '80 professor in the New York State School of Industrial and Labor Relations at Cornell University, where she directs the Institute for Compensation Studies and serves on the advisory board for the Center for Advanced Human Resource Studies. Burton studies employment relations and organizational change in entrepreneurial companies. Her primary research is a major study of high-tech startups in Silicon Valley with an emphasis on entrepreneurial teams and executive careers. Burton led an interdisciplinary research team in a 3-year project on the social science of creativity, innovation, and entrepreneurship and was part of an international team studying the career consequences of entrepreneurial employment. She earned her undergraduate degree in social and decision sciences at Carnegie Mellon University, an M.Ed. from Harvard University Graduate School of Education, and her Ph.D. in organizational sociology at Stanford University.

Ramalingam "Rama" Chellappa is a Bloomberg distinguished professor at Johns Hopkins University. He holds a nontenured position as a College Park professor in the Department of Electrical and Computer Engineering at the University of Maryland. Chellappa's research interests are in computer vision, pattern recognition, machine learning, and artificial intelligence. He received the 2012 K. S. Fu Prize from the International Association of Pattern Recognition (IAPR) and is a recipient of the Society, Technical Achievement, and Meritorious Service Awards from the IEEE Signal Processing Society, the Technical Achievement and Meritorious Service Awards from the IEEE Computer Society,

and the Inaugural Leadership Award from the IEEE Biometrics Council. Chellappa received the 2020 IEEE Jack S. Kilby Medal for Signal Processing, the 2024 Edwin H. Land Medal from Optica, the 2025 Azriel Rosenfeld Lifetime Achievement award, and the Distinguished Researcher in Computer Vision award from the IEEE Technical Community on Pattern Analysis and Machine Intelligence. He is a fellow of the Association for the Advancement of Artificial Intelligence, the American Association for the Advancement of Science, the Association for Computing Machinery, the American Institute for Medical and Biological Engineering, IAPR, IEEE, the National Academy of Inventors, the Optical Society of America, and the Washington Academy of Sciences, and he holds nine patents. Chellappa is a member of the National Academy of Engineering and a Foreign Fellow of the Indian National Academy of Engineering, and he has previously served on a number of National Academies consensus study committees, workshops, and standing boards. He served as CEO for two small businesses, ImageCorp and MUKH Technologies, LLC, which received SBIR awards from the Department of Defense. He earned his doctorate in electrical engineering at Purdue University.

Donna Ginther is the Roy A. Roberts and Regents distinguished professor of economics and the director of the Institute for Policy and Social Research at the University of Kansas and a research associate at the National Bureau of Economic Research. Prior to joining the University of Kansas faculty, she held positions at the Federal Reserve Bank of Atlanta, Washington University, and Southern Methodist University. Ginther's major fields of study are scientific labor markets, gender differences in employment outcomes, wage inequality, scientific entrepreneurship, children's educational attainments, and child abuse and neglect. She received her doctorate in economics in 1995, master's degree in economics in 1991, and B.A. in economics in 1987, all from the University of Wisconsin–Madison.

Jorge Guzman is the Gantcher associate professor of business at Columbia University and a faculty research fellow in the Innovation Program at the National Bureau of Economic Research (NBER). He is the cofounder of the Startup Cartography Project, a project aiming to measure the quality and quantity of entrepreneurship in the United States at any level of granularity. Guzman's research focuses on the measurement of entrepreneurship and the role of entrepreneurship in the economy, including the evolution of economic clusters and their role in enabling startups, entrepreneurial motivations, and entrepreneurial strategy. He was also a leader of the National Science Foundation's Regional Innovation Engines study group. Guzman was previously the entrepreneurship postdoctoral scholar at NBER and has a Ph.D. and an M.B.A. from the Massachusetts Institute of Technology and a B.S. in computer engineering from Tec de Monterrey.

Lauren Lanahan is associate professor of management and the Inman research scholar at the Lundquist College of Business at the University of Oregon. Her research investigates the relationship between institutions and the production of scientific knowledge. Lanahan examines outcomes related to innovation, technological change, and economic growth. She has published in a range of outlets including *American Economic Review*, *Organization Science*, *Research Policy*, and the *Journal of Policy Analysis and Management*. Lanahan has served as a committee member on two National Academies of Sciences, Engineering, and Medicine reviews of the SBIR/STTR programs, those of the programs at the Department of Energy and the National Science Foundation. She received her Ph.D. from The University of North Carolina at Chapel Hill and previously worked at the National Science Foundation in the Division of Social and Economic Sciences.

The Honorable Ellen Lord served as the first Under Secretary of Defense for Acquisition and Sustainment from 2017 to 2021, leading the Department of Defense's personnel, policy and processes for acquisition of hardware, software and services. Lord has more than 30 years of corporate experience in the automotive, aerospace and defense industries, serving in a variety of capacities and culminating in her role as president and CEO of Textron Systems Corporation, a subsidiary of Textron Inc. from 2012 to 2017. Currently, Lord serves on the Board of Directors for AAR Corporation, Parsons Corporation, SES S.A., Exiger, LightRidge Solutions, and Rebellion Defense. She is a senior fellow at the Johns Hopkins Applied Physics Laboratory and serves on the Advisory Board for MIT Lincoln Laboratory. She advises a number of aerospace, defense, and industrial companies and serves as vice-chair of the Naval Institute Board of Directors. Lord served as vice-chair for the Congressional Commission on the Planning, Programming, Budgeting and Execution Process and was tri-chair of the Center for a New American Security Defense Technology Task Force, both groups having published final reports in 2024. Lord has a B.A. in chemistry from Connecticut College and an M.S. in chemistry from the University of New Hampshire.

