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Women's Inclusion in Small Business Innovation Research & Small Business Technology Transfer Programs

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Acronyms List

ABS Annual Business Survey

AFPP Administrative Funding Pilot Program

AWARE Advancing Women And underRepresented Entrepreneurs

AWIS Association for Women in Science

BAA Broad Agency Announcement

CoE Center of Excellence

CDC Centers for Disease Control and Prevention

DARPA Defense Advanced Research Projects Agency

DHS Department of Homeland Security

DOC Department of Commerce

DoD Department of Defense

DOE Department of Energy

DOT Department of Transportation

DSBS Dynamic Small Business Search

ED Department of Education

EPA Environmental Protection Agency

FAST Federal and State Technology

FFRDC Federally Funded Research and Development Center

GAFC Growth Accelerator Fund Competition

HBCU Historically Black Colleges and Universities

HHS Department of Health and Human Services

HUBZone Historically Underutilized Business Zones

IWPR Institute for Women's Policy Research

MSI Minority Serving Institutions

MSRDC MSI STEM Research & Development Consortium

NAICS North American Industry Classification System

NASA National Aeronautics and Space Administration

NCSES National Center for Science and Engineering Statistics

NIH National Institutes of Health

NOAA National Oceanic and Atmospheric Administration

NSF National Science Foundation

NWBC National Women's Business Council

OII Office of Investment and Innovation

PI Principal Investigator

PM Program Managers

PTAC Procurement Technical Assistance Center

R&D Research and Development

REACH Research Evaluation and Commercialization Hub

ROI Return on Investment

SAM System for Award Management

SBA Small Business Administration

SBDC Small Business Development Center

SBIR Small Business Innovation Research

SBO Survey of Business Owners

SET Science, Engineering and Technology

STEM Science, Technology, Engineering and Mathematics

STEMM Science, Technology, Engineering, Mathematics and Medicine

STTR Small Business Technology Transfer

SUCCESS Study of Underrepresented Classes Chasing Engineering and Science Success

USDA U.S. Department of Agriculture

USPTO United States Patent and Trademark Office

WBC Women's Business Center

WOSB Women-Owned Small Business

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Executive Summary

In FY2018 the combined SBIR/ STTR budget was ~$3.6B across the 11 participating agencies

This study was conducted on behalf of the National Women's Business Council (NWBC). NWBC is a federal advisory committee established to serve as an independent source of advice and policy recommendations to the President, the U.S. Congress, and to the Administrator of the U.S. Small Business Administration on issues of importance to women business owners and entrepreneurs. NWBC is dedicated to encouraging women to start and grow their businesses in Science Technology Engineering and Math (STEM), industries with proven high-growth potential, and thus commissioned this study on the participation of women in the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs. This report provides the first comprehensive analysis of women's participation in the SBIR/STTR programs as business owners or principal investigators.

The SBIR/STTR programs are a key source of financing for early-stage research and development (R&D) that translates discoveries into impactful products, services, and companies. This study examines the participation of women as business owners and principal investigators in SBIR/STTR-funded small businesses using award-level administrative data provided by funding agencies to the U.S. Small Business Administration (SBA) and publicly available on SBIR.gov. The study then examines potential factors that may influence women's participation – the presence of women-owned small businesses (WOSBs) in Science Technology Engineering and Mathematics (STEM) intensive, SBIR-funded industries; SBIR funding agency outreach and initiatives; and promising practices on engaging women from organizations that support STEM entrepreneurs.

13% of Phase I awards were made to WOSB

Across the 11 Federal agencies that fund small businesses through the SBIR/STTR programs, 14.9% of Phase I proposals were submitted by WOSBs, and 14.1% of Phase I awards were made to WOSBs, with awards generally following the trend of proposals submitted over time. Across the entire portfolio, looking only at unique companies because an individual company may receive multiple awards, 13% were WOSBs, and about 13% of unique principal investigators (PIs) were women, with no clear trends over time.

Though major changes over time were not apparent in the overall participation of women in the SBIR/STTR programs, there were differences among participating agencies. Two agencies demonstrated the largest changes between 2011 and 2018: the National Science Foundation (NSF) went from awarding 15.5% SBIR Phase I awards to WOSBs

in 2011 to 22.4% in 2018, while the Department of Energy (DOE) went from 3.5% SBIR Phase I awards to WOSBs in 2011 to 10.5% in 2018. The Department of Education (ED) consistently had the highest portion of SBIR Phase I applications from and awards to WOSBs, with 40% of their SBIR Phase I awards going to WOSBs in 2018. Differences in the participation of WOSBs in the general population of businesses is a likely factor that influences the differences among agencies.

SBIR industries are a narrow subset of STEM-intensive industries and comprise only 3% of all firms with paid employees. Based on the 2012 Survey of Business Owners (SBO), women-ownership for businesses with paid employees in STEM-intensive, SBIR industries was 15%, slightly higher but within range of the proportion of WOSBs that apply and win SBIR/STTR awards. There was no major difference in the top four lmost prevalent SBIR industries that WOSBs and non-WOSBs participate in, with the majority of SBIR/STTR awardees in the R&D in the Physical, Engineering, and Life Sciences. R&D in the Social Sciences, and Educational Support are two industries within the top 10 most common industries for WOSB SBIR/STTR awardees, but not non-WOSB SBIR/STTR awardees, while various Manufacturing industries are among the top 10 most common industries for non-WOSB SBIR/STTR awardees.

The gender of PIs also varied across agencies where the percentage of unique women PIs was about the same or higher than the percentage of WOSBs for certain agencies, including the Department of Health and Human Services (HHS) and ED. There was a set of agencies with about 20% women PIs (HHS, USDA, EPA, and NSF), and another set with about 9% women PIs (DoD, NASA, DOC, DOE, and DOT). The proportion of degrees awarded to women in various science and engineering fields associated with the typical areas of funding for these different agencies is a potential influencing factor related to the participation of women as technical leads in SBIR/STTR awards.

Agencies and entrepreneurial support organizations are engaged in efforts to increase the participation of women in STEM-intensive entrepreneurship. Promising practices include ensuring that communication materials reflect diversity, including highlighting success stories of women entrepreneurs; creating technical assistance programs to support SBIR proposal development; creating programs to introduce and train diverse future STEM entrepreneurs; and reducing administrative barriers to the application process.

Agencies made use of SBA-coordinated outreach events such as the SBIR Road Tour and National SBIR/STTR Conferences, and the administrative funding pilot program that specifies use of funds for outreach to enhance the participation of underrepresented entrepreneurs.

SBIR support organizations identified efforts to ensure that women were actively engaged in leading conversations, and represented in marketing materials, showcasing the success of women entrepreneurs, and partnering with other organizations to expand diversity. Though social media and newsletters were the most frequently cited methods of outreach used, the support organizations identified direct email, personal invitations and interactions, and referrals as the most effective mechanisms for engagement.

Support organizations identified funding as one of the primary barriers that women entrepreneurs face, as well as childcare, and the perception that women did not belong in entrepreneurship. The most frequently occurring suggestion for a best practice to working with women entrepreneurs was the importance of creating a welcoming environment.

1.0 Introduction

Key Findings

- Across the SBIR/STTR programs, the proportion of Phase I applications and awards to women-owned small businesses (WOSBs) has remained consistent from 2011 to 2018, hovering between 13 – 15%.

- 13% of Principal Investigators (PIs) leading SBIR/STTR Phase I awards were women.

- Women own 15% of firms in the general population of small businesses in SBIR-funded industries.

- The top four most prevalent industries for SBIR/STTR awardees are the same for WOSBs and non-WOSBs: Research and Development (R&D) in the Physical, Engineering and Life Sciences; R&D in Biotechnology; Engineering Services; and Custom Computer Programming.

- R&D in the Social Sciences and Educational Support are two industries present among the top 10 industries for WOSB SBIR awardees but not non-WOSBs.

- SBIR funding agency initiatives to engage diverse entrepreneurs include: partnerships with professional organizations and associations that serve underrepresented populations; having dedicated staff and resources focused on communications; technical assistance programs for new applicants; supplemental funding for awardee companies to train talent that would enhance diversity; and programmatic or policy efforts to streamline application processes.

- Practices to engage women entrepreneurs from SBIR support organizations include: intentionally creating an environment that is welcoming by showcasing female-led teams; connecting women with successful peers; and building direct personal relationships.

- A practice common across agencies and support organizations was to intentionally highlight success stories that feature women and include more examples of diverse participants in outreach materials.

Starting at the National Science Foundation (NSF) as an experiment, the federal government's interest in small advanced technology firms blossomed and in 1982, the Small Business Innovation Research (SBIR) program was created with the passage of the Small Business Innovation Development Act. **This report focuses on one specific aspect of the SBIR program – the participation of women in technological innovation.** The original purposes of the program were:

1. to stimulate technological innovation;
2. to use small business to meet Federal research and development needs;
3. to foster and encourage participation by minority and disadvantaged persons in technological innovation; and
4. to increase private sector commercialization of innovations derived from Federal research and development.

However, it wasn't until the Small Business Research and Development Enhancement Act of 1992 (Public Law 102-564) that specific attention was drawn to women-owned small business (WOSB). Quoting from the legislation, "The purposes of this title are:

1. to expand and improve the small business innovation research program;
2. to emphasize the program's goal of increasing private sector commercialization of technology developed through Federal research and development;
3. to increase small business participation in Federal research and development;
4. to improve the Federal Government's dissemination of information concerning the small business innovation research program, **particularly with regard to program participation by women-owned small business concerns and by socially and economically disadvantaged small business concerns.**"

> "It is the policy of the Congress that assistance be given to small-business concerns to enable them to undertake and to obtain the benefits of research and development in order to maintain and strengthen the competitive free enterprise system and the national economy."
>
> -Small Business Act 15 USC 638

Through the SBIR program, investment by the federal government in research and development at small businesses has grown steadily since the early 1980s. Implemented by 11 agencies, SBIR funding to small business is provided in 2 rounds referred to as Phase I and Phase II. In 1983, 785 Phase I SBIR awards were provided to small businesses. Fast forward to 2018 — the number of Phase I SBIR awards was 3,135. Not only did the number of Phase I SBIR awards increase, but also the size of the awards themselves. At the outset, the average Phase I award was $48,216. In 2018, the average award size was $177,923. In 2018 the SBIR budget was over $3 billion dollars.

Ten years after the SBIR program started, that same Small Business Research and Development Enhancement Act of 1992 (Public Law 102-564) established the Small Business Technology Transfer (STTR) program. Though the SBIR program allows small businesses to partner with other research institutions, the STTR program requires the small business to formally partner with a nonprofit research institution, such as a university or Federally Funded Research and Development Center (FFRDC), to conduct cooperative research and development. Whether SBIR or STTR, the small business is always the applicant and awardee.

1.1 Purpose of this study

Previous studies have examined various aspects of the SBIR/STTR programs.[1,2,3,4] However, with respect to the participation of women within the SBIR/STTR programs, most studies have limited their analysis to the period between 1992 to 2001 using data collected through an evaluation prepared by the National Research Council.[5] Previous studies have also limited their scope to one or more agencies, rather than providing an analysis of the implementation of the SBIR/STTR programs as a whole. No comparison has been conducted at the individual agency level regarding participation by women in each program. This report:

The SBIR/STTR programs fund STEM entrepreneurs. Thus, the findings discussed take place within a context, within the experience of women in STEM, innovation and entrepreneurship more generally. To set the stage, to connect the findings of this report to their experience and to lay the foundation for future research, a brief overview of women in STEM entrepreneurship is presented.

1.2 Women in STEM

Science, technology, engineering and mathematics (STEM) affect every aspect of our lives. In the face of a pandemic, we turn to epidemiologists and virologists for solutions. When we no longer recognize the weather patterns in regions where we live, we ask meteorologists and earth scientists for answers. When information is needed more quickly, computer scientists and physicists often provide the needed breakthroughs. STEM occupations provide solutions to challenging problems and enable us to maintain societies that have been built upon specialized knowledge.

Because of this unique expertise, individuals working in STEM fields can expect to earn more than those working in non-STEM fields. According to the U.S. Bureau of Labor Statistics in 2015, the national average income for all STEM jobs was $85,750; while the average income for non-STEM jobs was $48,320.[6] Despite their importance to society, STEM jobs account for only a small percentage of all U.S. employment. In 2015, only 6.2% or 8.6 million people were employed in STEM occupations in the United States.
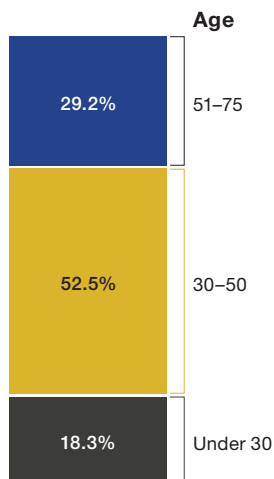
The process of classifying STEM occupations is complex. Various methods are used depending upon the data available and the assumptions made. The result of using different methodologies is that variations are introduced and outcomes may vary depending upon the source. In this report, data used to benchmark the engagement of women in STEM are drawn from the *Science and Engineering Indicators* reports prepared by the National Center for Science and Engineering Statistics (NCSES). "The S&E workforce can be defined in several ways: as workers in S&E occupations (6.7 million), as holders of S&E degrees (23.2 million), or as those who use S&E technical expertise on the job (19.4 million). The estimated size of the S&E workforce varies depending on the definitional criteria chosen."[7] According to the *2020 State of U.S. Science & Engineering* report, women accounted for 29% of S&E employment in 2017, compared with 26% in 2003. In 2017 women accounted for nearly half the workforce in the life sciences, psychology and social sciences; 27% of computer and mathematical scientists; 16% of engineers and 29% of physical scientists.[8] Women with STEM degrees are substantially more likely than men with STEM degrees to work in healthcare or education. Nearly one in five (19 percent) women with STEM degrees works in healthcare, compared to about one in ten (9 percent) men, while 13% of female STEM majors and 6% of male STEM majors work in education.[9]

It is useful to look at S&E data not only by gender, but also by age and other demographic characteristics. According to data provided by the NCSES, in 2015 women comprised 43% of the scientists and engineers under 75 years of age.[10] The side bar shows the distribution of women engaged with S&E by age group in 2015. The data show that the preponderance of the

Age

29.2% 51–75

52.5% 30–50

18.3% Under 30

Age distribution of U.S. female scientists and engineers 2015

Source: National Science Board

S&E workforce during 2015 fall between 30 and 50 years of age. As the population ages, more men and women continue productive S&E careers with 29.2% of the female S&E workforce being in the 51-75 age group in 2015, compared with 13.3% in 1993.

When one looks at the gender, race, and ethnicity of women, the opportunities in S&E take on a new dimension. While 18% of those in S&E occupations in 2017 were filled by white women and 7% by Asian women, only 2% of Hispanic women and 2% of black women were in S&E occupations. Figure 1 compares these percentages with population size.[11]

S&E Occupations by Percent		U.S. Population by Percent
49	White men	31
18	White women	31
14	Asian men	3
7	Asian women	3
3	Black men	6
2	Black women	7
4	Hispanic men	9
2	Hispanic women	8
2	Other men & women	3
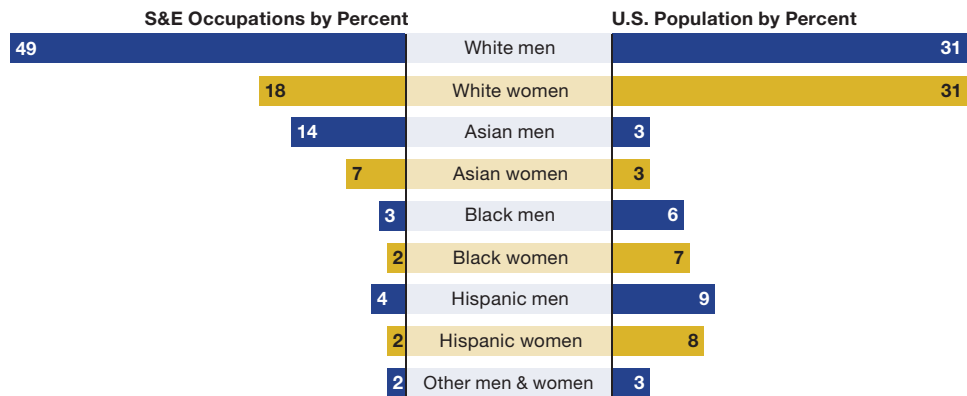
Source: National Center for Science and Engineering Statistics, National Science Foundation Women, Minorities, and Persons with Disabilities in Science and Engineering: 2017 https://nsf.gov/statistics/wmpd

Figure 1: Gender, race and ethnicity of workers in science and engineering occupations

1.3 Women and Patenting

There are a number of metrics that serve as indicators of innovation and mark the contributions made by inventors, many of whom are scientists or engineers. One of the most frequently used metrics is patenting activity. In recent years a number of studies have been conducted to explore gender differences in patent activity. The United States Patent and Trademark Office (USPTO) published their Study of Underrepresented Classes Chasing Engineering and Science Success (SUCCESS) Act report in October 2019, highlighting the limited amount of publicly available information regarding the participation rates of women, minorities, and veterans in the patent system. All studies indicate that women lag far behind men with respect to patent activity which can be measured in many ways. The share of patents with at least one female inventor has increased from about 4% in 1976 to about 15% in 1998 to about 21% in 2016. The percentage of women among all USPTO inventor-patentees has also increased, rising from just over 3% in 1976 to about 12% by 2016. The difference between the share of patents with a female inventor and the share of female inventors indicates that mixed-gender teams are driving most of the growth in granted patents with at least one female inventor.[12]

As the number of women entering STEM fields increases, so does patent activity. According to the study conducted by the Institute for Women's Policy Research, the share of STEM degrees awarded to women increased from 20.2 percent in 1977 to 33.5 percent in 2010. The share of patents with at least one woman inventor grew from 3.4 percent in 1977 to 18.8 percent in 2010.[13]
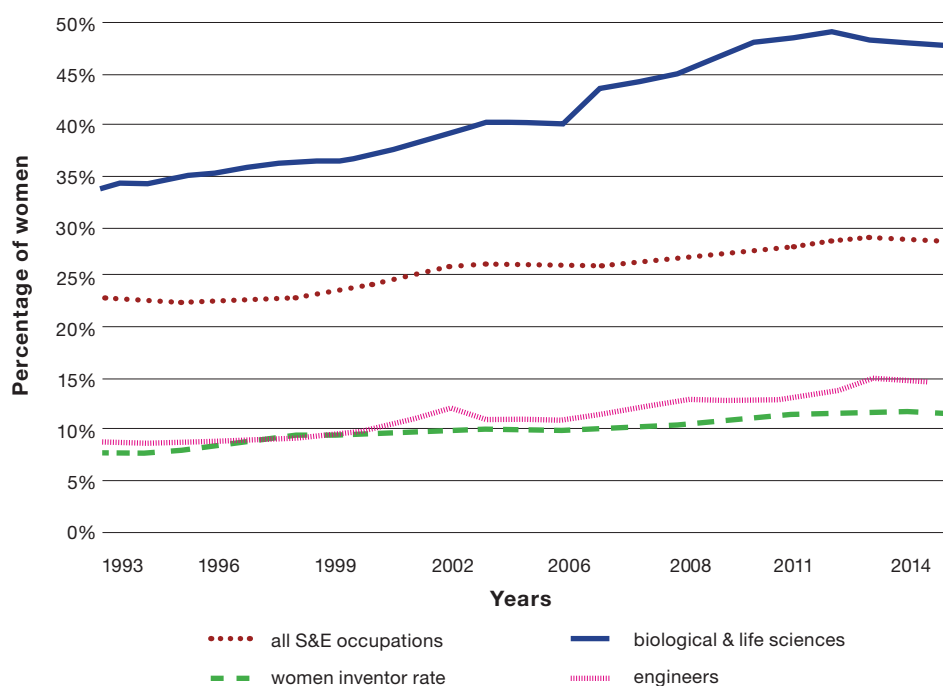
Source: USPTO Progress and Potential: A profile of women inventors on U.S. patents (2019)

Figure 2: Women inventor-patentees compared to women in science and engineering occupations

Although the participation of women in patenting activity is increasing, it still lags far behind that of men. The literature offers a number of hypotheses to explain this disparity: (1) the cost and time associated with filing patents is more of a deterrent for women inventors who generally earn less than men; (2) the lack of mentorship for women on the patent process makes it difficult to master; (3) the gender disparity is a reflection of the representation of women in S&E; (4) women tend to work in S&E areas that file fewer patents – such as social sciences rather than engineering. The literature also shows that women that are part of a team tend to produce more useful and successful patents.[14] Another finding is that most women inventors are found in tech-heavy states with a larger female workforce. This may provide more opportunities for mentorship by other women patents inventors.[15]

1.4 Women in STEM Business

Women in STEM occupations work for a wide variety of employers: 72% work in business; 16% work in educational institutions; and 12% work for the government.[16] While numerous programs exist from kindergarten through college aimed at increasing the number of women that choose STEM occupations, there is considerable literature to indicate that more than half the women in tech fields leave midway through their career.[17,18,19,20] The Athena Study, funded by 43 global companies in 2008, examined the career trajectories of women with science, engineering and technology (SET) degrees. They concluded that over time 52% of highly qualified women working in SET occupations quit their jobs. The reasons were summarized as:

- **Hostile macho cultures** – that were exclusionary and often hostile towards women and vulgar
- **Isolation** – which increases as one is promoted
- **Unclear career paths** – lack of clarity regarding what it takes to get ahead
- **Systems of risk and reward**
- **Extreme work pressures** – travel, long hours, 24/7 client demands

The decision to leave industry tends to spike about 10 years into one's career; though this is a time when family responsibilities also tend to increase, a study by Glass and colleagues found that family factors did not account for the majority of exits from STEM jobs. Roughly half (49%) of those that quit moved on to STEM jobs outside the corporate sector, some becoming employed as independent contractors (22%), while others started their own companies (10%) or took a job in government or with non-profit (17%). These data suggest that those who leave industry at this point may be potential candidates for entrepreneurship.
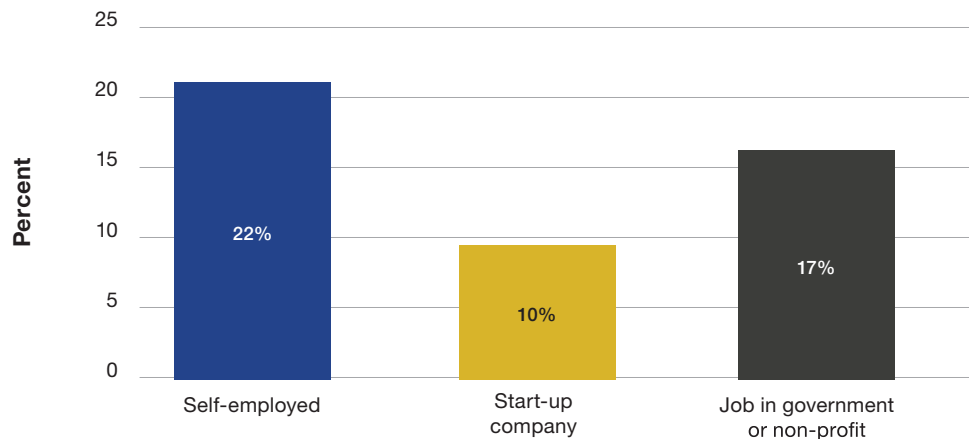
Source: Ashcroft, Catherine et al "Women in Tech: The Facts" NCWIT Workforce Alliance 2016 update

Figure 3: 49% of women who leave the private SET workforce move on to other STEM jobs

A study commissioned by NWBC in 2017 indicated that self-employed women in STEM constitute 0.4% of the population of employed women (307,753 women), and that there are more than twice as many men who are self-employed in a STEM field (0.8% of the population of employed men, 644,230). Women in general are less likely to be self-employed than men, and those who are self-employed are less likely to work in STEM fields.

This study also evealed that self-employed women in STEM are slightly younger than self-employed men in STEM (49 vs. 52) and are more likely to hold a master's degree but less likely to hold a professional or doctoral degree compared to self-employed men in STEM.[21] Self-employed women in STEM are also more likely to be non-white compared to self-employed men in STEM (20.9% vs. 16.8%). Across genders, entrepreneurs in STEM fields attain higher educational degrees than owners in non-STEM fields, highlighting the importance of education and training in STEM entrepreneurship.

1.4.1 Academia as a Source of Entrepreneurs

If one looks to academia as a source of potential STEM entrepreneurs different factors emerge. A 2014 study conducted for SBA focused on doctoral students and their decisions regarding entrepreneurship.[22]

Several conclusions were drawn in this report:

- Parenting young children significantly lowers the probability of entrepreneurial activity in the near term for women but has no significant effect for men.
- For both men and women, employment in the academic sector significantly decreases the likelihood of moving into entrepreneurship.
- For women, having their first postdoctoral employment in industry or with funding from an industry source significantly increases the probability of subsequent entrepreneurship.

- Among those who became small business owners, 74% came from industry and 6.8% from academia and 11% had been previously self-employed.

1.4.2 Funding for Women in STEM Entrepreneurship

Women often cite that the reason for pursuing a career in STEM was to make discoveries and solve societal problems. According to alumni of L'Oreal USA's For Women in Science (FWIS) fellowship program 100% of respondents indicated that award grants provided independence and growth opportunities; 98% indicated that family-friendly policies facilitated women's career advancements; and 91% cited that strong and fair networking opportunities assisted with women's career advancement.[23] Are these reasons that would lead some women in STEM to make the decision to enter entrepreneurship?

Irrespective of the reasons, men and women entrepreneurs all face challenges with respect to financing a startup. However, the literature clearly shows that it is much more difficult for women to secure financing from equity investors – a major source of investment for small high-tech companies. The Diana Project released its first report in 1999 indicating that at that time only 5% of U.S. firms[24,25] receiving venture capital investment in 1999 had a woman on the management team. In a 2020 report by Crunchbase they stated that "even if we combined VC investment in female-founded ad mixed co-founded companies in 2019, it still amounts to only 9 percent of all investment."[26] The SBIR and STTR programs provide funding for early stage, high-risk research and development (R&D) without giving up equity in the company.

1.5 Overview of the SBIR/STTR Programs

Annually, the federal government provides extramural R&D funds to a wide assortment of entities including universities and colleges, large business, nonprofit organizations, small business, state and local government, foreign performers and private individuals. The SBIR and STTR programs are funded by a percentage of these extramural R&D budgets. Specifically, agencies with an extramural budget in excess of $100 million must set aside 3.2% of that budget to fund their SBIR programs while agencies with an R&D budget in excess of $1 billion dollars must also set aside .45% of those funds for the STTR program. The resulting FY18 SBIR/STTR budget for the eleven participating agencies was $3.6 billion.

HHS, $1.08B
DOE, $280M
NSF, $202.4M
NASA, $198M
GRANTS
~$3.6B in FY 18 Across All Agencies
All Others, $82.2M
CONTRACTS
DoD, $1.75B
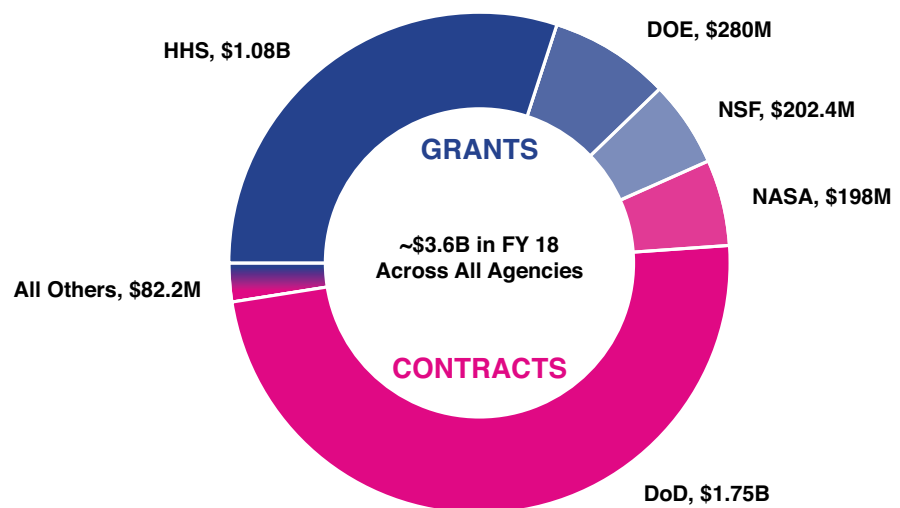
Figure 4: FY2018 SBIR/STTR budgets by agency

As can readily be seen in Figure 4 the five largest programs are those conducted by the Department of Defense (DoD), the Department of Health and Human Services (HHS), the

Department of Energy (DOE), the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). These agencies have both an SBIR and STTR program; while the six smallest agencies have only an SBIR program. These agencies include the U.S. Department of Agriculture (USDA), the Department of Homeland Security (DHS), the Department of Commerce (DOC), the Department of Education (ED), the Department of Transportation (DOT) and the Environmental Protection Agency (EPA).

There are a number of differences in how each agency implements the SBIR/STTR programs, but there is a core basic model common across the Federal government. Phase I SBIR/STTR awards typically provide $50,000 to $250,000 for six months to one year for concept development, followed by Phase II awards for up to $1,500,000 for two years of further R&D and prototype development. Agencies reserve funding from their extramural R&D budgets to award small businesses through the Phase I and Phase II SBIR/STTR programs. The expectation is that after completing these two phases the small business will secure funding from non-SBIR sources to bring the resulting technology to market. This final stage is referred to as Phase III or the commercialization phase. In recent years, there have been many modifications to this basic model. However, this analysis will focus on the basic Phase I to Phase II model.

Only Phases I/II use SBIR $$$$

Legend: Not funded with SBIR/STTR $ (blue) · Funded with SBIR/STTR $ (gold)
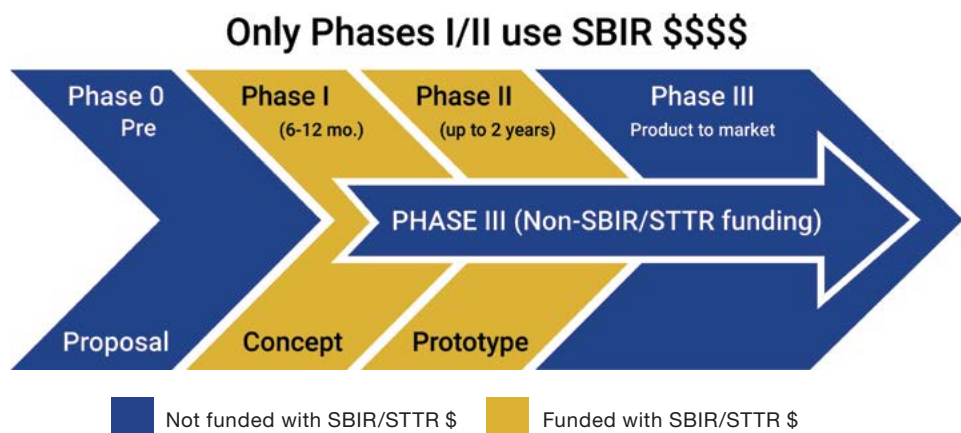
Figure 5: Basic model for SBIR and STTR programs

The SBIR/STTR programs are dynamic and vary in implementation at the agency level. Each agency has its own culture, its own priorities and its unique methods for conducting business. SBIR/STTR research priorities are dynamic and aligned with each agency's overall strategic plans for R&D. Often roadmaps are available that clarify the mission and direction of each agency. The SBIR/STTR programs provide a means for small business to play a role in filling the federal government's research needs.

Agencies also vary in the funding vehicles used to fund extramural R&D. DoD, DHS, DOT, EPA and NASA all use contracts with their SBIR and/or STTR programs. The vehicle used has significant implications for the guidelines that agencies must follow once a solicitation is released. Clear restrictions are placed on an agency's freedom to interact with potential applicants once the topics have been released. Most other agencies participating in the SBIR/STTR programs use grants as the vehicle of choice. The grant mechanism allows considerable latitude to interact with potential applicants once a solicitation is released. Whether an agency uses contracts versus grants accounts for some of the differences one sees in pre-submission interaction between applicant and agency personnel in programs such as the NSF SBIR/STTR programs which use grants and NASA which uses contracts.

Table 1 summarizes key differences in program implementation among agencies participating in the SBIR/STTR programs. Understanding these differences can suggest areas for policy or programmatic changes across the SBIR/STTR programs, as well as situations where inherent differences unique to an agency may require agency-specific actions.

	FY2018 Budget (SBIR/STTR)	Agreement	Opportunities to Submit Annually	Note	Topic Specificity	Contact Topic Authors?
DoD	$1.75B	Contract	3 (SBIR/STTR) solicitations	Not all services and components participate in all solicitations	Narrow	Pre-release only
HHS	$1.08B	Grants and Contracts	3 (SBIR/STTR) standard due dates	Additional targeted SBIR/STTR grant and contract opportunities throughout year	Broad	Yes
DOE	$280M	Grants	2 (SBIR/STTR) solicitations	Required Letter of Intent	Narrow	Yes
NSF	$202.4M	Grants	4 (SBIR/STTR) submission windows	Required Project Pitch	Broad	Yes
NASA	$198M	Contracts	1 (SBIR/STTR)		Narrow	No
USDA	$27M	Grants	1 SBIR		Broad	Yes
DHS	$20.8M	Contracts	1 SBIR		Narrow	Pre-Release only
DOC	$14.2M	Grants	1 SBIR	1 proposal per subtopic	Broad	No
ED	$8.5M	Contracts	1 SBIR		Broad	No
DOT	$7.5M	Contracts	1 SBIR	1 proposal per topic	Narrow	No
EPA	$4.2M	Contracts	1 SBIR		Narrow	No

1.6 Potential Stages to Engage Women with SBIR/STTR Programs
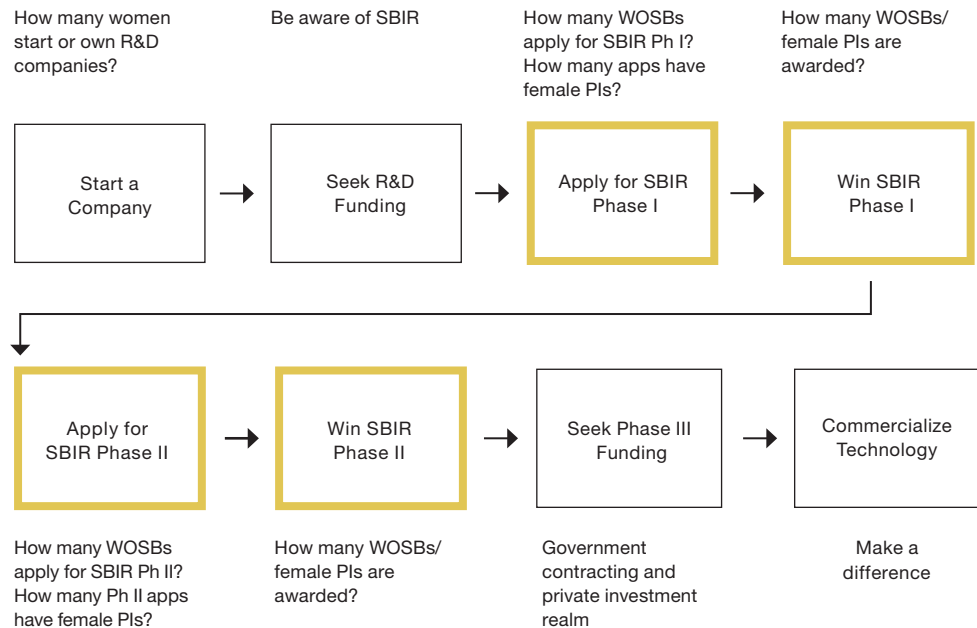
Figure 6: Potential intervention points to engage women in STEM in SBIR/STTR

Each of the participating federal agencies supports their agency's overall mission through the SBIR/STTR programs. In this report we examine the participation of women as they move through the prototypical stages of engaging with the SBIR/STTR programs. Figure 6

indicates the passage of the typical entrepreneur from the time they start a company and start looking for funding through the SBIR/STTR process and on through Phase III and commercialization. The stages highlighted in gold are within the purview of SBIR/STTR policy, though answers to the earlier stages impact what is possible. This study focuses on a descriptive analysis of the participation of women in the initial stages of the program – SBIR/STTR Phase I applications and awards from women-owned small businesses and the involvement of women as Principal Investigators (PI), the technical lead on these R&D projects. The study then examines potential factors that may influence women's participation – the presence of WOSB in STEM-intensive, SBIR-funded industries, SBIR funding agency outreach and initiatives, and promising practices on engaging women from organizations that support STEM entrepreneurs.

2.0 Findings and Analysis: SBIR/STTR Trends

This report provides the first comprehensive analysis of women's participation in the SBIR/ STTR programs as business owners or principal investigators (PI). Throughout this report the definition of women-owned small business (WOSB) is taken from the SBIR/ STTR Policy Directive, based on guiding statute (15 U.S.C. §638), defining a WOSB as a small business that is *"at least 51% owned by one or more women, or in the case of any publicly owned business, at least 51% of the stock is owned by women, and women control the management and daily business operations."*

We note that this definition of WOSBs differs slightly from the definition used by the SBA women-owned small business Federal contracting program that provides set-aside contracts to certified WOSB and requires a formal certification to be eligible. The primary differences are: 1) SBIR/STTR company owners may be U.S. citizens or permanent resident aliens; and 2) the small business size standard for SBIR/STTR is 500 employees regardless of North American Industry Classification System (NAICS) code. In addition, SBIR/STTR applicants do not need to be formally certified as WOSB to indicate WOSB status.

2.1 Methodology

To examine the participation of women in the SBIR/STTR programs, we analyzed administrative data provided by SBIR funding agencies to SBA. These data are publicly available at SBIR.gov. Data were retrieved in October 2019. Due to the dynamic nature of the award database at SBIR.gov and continued data quality improvements, exact numbers presented in this report may be different from data retrieved at other points in time.