Victor R. McCrary is vice provost for National Security Innovation at The Catholic University of America. Previously, he served as vice president for research at the University of the District of Columbia. McCrary has held similar research leadership positions at the Johns Hopkins University Applied Physics Laboratory, Morgan State University, and the National Institute of Standards and Technology. He served two terms as the national president of the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers, and he is a fellow of the American Chemical Society and a fellow of the American Association for the Advancement of Science. He is currently the elected chair of the National Science Board, which oversees the National Science Foundation. He received his doctoral degree in chemistry from Howard University in 1986, a master's degree in engineering from the University of

Pennsylvania in 1995, and a bachelor's degree in chemistry from The Catholic University of America in 1978.

J. Michael McQuade is director of the program on Emerging Technology, Scientific Advancement, and Global Policy at Harvard University's John F. Kennedy School of Government. He previously served as special advisor to the president of Carnegie Mellon University (CMU), where he provided strategic advice on the university's research enterprise and advocating for the role that science, technology, and innovation play nationally and globally. From 2019 to 2021, he served as vice president for research at CMU. From 2006 to 2018, McQuade served as senior vice president for science and technology at United Technologies Corporation, where his responsibilities included providing strategic oversight and guidance for research, engineering and development activities throughout the business units of the corporation and at the United Technologies Research Center. He held senior positions with technology development and business management at 3M and Eastman Kodak, and served as vice president of 3M's Medical Division and president of Eastman Kodak's Health Imaging Business. McQuade has served as a member of the President's Council of Advisors on Science and Technology, the Secretary of Energy Advisory Board, and the Defense Innovation Board. He holds Ph.D., M.S., and B.S. degrees in physics from Carnegie Mellon University. He received his Ph.D. in experimental high-energy physics for research performed at the Fermi National Accelerator Laboratory.

Kyle Myers is an associate professor in the Technology and Operations Management Unit at the Harvard Business School (HBS). His research revolves around the economics of innovation and lies at the intersection of science, business, and public policy. Myers served as a committee member on the National Academies of Sciences, Engineering, and Medicine's review of the SBIR and STTR programs at the National Institutes of Health. He has an M.S. in health policy and management and a B.S. in biology from The Pennsylvania State University, and a Ph.D. from the Wharton School's Department of Health Care Management and Economics. Prior to joining HBS, he served as a postdoctoral fellow at the National Bureau of Economic Research and worked at the Centers for Disease Control and Prevention.

Arun Seraphin is the executive director of the Emerging Technologies Institute at the National Defense Industrial Association. In this role, he helps lead a nonpartisan institute focused on technologies that are critical to the future of national defense and provides research and analyses to inform the development and integration of emerging technologies and policies to support defense missions. Between 2014 and 2021, Seraphin was a professional staff member on the staff of the United States Senate Committee on Armed Services. His areas of responsibility included acquisition policy, funding and policies for the

Department of Defense's science and technology programs and information technology systems, technology transition issues, defense laboratories and test ranges, Small Business Innovation Research program, manufacturing programs, test and evaluation programs, and Pentagon management issues. Seraphin rejoined the committee staff in 2014, after previously serving there between 2001 and 2010. From 2010 to 2014, he served as principal assistant director for National Security and International Affairs at the White House Office of Science and Technology Policy (OSTP). During this time, he both led (in an acting capacity) and served as the deputy director of the OSTP National Security and International Affairs division. Seraphin was on detail to OSTP from the Defense Advanced Research Projects Agency (DARPA), where he was the special assistant for policy initiatives to the director of DARPA. He has also worked on the United States House of Representatives Committee on Science's Subcommittee on Research and the Institute for Defense Analyses. He has a Ph.D. in electronic materials from the Massachusetts Institute of Technology, and an undergraduate degree in American Government and Engineering Science from the State University of New York Stony Brook.

Stephanie S. Shipp is a research professor at Iowa State University (ISU). At ISU Center for Survey Statistics and Methodology, she is introducing federal household and business statistics to enrich survey analyses. Until recently, in 2024, she was acting director and professor in the Social and Decision Analytics Division of the Biocomplexity Institute at the University of Virginia. As a member of the U.S. Senior Executive Service, she led the Economic Assessment Office for the Advanced Technology Program at the National Institute of Standards and Technology, enhancing economic evaluation by collaborating with academic researchers to explore innovative companies conducting high-risk research. Beginning her career at the Federal Reserve Board, she has also directed programs at the Census Bureau and the Bureau of Labor Statistics, fostering partnerships across federal agencies. Her research at the Institute of Defense Analyses Science and Technology Policy Institute contributed to analyses for the White House on advanced manufacturing trends. She also led projects examining innovation and technology transfer with the departments of Energy and Defense. She earned a Ph.D. in economics from The George Washington University.

Rosemarie Ziedonis is a professor of strategy and innovation at Boston University's Questrom School of Business, where she has also served as academic director for entrepreneurship. She is associate editor at *Management Science* and research associate at the National Bureau of Economic Research Program on Productivity, Innovation, and Entrepreneurship. Ziedonis's research examines the value and strategic use of intellectual property and broader aspects of innovation policy and management. Prior to joining Boston University, she served on the faculty at the University of Oregon; the Wharton School; and the University of Michigan's Ross School of Business, where she codirected the Program for Law, Economics, and Technology. Ziedonis has a Ph.D. in business and public policy

from the University of California, Berkeley's Haas School of Business and an undergraduate degree in economics from The University of North Carolina at Chapel Hill.