2.1.1 Application Analysis

Data from SBA-published Annual Reports to Congress from 2013–2018 (https://www.sbir.gov/annual-reports-files) were used to analyze rates of WOSB submissions of SBIR/STTR Phase I applications. For the years 2011-2012 agency-level data were not available and therefore, those years were not included in this analysis.

2.1.2 Award Analysis

For WOSB awards and PI analyses, we use award-level data submitted to SBA from SBIR funding agencies for the period between 2011 and 2018 (https://www.sbir.gov/sbirsearch/award/all). Because data were available for each award made, we analyzed the participation of individual companies and individual PIs by removing duplicates across years and agencies. This process is referred to as de-duplication and facilitates counting individual companies and principal investigators irrespective of the number of awards received. The time frame 2011–2018 was selected for the analyses because datasets from this period have been consistently reviewed over the last few years to correct errors and detect inconsistencies. This time frame also encompasses a period of major policy and programmatic changes to the SBIR/STTR programs that occurred with the SBIR/STTR Reauthorization Act of 2011, including the 3% Administrative Funding Pilot Program (AFPP) that provided agencies with the ability to dedicate funding to outreach activities and other initiatives to increase the participation of women and socially or economically disadvantaged individuals.

The classification of a company as WOSB is based on self-report. One issue that was identified during the analysis was inconsistency across years in the categorization of some WOSBs. This tended to occur with companies that had participated in the SBIR/STTR program for many years. Small businesses must indicate their ownership status with each SBIR/STTR application. We could not determine if a change in WOSB status between different awards was due to an actual change in ownership, or an error in the data submitted or in the reporting transmission by the agency to SBA. When this type of inconsistency arose, the business was classified as WOSB if more than 50% of the time it was identified as women-owned in the data downloaded from SBIR.gov.

2.1.3 Principal Investigator Analysis

The SBIR/STTR Reauthorization Act of 2011 (Public Law 112-81) added the requirement that participating agencies identify whether an awardee "is owned by a woman or has a woman as a principal investigator" and if the awardee "is owned by a socially or economically disadvantaged individual or has a socially or economically disadvantaged individual as a principal investigator." However, agencies have not consistently collected or reported this data to SBA. Thus, PI gender was inferred based on name using the Gender API software platform to analyze the names of PIs associated with SBIR/STTR awards between 2011 and 2018. Gender API uses a worldwide gender-name dictionary as the basis for the analysis. In reporting results, Gender API provides the sample size and probability that the gender is correct for each name analyzed. In using these data, in those instances where the accuracy of gender prediction was less than 59%, these PIs were excluded from the analysis.

To understand how many individual, principal investigators participated in the SBIR program for each agency, duplicate names were removed. This enabled the determination of how many individual PIs worked in the SBIR program during the period of interest and how many were female. As a result, a PI who worked on multiple awards in a given year is counted just once, rather than repeatedly for each award.

2.1.4 Data Considerations

Information regarding the gender of an owner or PI begins with the small business and the information that it submits in its applications and to various government databases. Depending upon who provides the information there may be inconsistencies in what is reported regarding ownership between different applications. A new PI, for example, may not know the true ownership of the company. Nonetheless, the PI has been tasked with completing a variety of forms. In this case, the PI may have listed the ownership of the business as women-owned, when in truth, it was not. Data received from small businesses are in turn entered into proprietary systems that each agency maintains to store SBIR/STTR and other data.

Since 1982 the Small Business Administration (SBA) has had the responsibility to issue Policy Directives for the general conduct of the SBIR/STTR programs. Each directive covers numerous topics including a clarification of the data that each agency should provide annually to SBA. As there have been changes in the requirements for data reporting in each Policy Directive, the type and quality of data available has changed over time. The data received by SBA are entered into the SBIR.gov database which has a public interface, as well as a government-use only interface for evaluation purposes.

Data available through the SBIR.gov database depends on a number of factors including: (1) changes in the guiding statute (15 U.S.C. §638) which dictates what information agencies must provide to SBA annually regarding applicants and awardees; (2) the accuracy of the records that agencies keep and/or the "goodness" of the transmission protocols implemented by each agency when submitting data to SBA; (3) the ability of the SBIR.gov database to detect inconsistencies in data received; (4) the information that each agency requires applicants to provide; and (5) ultimately, the knowledge of the applicant who is responsible for completing the forms submitted with their proposals.

2.2 SBIR/STTR Women-Owned Small Business Applications and Awards

What is the percent of women-owned firms submitting Phase I applications and winning Phase I awards in the SBIR/STTR programs?

2.2.1 SBIR/STTR Applications Submitted by Women-owned Small Businesses

Data from published SBIR/STTR Annual Reports to Congress were used for the period between 2013-2018 as data were available at the agency level. Table 2 provides a cumulative summary of the SBIR applications for this six year period. The percentage of SBIR Phase I proposals submitted by women-owned small business (WOSB) varies significantly by agency. EPA had the lowest percentage of proposals submitted by WOSB (8.1%)[27] while the Department of Education had the highest (29.4%). For smaller agencies, small fluctuations in the number of WOSB proposals submitted can lead to a larger percentage change due to the smaller number of total proposals received; there can be greater noise from year to year that can be misleading. Of the five largest agencies, DOE had the lowest overall percentage of proposals submitted by WOSB during this time period (9.8%), while NSF had the highest (17.5%). The overall average for WOSB submitting applications to the SBIR program as a whole during this six year period was 15.2%, with the balance (84.8%) of the proposals being submitted by companies whose ownership was not listed as women-owned. As noted in the Methodology section, in this study WOSB are identified by 51% or more ownership by women. Equal ownership is NOT considered women-owned. All data regarding business ownership are self-reported by the applicant.

> Between 2013 and 2018, ED, DOT, DHS, and NSF received the highest percentage of SBIR Phase I proposals from WOSBs.

Table 2: Total number of SBIR Phase I proposals submitted by WOSBs in response to all SBIR solicitations by agency (2013-2018)

TOTAL SBIR FOR AGENCY (2013-2018)	DOD	HHS	DOE	NSF	NASA	DHS	USDA	DOT	ED	DOC	EPA	TOTAL
Total Proposals Received	44,110	29,728	9,489	11,555	8,298	863	2,947	968	1,465	1,031	933	**111,387**
Proposals Received from WOSB	7,422	4,059	933	2,025	995	166	444	214	430	169	76	**16,933**
% Proposals Received from WOSB	16.8%	13.7%	9.8%	17.5%	12.0%	19.2%	15.1%	22.1%	29.4%	16.4%	8.1%	**15.2%**

Largest SBIR programs   Smallest SBIR programs

Note: During this period, NOAA, a branch of DOC was a contracting organization, but today provides grants.

Figure 7: Percentage Phase I SBIR applications submitted by WOSB (2013-2018)

Figure 7 shows the same data, differentiating between those agencies that use contracts (magenta) and those that use grants (blue). While there appears to be a greater percentage of WOSBs submitting proposals to agencies that use a contracting mechanism, there are likely factors other than the funding mechanism that have a stronger influence. For example, the education industry tends to have more women.

The data for participation of WOSB in the STTR program during this same period is represented in Table 3. In general, the percentage of women-owned small business submitting STTR proposals to the five participating agencies overall (13.1%) is less than those submitting SBIR proposals (15.2%). DOE had a slightly greater percentage of WOSB STTR applicants than for SBIR, while NASA had roughly the same proportion of WOSB applicants for both programs.

Table 3: Total number of STTR Phase I proposals submitted by WOSBs in response to all STTR solicitations by agency (2013-2018)

TOTAL STTR FOR AGENCY (2013-2018)	DoD	HHS	DOE	NASA	NSF	TOTAL
Total Proposals Received	5,140	6,288	1,521	886	2,423	**16,258**
Proposals Received from WOSB	774	708	162	107	386	**2,137**
% Proposals Received from WOSB	15.1%	11.3%	10.7%	12.1%	15.9%	**13.1%**

Using the same aggregated data reported by agencies for the SBIR/STTR Annual Reports to compare award rates over time across agencies shows that the proportion of WOSB submitting SBIR Phase I proposals has not changed much between 2013 – 2018. The proportion of WOSB awards shows greater variability over the years, with the largest year-to-year difference between 15.8% WOSB SBIR Phase I awards in 2015 to 13.8% WOSB SBIR Phase I awards in 2016. This drop in proportion is driven by both an increase in the total number of SBIR Phase I awards and a decrease in number of WOSB awards from 2015 to 2016. **Across all agencies for both SBIR/STTR programs during this time period, 14.9% of Phase I proposals were submitted by WOSB, with a range of 14.0% to 15.4%, and 14.1% of Phase I awards were made to WOSB, ranging from 13.0% to 15.6%. Awards generally followed the trend of proposals over time.**

15.2% of all SBIR Phase I applications received between 2013 and 2018 were submitted by WOSB and 13.1% of all STTR Phase I applications.

	2013	2014	2015	2016	2017	2018
% WOSB SBIR/STTR Proposals	14.8%	15.4%	15.4%	14.8%	15.3%	14.0%
% WOSB SBIR/STTR Awards	14.4%	14.3%	15.6%	13.5%	13.8%	13.0%
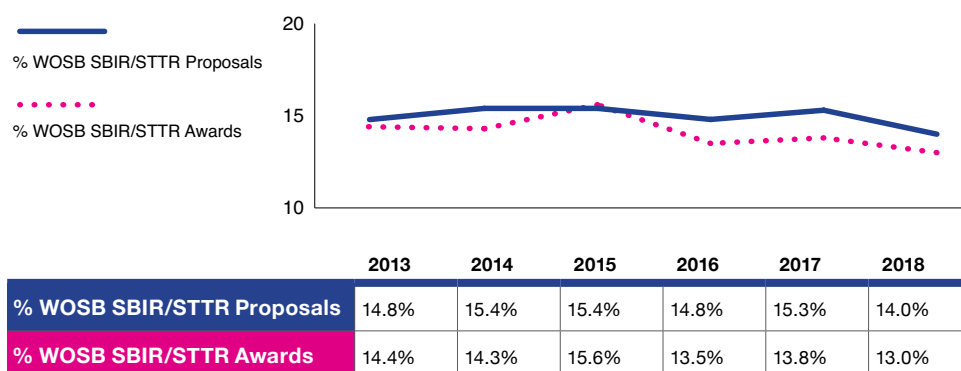
Figure 8: SBIR/STTR WOSB proposals vs. awards (2013-2018)

2.2.2 SBIR/STTR Awards to Unique Women-Owned Small Business

> How have SBIR/STTR award rates for women-owned small business changed over time? Does the award rate vary across agencies?

The agencies with the highest WOSB participation were NSF and ED.

Some businesses submit and win multiple awards, so to better understand the participation of unique WOSB, we de-duplicated multiple awards made to individual companies to enable analysis at the unique company level. In other words, if during a given year a specific company received 5 SBIR Phase I awards from an agency, the company would be counted once, rather than 5 times once "duplicates" were removed. Data was not available at the individual proposal level, so it was not possible to identify how many unique WOSB applied for SBIR/STTR funding and compare the number awarded.

Data showing trends over time are presented in two separate tables – one for agencies with the largest SBIR programs (Table 4) and another for agencies with smaller SBIR programs (Table 5). In all cases the data represent individual WOSB that received Phase I SBIR awards from that agency by year. These figures do not reflect the number of Phase I awards given to WOSB, but the number of unique WOSB that won awards. If one compares the data in Table 4 between 2011 and 2018, **the two agencies that had the largest changes over time are the National Science Foundation which went from 15.5% in 2011 to 22.4% in 2018 and the Department of Energy that went from 3.5% in 2011 to 10.5% in 2018.**

Table 4: Percent unique WOSB receiving SBIR Phase I awards in larger agencies (2011-2018)

	2011	2012	2013	2014	2015	2016	2017	2018
NSF	15.5%	12.4%	17.4%	14.7%	22.1%	19.0%	16.4%	22.4%
DoD	12.9%	12.9%	11.5%	14.1%	12.5%	11.8%	14.3%	11.5%
HHS	12.8%	10.5%	12.8%	11.3%	11.6%	13.9%	12.1%	13.7%
NASA	11.3%	10.8%	13.5%	8.4%	12.7%	10.7%	9.3%	9.0%
DOE	3.5%	5.7%	6.4%	7.2%	6.5%	9.7%	9.4%	10.5%

The percent of WOSB receiving Phase I SBIR awards from the DOE increased from 3.5% in 2011 to 10.5% in 2018.

The data in Table 5 show greater variability among agencies with smaller SBIR programs between 2011 and 2018. The USDA experienced an apparent decline in the number of WOSB receiving Phase I SBIR awards between 2011 (20.8%) and 2018 (12.0%). Most of the other SBIR programs experienced an increase in the percentage of WOSB receiving awards during this period. As noted in the earlier section, for smaller agencies, small fluctuations in the exact numbers of applications submitted or awards made can lead to larger percentage change due to the smaller number of total proposals received and awards made. If one looks across these two figures, **two agencies stand out as having the highest overall engagement of unique WOSB – NSF with 22.4% in 2018 and ED with 40% in 2018.**

Table 5: Percent unique WOSB receiving SBIR Phase I awards in smaller agencies (2011-2018)

	2011	2012	2013	2014	2015	2016	2017	2018
ED	31.6%	28.6%	28.6%	14.3%	33.3%	22.2%	45.5%	40.0%
USDA	28.8%	19.0%	17.5%	12.5%	8.6%	7.1%	13.3%	12.0%
DOT	14.3%	25.0%	33.3%	33.3%	18.8%	33.3%	23.1%	14.3%
DOC	4.3%	11.5%	11.1%	13.6%	16.1%	13.5%	14.3%	12.8%
EPA	3.8%	12.0%	7.7%	4.8%	21.1%	15.4%	13.3%	6.3%
DHS	0.0%	20.0%	10.3%	2.5%	11.5%	11.1%	13.3%	16.7%

Companies may start their involvement with the SBIR program working with one agency but may also begin to apply to other agency SBIR/STTR programs and win awards with those agencies as well. Key examples of this are Physical Optics Corporation (1374 Phase I SBIR /STTR awards) and Intelligent Automation, Inc. (749 Phase I SBIR/STTR awards) — both women-owned businesses that have won many awards across multiple agencies over an extended number of years.

The previous analyses removed duplicates within agency programs in order to determine how many WOSB uniquely won awards from that agency during the period of interest. However, that analysis does not define how many unique companies participated in the SBIR program — across all agencies — during the period 2011-2018. Thus, we examined how many unique WOSB participated in the SBIR program between 2011 and 2018. To conduct this analysis, all SBIR Phase I records across all agencies for the period between 2011 and 2018 were downloaded and duplicate awards to companies removed. In this fashion, if a hypothetical WOSB had received 5 Phase I SBIR awards from DoD and 3 from DHS – the WOSB would only be counted once in this analysis, rather than twice (once for DoD and again for DHS). This enables one to determine the number of unique WOSB that participated in the SBIR program as a whole during this period.

Figure 9 and Figure 10 show the results of this analysis for the SBIR and STTR programs respectively. **In the period 2011 – 2018, 13.7% (3,454) of SBIR Phase I awards and 12.6% (531) STTR Phase I awards were made to unique WOSB. These unique WOSB made up 13.3% (1,113) of SBIR Phase I companies and 12.9% (308) of STTR Phase I companies across all agencies.** What we cannot tell from these data is how many of these firms (WOSB and non-WOSB) had their first engagements with the SBIR or STTR programs during this period as some may have started working with these programs in prior years.

SBIR
There were a total of 25,268 Phase I SBIR awards made across all agencies between 2011 and 2018. 13.3% of all companies that received Phase I SBIR awards were WOSB.
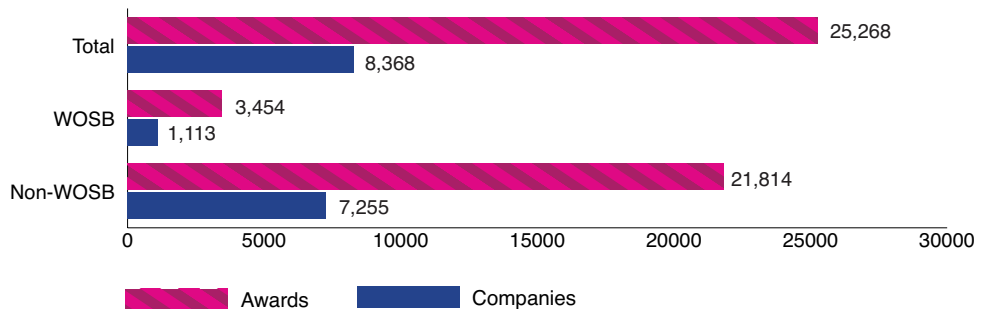
Figure 9: Unique WOSB across all agencies' Phase I SBIR awards (2011-2018)

STTR

A total of 4,218 STTR awards were made across all participating agencies between 2011 and 2018. 12.9% of the companies that received STTR Phase I awards were WOSB.
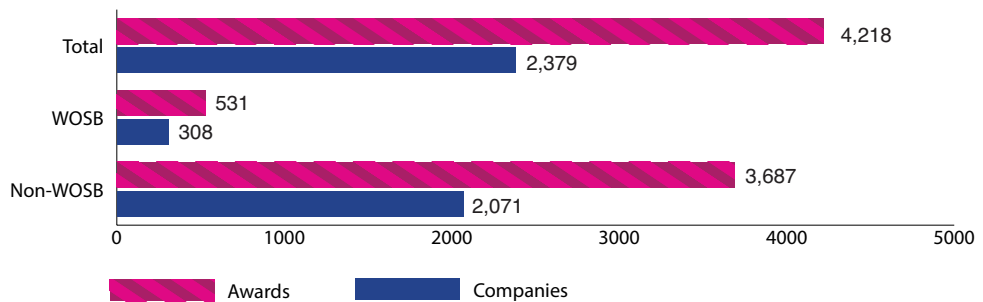
Figure 10: Unique WOSB across all agencies' Phase I STTR awards (2011-2018)

Table 6 highlights the cumulative number of awards made by each agency participating in the SBIR program between 2011 and 2018. As one would expect, agencies with a larger budget made more awards. DoD for example, made 11,033 Phase I SBIR awards during this period—1,713 of these awards were to WOSB. If one then looks at the number of unique companies that received Phase I SBIR awards from DoD, there were 2,923 unique companies that received awards during this period – 383 of which were WOSB. The % WOSB is the percent of unique WOSB that received awards.

Looking at the data in this fashion allows one to see the average number of awards that an agency makes to WOSB. On average DoD makes 4.5 awards to WOSB. Other agencies with large SBIR budgets also tend to provide a higher number of Phase I SBIR awards to WOSB (2 or more) – the exception here is NSF. This may reflect the change in NSF's policy to limit companies to submit only a single application per solicitation.

Table 6: SBIR Phase I awards made to WOSBs by agencies (2011-2018)

	Total Awards	Awards to WOSB	% Awards WOSB	Total Companies	# Unique WOSB	% WOSB	Average Awards to WOSB
DoD	11,033	1,713	15.5%	2,923	383	13.1%	4.5
HHS	5,992	727	12.1%	2,920	362	12.4%	2.0
DOE	2,100	154	7.3%	909	68	7.5%	2.3
NASA	2,626	284	10.8%	923	118	12.8%	2.4
NSF	2,008	346	17.2%	1,823	320	17.6%	1.1
USDA	583	74	12.7%	549	73	13.3%	1.0
DHS	255	32	12.5%	230	26	11.3%	1.2
DOC	230	29	12.6%	182	24	13.2%	1.2
DOT	131	36	27.5%	119	27	22.7%	1.3
ED	145	43	29.7%	129	38	29.5%	1.1
EPA	165	16	9.7%	161	16	9.9%	1.0

2.3 Gender of Principal Investigators Participating in the SBIR/ STTR Programs (2011-2018)

What is the gender of principal investigators that participate in the SBIR/ STTR programs? How has this changed over time? Does PI gender vary across agencies?

Table 7 lists all Phase I SBIR awards made by year and indicates how many unique PIs there were (male and female) that worked on those awards. When conducting this analysis for all years, duplicates across years were removed, so the figure in the TOTAL row is not

the result of simple addition of the data in each column. The analysis reveals that **during the period 2011-2018 across the entire portfolio, 13.1% of unique PIs for SBIR Phase I awards were women.** Though the exact number of unique women PI increased and peaked in 2018 with 399 unique women PI, so did the total number of unique PI, such that 2018 had the lowest percentage of women PI (10.6%) in the time period examined.

Table 7: Gender of Principal Investigators for all Phase I SBIR awards (2011-2018)

Year	Total Awards	# Unique PIs (male and female)	# Unique Female PI	% Female PI
2011	3,628	3,031	348	11.5%
2012	3,417	2,890	356	12.3%
2013	3,016	2,689	334	12.4%
2014	3,088	2,711	342	12.6%
2015	2,807	2,499	293	11.7%
2016	2,960	2,605	333	12.8%
2017	3,217	2,879	344	11.9%
2018	3,135	3,769	399	10.6%
TOTAL	**25,268**	**15,851**	**2,073**	**13.1%**

The same analysis was conducted for the STTR program, with comparable results; 13.2% of STTR Phase I awards involved unique women PIs. Analysis by agency can be found in Appendix B.

Table 8: Gender of Principal Investigators for all Phase I STTR awards (2011-2018)

Year	Total Awards	# Unique PIs (male and female)	# Unique Female PI	% Female PI
2011	466	447	50	11.2%
2012	466	455	62	13.6%
2013	456	445	55	12.4%
2014	493	475	67	14.1%
2015	548	527	62	11.8%
2016	599	574	81	14.1%
2017	623	603	77	12.8%
2018	567	547	76	13.9%
TOTAL	**4,218**	**3,493**	**462**	**13.2%**

2.4 Relationship Between WOSB Status and PI Gender

As noted earlier, information regarding business ownership is provided by companies each time they submit an application. In this analysis, if companies did not list their ownership as WOSB, they were classified as non-WOSB, including companies that may be equally-owned by a woman. Additional analyses were then conducted to determine if women business owners were more likely to employ women principal investigators.

Figure 11 represents two related concepts: Total number of awards made to companies and the total number of unique companies that received awards. In each case the unit of analysis is different. In the figure on the left if a unique woman-owned company received 10 awards, all 10 awards would be attributed to the pool of awards made to WOSB. In the smaller pie to the right, that company would be counted just once, rather than 10 times – as the unit of analysis was unique companies. Applying this process enables one to see

that **the 25,268 SBIR Phase I awards were given to 8,368 unique companies during this period. Of these companies 13.3% (N=1,113) were WOSB; while 86.7% were classified as non-WOSB.**

Total <u>Awards</u> by Company Ownership
N = 25,268

Unique <u>Companies</u> Receiving Awards
N = 8,368
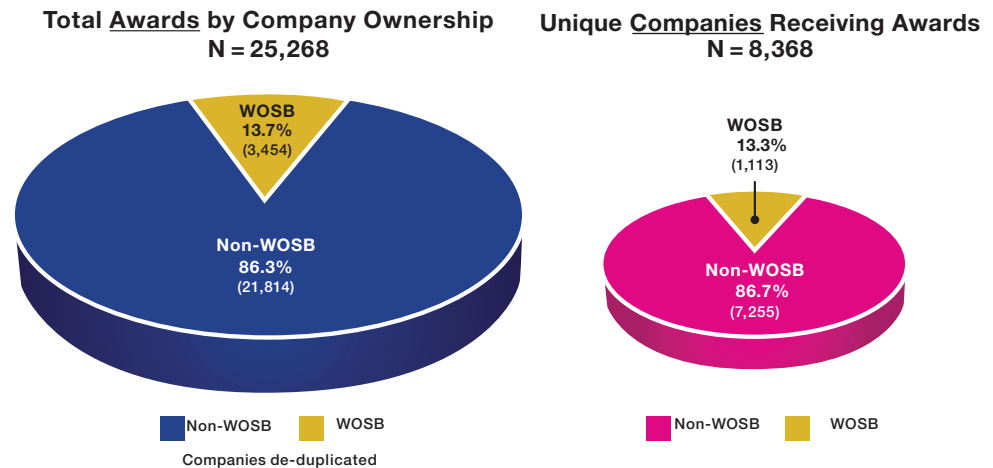
Figure 11: SBIR Phase I awards and companies by gender of business owner (2011-2018)

> Female PIs are more likely to work for a WOSB. More than half the female PIs worked for WOSBs, despite WOSBs being a much smaller pool of companies to work for.

An additional variable of interest is the gender of the principal investigators. Every award had a PI assigned to the project. Now the question becomes how many of the 25,268 awards had the research conducted by a male or female PI. The data used in this analysis came from the results of the Gender API analysis. The same issue arises: i.e., do you count individual PI that work on many awards once or more? The decision was made to use the same de-duplication process in the analysis of principal investigators. Therefore, each PI was counted once for this analysis, irrespective of how many awards they served on as the lead researcher.

PI Gender
N = 15,851

Where Do Female PIs Work–Unique PI
N = 2,073
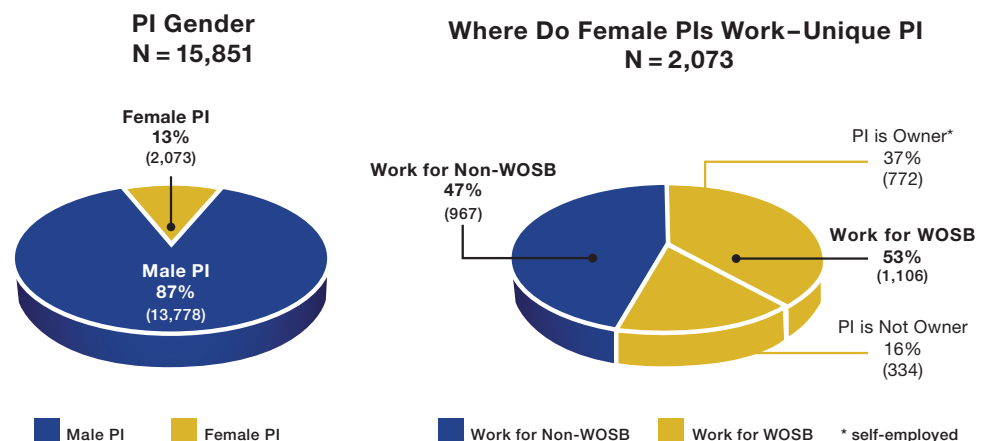
Figure 12: Female PIs working on SBIR Phase I awards by business ownership (2011-2018)

Figure 12 shows that a total of 15,851 principal investigators worked on the SBIR Phase I awards during the period between 2011-2018. In other words, this was the number of scientists and engineers that worked on the 25,268 Phase I awards. Of these, 13% of the PI were female (2073) and 87% (13,778) were male. As most agencies only allow 1 PI per award this figure is very similar to number of awards.

What is the relationship between WOSB status and PI gender? Is a WOSB more likely to have a woman PI than a non-WOSB company? Because the business owner may also be

the PI, we analyzed the number of occurrences in which the listed business contact of the award was the same as the PI, under the assumption that the business contact is the owner. The chart on the right-hand side of Figure 12 addresses this question. Thirty-seven percent of female PI were also the business owner. In this chart, they are referred to as self-employed – in other words, the owner employed themselves as the PI. This occurred 37% of the time (N=772). 16% of female PI worked for other WOSB where the PI was not the same as the business owner, so **53% of female PIs   worked for a WOSB firm, while 47% of female PI worked for non-WOSB firms.**

2.5 Discussion: Participation of Women in the SBIR/STTR programs

This section of the report explores the participation of women in the SBIR/STTR programs during the period between 2011 and 2018. In examining the first stage of how many WOSB submitted SBIR/STTR Phase I applications, only data for the period 2013-2018 were available. Although one can conclude that 16,933 applications were submitted by WOSB, the aggregated data available through the SBIR/STTR Annual Reports do not allow one to identify how many unique WOSB submitted those proposals. There is not a one-to-one correspondence between the number of applications submitted and the number of WOSB that submit them.

Using award-level administrative data submitted by agencies to SBA, we saw there were 3,454 awards made to WOSB between 2011-2018. When the data are de-duplicated at the company level, it reveals that these proposals were submitted by 1,113 WOSB during this period across the various agency SBIR programs. Data presented at the agency level indicate that the largest absolute number of WOSB work with DoD, HHS, and NSF.

Data for SBIR/STTR Phase II applications submitted by WOSB are only available in aggregate through the SBIR/STTR Annual Reports for 2013 – 2018. They generally show similar percentages of WOSB submitting Phase II proposals as submitted Phase I proposals (11 – 15%) with the percentage of WOSB Phase II awards at or slightly below the proportion submitted. However, this proxy of selection rate in a given year does not directly measure the transition of specific Phase I awards to Phase II. Preliminary analysis was conducted for every agency by year to examine the transition of Phase I awards to Phase II by tracing individual Phase I awards made to WOSB over the following 2-3 years to determine if they received a Phase II award. Preliminary results appear to indicate that the transition of specific awards from Phase I to Phase II occurs at a lower frequency than selection rate provided in the Annual Reports. This is recommended as an area for further examination.

This report provides an important benchmark on the participation of women as business owners and PI in the SBIR/STTR programs during the period 2011-2018 and lays the foundation for future research, as well as improvements in data collection. Agency level information regarding the number of Phase I awards made to WOSB is included in Appendix A. Given that each Agency implements its SBIR/STTR program in a manner consistent with its culture, it is likely that some variations among agencies are accounted for by agency level information. The following differences are discussed in brief, as they relate to differences in agency programs.

2.5.1 Agency variables that may affect women's participation in SBIR/STTR Phase I programs

The overview of the SBIR/STTR programs in the Introduction lays the foundation for considering what agency variables may account for some of the results presented. Potential variables to consider include the mission of the agency, if it is a contracting or granting agency, the size of the SBIR/STTR awards, the number of solicitations released by each agency, the number of proposals one can submit in response to a solicitation, the industry that agency draws upon, the size of the agency staff and the quality of the data provided to SBA. Although agency variables are not the only factors to consider,

Agency variables include: whether awards are contracts or grants; size of awards; number of solicitations released; primary industry funded; size of agency staff.

it provides a starting point for a discussion of the findings. The discussed factors are speculative and identify potential areas to explore for further research.

The following were mentioned as noteworthy in the results section and possible explanations are discussed in brief, as they relate to differences in agency programs.

The agencies that received the highest proportion of Phase I applications from WOSB between 2013 and 2018 were the Department of Homeland Security, the Department of Transportation and the Department of Education.

A smaller data set was used for this analysis (2013-2018) as data on applications by gender were not available in a reliable form for FY2011 and FY2012. One shared feature of these agencies is that they all happen to be contracting organizations. Contracting organizations tend to publish specific topics with clear problem statements, deliverables and performance expectations. For some applicants this may make the proposal application process easier. Applicants may also feel a greater incentive to self-identify as WOSB for contracting organizations, because for non-SBIR types of contracts issued by that agency, there are set-asides through the WOSB Federal contracting program. In addition, this may help support the transition to SBIR Phase III with agencies that may become a customer. For ED, the field of education has traditionally had greater participation by women and thus, industry dynamics may be the primary driver. The high WOSB percentage for the Department of Education is likely driven by the high proportion of women in the field of education and receiving education-related college degrees.

Of agencies with both SBIR and STTR programs, the National Science Foundation had the highest percentage of WOSB Phase I SBIR/STTR awards overall, and saw an increasing trend from 2011 to 2018.

NSF supports research across all fields of science and engineering, with a researcher-driven culture, including through their SBIR/STTR programs. During the past several years the **NSF SBIR/STTR program has consciously shifted its focus to startups and first-time applicants.** To provide greater user-friendliness for new companies, NSF made a number of changes to de-emphasize grantsmanship in the review process and remove administrative barriers that lead to applications being rejected for technical issues. NSF has also limited the number of proposals that a company may submit to one per cycle. More than 50% of NSF Phase I SBIR and STTR awardees have been in business for less than 5 years. From 2014 to 2019, women-owned businesses in general grew 21%, with an annual growth rate of more than double all businesses. Focusing on startups may capture the national increase in women-owned businesses. Examining award rates to new companies and first-time winners across the agencies is a potential area for future research.

The Department of Energy increased the portion of Phase I awards to WOSBs during this period from 3.5% in 2011 to 10.5% in 2018.

While a number of factors may have influenced the change in the number of awards DOE made to WOSBs during this time period, the agency was intentional in creating programs to increase the participation of diverse entrepreneurs. **In 2015 DOE initiated a Phase 0 program to assist WOSB; social and economically disadvantaged entrepreneurs and those living in underserved states to prepare and submit SBIR/STTR proposals to DOE.** To be eligible for the mentoring services provided, registrants must have never prepared and submitted a proposal to DOE in the past and have a relevant technical background. This criterion required outreach to new populations; active outreach campaigns were initiated. Since the program began in 2015, over 600 companies have received Phase 0 assistance from the targeted populations and submitted Phase I

applications to DOE. The win rate for new applicants from the targeted populations is equivalent to the win rate for experienced applicants.[28]

WOSBs were 13.3% of SBIR and 12.9% of STTR Phase I awardee firms between 2011 and 2018.

The profile of new awardees to the SBIR/STTR program is a topic of great interest. However, **it is important to differentiate between an applicant who is truly new to the SBIR/STTR programs as opposed to a company that is new to working with a particular agency.** It is not uncommon for a company to begin its SBIR/STTR experience working with one agency and after a few years, begin to work with another agency as well. For this reason, an analysis was conducted in which all duplicate records were removed – so that one could simply count the number of companies that participated between 2011 and 2018. **The results indicate that during this period 1,113 unique WOSB won SBIR Phase I awards.**

3.0 Findings and Analysis: Industry Trends

> **What is the potential pool of women-owned small businesses that could apply to the SBIR/STTR programs?**

Top SBIR-funded Industries
- R&D in the Physical, Engineering, and Life Sciences
- R&D in Biotechnology
- Engineering Services
- Custom Computer Programming

To investigate this question, the top industry sectors funded through the SBIR/STTR programs were examined. We explored whether there were industry differences between WOSB SBIR awardees and non-WOSB SBIR awardees; and whether WOSBs participating in the SBIR/STTR programs were reflective of the state of women's business ownership in STEM-intensive, SBIR industries. We also looked at differences between the percentage of SBIR-funded WOSBs in the five largest agencies and the proportion of WOSBs in the general population for these agencies' most frequently occurring industries. This initial analysis focused on industry factors and does not account for other important variables, such as company size or year founded. Future research could be expanded to encompass more variables towards refining comparisons of the SBIR/STTR programs to data on general industry trends.

3.1 Methodology

The most commonly used surrogate for industry is the North American Industry Classification System (NAICS).[29] The System for Award Management (SAM)[30] requires that all registrants provide one or more NAICS codes, and every organization that works with the federal government must register with SAM. SBA has a database called Dynamic Small Business Search (DSBS) that imports and archives data from SAM.gov. To match SBIR.gov data to SAM datasets from SAM.gov and DSBS, the DUNS number was used as a company identifier. Merging datasets resulted in a composite dataset of SBIR/STTR awardee companies along with their NAICS codes.

The NAICS classification system ranges from more general industry categories to very specific industry niches. There are 20 two-digit NAICS codes, whereas there are over 1,000 six-digit codes. Hence, it was necessary to explore which level of granularity would

be appropriate for this study to achieve a high degree of accuracy, yet not too deep to miss the bigger picture. It was determined that both 4-digit and 6-digit levels were useful to describe STEM-intensive and the SBIR industries and that the 2-digit and 3-digit levels were too general. The 5-digit was found to be very similar to both 4- and 6-digit.

To compare the participation of women in the SBIR/STTR programs to the current state of overall women-owned advanced technology firms it was necessary to find comparison studies that met the above criterion for NAICS granularity, women-ownership, and employment; as well as to define "advanced technology industry". Research by the U.S. Census Bureau and the Brookings Institution identifies NAICS industries with a high percentage of STEM occupations. The Brookings Institution published a list of 4-digit NAICS that are considered STEM-intensive. The Census has similarly published information pertaining to STEM-intensive industries. These STEM-intensive industry lists were cross-referenced with the SBIR-industry dataset towards understanding to what degree SBIR companies were in STEM-intensive industries.

We used the 2012 Survey of Business Owners (SBO)[31] which surveyed 1.15 million companies, to examine the overall state of women-ownership of advanced technology firms in the general population. The 2012 SBO includes 6-digit NAICS and also a parameter for majority-owned WOSB. For employment demographics, the 2012 SBO included ranges for the number of employees. The 2012 SBO also included: (1) the total number of firms; (2) the number of firms with paid employees; and (3) the number of firms without paid employees. The 2017 Annual Business Survey (ABS) data were published in May 2020 after analysis using 2012 SBO data was completed. We compared the 2012 SBO data with 2017 ABS data for the top 20 SBIR industries to note if there were changes in WOSB representation in SBIR industries. **The top five largest industries showed minimal changes in WOSB representation between 2012 and 2017, with the largest difference being an increase of 1.9% from 2012 to 2017 in Engineering Services (NAICS 541330)**.

3.1.1 Identifying STEM-Intensive Industries

Prior work by several organizations have categorized specific NAICS codes as STEM or non-STEM.[32] These analyses used various measures including, but not limited to (1) STEM employment, (2) R&D intensity, and (3) high-tech products. Studies that classify STEM industries differ in several dimensions, as well as thresholds used.

Despite different methodologies, these studies have considerable overlap. For example, a 2016 Census Bureau study classified STEM-intensive industries as those industries "that had a share that was two and a half times the national average (industries in which at least 14.5 percent of jobs were in STEM occupations) as high-tech industries." This resulted in the inclusion of 33 4-digit NAICS codes (out of a total of 311 4-digit NAICS codes, or about 11%). Another study released by the Brookings Institution in 2013[33] used occupations via the O*NET database and R&D intensity to define STEM-intensive industries. "Occupations were deemed STEM-intensive, or to require a high degree of STEM knowledge, if they scored at least 1.5 standard deviations above the mean in one or more of the core STEM fields." Brookings identified 50 4-digit NAICS codes as STEM-intensive.