Appendix C

Annex to Chapter 4

ANNEX 4-1
DOD Program Manager Interviews: Attendees and Dates

Service/Component	Interview Date	DOD Attendee(s)	DOD Attendee Title(s)
Department of Army (Army)	8/15/2024	Dr. Matt Willis	Director, Army Prize Competitions & Army Applied SBIR Program
Department of Navy (Navy)	4/11/2024	Robert Smith, Brian Shipley, Kathy Fontana, Kyle Mullen	Director Department of the Navy (DON) SBIR/STTR; Director DON SBIR/STTR; Contractor Support; Senior Policy and Strategy Analyst at Engineering Services Network (ESN)
Department of Air Force (Air Force)	5/22/2024	Daniel Carrol, Lane McNeil, Sarah Perry	Air Force (AF) Ventures Director, Division Chief, and SBIR/STTR Program Manager; AF Ventures Executive Operations Officer; Executive Administrator
Chemical and Biological Defense Command (CBD)	8/21/2024	Nathan Weaver, Eric Lowenstein	CBD SBIR/STTR Program Support Contractor; Chief of Research Operations for CBD

Defense Advanced Research Projects Agency (DARPA)	6/24/2024, 8/19/2024	Jen Thabet, Aaron Sparks, Jessica Camper	SBIR/STTR Program Director; Lead Contractor for Program; Chief of Staff
Defense Health Agency (DHA)	9/19/2024	James Meyers, Colleen Gibney	SBIR Project Manager; Deputy Project Manager
Missile Defense Agency (MDA)	9/05/2024	Candace Wright	SBIR/STTR Program Lead
National Geospatial-Intelligence Agency (NGA)	9/05/2024	Michael Winkler, Matthew Davis, Patrick Grandt	Program Lead; Contracting Officer; Contracting Officer
Defense Logistics Agency (DLA)	9/25/2024	Denise Price	Program Manager
Defense Threat Reduction Agency (DTRA)	10/3/2024	Mark Flohr	SBIR/STTR Program Lead

NOTES: Program managers for the Defense Microelectronics Activity (DMEA), United States Special Operations Command (USSOCOM), Space Force, and Office of Strategic Capital did not meet with the committee. All interviews conducted via Zoom.

ANNEX 4-2
DOD Program Manager Interviews: Discussion Questions

1. **Process Overview**
   - Can you please take us through the award process starting with **topic selection.** How are topics developed?
   - How do you find **reviewers**?
     - What are the key criteria that you use to select reviewers?
     - How often do reviewers serve on review panels?
     - What instructions are given to reviewers?
     - Do you consider transition and commercialization potential?
     - How do you use the reviewers' comments to rank applications for funding?
   - What is the **approval process** for selected awards?
     - Do you have discretion in making awards?

    - What is the primary source of accountability or oversight?
  - Are there differences between SBIR and STTR in the processes we just discussed (outreach, topic development, proposal review and selection, reviewers, and commercialization)?

2. Technology Transitions

- Can you tell us about how companies transition to meet DOD mission needs or commercialize technology?
- Can you tell us about a time that you helped an awardee move toward commercialization? What was the firm trying to do? How did you help?
- How are program managers who transition Phase II projects to Phase III rewarded by their DOD service or agency?
- Was the kind of help you describe unique for the firm, or is this something that happens often?
- What kinds of DOD SBIR/STTR commercialization services and programs are available for applicants? awardees?
- Have you helped SBIR awardees with procurement contracts from DOD?
- Are there particular attributes/characteristics about firms and/or projects that increase the likelihood that the awardee will move into transition?

3. Success Stories

- Please describe the most impactful SBIR/STTR awards you made. Why do you think this was impactful?
- Open vs focused topics—are there differences in company success? Can you provide an example?
- Are there SBIR/STTR companies that we should talk to? Please tell us why.
- Can you tell us about technologies that did not transition? Are there lessons to learn?

4. Multiple Award Winners

- What are the situations where you continue to fund the same company multiple times?
- Are multiple awardees subject to more scrutiny?

5. Outreach

- Can you tell us how you educate potential applicants about the SBIR/STTR programs?
- Do you reach out to potential applicants? How do you decide which communities to conduct outreach with?
- Do you attend academic conferences or industry conferences?

- Some agencies have programs that help new applicants apply for an SBIR/STTR award, e.g., the National Institutes of Health's (NIH's) Applicant Assistance Program. Do you (your department at DOD) have a similar program? How do they help new applicants?

6. Goals of the Program

- What are the goals of the SBIR/STTR programs from your vantage point?
- How does SBIR/STTR fit into the DOD technology roadmap?
- How often do you work with small business outside of SBIR?
- How do you decide whether to fund an SBIR company or a non-SBIR company to address a challenge? Does it depend on who will own the intellectual property (IP)?

7. Background

- We'd like to learn more about your background and how you became involved with the SBIR/STTR programs. How long have you been working on SBIR/STTR?
- What training did you receive when becoming an SBIR/STTR program manager?
- How involved are you with companies through the application and award process?
- What share of your time do you spend on SBIR/STTR?

8. Insights for Improvements

- If you could change one anything about the SBIR/STTR programs, what would that be?

9. Other

- Do you do anything different compared to other DOD SBIR/STTR programs you know?
- Is the anything else you think we should ask about or need to know?
- Is the anyone else we should speak with?

Appendix D

Annex to Chapter 5

Annex contents begin on the next page.

ANNEX 5

DOD SBIR/STTR Awards and Applications by Congressional District: Fiscal Years 2019–2023

District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
	72	22.22	18.65	10	60.00	66.67
AK-0200	20	20.00	27.64	2	50.00	50.00
AL-0101	27	0.00	0.00			
AL-0102	20	25.00	29.45	2	50.00	50.00
AL-0103	44	27.27	31.69	6	66.67	77.78
AL-0104	2	0.00	0.00			
AL-0105	1,479	19.95	19.68	260	51.15	51.46
AL-0106	15	6.67	10.00	1	0.00	0.00
AL-0107	33	6.06	6.54	1	100.00	100.00
AR-0501	7	14.29	6.25	1	0.00	0.00
AR-0502	17	5.88	3.33	1	0.00	0.00
AR-0503	84	17.86	19.03	11	63.64	70.00
AR-0504	16	0.00	0.00	1	100.00	100.00

AZ-0401	183	13.66	15.48	21	52.38	47.38
AZ-0402	23	21.74	23.75	4	25.00	50.00
AZ-0403	45	15.56	12.67	9	55.56	72.92
AZ-0404	231	23.81	22.93	37	51.35	43.96
AZ-0405	19	5.26	6.67			
AZ-0406	372	19.09	18.40	78	55.13	53.67
AZ-0407	93	18.28	17.37	17	58.82	58.33
AZ-0408	12	8.33	6.67			
AZ-0409	25	12.00	10.67	3	33.33	25.00
CA-06**	10	10.00	16.67	1	100.00	100.00
CA-0601	9	0.00	0.00			
CA-0602	103	13.59	17.11	10	60.00	65.00
CA-0603	50	18.00	18.31	9	77.78	60.00
CA-0604	30	20.00	19.00	4	25.00	25.00
CA-0605	17	17.65	16.67	3	33.33	25.00
CA-0606	22	36.36	30.33	6	50.00	50.00
CA-0607	58	17.24	15.90	3	66.67	75.00
CA-0608	70	18.57	15.79	11	45.45	59.38
CA-0609	5	0.00	0.00			

(Continued)

Continued

District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
CA-0610	141	14.89	13.67	20	70.00	74.67
CA-0611	578	25.43	26.49	100	51.00	46.78
CA-0612	221	19.91	20.00	31	51.61	59.67
CA-0613	16	18.75	15.00	3	100.00	100.00
CA-0614	196	11.22	11.45	30	43.33	51.67
CA-0615	370	19.19	19.28	51	47.06	42.92
CA-0616	788	23.86	23.50	174	55.75	53.01
CA-0617	741	17.95	18.47	106	39.62	37.90
CA-0618	176	14.77	16.02	14	35.71	32.08
CA-0619	59	20.34	25.03	5	60.00	66.67
CA-0620	28	28.57	23.00	6	66.67	62.50
CA-0621	1	0.00	0.00			
CA-0623	23	26.09	24.17	7	28.57	20.00
CA-0624	771	22.70	22.41	151	52.32	51.98
CA-0625	1	100.00	100.00			

CA-0626	227	24.67	24.30	46	58.70	63.38
CA-0627	40	10.00	7.52	4	75.00	83.33
CA-0628	157	22.93	23.42	31	35.48	30.57
CA-0629	84	19.05	20.11	13	46.15	41.67
CA-0630	233	13.73	14.26	34	55.88	55.33
CA-0631	115	24.35	24.33	26	57.69	50.48
CA-0632	322	31.06	31.26	87	51.72	48.55
CA-0633	2	0.00	0.00			
CA-0634	82	13.41	15.83	8	50.00	62.50
CA-0635	22	9.09	7.33	1	0.00	0.00
CA-0636	1,313	21.93	21.19	244	45.90	45.73
CA-0637	176	14.77	13.56	19	78.95	88.50
CA-0638	41	4.88	4.00	1	0.00	0.00
CA-0639	40	17.50	14.81	5	60.00	66.67
CA-0640	329	14.29	14.53	45	37.78	30.50
CA-0641	36	13.89	13.79	6	16.67	25.00
CA-0642	117	19.66	19.68	19	57.89	54.29
CA-0643	186	17.20	17.36	37	67.57	67.56
CA-0644	209	12.92	13.68	30	33.33	27.49

(Continued)

Continued

District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
CA-0645	150	11.33	10.95	18	61.11	59.00
CA-0646	74	9.46	8.71	6	16.67	33.33
CA-0647	354	20.90	20.94	67	44.78	39.83
CA-0648	178	23.03	24.29	42	54.76	57.78
CA-0649	243	14.81	14.32	33	39.39	32.29
CA-0650	401	19.95	20.00	64	45.31	44.15
CA-0651	469	22.60	22.57	117	62.39	61.44
CA-0652	224	13.39	12.95	41	51.22	39.83
CO-0801	233	24.03	25.59	49	53.06	51.37
CO-0802	667	22.34	22.14	153	52.29	51.84
CO-0803	21	19.05	27.86	2	50.00	50.00
CO-0804	234	21.79	20.54	59	54.24	59.35
CO-0805	428	21.50	20.15	82	56.10	51.86
CO-0806	71	14.08	14.23	6	33.33	27.78
CO-0807	432	24.54	24.39	92	52.17	57.33
CO-0808	90	25.56	25.84	13	46.15	53.75

CT-0901	234	9.83	19.89	18	61.11	60.00
CT-0902	156	16.03	15.92	22	54.55	47.00
CT-0903	150	15.33	18.47	25	60.00	52.50
CT-0904	97	18.56	18.56	9	22.22	25.00
CT-0905	68	11.76	11.62	6	83.33	87.50
DC-1100	399	18.30	18.87	51	47.06	45.56
DE-1000	322	15.84	15.91	39	58.97	58.93
FL-1201	148	22.30	25.46	22	31.82	34.00
FL-1202	70	21.43	22.23	10	70.00	70.83
FL-1203	47	17.02	22.84	10	20.00	24.00
FL-1204	77	3.90	3.85	4	100.00	100.00
FL-1205	29	10.34	8.44	2	50.00	50.00
FL-1206	57	12.28	11.39	6	33.33	33.33
FL-1207	32	25.00	23.00	6	66.67	62.50
FL-1208	632	13.13	13.08	100	54.00	51.63
FL-1209	73	5.48	3.95	1	100.00	100.00
FL-1210	502	21.51	21.82	86	53.49	54.86
FL-1211	66	13.64	15.63	8	50.00	45.83
FL-1212	21	14.29	14.52	3	0.00	0.00