This study defines STEM-intensive industries as the 22, 4-digit NAICS codes identified as STEM-intensive industries by both the Census Bureau and Brookings Institution studies. These studies overlapped for the most STEM-intensive sectors but were in less agreement for industries with lower STEM concentration.

3.1.2 Identifying SBIR Industries

We were able to identify a primary NAICS code for a total of 6,731 unique small businesses that received SBIR/STTR funding between 2011 and 2018 by merging SBIR.gov data with SAM.gov information using a company's DUNS number as the unique identifier.

SBIR awards are primarily in the Professional, Scientific, and Technical Services (NAICS 54), Information (NAICS 51), and Manufacturing (NAICS 32, 33) industries.

Companies with SBIR awards from 2011 to 2018 were found to be primarily within the 54 (Professional, Scientific, and Technical Services), 51 (Information), and 32 and 33 (Manufacturing) two-digit NAICS industries. However, several 2-digit and even 4-digit NAICS codes include both STEM and non-STEM industries. For example, NAICS code 5413 (Architectural, Engineering, and Related Services) includes the non-STEM-intensive industry Landscape Architectural Services (541320) in addition to the STEM-intensive industry Engineering Services (541330), and NAICS code 5416 (Management, Scientific, and Technical Consulting Services) includes Human Resources Consulting Services (541612) and Marketing Consulting Services (541613). A number of the non-STEM-intensive industries included at the 4-digit NAICS level tend to have greater women ownership than the SBIR industries at the 6-digit NAICS level, so using only 4-digit NAICS as a comparison may be misleading about the potential pool of SBIR-eligible WOSBs. Thus, **we use 6-digit NAICS codes to provide a more accurate comparison of women-ownership metrics**.

3.2 Women-Owned Small Business in STEM-Intensive Industries

The SBIR/STTR programs are strongly aligned with STEM employment, R&D intensity, and high-tech products as these programs provide R&D funding for small businesses engaged in these activities. Theoretically then, one could consider all SBIR/STTR projects as STEM-intensive. Empirical analysis using NAICS of industries associated with SBIR/STTR-funded companies appears to bear this out. The most frequently occurring industries identified by SBIR/STTR awardees in their SAM registration have a high degree of overlap with STEM-intensive industries. **SBIR industries are primarily a narrower subset of STEM-intensive industries**, though not all SBIR industries fell within these STEM industry lists. For example, 541990 (All Other Professional, Scientific, and Technical Services) is well-represented in SBIR awardees but is not identified as a STEM-intensive industry, as the 4-digit NAICS used (5419) includes services that are likely not provided through SBIR awardees, such as consumer credit counseling services, handwriting analysis, and mediation product services.

Does the percent of WOSB participating in the SBIR/STTR programs reflect the current state of women business ownership in advanced technology firms?

Women-ownership in the SBIR/STTR programs was compared to women-ownership results from the 2012 SBO for STEM-intensive industries, as well as the industries associated specifically with SBIR/STTR awardees. In Section 2 of this report, the **overall percentage of unique WOSBs winning SBIR awards between 2011–2018 was found to be 13.3%. In comparison, data from the SBO shows the overall women-ownership for businesses with paid employees in SBIR industries was 15.0%.** Table 9 also shows that companies in SBIR industries make up only 3% of all firms with paid employees.

Table 9: Firms in STEM and SBIR Industries using data from the 2012 Survey of Business Owners

	All Industries	STEM Industries (4-Digit)	SBIR Industries (6-Digit)
Firms with Paid Employees	5,424,458	420,363	177,934
Percent of All Firms	100%	8%	3%
# WOSB Businesses	1,035,655	73,088	26,137
% WOSB	19%	17%	15%

The most frequently occurring NAICS codes for WOSBs and non-WOSBs participating in the SBIR/STTR programs are similar (Table 10). The most prevalent NAICS across SBIR/STTR awardees is 541715 R&D in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology). This is not surprising inasmuch as the SBIR/STTR programs are intended to fund research and development. In addition, some agencies have historically specified this NAICS code as a requirement in their solicitation. A review of current SBIR solicitations indicates that NASA and DOT specify that eligible companies are in NAICS 541715.

Table 10: Top Industries for WOSB vs. non-WOSB SBIR awardees

WOSB SBIR Awardees		Non-WOSB SBIR Awardees
541715 R&D in the Physical, Engineering, and Life Sciences	1	541715 R&D in the Physical, Engineering, and Life Sciences
541714 R&D in Biotechnology	2	541714 R&D in Biotechnology
541330 Engineering Services	3	541330 Engineering Services
541511 Custom Computer Programming	4	541511 Custom Computer Programming
541720 R&D in the Social Sciences	5	511210 Software Publishers

Though the top four industries were the same for WOSB and non-WOSB SBIR awardees, examining the top 10 industries with the highest number of SBIR-funded WOSBs compared to non-WOSBs reveals a difference in the prevalence of WOSBs in manufacturing-related industries.

Unique Industries for WOSBs in SBIR
- R&D in the Social Sciences
- Educational Support
- Computer Systems Design

Unique Industries for non-WOSBs in SBIR
- Analytical Laboratory Instrument Manufacturing
- Semiconductor Manufacturing
- Surgical and Medical Equipment Manufacturing

Examining the difference (Table 11, Delta) between the prevalence of WOSBs in a particular industry in the general business environment (% SBO WOSB) to the prevalence of WOSBs in that industry among the SBIR/STTR awardees (% SBIR WOSB) reveals how well the SBIR/STTR programs reflect the state of women's business ownership in advanced technology firms. There appears to be **over-representation of WOSBs funded by SBIR/STTR for R&D in the Social Sciences and Humanities (NAICS 541720), but an under-representation of SBIR/STTR awardees for WOSBs in R&D in Biotechnology (NAICS 541714).**

Table 11: Most Frequently Cited NAICS by Women-Owned SBIR-funded Companies Compared to SBO

NAICS	Description	# SBIR Companies	# SBIR WOSB	# SBIR non-WOSB	% SBIR WOSB	% SBO WOSB	Delta
541715	R&D in the Physical, Engineering, and Life Sciences	1954	243	1711	12%	18%	-6%
541714	R&D in Biotechnology	982	116	866	12%	20%	-8%
541330	Engineering Services	566	104	462	18%	10%	8%
541511	Custom Computer Programming Services	302	41	261	14%	15%	-1%
541720	R&D in the Social Sciences and Humanities	71	33	38	46%	37%	11%
511210	Software Publishers	215	32	183	15%	10%	5%
541690	Other Scientific and Technical Consulting	108	19	89	18%	20%	-2%
541512	Computer Systems Design	101	19	82	19%	16%	3%
611710	Educational Support	41	18	23	44%	47%	-3%
334510	Electromedical Apparatus Manufacturing	102	15	87	15%	10%	5%
334413	Semiconductor Manufacturing	138	14	124	10%	11%	-1%
541713	R&D in Nanotechnology	97	12	85	12%	n/a	n/a
333314	Optical Instrument and Lens Manufacturing	83	10	73	12%	17%	-5%
541990	Other Professional, Scientific, Technical	59	10	49	17%	24%	-7%
334516	Analytical Laboratory Instrument Manufacturing	144	7	137	5%	14%	-9%
325412	Pharmaceutical Preparation Manufacturing	69	7	62	10%	17%	-7%
339112	Surgical and Medical Instrument Manufacturing	96	6	90	6%	13%	-7%
334220	Communications Equipment Manufacturing	42	6	36	14%	9%	5%
334511	Search, Detection, Navigation, Instrument Manufacturing	66	5	61	8%	9%	-1%
334419	Other Electronic Component Manufacturing	38	5	33	13%	13%	0%

Note: NAICS code 541713 R&D in Nanotechnology was created in 2017, so 2012 SBO does not have data.

NAICS code 541715 R&D in the Physical, Engineering, and Life Sciences (except Biotechnology and Nanotechnology) was created in 2017; 2012 SBO uses NAICS code 541712. NAICS code 541714 R&D in Biotechnology was created in 2017; 2012 SBO uses NAICS code 541711.

3.3 SBIR Agency-Specific Industries

Table 12 shows data for the five largest agencies by their most frequently occurring NAICS codes. This data is based on companies that had awards from a single agency. Also, subsets are shown for when the sample size of companies was thirty or greater. Looking at the difference (Delta) between % SBIR WOSB and % SBO WOSB highlights certain industries at agencies that have WOSB over-representation in SBIR/STTR compared to the general business population, such as Software Publishers (NAICS 511210) at NSF or Engineering Services (NAICS 541330) at DoD, as well as industries that appear to have WOSB under-representation in SBIR/STTR, such as Analytical Laboratory Instrument Manufacturing (NAICS 334516) at NIH.

Table 12: Differences Between Presence of WOSBs as SBIR Awardees in Agency-Specific Industries and Prevalence of WOSBs in These Industries as Identified in 2012 SBO

Agency	NAICS	Description	# SBIR Companies	# SBIR WOSB	% SBIR WOSB	% SBO WOSB	Delta
DoD	All		1615	225	14%	15%	-1%
	541715	R&D in the Physical, Engineering, and Life Sciences	563	82	15%	18%	-3%
	541330	Engineering Services	299	60	20%	10%	10%
	541511	Custom Computer Programming	100	14	14%	15%	-1%
	511210	Software Publishers	39	3	8%	10%	-2%
	541512	Computer Systems Design	36	9	25%	16%	9%
HHS	All		1786	212	12%	15%	-3%
	541714	R&D in Biotechnology	701	78	11%	20%	-9%
	541715	R&D in the Physical, Engineering, and Life Sciences	262	23	9%	18%	-9%
	541511	Custom Computer Programming	62	6	10%	15%	-5%
	334516	Analytical Laboratory Instrument Manufacturing	59	4	7%	14%	-7%
	334510	Electromedical Apparatus	59	4	7%	10%	-3%
NSF	All		785	153	19%	15%	4%
	541715	R&D in the Physical, Engineering, and Life Sciences	138	26	19%	18%	1%
	511210	Software Publishers	63	17	27%	10%	17%
	541714	R&D in Biotechnology	62	18	29%	20%	9%
	541511	Custom Computer Programming	60	10	17%	15%	2%
	541330	Engineering Services	39	8	21%	10%	11%
NASA	All		209	30	14%	15%	-1%
	541715	R&D in the Physical, Engineering, and Life Sciences	108	11	10%	18%	-8%
DOE	All		281	22	8%	15%	-7%
	541715	R&D in the Physical, Engineering, and Life Sciences	73	10	14%	18%	-4%

3.4 Discussion

Differences in the presence of WOSBs in STEM-intensive industries are a likely factor in the participation of women in the SBIR/STTR programs. A recent report from the SBA Office of Advocacy[34] highlights that women in general are more likely to start businesses in low growth (firms and employment decreasing) rather than high growth (firms and employment increasing) industries, expanding on previous research of industry-based gender differences among business owners. Though SBIR industries are a small subset (3%) of all industries and the primary industries funded by SBIR are the same for WOSBs and non-WOSBs, there are some industry differences between women-owned and non-women-owned SBIR awardees that appear to follow historically gendered industries. WOSB SBIR awardees are more likely to perform R&D in the Social Sciences or be funded for Educational Support, whereas non-WOSB SBIR awardees are more likely to be involved in Manufacturing industries. The top industries were determined based on the number of SBIR-funded businesses. Examining industries that have the highest proportion of WOSBs highlights Engineering Services (NAICS 541330), where there is a higher proportion of WOSBs among SBIR/STTR awardees than in the general small business population (Table 11, Delta = 8%), and R&D in Biotechnology (NAICS 541714), where there is a lower proportion of WOSBs among SBIR/STTR awardees than in the general small business population (Delta = -8%). An area for further examination is whether the choice of industry and research topics contributes to the lower participation of women in the SBIR/STTR programs. Previous

research has indicated that research topic choice contributes to racial disparities in award rates for academic research awards at NIH.

For agencies that fund companies in a variety of different industries, it may be interesting to analyze the contribution of these different industries to the overall portfolio of WOSBs. It may also be of use to identify where some agencies appear to have greater WOSB participation among their SBIR awardees than exists in the general population. Agencies that fund companies in the same industry but with under-representation of WOSBs may wish to identify promising practices from the agencies with over-representation.

4.0 Promising Practices: Agency Outreach & Initiatives

Only 1,113 unique WOSB received Phase I SBIR awards between 2011-2018. This is 1.5% of STEM-intensive WOSBs.

The percentage of WOSB SBIR awardees (13.3%) is slightly lower, but within range of the percentage of WOSB in SBIR-industries based on NAICS (15.0%). These percentages translate to 26,137 WOSB in SBIR-industries or 73,088 WOSB in STEM-intensive industries in 2012 (Table 9). Although it is not possible to determine how many unique WOSB actually submitted Phase I applications, only 1,113 unique WOSBs received Phase I SBIR awards during the period studied, which is 4.3% of SBIR industry specific WOSBs or 1.5% of STEM-intensive WOSBs. What does this reveal about the potential pool of WOSBs that could participate in the SBIR/STTR programs? How are SBIR participating agencies engaging new women-owned small business in the SBIR/STTR programs?

One reason for analyzing SBIR/STTR participation data in the time period from 2011–2018 was that it encompasses a period of major policy and programmatic changes to the SBIR/STTR programs that occurred with the SBIR/STTR Reauthorization Act of 2011. This included an Administrative Funding Pilot Program that provided agencies with the ability to dedicate funding to outreach activities and other initiatives to increase the participation of women and socially or economically disadvantaged individuals. Conference participation and targeted technical assistance programs were typically supported through the use of the agency Administrative Funding Pilot Program funds.

The Administrative Funding Pilot Program provides agencies with funding for outreach initiatives to increase participation of women and socially or economically disadvantaged individuals.

4.1 Methodology

In March 2020, phone interviews were conducted with program managers from 14 funding agencies to discuss the outreach methods they use to promote the SBIR/ STTR programs (see interview guide in Appendix C). Program managers from Air Force, Army, Navy, NIST, and NOAA were interviewed as distinct programs, rather than at the Department-level. The questions asked were initially broad in order to learn about the methods most commonly used – irrespective of target group. The next series of questions focused on metrics for determining if the outreach methods used were effective. See Appendix D for the specific questions posed.

SBA Annual Reports to Congress on the SBIR/STTR programs contain information submitted by agencies on specific efforts to increase outreach and awards to WOSBs and socially and economically disadvantaged small businesses. Certain initiatives reported by agencies are included to highlight unique programs or programs agencies identified as impactful.

4.2 Common Practices for Engaging Entrepreneurs

Program managers from all agencies identified attending conferences as a primary means of outreach. While in attendance, agency personnel made every effort to leverage their time by participating in panels, participating in one-on-one meetings, networking at their booth and distributing literature. The smaller SBIR programs with limited staff and budgets took advantage of events arranged by SBA – specifically the SBIR Road Tour and the National SBIR Conferences.

> A key focus of the SBIR Road Tour is to engage with entrepreneurs who are underrepresented in the program. Program managers from across the agencies travel to various parts of the country to participate.

The SBIR Road Tour brings program managers from across SBIR funding agencies, as well as other innovation-focused agency partners such as USPTO, to various parts of the country to participate in a series of one-day events in a region over the period of four or five days. The four SBIR Road Tours held annually in late spring and summer leverage relationships with state service providers. A key focus of the SBIR Road Tour is to engage with entrepreneurs who are underrepresented in the program, including with women, socially and economically disadvantaged individuals, and entrepreneurs living in rural areas and other underrepresented geographies. In addition, the National SBIR Conference held in partnership with TechConnect, provides another opportunity for the agencies to meet with small business representatives. In 2016, SBA partnered with MIT to host the New England Regional Innovation Summit that included a pre-conference focused on Women in STEM and dedicated meetings between female researchers and SBIR agency program managers.

Other common outreach practices include the use of email listservs, social media, educational webinars, and producing success stories.

About half the program managers mentioned that their metric for success was an increase in the number of proposals received. Program managers acknowledged challenges identifying appropriate metrics, or concerns with not being allowed to collect demographic information from outreach events that would allow them to evaluate more direct impacts of attending events. Various information technology tools, such as Google Analytics, are used to track digital marketing efforts such as social media campaigns, or sign-ups for an agency listserv, though these were not gender specific.

4.2.1 Partnerships

Many agencies target their outreach by attending conferences focused on specific populations, such as women in science conferences, or developing partnerships with professional organizations and associations that serve diverse populations. **While most agency SBIR programs collaborate across their agency's technical divisions, few agencies discussed explicit collaboration with their agency's diversity, equity, and inclusion programs, which are typically focused on either STEM education efforts or small business procurement for non-R&D focused products and services.**

Many agencies engage with universities and a number include specific efforts to work with Minority Serving Institutions (MSIs) and Historically Black Colleges and Universities (HBCUs). For example, NASA has led an HBCU Road Tour which other agencies have joined, and the SBA has signed a Strategic Alliance Memorandum with the MSI STEM Research & Development Consortium (MSRDC) to enhance the flow of information about the SBIR/STTR programs to MSIs.

NOAA described productive partnerships with economic development agencies where the agency has a high concentration of research labs. The NOAA SBIR program is managed by their Technology Partnerships Office, which also has responsibility for technology transfer from the agency's research labs. Through an Intellectual Property (IP) Road Tour, they provide training about IP and the SBIR program to their labs and partnering academic institutions.

The ED program manager has built up relationships with a variety of educational technology-relevant associations and regularly interacts with networks of accelerators and incubators that support education technology developers. The program convenes the ED Games Expo each year at the Kennedy Center, which showcases the SBIR programs at ED, NSF, NIH, USDA, and others, as a form of outreach to the developer community. The ED Games Expo has featured panels of female edtech developers, and programming to educate students about entrepreneurial pathways.

4.3 Unique Agency Initiatives

4.3.1 Targeted Outreach and Communications

A promising practice from a few agencies is hiring full-time or dedicated communications staff to target outreach and communications. NSF hired a full-time communications lead in 2016, and prioritized outreach, with program directors attending more than 100 events each year, selecting events based on the audience. They aim to demonstrate that they "value diversity in everything that we do: in our panels, in our videos and on our website" including creating videos that highlight NSF-funded diverse and female entrepreneurs. DHS started a Facebook Live series on "Deconstructing SBIR" that also emphasizes WOSBs and promoting women in the SBIR program.

NIH launched the #DiversifySBIR social media campaign to highlight women and minorities in leadership at their agency, and the importance of diversity in the scientific workforce. NSF uses digital marketing strategies as well to promote funding opportunities for startups and small businesses on social media, (Twitter, LinkedIn, Reddit) and banner advertisements on websites such as TechCrunch, WIRED, and Fast Company. They have also co-written paid pieces in TechCrunch and Fast Company with a focus on NSF-funded companies that have had broad impact.

A few agencies financially sponsor existing events to ensure that the event partners promote their attendance and message to their audiences before the event and after the event. At their own conferences, HHS and NSF have also featured dedicated sessions encouraging women and minority SBIR/STTR applicants to participate, and dedicated networking sessions for female innovators and entrepreneurs.