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
FL-1213	66	10.61	10.19	6	66.67	62.50
FL-1214	244	16.80	21.29	30	40.00	32.62
FL-1215	117	7.69	7.93	8	25.00	23.33
FL-1216	14	14.29	10.00	3	66.67	75.00
FL-1217	26	15.38	15.71	4	25.00	33.33
FL-1218	6	16.67	11.11			
FL-1219	24	12.50	9.00	3	66.67	66.67
FL-1220	15	0.00	0.00			
FL-1221	46	17.39	16.54	7	28.57	25.00
FL-1222	39	7.69	4.41	1	100.00	100.00
FL-1223	69	11.59	12.22	9	44.44	50.00
FL-1224	27	22.22	29.52	3	33.33	25.00
FL-1225	25	12.00	17.90	3	66.67	66.67
FL-1226	23	4.35	1.82			
FL-1227	128	12.50	10.98	13	30.77	33.33
FL-1228	35	11.43	23.75	1	100.00	100.00

GA-1301	8	0.00	0.00			
GA-1302	22	13.64	14.17	3	100.00	100.00
GA-1303	15	13.33	24.00	4	50.00	66.67
GA-1304	51	11.76	10.36	9	44.44	44.44
GA-1305	153	24.18	24.65	32	75.00	71.28
GA-1306	14	0.00	0.00	1	0.00	0.00
GA-1307	77	18.18	20.77	14	64.29	62.50
GA-1308	40	10.00	8.33	4	50.00	50.00
GA-1309	54	9.26	8.89	4	50.00	66.67
GA-1310	6	0.00	0.00			
GA-1311	185	18.38	18.33	33	48.48	50.12
GA-1312	9	11.11	8.33	3	0.00	0.00
GA-1313	43	16.28	20.77	5	80.00	75.00
GA-1314	2	0.00	0.00			
HI-1501	361	14.40	14.61	55	54.55	53.15
HI-1502	109	21.10	21.64	22	63.64	70.00
HI-6600	3	0.00	0.00			
IA-1901	21	19.05	34.44	2	0.00	0.00
IA-1902	9	0.00	0.00	1	100.00	100.00

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
IA-1903	10	0.00	0.00			
IA-1904	14	14.29	15.00	3	66.67	66.67
ID-1601	60	18.33	15.95	6	50.00	62.50
ID-1602	85	22.35	24.55	14	35.71	35.00
ID-5305	1	0.00	0.00			
IL-17**	1	0.00	0.00			
IL-1701	14	14.29	12.50	3	33.33	25.00
IL-1702	8	0.00	0.00			
IL-1703	35	31.43	27.44	10	60.00	54.17
IL-1704	26	0.00	0.00			
IL-1705	39	17.95	26.49	3	66.67	66.67
IL-1706	27	18.52	21.33	5	20.00	16.67
IL-1707	65	20.00	23.60	8	62.50	61.11
IL-1708	45	13.33	19.87	6	83.33	87.50
IL-1709	179	17.32	16.16	32	50.00	42.67
IL-1710	43	25.58	21.99	11	27.27	18.75

IL-1711	124	19.35	20.08	22	27.27	34.52
IL-1712	6	16.67	8.33	1	100.00	100.00
IL-1713	104	25.00	25.94	21	57.14	52.50
IL-1714	24	8.33	5.00	4	75.00	83.33
IL-1715	1	0.00	0.00			
IL-1716	44	31.82	34.86	9	66.67	60.00
IL-1717	6	16.67	11.11			
IN-1801	4	25.00	33.33	1	0.00	0.00
IN-1802	132	26.52	26.31	31	54.84	51.11
IN-1803	6	16.67	12.50	2	100.00	100.00
IN-1804	150	20.67	20.01	31	67.74	63.67
IN-1805	85	16.47	18.13	12	33.33	40.00
IN-1806	30	13.33	14.00	3	100.00	100.00
IN-1807	34	14.71	31.75	2	100.00	100.00
IN-1808	33	12.12	16.67	1	0.00	0.00
IN-1809	9	0.00	0.00			
KS-2001	3	33.33	50.00	1	100.00	100.00
KS-2002	77	18.18	17.50	4	50.00	66.67
KS-2003	75	16.00	25.09	7	71.43	79.17

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
KS-2004	74	17.57	15.07	10	20.00	16.67
KY-2101	5	40.00	44.44			
KY-2102	8	37.50	15.00	2	100.00	100.00
KY-2103	89	13.48	15.30	12	58.33	48.33
KY-2104	37	10.81	9.50	7	57.14	33.33
KY-2105	3	0.00	0.00			
KY-2106	86	11.63	10.07	7	42.86	50.00
LA-2201	39	20.51	17.69	2	100.00	100.00
LA-2202	40	10.00	8.40	4	75.00	66.67
LA-2203	18	22.22	32.50	2	0.00	0.00
LA-2204	64	12.50	13.35	9	66.67	53.33
LA-2205	70	20.00	20.30	7	0.00	0.00
LA-2206	86	18.60	24.90	10	60.00	63.33
MA-2501	31	3.23	4.00	2	100.00	100.00
MA-2502	222	22.52	22.64	47	59.57	60.77
MA-2503	827	28.78	28.32	182	46.15	46.03

MA-2504	319	21.00	20.76	45	53.33	52.13
MA-2505	1,559	23.41	22.73	339	53.39	51.52
MA-2506	800	27.75	27.77	204	59.80	59.99
MA-2507	465	18.06	18.50	53	54.72	53.54
MA-2508	271	21.03	21.64	51	54.90	58.29
MA-2509	65	21.54	21.33	8	62.50	60.00
MD-1000	1	0.00	0.00			
MD-2401	157	14.01	14.48	18	38.89	47.67
MD-2402	183	15.30	15.31	27	59.26	55.00
MD-2403	381	16.80	16.90	62	38.71	36.95
MD-2404	251	19.12	19.10	30	63.33	60.83
MD-2405	213	14.55	14.46	24	62.50	63.33
MD-2406	445	11.01	10.95	52	32.69	33.45
MD-2407	104	14.42	14.20	16	56.25	50.00
MD-2408	780	19.62	15.36	162	40.12	31.16
ME-2301	31	16.13	15.11	3	33.33	25.00
ME-2302	18	22.22	26.19	4	0.00	0.00
MI-2601	134	20.15	21.42	31	48.39	40.93
MI-2602	30	20.00	25.87	4	50.00	66.67

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
MI-2603	86	11.63	14.53	11	54.55	43.75
MI-2604	21	14.29	19.00	2	0.00	0.00
MI-2605	25	20.00	46.44	9	44.44	40.00
MI-2606	575	19.83	19.14	101	50.50	51.58
MI-2607	62	11.29	13.50	8	62.50	41.67
MI-2608	11	27.27	37.50			
MI-2609	31	19.35	23.02	8	50.00	50.00
MI-2610	37	8.11	11.67	3	33.33	25.00
MI-2611	37	13.51	14.54	7	71.43	75.00
MI-2612	12	0.00	0.00			
MI-2613	6	16.67	8.33			
MN-2701	33	18.18	12.12	5	0.00	0.00
MN-2702	9	0.00	0.00			
MN-2703	156	16.67	18.72	27	51.85	53.69
MN-2704	38	18.42	19.08	11	36.36	33.33
MN-2705	67	29.85	29.68	23	60.87	70.83

MN-2706	24	20.83	16.67	7	28.57	27.78
MN-2707	4	0.00	0.00			
MN-2708	6	0.00	0.00			
MO-2901	77	12.99	12.51	5	40.00	37.50
MO-2902	40	20.00	17.94	9	55.56	62.50
MO-2903	65	15.38	16.90	8	25.00	33.33
MO-2904	9	22.22	25.00	2	100.00	100.00
MO-2905	26	11.54	10.83	3	0.00	0.00
MO-2907	14	14.29	12.86	1	0.00	0.00
MO-2908	29	24.14	27.86	8	87.50	75.00
MS-2801	15	13.33	10.42	3	33.33	25.00
MS-2802	7	14.29	33.33	1	0.00	0.00
MS-2803	9	0.00	0.00	1	100.00	100.00
MS-2804	4	0.00	0.00			
MT-3001	103	18.45	19.54	13	53.85	50.00
MT-3002	2	0.00	0.00			
NC-3701	6	0.00	0.00			
NC-3702	263	20.91	19.99	55	67.27	69.17
NC-3703	11	9.09	16.67			

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
NC-3704	225	19.11	18.38	47	42.55	43.74
NC-3705	58	17.24	20.89	10	40.00	29.17
NC-3706	22	18.18	18.19	3	33.33	25.00
NC-3707	31	9.68	5.78	1	100.00	100.00
NC-3708	44	25.00	26.71	7	57.14	58.33
NC-3709	101	18.81	19.50	12	50.00	63.33
NC-3710	200	29.00	28.92	62	50.00	48.19
NC-3711	21	33.33	45.14	6	50.00	44.44
NC-3712	36	2.78	5.00	1	0.00	0.00
NC-3713	23	26.09	20.00	7	57.14	50.00
NC-3714	18	5.56	20.00	1	0.00	0.00
ND-3800	28	7.14	4.44			
NE-3101	45	15.56	11.43	9	55.56	50.00
NE-3102	40	7.50	6.41	2	50.00	50.00
NE-3103	15	0.00	0.00			
NH-3301	192	21.88	22.15	35	51.43	57.52

NH-3302	343	24.20	23.09	102	58.82	61.06
NJ-3401	27	33.33	36.26	5	20.00	33.33
NJ-3402	12	0.00	0.00			
NJ-3403	253	18.18	18.66	37	67.57	67.18
NJ-3404	76	15.79	16.01	8	87.50	90.00
NJ-3405	61	4.92	5.17	2	50.00	50.00
NJ-3406	52	17.31	12.90	9	44.44	35.56
NJ-3407	65	13.85	13.87	18	50.00	41.19
NJ-3408	25	12.00	11.11	3	33.33	33.33
NJ-3409	183	24.04	23.34	43	62.79	56.61
NJ-3410	19	15.79	32.14	2	50.00	50.00
NJ-3411	120	11.67	12.05	14	50.00	33.93
NJ-3412	200	16.50	17.92	39	48.72	54.67
NM-3501	396	23.99	23.55	96	52.08	51.35
NM-3502	107	11.21	12.31	12	58.33	60.00
NM-3503	50	24.00	23.49	9	44.44	37.50
NV-3201	53	18.87	17.54	7	28.57	50.00
NV-3202	94	21.28	23.32	12	58.33	52.08
NV-3203	32	9.38	7.71	2	0.00	0.00