4.3.2 Technical Assistance

In 2015 DOE initiated a Phase 0 program to assist WOSBs, social and economically disadvantaged entrepreneurs and those living in under-served states to prepare and submit SBIR/STTR proposals to DOE. To be eligible for the mentoring services provided, registrants must have never prepared and submitted a proposal to DOE in the past and have a relevant technical background. This criterion required outreach to new populations; active outreach campaigns were initiated. Since the program began in 2015, over 700 companies have received Phase 0 assistance from the targeted populations and submitted Phase I applications to DOE. **The win rate for new applicants from the targeted populations is equivalent to the win rate for experienced applicants.** In 2018 the DOE SBIR/STTR Programs office established a partnership with the Institute for Women's Policy Research (IWPR), which featured the DOE Phase 0 program in an IWPR July 24, 2018 report titled "Closing the Gender Gap in Patenting, Innovation, and Commercialization: Programs Promoting Equity and Inclusion."[35]

In 2018, **NIH piloted an Applicant Assistance Program** to help new or previously unawarded small businesses with direct support in developing an SBIR/STTR application, with a particular focus on companies owned or operated by individuals underrepresented in the biomedical sciences, including women.

USDA has supported Train-the-Trainer programs to train USDA extension staff on the USDA SBIR program to ensure that USDA extension staff are able to assist small businesses in the development of applications to the SBIR program.

Unique Agency Initiatives
- HBCU Road Tour-NASA
- Intellectual Property Road Tour-NOAA
- ED Games Expo-ED
- Deconstructing SBIR-DHS
- Phase 0 SBIR/STTR Assistance-DOE
- #Diversify SBIR-NIH
- Train-the-Trainer-USDA

4.3.3 Supporting Future Entrepreneurs

NSF and NIH each have programs that encourage SBIR/STTR awardees to hire and train students or postdoctoral scholars from underrepresented groups. NSF partners with the American Society of Engineering Education to manage the Innovative Postdoctoral Entrepreneurial Research Fellowship Program. This program provides financial support to underserved doctoral degree holders to do postdoctoral research and acquire entrepreneurial research experience at an active NSF SBIR/STTR Phase II grantee company. NIH released an SBIR/STTR-specific diversity supplement (PA-18-837) to provide additional funding to awardee companies to provide support and entrepreneurial experiences for individuals at the undergraduate through faculty level from underrepresented groups.

Through their Advancing Women And underRepresented Entrepreneurs (AWARE) awards, NSF has also supported academic institution training and mentorship efforts to enhance success for women- and minority-owned businesses.

The NIH supports a national network of proof-of-concept centers to support mentoring, training, and product development assistance to academic innovators to translate biomedical research into public benefit. **The STTR-funded Research Evaluation and Commercialization Hubs (REACH) partner academic institutions with regional life science and economic development organizations, providing entrepreneurship education and project management support, with the requirement that they provide access to their services to women and individuals from underrepresented groups in innovation, technology translation, and entrepreneurship, and include students and post-doctoral trainees**.

4.3.4 Policies and Program Structure

As described in Section 2, NSF has made a concerted effort to design their program for startups and first-time applicants. This includes removing administrative landmines that would lead to rejecting proposals for simple omissions or administrative issues and de-emphasizing grantsmanship in the review process. **In 2019, NSF introduced a short Project Pitch to enable entrepreneurs and startups to more easily submit their idea to NSF.** Startups or entrepreneurs who submit a three-page Project Pitch will know within three weeks if they meet the program's objectives to support innovative technologies that show promise of commercial and/or societal impact and involve a level of technical risk. They will also get additional guidance and feedback from NSF staff. If the Project Pitch is a good fit for the program, they will receive an official invitation from NSF to submit a full proposal. If they are not invited to submit, they are told why their project is not appropriate for the program. NSF also now accepts proposals at any time, with four submission windows when applications undergo panel and merit reviews.

Air Force has also moved toward a program structure that aims to reduce barriers to application and award. In 2019, they began doing Pitch Day events that award contracts "on the spot." Both Air Force and Navy have created contracting Centers of Excellence (CoE) with dedicated SBIR contracting personnel to reduce the amount of time to issue awards to companies. Navy also began a Technology Acceleration Pilot that cuts proposal requirements by 75% and uses new contracting tools to make awards within 30 days.

NIST is the only agency that identified that they consider participation by women and socially and economically disadvantaged small businesses or small businesses from Historically Under-utilized Business Zones (HUBZones) or underserved states in the selection factors for SBIR award selection.

4.3.5 Other agency comments

A number of comments were made during the interviews that shed additional light on how the agencies approach outreach. A couple agencies mentioned that they are prohibited from collecting demographic information about attendees at events because of the

Paperwork Reduction Act. Others commented that SBA guidelines prohibited them from providing services specifically to women and socially and economically disadvantaged individuals as it was considered discriminatory. Others commented that the 51% ownership rule for women-owned small businesses masks 50-50 splits in ownership. With respect to the classification as WOSB there were also a number of comments about false positives and false negatives – that is, companies that are listed as WOSB, which are not and those that are WOSB but don't position themselves in this fashion.

AIDA MODEL

A
Awareness

I
Interest

D
Desire

A
Action
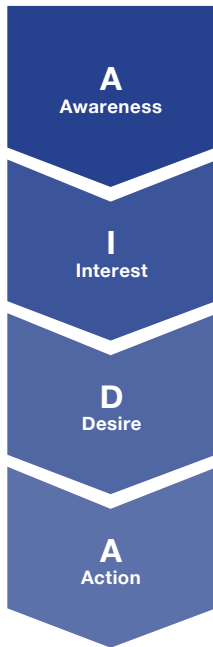
4.4 Discussion

In 2014, the SBIR/STTR Interagency Policy Committee produced a report to Congress on Outreach that issued four key recommendations: 1) unify the outreach effort across the SBIR/STTR programs for cost effectiveness; 2) implement new methods of communication and outreach tools using state, regional and local agencies and trade groups; 3) develop a new series of narratives around the programs highlighting its impact to these communities and its correlation around economic development and prosperity; and 4) monitor the outreach efforts and compare to program participation by socially disadvantaged small businesses and small businesses located in underserved communities. The Committee also released a report on a Standard Evaluation Framework that included proposed metrics to assess Outreach, including measuring new applicants, first-time award winners, cost of outreach per number of applicants or increases in numbers of applicants, and identifying how new applicants learn about the SBIR/STTR programs.

What should the metrics be for successful outreach? The most commonly cited outreach methods, used in combination as part of an overall communication strategy often include the following:

- Create an outreach list
- Target your audience with your message
- Include calls to action in your messaging
- Conferences and face-to-face meetings
- Listen – polls, surveys
- Use social media
- Referral programs
- Invite guest speakers from targeted group
- Local partnerships
- Community involvement
- Press releases
- Workshops and webinars
- Videos
- Radio, podcasts

As part of an outreach campaign, one typically begins with an objective, a strategy and metrics to determine if it has been successful. With most of the items listed above, data should not be difficult to collect, as long as agencies perceive they are allowed to collect these data and have the funding and staff to do it. Metrics typically include the number of people from the target population that participate either in person or digitally (using various analytics). It should be noted that the outreach methods described by program managers did not appear to start with attention to creating a targeted outreach list for women entrepreneurs.

A typical outreach objective is to increase awareness of a service, product, or program. However, awareness is but one step on the path to action. The AIDA model (A for awareness, I for interest, D for Desire, and A for action) draws attention to this fact.[36] According to this frequently used model, one must pass through all of these stages to take the desired action. What should the desired action be? Should it be, as some suggest, to submit a proposal or should it be to seek assistance in writing a proposal to submit? In considering this question, it is important to note that the SBIR/STTR proposal preparation process is complex and takes a significant amount of one's time.

5.0 Promising Practices: Support Organizations

Many programs have been developed to support prospective entrepreneurs, as well as existing small, advanced tech firms that seek assistance specifically with the SBIR/ STTR programs. These programs offer support in the form of mentoring and coaching. **The Small Business Administration, through the Office of Investment and Innovation (OII) administers two programs which provide such support: the Growth Accelerator Fund Competition (GAFC) and the Federal and State Technology Partnership (FAST) programs.** In this section of the report, the services provided by a sample of GAFC and FAST recipients are explored. The goal is to learn how they assist women entrepreneurs; how they conduct outreach and which outreach methods they have identified to be the most effective. Organizations selected to interview are recognized as having effective programs for women entrepreneurs. This section is not an evaluation of either GAFC or FAST, but merely a brief discussion of what they have learned working with women entrepreneurs in STEM.

5.1 Methodology

To collect data, information, and best practices on outreach to and engagement of women entrepreneurs in STEM, phone interviews were conducted with GAFC and FAST recipients identified by SBA using a standardized discussion guide (OMB Control No: 3245-0398; see discussion guide in Appendix D). Between March and April 2020, 22 phone interviews were conducted with a management representative from 10 GAFC and 12 FAST-funded organizations. If another person from the organization was responsible for outreach, they were also included in the interview. All interviews were conducted by a team of two people – one person responsible for conducting the interviews and the other for writing up the comments. Answers to all open-ended questions were then coded and provide the basis for the results presented in this section.

5.2 Growth Accelerator Fund Competition (GAFC)

SBA has conducted the Growth Accelerator Fund Competition since 2014. Through a competitive process, organizations are provided with a prize award of $50,000 often used to develop an initiative, usually focused on women, minority or underserved entrepreneurs.

The first years of the GAFC program included a wider variety of accelerator or accelerator-like programs, while the current competition fully focuses on organizations that can provide SBIR assistance to their clients or networks. In 2018, the Library of Congress conducted a study and released a report on the GAFC initiative stating that "most of the prize recipients offer cohort-based programs, demo days, and mentoring and networking services, but not all offer seed capital or take an equity interest in their startups."[37] The report starts with a review of the accelerator movement which started in the U.S. around 2005. The intent of accelerators continues to evolve.

"Accelerators provide fixed-term programs that last for fewer than 12 months; most last about three months. They provide mentorship and technical assistance that enable the 'fast-test' validation of ideas. Additionally, accelerators link entrepreneurs to business consultants and provide assistance in the preparation of pitches needed to obtain further investment. In the short term, the success rate of an accelerator can be measured against the acceptance rate of startups and the frequency with which they are acquired or otherwise exit the program."[38]

As part of this study, phone interviews were conducted with representatives from ten previous GAFC winners. The interviews were NOT focused on the GAFC award – but on their engagement with women entrepreneurs. Appendix D contains a brief description of each GAFC awardee interviewed. Most of these organizations offer their services for a fee while others provide free services to invited potential candidates who go through a selection process. Typical services include mentorship, commercialization assistance, pitch opportunity, resource sharing, and small amounts of angel seed investment.

5.2.1 Diversity of Women Entrepreneurs

Women entrepreneurs working in advanced technology fields vary in age, ethnicity and experience. According to data from NCSES, in 2015 women comprised 43% of the U.S. work force of scientists and engineers under 75 years of age. For those under 29 years old, women comprised 56% of the science and engineering workforce. Of interest was the extent to which the organizations interviewed tailored their outreach to the diversity of women entrepreneurs.

To what extent do you reach out to • College/University students/Postdocs • Early career women (outside of academic career) • Faculty women • Mid-to-late career women • Racially and ethnically diverse women • and Women with disabilities?

A five-point rating scale was used by respondents to represent their programs' emphasis on each group. A rating of one (1) indicates little emphasis while five (5) indicates a great deal of emphasis. Within each group there was a wide diversity of responses. However, the only categories that received answers indicating no emphasis were "women faculty" and "women with disabilities."
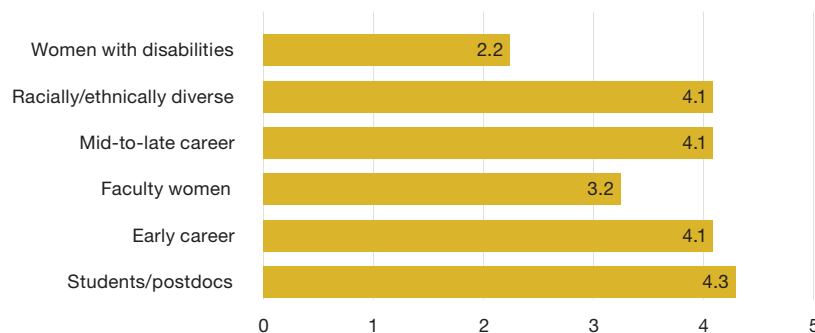
Figure 13: GAFC interviews: Outreach emphasis on diversity of women entrepreneurs

5.2.2 Outreach Methods

What outreach methods does your organization use to promote the services that you provide?

Most organizations indicated that the primary purpose of outreach was to increase the number of applicants or clients to help them grow or start their business. Others commented that the objective was to increase the diversity of entrepreneurs in their start up ecosystem and to build awareness of opportunities. When asked what outreach methods they used, top of mind was "social media." What was unique about this discussion was the emphasis on diversity at multiple levels both within their marketing strategies and within their organization. When putting together seminars and events these organizations went out of their way to ensure that women were active in leading the conversations, that they represented their community as a whole. When developing marketing materials, they wanted to ensure that women saw themselves in the materials. They showcased the success of women entrepreneurs, the companies in which they invested and frequently partnered with other organizations to expand their diversity.
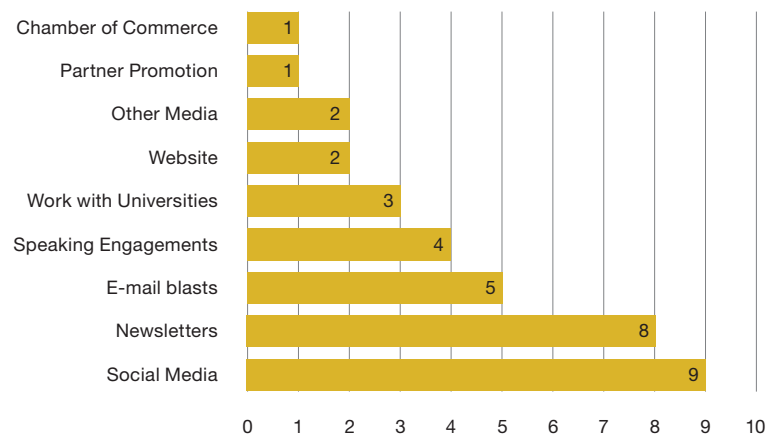
Figure 14: Outreach methods used by GAFC interviewees

Although social media was the most frequently mentioned outreach method, the most effective methods identified were more personal in nature and included email, referrals (word of mouth) and personal interaction. The methods used at the local level by GAFC awardees included working with network partners, participating in community events, and engaging women champions at the local level.

"We recognize that there are short, intermediate and long term metrics to gauge the effectiveness of our outreach. Efforts may not turn into solidified partnerships right away … sometimes this takes a lot of time. However, we have a detailed database that allows us to track when we initially met with a particular person, dates for subsequent touch points, and follow-up notes. We track entrepreneurs over time. In the short term, we may look at who signed up for a newsletter, who reached out to us for consulting, who submitted an application, and who looked at an article that we have written. However, we can track longer term engagement. Assessment of the effectiveness of outreach needs to be built with intentionality right from the start."

5.2.3 Barriers Women Entrepreneurs Face

The organizations interviewed all placed a special emphasis on women entrepreneurs. Some programs, such as the Association for Women in Science (AWIS) accelerator program were exclusively focused on women; while others included this as one group of interest, among many. Given the focus on women in STEM entrepreneurship, we asked participants to share their perceptions of the barriers that women entrepreneurs face. The most frequent response was funding. Other responses included childcare and the perception that women did not see themselves as entrepreneurs. The following excerpts from the phone interviews provide additional perspectives.

- "Adding something else to one's current workload when they already have so many competing responsibilities is a greater concern for women, than for men."
- "In pitch settings, the way a woman responds may be viewed differently."
- "There is a sense that a startup culture is male dominated."
- "An entrepreneurship relationship can be a challenge; that falls into 'fix the woman' which translates into 'please adopt male stereotype behaviors in terms of how you do this."

5.2.4 Promising Practices for Engaging Women Entrepreneurs

Also explored were promising practices for working with women entrepreneurs. The best practices mentioned included the following:

- Create a space that's flexible and holistic, and provide specific resources to help address hurdles as they arise.
- Bolster the strengths of women entrepreneurs, rather than focusing on what to change.
- Guarantee that women have a voice in the room.
- Promote diversity – showcase female led teams.
- Emphasize examples of women who have received equity financing or other competitive funding.
- Make it easy for women to find relevant mentors.

"Diversity and inclusivity are important to us at multiple levels. We have diversity on our Board and incorporate this as a priority when fostering partnerships, conducting outreach and working with entrepreneurs. We have fostered good angel investor and partner networks with women-led groups, ensuring a more concentrated effort to create connectivity with female investors, mentors and entrepreneurs. From a pipeline standpoint, we look to ensure that women get the message that they are welcome here. We ensure that there is a balance of genders in our programs."

5.3 Federal and State Technology (FAST) Partnership Program

The Federal and State Technology (FAST) Partnership Program is a competitive grant program, administered by SBA. As set forth in the Small Business Act (Rev.13), FAST awards build the SBIR/STTR ecosystem through:

1. **Outreach:** which increases the pipeline of possible applicants and builds the capacity of partner organizations and individuals to refer possible SBIR/STTR applicants through Train-the-Trainer activities.
2. **Technical assistance:** to support new business formation through programs or services that improve proposal development and team creation; provide assistance that leads to the commercialization of technology developed through SBIR/STTR program funding; and form or encourage relevant mentoring networks to provide business advice and counseling.
3. **Financial support:** make grants or loans to applicants to pay a portion or all the cost of developing SBIR/STTR proposals, attending relevant conferences, and bridging gaps between phases.

FAST awards are made to a broad array of organizations including state and local economic development agencies, Small Business Development Centers (SBDCs), accelerators, incubators, Women's Business Centers (WBCs), Procurement Technical Assistance Centers (PTACs), colleges, universities, and more. FAST places particular emphasis on helping women, socially/economically disadvantaged individuals, and applicants from underrepresented or rural areas compete in the SBIR and STTR programs. In awarding FAST grants, SBA gives special consideration to entities located in states that have historically lacked awards. It is noteworthy that only one entity may apply per state and must have a Governor's signature to do so.

Interviews were conducted with representatives from 12 FAST awardees known to have strengths in working with women entrepreneurs. Information on the organizations interviewed is in Appendix D and includes a list of the organizations included in this part of the study with a description of any special programs that they have that focus on women.

5.3.1 Diversity of Women Entrepreneurs

Like the GAFC respondents, FAST awardees emphasized the engagement of Students and PostDocs in their outreach. The next highest rated target groups were Faculty Women and Racially/Ethnically diverse clients. With GAFC, outreach to Faculty Women had been a lower priority. With FAST, groups receiving the least attention from an outreach perspective included early-career and mid-to-late career women, as well as women-with disabilities.
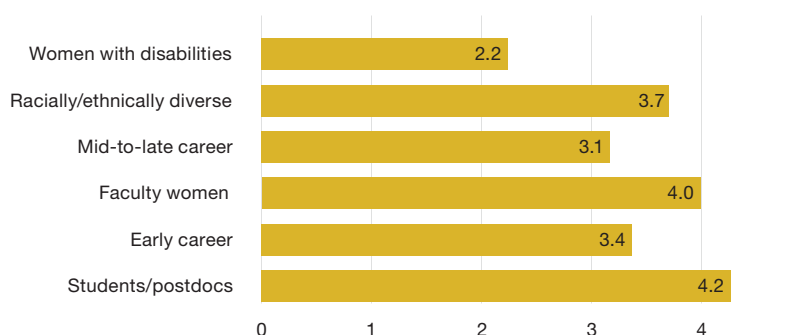
Figure 15: FAST interviews: Outreach emphasis on diversity of women entrepreneurs

5.3.2 Outreach Methods

With respect to outreach methods, the feedback from FAST awardees was very similar to that seen previously from GAFC with one exception: FAST awardees placed a much greater emphasis on strategic partnerships. The strategic partnerships also tended to be at the state level, rather than local including Small Business Development Centers (SBDC), Minority Business Offices, Cooperative Extension Services and economic development organizations.

- "We rely on partners working with economic development to reach rural populations."
- "We value relationship building and recognize the information exchange takes place through these relationships."
- "We use economic development organizations to disseminate marketing materials and partner on events."
- "We attend events to develop relationships with both the WOSB and the networking communities. We need those relationships and that trust to secure referrals."
- "We work closely with partners in parts of the state where we have less experience."

> "Strategic partnerships are very important. We have established partnerships in every part of the state – each of whom has their own networks. They are the trusted voice. We are building a Customer Relationship Management (CRM) database, a foundation for all of our communication and tracking. We have a contractor on our team that does a lot of the marketing for us including a weekly post on social media. We also work with a research librarian who is building a list of science instructors for us so that we can get the word out to their students. We also travel to rural areas to engage others who are less likely to hear about us."

The most effective outreach methods continued to be personal emails, one-on-one meetings, leveraging networks and attending conferences.

5.3.3 Barriers Women Entrepreneurs Face

As with GAFC, the primary barrier mentioned was a financial one. A number of the organizations talked about the importance of explaining that the SBIR/STTR programs provide non-dilutive funding. If companies are struggling with securing equity investment, and are working on an appropriate technology, SBIR can be a promising funding source. Lack of women investors was also called out as an issue. Other barriers identified were quite diverse:

- "For younger groups, grad students, post docs, and the like - the thought of taking research to a business feels daunting. If you have to engage with SBIR on your own, it is overwhelming. It's much less intimidating when you know you have a team to help you through the process. For many young researchers, the process is out of their wheelhouse and they don't have the business background to consider starting a business. When they discover that there are people out there that do have this knowledge and can help them, this breaks down that barrier."
- "It's still a male dominated field. If women are uncomfortable in this space, it's a barrier."
- "The founder was told that people within the industry, won't take his business seriously if he hires a woman into that position. She didn't have the look of a pharma CEO."
- "All have seasons to their life which makes starting a business more difficult. For example, having small children would appear to weigh more heavily on women."
- "Women look at a solicitation and if it doesn't perfectly fit their capabilities, they will not apply."

5.3.4 Promising Practices for Engaging Women Entrepreneurs

A quite lengthy list of best practices was shared. The theme of inclusivity of women within organizations, events, marketing materials and success stories was mentioned numerous times. Other best practices suggested:

- Be available – provide encouragement and assure that they are on the right path.
- Get the messaging right – run descriptors and general wording by other to ensure that all messaging is inclusive and not patronizing.
- Carve out time to build partnerships with organizations related to women in STEM.
- Keep in constant communication - keep lines of communication open and check in about upcoming events and opportunities.
- Make people aware that there are financial resources available and provide more heavy lifting to assist in securing those funds.
- Provide multiple formats to foster discussion on engagement and support, both virtual and in person.
- Facilitate a mentor-protégé program that provides direct access to female expertise

"Messaging and mentoring are best practices. With respect to mentoring be readily available for Q&A at any time. Provide encouragement and reinforce when they are on the right track and provide technical assistance as needed. Mentorship programs definitely help. With respect to messaging – Women encouraging other women to do great things is powerful. Our messaging comes through a female lens and seems to make the technical path more approachable."

5.4 Discussion

If women scientists, engineers and entrepreneurs are not aware of the SBIR/STTR programs, they cannot compete for an award. Both GAFC and FAST specifically provide funding to organizations focused on increasing the competitiveness of target populations including women. The purpose of this section was to shed some light on outreach approaches that others have used effectively in engaging women entrepreneurs.

The feedback from organizations trying to involve women entrepreneurs is that a focus on women of all ages and ethnicities is important in messaging. To that end, the **support organizations interviewed, as well as SBIR funding agencies, are more intentionally highlighting success stories that feature women.**

The organizations interviewed consider the objective for outreach to be registration in a program that can provide assistance. In other words, they make a distinction between outreach and training. They also leverage local, regional and professional networks and emphasize personal interaction through meetings, conferences, and one-on-one meetings.

Mentoring and training to assist entrepreneurs in the preparation of SBIR/STTR proposals was a focus of a number of FAST recipients. Agencies such as the DOE and HHS also provide mentoring programs to assist first time applications with this endeavor. It is important to keep in mind that awareness of the SBIR/STTR programs and training on how to develop a responsive proposal are two distinct tasks.

The 2020 report from the National Academies of Sciences, Engineering, and Medicine "Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine: Opening Doors"[39] highlights evidence-based processes for institutions to address gender disparity in recruitment, retention, and advancement in STEMM (Science, Technology, Engineering, Mathematics and Medicine). While primarily focused on individual institutions, similar lessons may be considered across the SBIR/STTR programs to support institutional change, including:

- Committed leadership at all levels
- Dedicated financial and human resources
- An understanding of institutional context
- Accountability and data collection
- Adoption of an intersectional approach

6.0 Conclusions and Future Directions

This report explores the participation of women in the SBIR/STTR programs through the use of award-level administrative data to examine trends in the SBIR/STTR programs from 2011–2018 for Phase I applications and awards, which serve as the initial point of entry for the programs. We then explored two potential factors that could impact the participation of women in the SBIR/STTR programs: 1) Participation of women in the STEM-intensive industries funded by SBIR; 2) Outreach, mentoring, and training efforts by funding agencies and SBIR support organizations.

6.1 SBIR/STTR Trends

- Across the SBIR/STTR programs, there has not been much change between 2011 and 2018 in the proportion of WOSB applications or WOSB awards, which have hovered between 13–15%. The proportion of women PIs in SBIR/STTR Phase I awards was 13%.

- Different agencies show variability between each other, and two agencies (DOE and NSF) show steady increases from 2011 to 2018 of both applications and awards from WOSB.

- Slightly more women PIs are associated with WOSB (53%) than non-WOSB (47%), with 37% of all women PIs also being listed as the business contact, which likely means they are also an owner.

Between 2013–2018, WOSB submitted 14.9% of SBIR/STTR Phase I applications, winning 14.1% of SBIR/STTR Phase I awards. The proportion of WOSB applications submitted in aggregate to the program did not vary more than 2% year to year between 2013–2018. However, WOSB applications submitted to specific agencies did vary from year to year and changes in awards made to WOSB generally followed the application trends over time. Across this timeframe, the average proportion of WOSB applications submitted to each SBIR funding agency varied from a low of 9.8% at DOE to a high of 29.4% at ED.

Because an individual company might receive multiple awards, award-level data between 2011–2018 were analyzed to identify unique companies and better understand how many unique WOSB participate in the SBIR/STTR programs. Individual proposal data is not currently available to evaluate the proportion of unique WOSB that submitted applications. 13.3% of SBIR Phase I awards were made to unique WOSB, while 12.9% of STTR Phase I awards were made to unique WOSB. Though the average proportion of WOSB awards across the SBIR/STTR programs during this time period did not vary more than 1% for SBIR and 3% for STTR from year to year, two agencies saw the greatest increases over time: DOE went from 3.5% unique WOSBs receiving SBIR awards in 2011 to 10.5% in 2018; NSF went from 15.5% in 2011 to 22.4% in 2018, with an absolute number of unique WOSB firms awarded from 2011– 2018 (320) close to the number of WOSB firms awarded by DoD (369), the largest program with more than 8 times the budget.

To understand the participation of individual women as principal investigators (PI) leading SBIR/STTR Phase I projects, PI gender was inferred from the individual's name using a gender identification database platform. The proportion of unique female PIs leading SBIR Phase I awards between 2011–2018 was 13.1% overall, with no clear trend over time. The proportion of unique female PIs leading STTR Phase I awards between 2011–2018 was about the same as with SBIR at 13.2% overall, with an increase from 11.2% in 2011 to 13.9% in 2018.

Analyzing the relationship between the gender of the PI and gender of the majority owner(s) shows that 37% of women PIs work for a WOSB and are listed as the business contact, which likely means they are the woman who owns the company. 16% of women PIs work for WOSB where they are not the listed business contact, for a total of 53% of the women PIs working for a WOSB, while 47% of women PIs work for non-WOSB.

6.2 Industry Trends

- SBIR industries are a narrow subset of STEM-intensive industries, making up only 3% of all firms with paid employees.
- The percentage of WOSB SBIR/STTR awardees (13%) is slightly lower but within range of the percentage of WOSBs in SBIR industries based on NAICS (15%).
- The top four most prevalent SBIR industries are the same for WOSB and non-WOSB: R&D in the Physical, Engineering and Life Sciences; R&D in Biotechnology; Engineering Services; and Custom Computer Programming.
- R&D in the Social Sciences and Educational Support are within the top 10 most common industries for WOSB SBIR awardees, but not non-WOSBs.

Part 3 of the report focuses on whether there is a difference between the WOSB industries in the general business population compared to SBIR to address the issue of whether the SBIR/STTR program is reaching all possible WOSBs in the industries that are typically funded.

Based on 2012 Survey of Business Owners (SBO) data, WOSB make up 19% of all industries. STEM-intensive industries, based on 4-digit NAICS, make up 8% of firms, with 17% of those firms women-owned. SBIR industries, based on 6-digit NAICS, make up only 3% of all firms, with 15% of those firms women-owned. Comparing the 2017 Annual Business Survey (ABS) data with the 2012 SBO, there was a slight overall increase in the number and percentage of WOSB from 15.2% to 16.0% across the SBIR industries, though the top five SBIR industries had only a 1% change.

There was no difference between WOSB and non-WOSB in the top four industries for SBIR-funded companies, which were R&D in the Physical, Engineering and Life Sciences (541715), R&D in Biotechnology (541714), Engineering Services (541330), and Custom Computer Programming (541511). The fifth most common industry for women-owned

SBIR-funded companies was R&D in the Social Sciences (541720), while it was Software Publishers (511210) for non-WOSB SBIR awardees.

6.3 Promising Practices in Outreach, Mentoring, and Training

Interviews with SBIR funding agencies and entrepreneur support organizations involved in the Federal and State Technology (FAST) Partnership program and Growth Accelerator Fund Competition (GAFC) provide promising practices in engaging with women in STEM entrepreneurship.

Agencies made use of SBA-coordinated outreach events such as the SBIR Road Tour and National SBIR/STTR Conferences, and the administrative funding pilot program that specifies use of funds for outreach to enhance the participation of underrepresented entrepreneurs. Outreach methods included leveraging external networks, particularly social media, partnering with professional organizations that serve diverse populations, participating in webinars, sponsoring conferences, and developing success stories highlighting women. Specific agency initiatives that focus on reaching diverse populations include:

- **Having dedicated staff and resources focused on communications**
- **Highlighting diverse awardees in success stories and messaging**
- **Application assistance programs that provide one-on-one consulting with new applicants on how to put together a successful proposal**
- **Supplemental funding for awardee companies to train future talent to enhance diversity**

SBIR support organizations identified efforts to ensure that women were actively engaged in leading conversations, represented in marketing materials, showcasing the success of women entrepreneurs, and partnering with other organizations to expand diversity. Though social media and newsletters were the most frequently cited methods of outreach used, the support organizations identified direct email, personal invitations and interactions, and referrals as the most effective mechanisms for engagement.

Support organizations identified funding as one of the primary barriers that women entrepreneurs face, as well as childcare and the perception that women didn't belong in entrepreneurship. The most frequently occurring suggestion for a best practice to working with women entrepreneurs was the importance of creating a welcoming environment.

6.4 Future Directions

This study lays a foundation for future research into factors that may explain the variation in the participation of women in the SBIR/STTR programs. Potential influences on the participation of women and differences between funding agencies may be due to factors that are either inherent to the agency (though that does not necessarily mean it cannot change) or programmatic or policy practices that may be adopted more broadly across the SBIR/STTR programs regardless of agency. Funding agency factors to investigate further as they relate to impacts on the participation of women include:

- Nature of the industry the agency primarily funds. For example, there are more women with degrees in the biomedical sciences than in energy, and since HHS funds companies in the biomedical industry while DOE funds companies in the energy industry, you might expect to see greater participation of women, particularly in technical roles such as PI, at HHS than DOE.
- Funding mechanism – whether SBIR/STTR awards are made through grants or contracts. Unlike with the WOSB Federal Contracting program, there are

no specific set-aside programs or explicit incentives across the SBIR/STTR programs to be identified as WOSB. However, awareness of the WOSB Federal Contracting program may lead to more companies self-identifying as WOSB for agencies that use contracts for their SBIR/STTR awards.

- Number of solicitations each year/number of opportunities to submit an application. Agencies vary in the number of funding opportunities that are published each year (see Section 1.5). While some agencies only have a single opportunity to submit an application for funding each year, others have multiple deadlines when they accept applications.

- Breadth of topics – whether they are researcher-driven and broad, such as with USDA and NSF, or more narrow and specific, limiting who might have the technical expertise to submit to that topic, such as with DOE and NASA.

- Whether an applicant can resubmit an application to the same topic. For example, HHS applicants receive reviewer feedback on their applications and have the opportunity to incorporate the feedback and submit their application again. Resubmitted applications have a higher probability of success than first submissions.

- Review process – who is engaged in the review and whether feedback is provided to applicants.

- Ability to interact with program staff prior to submission.

- Changes in overall agency budgets.

- Changes in program management and support. For example, having dedicated personnel for SBIR awards who are familiar with the challenges of small businesses may improve the ability of the applicants or awardees to receive appropriate support.

- Speed of award notifications.

- Targeted outreach and training opportunities.

- Coordination of agency SBIR program with other agency initiatives to engage underrepresented populations.

Other potential explanatory factors for variation in the participation of women may be tied more to broader economic or scientific contexts. Despite women representing 29% of people in all S&E occupations in 2017, only 12% of inventors named on granted patents were women and only 15% of businesses in SBIR industries were owned by women. There are differences in the participation of women in different technology fields. In 2016, women accounted for more than one-fifth of inventors granted patents in biotechnology (25% women inventor rate), pharmaceuticals (23%) and organic fine chemistry (21%). This is in contrast to the 12% and 11% of inventors named on patents in instruments and electrical engineering from 2007-2016. While in nearly all science occupations, women participate at a higher rate than they appear as inventor-patentees, in engineering, women's workforce participation rate resembles the overall women inventor rate. The participation of women in invention appears to be similar to their participation in the SBIR/ STTR programs. About 13% of unique PIs were women and 13% of unique companies with Phase I awards were owned by women.

Further study and better data is needed to examine the transition from Phase I awards to Phase II for WOSB or women PIs, and then the success of women in commercializing technology following the Phase II award. Andersen et al. (2017) found that NIH Phase II SBIR WOSB firms were less likely to fail. Future studies could also explore intersectionality and the combination of social and economic disadvantage with gender.

Data regarding the participation of women at different stages of the program can indicate potential stages to intervene, and whether they are within the sphere of control for the SBIR/STTR programs. If a lower percentage of WOSB apply to the SBIR/STTR programs than exist in the general industries funded through the programs, this could indicate a lack

of awareness, a lack of interest, or a lack of know-how. If a lower percentage of WOSB are awarded than applied, this could indicate a subject matter mismatch for agency priorities, poorer application quality, challenges or biases in review criteria, or biases by review panelists. If there are differences in the percentage of female PIs compared to WOSBs, this could indicate a distinction between the engagement of women as technical leads versus women as business leads. One would expect that the proportion of women engaged as PIs would be more closely linked to changes in women's attainment of STEM degrees, and potentially more closely tied to similar root causes that lead to gender differences seen in patenting and technology transfer. These could also be due to industry differences of the likelihood of women being majority owners of companies.

A challenge that is often raised within the SBIR community is the definition of WOSB being greater than 51% ownership and control of the company by a woman or women. Companies funded through the SBIR/STTR programs are frequently the types of companies that would also take on equity investment through venture capital or other institutional financing vehicles, or have co-founders who are not women. By focusing on the WOSB definition as the mechanism to measure the participation of women in the SBIR/STTR programs, this excludes the participation of women who may be co-founders, equal owners, or have critical executive level decision-making authority and control without having greater than 51% ownership of the company.

STEM-intensive companies, such as those funded through SBIR, require leadership in both the business and technical realms. SBIR companies are frequently founded by a technical co-founder, but is that where there is the greatest potential to engage women in innovation and entrepreneurship? A woman may own a company but not be the technical lead or co-founder; this does not minimize her importance in the success of the company. This report provides a baseline understanding of women's participation in the SBIR/STTR programs using available data and highlights opportunities to increase their engagement.

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Appendix A:

SBIR and STTR Awards and Unique Companies by Agency

This Appendix contains SBIR and STTR Phase I award data for each participating agency and identifies both the percentage of awards received by women-owned small business (WOSB) and the percent of unique WOSB which won those awards. The term "unique" indicates that each WOSB was counted just once in the company data, irrespective of how many awards that entity may have received in a given year. Please note that when this same process is applied to the entire data set for all years (2011-2018) adjustments were made such that each company was counted just once across years in the entire data set. Therefore, the TOTAL row is not the result of the simple addition of numbers in each column.

For the analysis conducted throughout this report, agency data were extracted from the publicly available Award database on SBIR.gov in October 2019. In June 2020, we were notified that some of the data uploaded into SBIR.gov for both EPA and HHS were incorrect. Those corrections are noted in the endnote. However, the analyses for this report are based strictly on data extracted in October 2019. As the data for each agency vary considerably, the data by year are included for review. The SBIR analyses are presented first and listed in decreasing order of budget size for FY2018. STTR data are also included subsequently.