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
NV-3204	24	12.50	13.33	2	0.00	0.00
NY-0904	1	0.00	0.00			
NY-3601	71	16.90	14.30	7	57.14	58.33
NY-3602	76	26.32	23.13	23	56.52	52.89
NY-3603	14	7.14	4.17	1	0.00	0.00
NY-3604	30	13.33	10.86	2	0.00	0.00
NY-3605	2	0.00	0.00			
NY-3606	10	0.00	0.00			
NY-3607	139	22.30	22.33	18	44.44	43.75
NY-3608	51	23.53	26.54	12	66.67	80.00
NY-3609	17	11.76	10.00	1	100.00	100.00
NY-3610	202	18.32	22.68	31	48.39	48.00
NY-3611	32	18.75	18.17	6	33.33	41.67
NY-3612	272	16.18	15.96	31	51.61	52.52
NY-3613	25	0.00	0.00			
NY-3614	6	0.00	0.00			

NY-3615	3	0.00	0.00			
NY-3616	30	16.67	19.15	5	40.00	33.33
NY-3617	78	19.23	20.38	11	45.45	55.83
NY-3618	53	24.53	24.11	11	54.55	54.17
NY-3619	154	20.78	21.65	22	50.00	48.67
NY-3620	172	21.51	21.23	42	50.00	47.35
NY-3621	27	3.70	2.00	1	0.00	0.00
NY-3622	268	17.16	17.74	32	53.13	51.43
NY-3623	14	35.71	27.38	4	75.00	83.33
NY-3624	116	9.48	9.88	11	63.64	64.29
NY-3625	138	23.19	23.27	25	48.00	49.71
NY-3626	84	16.67	16.10	8	50.00	50.00
OH-3901	163	23.93	24.33	28	60.71	59.44
OH-3902	7	0.00	0.00	3	66.67	75.00
OH-3903	134	19.40	18.95	17	58.82	61.67
OH-3904	194	31.44	31.78	50	38.00	37.41
OH-3905	24	16.67	32.22	6	50.00	50.00
OH-3906	23	21.74	18.67	3	33.33	25.00
OH-3907	45	15.56	24.72	6	50.00	50.00

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
OH-3908	131	18.32	18.34	20	70.00	60.00
OH-3909	10	10.00	6.67	1	100.00	100.00
OH-3910	1796	18.49	18.24	320	46.56	46.11
OH-3911	118	18.64	17.33	22	40.91	53.33
OH-3912	4	0.00	0.00	1	0.00	0.00
OH-3913	93	16.13	18.18	11	63.64	75.00
OH-3914	24	33.33	23.76	9	22.22	16.67
OH-3915	217	22.12	22.11	32	50.00	55.29
OK-4001	72	13.89	13.77	10	30.00	29.17
OK-4002	10	20.00	25.00	1	100.00	100.00
OK-4003	66	21.21	20.63	10	60.00	50.00
OK-4004	78	15.38	15.35	11	45.45	46.67
OK-4005	69	24.64	23.45	15	66.67	68.00
OR-4101	185	22.70	22.90	37	45.95	43.52
OR-4102	20	20.00	15.56	1	0.00	0.00
OR-4103	45	17.78	21.75	5	20.00	25.00

OR-4104	23	26.09	30.00	5	60.00	77.78
OR-4105	49	20.41	20.22	11	45.45	50.00
OR-4106	15	13.33	13.33	1	100.00	100.00
PA-4201	213	23.94	23.61	54	55.56	54.88
PA-4202	37	32.43	31.38	5	80.00	75.00
PA-4203	91	20.88	26.51	9	55.56	54.17
PA-4204	110	10.00	11.64	10	60.00	78.00
PA-4205	219	23.74	24.02	49	63.27	61.39
PA-4206	110	19.09	16.33	25	72.00	83.33
PA-4207	17	23.53	35.83	3	66.67	66.67
PA-4208	25	8.00	13.33	2	0.00	0.00
PA-4209	16	43.75	27.50	8	87.50	83.33
PA-4210	4	25.00	16.67	1	100.00	100.00
PA-4211	114	19.30	19.43	19	36.84	48.33
PA-4212	210	23.81	22.90	40	42.50	35.61
PA-4213	20	25.00	18.67	3	100.00	100.00
PA-4214	219	8.22	8.28	20	40.00	45.71
PA-4215	95	26.32	29.04	30	66.67	67.83
PA-4216	30	16.67	24.44	5	60.00	62.50

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications	Average Annual Percentage of Funded Phase I Applications	Number of Phase II Applications	Percentage of Funded Phase II Applications	Average Annual Percentage of Funded Phase II Applications
PA-4217	120	21.67	21.53	18	66.67	67.92
PR-7200	21	9.52	8.00	1	0.00	0.00
RI-4401	165	24.85	25.68	26	65.38	64.00
RI-4402	65	12.31	12.40	10	50.00	50.00
SC-45**	2	100.00	100.00	2	50.00	50.00
SC-4501	47	10.64	11.65	4	100.00	100.00
SC-4502	11	0.00	0.00			
SC-4503	43	4.65	4.87	4	25.00	33.33
SC-4504	28	10.71	11.67	3	100.00	100.00
SC-4505	14	0.00	0.00			
SC-4506	90	17.78	27.40	15	40.00	35.42
SD-4600	101	17.82	17.78	16	43.75	31.67
TN-4701	8	12.50	20.00			
TN-4702	103	21.36	19.13	14	35.71	44.00
TN-4703	25	20.00	20.86	5	20.00	11.11
TN-4704	86	20.93	23.65	14	64.29	56.67

TN-4705	43	16.28	17.34	7	42.86	37.50
TN-4706	51	15.69	21.44	8	62.50	65.00
TN-4707	74	21.62	23.26	12	75.00	85.00
TN-4708	2	0.00	0.00			
TN-4709	6	0.00	0.00			
TX-4801	3	0.00	0.00			
TX-4802	52	25.00	29.37	7	14.29	11.11
TX-4803	35	14.29	13.71	3	100.00	100.00
TX-4804	156	12.82	12.90	19	15.79	14.52
TX-4805	4	0.00	0.00			
TX-4806	5	0.00	0.00			
TX-4807	68	16.18	17.36	8	75.00	87.50
TX-4808	10	20.00	33.33	2	100.00	100.00
TX-4809	68	26.47	25.60	11	81.82	88.33
TX-4810	726	18.18	17.71	111	47.75	47.06
TX-4811	9	22.22	24.00	2	50.00	50.00
TX-4812	31	9.68	10.56	2	100.00	100.00
TX-4813	16	12.50	12.22	1	0.00	0.00
TX-4814	12	0.00	0.00	1	0.00	0.00

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District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications (%)	Average Annual Percentage of Funded Phase I Applications (%)	Number of Phase II Applications	Percentage of Funded Phase II Applications (%)	Average Annual Percentage of Funded Phase II Applications (%)
TX-4815	4	0.00	0.00			
TX-4816	27	11.11	7.78	5	0.00	0.00
TX-4817	54	11.11	15.78	4	75.00	83.33
TX-4818	88	14.77	16.31	10	60.00	56.67
TX-4819	13	15.38	6.25	2	0.00	0.00
TX-4820	85	25.88	25.53	15	53.33	50.00
TX-4821	198	17.17	18.15	30	46.67	54.88
TX-4822	35	20.00	15.03	3	66.67	66.67
TX-4823	101	15.84	17.93	13	38.46	44.67
TX-4824	139	20.14	25.91	20	65.00	63.33
TX-4825	174	18.97	18.21	30	26.67	26.22
TX-4826	64	9.38	9.89	7	28.57	22.22
TX-4827	34	23.53	26.57	7	57.14	44.44
TX-4828	50	24.00	22.55	6	50.00	38.89
TX-4829	18	27.78	25.71	2	100.00	100.00
TX-4830	39	12.82	11.39	2	50.00	50.00

TX-4831	30	13.33	31.84	2	0.00	0.00
TX-4832	151	19.21	19.65	22	31.82	31.67
TX-4833	54	20.37	26.01	8	25.00	20.00
TX-4834	6	16.67	16.67	1	0.00	0.00
TX-4835	362	17.13	17.05	57	50.88	50.00
TX-4836	48	18.75	17.86	8	62.50	62.50
TX-4837	670	22.69	22.26	110	48.18	44.95
TX-4838	34	14.71	11.08	4	50.00	33.33
UT-0403	1	0.00	0.00			
UT-4901	159	15.09	14.89	27	70.37	70.28
UT-4902	181	19.34	18.42	41	70.73	70.89
UT-4903	196	17.86	18.67	30	46.67	45.71
UT-4904	64	12.50	13.62	9	44.44	50.00
VA-5101	45	8.89	8.91	1	0.00	0.00
VA-5102	161	16.15	17.14	18	66.67	57.62
VA-5103	178	20.22	18.68	31	58.06	47.11
VA-5104	87	14.94	20.26	8	75.00	77.78
VA-5105	222	36.49	36.33	59	45.76	46.40
VA-5106	194	28.87	25.16	68	52.94	51.01

(Continued)

Continued

District ID	Number of Phase I Applications	Percentage of Funded Phase I Applications (%)	Average Annual Percentage of Funded Phase I Applications (%)	Number of Phase II Applications	Percentage of Funded Phase II Applications (%)	Average Annual Percentage of Funded Phase II Applications (%)
VA-5107	122	15.57	15.32	19	42.11	46.00
VA-5108	1,080	18.70	18.49	170	52.35	53.95
VA-5109	310	16.77	17.66	52	63.46	59.12
VA-5110	751	19.04	19.15	136	55.88	52.33
VA-5111	940	20.32	20.04	159	57.23	55.98
VT-0905	14	0.00	0.00			
VT-5000	111	13.51	13.33	16	68.75	42.26
WA-1601	3	33.33	33.33			
WA-4102	1	0.00	0.00			
WA-5301	77	14.29	13.85	13	46.15	69.17
WA-5302	45	17.78	23.39	10	40.00	30.00
WA-5303	33	21.21	16.19	5	20.00	16.67
WA-5304	15	13.33	29.17	2	50.00	50.00
WA-5305	29	10.34	4.29	5	40.00	44.44
WA-5306	100	9.00	10.51	9	66.67	81.25
WA-5307	172	19.19	21.09	23	56.52	48.33

WA-5308	118	30.51	33.20	34	58.82	59.27
WA-5309	104	19.23	20.08	21	42.86	54.44
WA-5310	16	25.00	30.00	1	0.00	0.00
WI-5501	7	0.00	0.00			
WI-5502	109	17.43	18.01	14	64.29	56.67
WI-5503	10	10.00	10.00			
WI-5504	39	23.08	19.30	8	75.00	75.00
WI-5505	30	23.33	17.21	2	100.00	100.00
WI-5506	36	2.78	1.54	2	50.00	50.00
WI-5507	13	23.08	15.48	2	0.00	0.00
WI-5508	1	0.00	0.00			
WV-5401	5	0.00	0.00			
WV-5402	126	15.87	14.27	20	50.00	50.00
WY-5600	167	18.56	19.12	14	85.71	85.00
Total	53,385	15.99	16.60	9,012	50.57	50.52

NOTE: Total number of applicants does not match the data in Table 5-1 because data for some applications contain addresses, such as those on military installations, that cannot be mapped to a congressional district.
SOURCE: Committee calculations based on application data provided by the Department of Defense.