Table 13: Summary of SBIR Phase I Awards made to WOSB by agency during the period (2011-2018)

	Total Awards	Awards to WOSB	% Awards WOSB	Total Companies	# Unique WOSB	% WOSB	Average Awards to WOSB
DoD	11,033	1,713	15.5%	2,923	383	13.1%	4.5
HHS	5,992	727	12.1%	2,920	362	12.4%	2.0
DOE	2,100	154	7.3%	909	68	7.5%	2.3
NASA	2,626	284	10.8%	923	118	12.8%	2.4
NSF	2,008	346	17.2%	1,823	320	17.6%	1.1
USDA	583	74	12.7%	549	73	13.3%	1.0

	Total Awards	Awards to WOSB	% Awards WOSB	Total Companies	# Unique WOSB	% WOSB	Average Awards to WOSB
DHS	255	32	12.5%	230	26	11.3%	1.2
DOC	230	29	12.6%	182	24	13.2%	1.2
DOT	131	36	27.5%	119	27	22.7%	1.3
ED	145	43	29.7%	129	38	29.5%	1.1
EPA	165	16	9.7%	161	16	9.9%	1.0

SBIR Phase I Awards and Unique Women-Owned Small Businesses (2011-2018) – by Agency

Department of Defense – FY2018 budget: $1.75 billion

The data in Table 13 provides an introduction to the complexity of the analysis. The data included is the underlined award level data (SBIR Phase I) for DoD between 2011 and 2018. In 2011 there were a total of 1,816 SBIR Phase I awards made with 283 awards to WOSB, resulting in a 15.6% award rate. The table on the right represents the same data using companies as the unit of analysis, rather than awards. As DoD allows applicants to submit multiple proposals, to determine how many unique WOSB received awards, one needs to modify the data set – so that each company that receives an award is represented just once in the data set, irrespective of ownership. That adjustment results in the total number of unique companies that received one or more Phase I SBIR awards during any given year from the DoD SBIR program. One can then analyze the data by gender to determine the number of WOSB that received Phase I SBIR awards by year. For example, in 2011, there were 920 unique companies that received Phase I SBIR awards from DoD, 119 of which were classified as WOSB. What this analysis also enables one to determine is the average number of Phase I awards (4.5) made to WOSB during the entire period between 2011-2018. In addition, one can determine that 13% of DoD Phase I awards made during this eight year period were to women-owned small business. The adjustment removed duplicate companies across all years in the total row.

Table 14: DoD – SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	1816	283	15.6%	920	119	12.9%
2012	1720	248	14.4%	902	116	12.9%
2013	1318	209	15.9%	719	83	11.5%
2014	1296	227	17.5%	738	104	14.1%
2015	1132	182	16.1%	663	83	12.5%
2016	1213	190	15.7%	660	78	11.8%
2017	1433	235	16.4%	770	110	14.3%
2018	1105	139	12.6%	615	71	11.5%
TOTAL	**11033**	**1713**	**15.5%**	**2923**	**383**	**13.1%**

4.5 average awards made to each unique WOSB

Health and Human Services – FY2018 Budget: $1.08 billion

The same analysis was conducted for the Department of Health and Human Services. For HHS the average number of awards that each women-owned small business received during this period was 2.0 awards. During the period 2011-2018, 12.4% of the Phase I SBIR awards were made to WOSB which is comparable to what was seen with DoD (13%).

Table 15: HHS - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	698	88	12.6%	584	75	12.8%
2012	808	93	11.5%	609	64	10.5%
2013	644	83	12.9%	532	68	12.8%
2014	809	91	11.2%	635	72	11.3%
2015	673	71	10.5%	568	66	11.6%
2016	691	88	12.7%	570	79	13.9%
2017	738	94	12.7%	619	75	12.1%
2018	931	119	12.8%	737	101	13.7%
TOTAL	**5992**	**727**	**12.1%**	**2920**	**362**	**12.4%**

2.0 average awards made to each unique WOSB

Department of Energy – FY 2018 Budget: $280 million

Between 2011-2018, the average number of Phase I SBIR awards made by DOE to WOSB was 2.3 which is comparable to the average number of awards made by HHS to WOSB (2.0). However, the percentage of WOSB that received SBIR Phase I awards was less (7.5%) than what was seen with either DoD (13%) or HHS (12.4%). However, the data also show an accelerating trend (3.5% in 2011 and 10.5% in 2018).

Table 16: DOE- SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	198	7	3.5%	144	5	3.5%
2012	223	11	4.9%	176	10	5.7%
2013	283	17	6.0%	219	14	6.4%
2014	214	16	7.5%	167	12	7.2%
2015	254	17	6.7%	201	13	6.5%
2016	286	28	9.8%	216	21	9.7%
2017	292	28	9.6%	203	19	9.4%
2018	350	30	8.6%	275	29	10.5%
TOTAL	**2100**	**154**	**7.3%**	**909**	**68**	**7.5%**

2.3 average awards made to each unique WOSB

National Science Foundation: FY2018 budget: $202.4 million

NSF had the highest percentage of WOSB awardees during this period with 17.3% of awards being made to WOSB. The average number of Phase I awards made to WOSB by NSF was the lowest at 1.1. This is likely a reflection of a policy decision NSF made in 2016 to limit the number of Phase I proposals that can be submitted to one application per company per solicitation.

Table 17: NSF - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	272	42	15.4%	264	41	15.5%
2012	223	27	12.1%	218	27	12.4%
2013	345	61	17.7%	340	59	17.4%
2014	224	33	14.7%	224	33	14.7%
2015	199	44	22.1%	199	44	22.1%
2016	250	47	18.8%	248	47	19.0%
2017	240	35	14.6%	240	35	14.6%
2018	255	57	22.4%	255	57	22.4%
TOTAL	**2008**	**346**	**17.2%**	**1823**	**320**	**17.6%**

1.1 average awards made to each unique WOSB

National Aeronautics and Space Administration: FY 2018 budget: $198 million

During the period 2011-2018, the average number of Phase I SBIR awards NASA made to WOSB was 2.5, slightly higher than HHS (2.0) and DOE (2.3). The percentage of Phase I awards made to WOSB during this five-year period has trended down in recent years from a high of 12.7% in 2015 to 9.0% in 2018.

Table 18: NASA - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	450	53	11.8%	309	35	11.3%
2012	258	25	9.7%	194	21	10.8%
2013	259	34	13.1%	192	26	13.5%
2014	348	31	8.9%	237	20	8.4%
2015	332	44	13.3%	237	30	12.7%
2016	340	33	9.7%	233	25	10.7%
2017	338	31	9.2%	247	23	9.3%
2018	301	33	11.0%	233	21	9.0%
TOTAL	**2626**	**284**	**10.8%**	**923**	**113**	**12.2%**

2.5 average awards made to each unique WOSB

U.S. Department of Agriculture: FY 2018 budget: $27 million

During the time period 2011-2018, the USDA made an average of 1.0 Phase I SBIR awards to WOSB. The percentage of Phase I SBIR awards USDA made to WOSB during the same time period was 13.3%, slightly higher than DHS (11.3%), DOC (12.8%).

Table 19: USDA - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	56	11	19.6%	53	11	20.8%
2012	63	11	17.5%	58	11	19.0%
2013	60	10	16.7%	57	10	17.5%
2014	76	9	11.8%	72	9	12.5%
2015	85	8	9.4%	81	7	8.6%

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/ America's Seed Fund /

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2016	76	5	6.6%	70	5	7.1%
2017	88	11	12.5%	83	11	13.3%
2018	79	9	11.4%	75	9	12.0%
TOTAL	**583**	**74**	**12.7%**	**549**	**73**	**13.3%**

1.0 average awards made to each unique WOSB

Department of Homeland Security: FY2018 budget: $20.8 million

During the period 2011-2018, DHS made an average number of 1.2 Phase I SBIR awards to WOSB. Of the total SBIR Phase I awards, 11.3% were made to WOSB. After a high of 20.0% in 2012, the percentage has trended down to a low of 11.1% in 2016 but has increased again in recent years to 16.7% in 2018.

Table 20: DHS - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	47	1	2.1%	38	0	0.0%
2012	36	7	19.4%	30	6	20.0%
2013	29	3	10.3%	29	3	10.3%
2014	34	5	14.7%	32	4	12.5%
2015	30	4	13.3%	26	3	11.5%
2016	38	6	15.8%	36	4	11.1%
2017	16	2	12.5%	15	2	13.3%
2018	25	4	16.0%	24	4	16.7%
TOTAL	**255**	**32**	**12.5%**	**230**	**26**	**11.3%**

1.2 average awards made to each unique WOSB

Department of Commerce: FY2018 budget: $14.2 million

DOC has two distinct branches that participate in the SBIR program, each with its own program manager: the National Oceanic and Atmospheric Administration (NOAA) and the National Institute of Standards (NIST). However, not all award data specified the branch that made the award. As there were a large number of awards that were not designated to a branch, this analysis is for DOC with NOAA and NIST combined.

Table 21: DOC - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	23	1	4.3%	23	1	4.3%
2012	16	3	18.8%	26	3	11.5%
2013	19	2	10.5%	18	2	11.1%
2014	23	3	13.0%	22	3	13.6%
2015	35	5	14.3%	31	5	16.1%
2016	41	5	12.2%	37	5	13.5%
2017	31	4	12.9%	28	4	14.3%
2018	42	6	14.3%	39	5	12.8%
TOTAL	**230**	**29**	**12.6%**	**182**	**24**	**13.2%**

1.2 average awards made to each unique WOSB

Department of Transportation: FY2018 budget: $8.5 million

The DOT made an average of 1.3 Phase I SBIR awards to Women-Owned Small Business during the period 2011-2018, slightly higher than DHS (1.2) and DOC (1.0). However, DOT had the second highest percentage of WOSB awardees during this time, with 22.7% of awards being made to WOSB.

Table 22: DOT - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	15	2	13.3%	14	2	14.3%
2012	21	9	42.9%	16	4	25.0%
2013	9	3	33.3%	9	3	33.3%
2014	19	7	36.8%	18	6	33.3%
2015	35	8	22.9%	32	6	18.8%
2016	3	1	33.3%	3	1	33.3%
2017	14	3	21.4%	13	3	23.1%
2018	15	3	20.0%	14	2	14.3%
TOTAL	**131**	**36**	**27.5%**	**119**	**27**	**22.7%**

1.3 average awards made to each unique WOSB

Department of Education: FY2018 budget: $7.5 million

ED had the highest percentage of WOSB awardees compared to all other agencies with 29.5% of awards being made to WOSB. The average number of Phase I awards made to WOSB by ED was 1.1 which is within the range of the other smaller agencies such as DHS (1.2), DOC (1.0) and DOT (1.3).

Table 23: ED - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	25	8	32.0%	19	6	31.6%
2012	24	6	25.0%	21	6	28.6%
2013	24	8	33.3%	21	6	28.6%
2014	24	3	12.5%	21	3	14.3%
2015	13	5	38.5%	12	4	33.3%
2016	9	2	22.2%	9	2	22.2%
2017	11	5	45.5%	11	5	45.5%
2018	15	6	40.0%	15	6	40.0%
TOTAL	**145**	**43**	**29.7%**	**129**	**38**	**29.5%**

1.1 average awards made to each unique WOSB

Environmental Protection Agency: FY2018 budget: $4.2 million

During the period 2011-2018, the EPA made an average number of 1.0 Phase I SBIR awards to WOSB, slightly lower than ED (1.1) and DHS (1.2). In addition, the percentage of WOSB that received SBIR Phase I awards (9.9%) was considerably less than what was seen with the other smaller agencies such as DHS (11.3%), DOC (12.8%) and DOT (23.1%). The data also show a decreasing trend from a high of 21.1% in 2015 to 13.3 % in 2017 and 6.3% in 2018.

Table 24: EPA - SBIR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	28	1	3.6%	26	1	3.8%
2012	25	3	12.0%	25	3	12.0%
2013	26	2	7.7%	26	2	7.7%
2014	21	1	4.8%	21	1	4.8%
2015	19	4	21.1%	19	4	21.1%
2016	13	2	15.4%	13	2	15.4%
2017	16	2	12.5%	15	2	13.3%
2018	17	1	5.9%	16	1	6.3%
TOTAL	**165**	**16**	**9.7%**	**161**	**16**	**9.9%**

1.0 average awards made to each unique WOSB

STTR Phase I Awards and Unique Women-Owned Small Businesses (2011-2018) – by Agency

Table 25: Summary of STTR Phase I awards made to WOSB by agency (2011-2018)

	Total Awards	Awards to WOSB	% Awards WOSB	Total Companies	# Unique WOSB	% WOSB	Average Awards to WOSB
DoD	1875	241	12.9%	919	110	9.9%	2.2
HHS	1283	159	12.4%	917	120	13.1%	1.3
DOE	324	27	8.3%	232	19	8.3%	1.4
NASA	359	40	11.1%	201	20	10.0%	2
NSF	376	65	17.3%	361	64	17.7%	1.0

Department of Defense - STTR

During the period 2011-2018, DoD made 1,875 Phase I STTR awards to 110 Women-Owned Small Business. Of the total STTR Phase I awards, an adjusted average of 12.0% were made to WOSB. After a low of 10.3% in 2017, the percentage has trended up to a high of 21.2% in 2018.

Table 26: DOD - STTR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	307	32	10.4%	242	24	9.9%
2012	253	29	11.5%	206	22	10.7%
2013	225	33	14.7%	182	26	14.3%
2014	184	20	10.9%	152	16	10.5%
2015	229	32	14.0%	186	25	13.4%
2016	209	28	13.4%	179	19	10.6%
2017	276	29	10.5%	204	21	10.3%
2018	192	38	19.8%	151	32	21.2%
TOTAL (de-duplicated)	**1875**	**241**	**12.9%**	**919**	**110**	**12.0%**

Department of Health and Human Services - STTR

During the period 2011-2018, HHS made 1,283 Phase I STTR awards to 120 Women-Owned Small Business. Of the total STTR Phase I awards, an adjusted average of 13.1% were made to WOSB. After a high of 18.1% in 2012, the percentage has trended down to a low of 9.2% in 2018.

Table 27: HHS - STTR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	84	8	9.5%	78	8	10.3%
2012	122	21	17.2%	116	21	18.1%
2013	124	15	12.1%	116	15	12.9%
2014	164	22	13.4%	151	21	13.9%
2015	161	19	11.8%	144	18	12.5%
2016	207	26	12.6%	191	24	12.6%
2017	184	25	13.6%	166	22	13.3%
2018	237	23	9.7%	218	20	9.2%
TOTAL (de-duplicated)	**1283**	**159**	**12.4%**	**917**	**120**	**13.1%**

Department of Energy - STTR

During the period 2011-2018, DOE made 324 Phase I STTR awards to 19 Women-Owned Small Business. Of the total STTR Phase I awards, an adjusted average of 8.2% were made to WOSB, which is the lowest of STTR agencies. After reaching a high of 16.7% in 2017, the percentage significantly dropped to 5.6% the following year.

Table 28: DOE - STTR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	26	0	0.0%	19	0	0.0%
2012	34	3	8.8%	33	3	9.1%
2013	38	3	7.9%	34	1	2.9%
2014	35	4	11.4%	33	4	12.1%
2015	39	1	2.6%	36	1	2.8%
2016	44	5	11.4%	41	5	12.2%
2017	50	8	16.0%	48	8	16.7%
2018	58	3	5.2%	54	3	5.6%
TOTAL (de-duplicated)	**324**	**27**	**8.3%**	**232**	**19**	**8.3%**

National Aeronautics and Space Administration - STTR

During the period 2011-2018, NASA made 359 Phase I STTR awards to 20 Women-Owned Small Business. Of the total STTR Phase I awards, an adjusted average of 10.0% were made to WOSB, which is lower than DoD (12.0%) and HHS (13.1%), but higher than DOE (8.2%). Over the period 2012-2016, the percentage was fairly consistent ranging around 8%-9%, hitting a low of 3.8% in 2017, and jumping back up in 2018 (11.9%).

Table 29: NASA - STTR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	45	9	20.0%	41	7	17.1%
2012	40	4	10.0%	37	3	8.1%
2013	32	4	12.5%	32	3	9.4%
2014	32	3	9.4%	32	3	9.4%
2015	49	7	14.3%	41	4	9.8%
2016	58	4	6.9%	50	4	8.0%
2017	60	3	5.0%	52	2	3.8%
2018	43	6	14.0%	42	5	11.9%
TOTAL (de-duplicated)	**359**	**40**	**11.1%**	**201**	**20**	**10.0%**

National Science Foundation - STTR

During the period 2011-2018, NSF made 376 Phase I STTR awards to 64 Women-Owned Small Business. Of the total STTR Phase I awards, an adjusted average of 17.7% were made to WOSB, which is higher than all other STTR programs - DoD (12.0%), HHS (13.1%), DOE (8.2%) and NASA (10.0%). During the period 2011-2018, NSF has consistently achieved double digit percentage in Phase I awards to WOSB.

Table 30: NSF - STTR Phase I awards to WOSBs and to unique companies (2011-2018)

Year	Total Awards	Awards to WOSB	% WOSB Awards	Total Companies	# Unique WOSB	% Unique WOSB
2011	4	1	25.0%	4	1	25.0%
2012	17	4	23.5%	17	4	23.5%
2013	36	5	13.9%	36	5	13.9%
2014	78	20	25.6%	77	20	26.0%
2015	70	12	17.1%	70	12	17.1%
2016	81	9	11.1%	81	9	11.1%
2017	53	9	17.0%	53	9	17.0%
2018	37	5	13.5%	37	5	13.5%
TOTAL (de-duplicated)	**376**	**65**	**17.3%**	**361**	**64**	**17.7%**

Appendix B:

SBIR and STTR Awards and Unique Principal Investigators by Agency

Gender of Principal Investigators participating in the SBIR program (2011-2018) – by Agency

Section **2.3 Gender of Principal Investigators participating in the SBIR program (2011-2018)** of this report provides information on the analyses of the gender of principal investigators (PI) participating in the SBIR program for all agencies. This Appendix provides PI information at the Agency level. Within each agency and year duplicate PIs were removed. This enabled the determination of how many individual PIs worked in the SBIR arena during this period and how many were female. For analyzing the data across years for each agency (2011-2018), this same process was applied across all years, so the TOTAL row is not the simple sum of unique PIs as an individual PI may have received awards in multiple years. If Jane Smith was the PI on 5 SBIR awards and Amanda Jones was the PI on 1 SBIR award during 2011, they would each be counted once. If duplicates were not removed within the year, instead of two distinct women PIs, it would appear that there were six female principal investigators. Similarly, if Jane Smith had been PI on 5 SBIR awards in different years, the total number of unique PIs for 2011-2018 may count her multiple times.

As noted earlier, the gender of all PI was determined by using the Gender API software tool. This was necessary as PI gender was not consistently available from SBIR.gov. Each table starts by reiterating how many Phase I awards each agency made by year. Next, using a de-duplication process, the number of individual PIs (male and female) is identified, followed by the number of women PI. The de-duplication process was applied once more across all years to determine the total number of PI that worked with that agency between 2011-2018. The TOTAL row is not the result of simple addition of the data in each column.

Department of Defense

The DoD analysis indicates that a total of 6,690 PI (male and female) worked with DoD during this 8-year period and received 11,033 awards. Of the 6,690 PI, 568 were women or approximately 8.5%.

Table 31: PI gender by year awarded DoD SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	1816	1467	125	8.5%
2012	1720	1441	126	8.7%
2013	1318	1131	98	8.7%
2014	1296	1122	84	7.5%
2015	1132	998	84	8.4%
2016	1213	1079	72	6.7%
2017	1433	1267	104	8.2%
2018	1105	965	74	7.7%
TOTAL	**11033**	**6690**	**568**	**8.49%**

Department of Energy

Between 2011-2018, the DOE made 2,100 Phase I SBIR awards to 1,450 individual PIs (male and female). Of these 140 were female PI or 9.7%.

Table 32: PI gender by year awarded DOE SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	198	182	11	6.0%
2012	223	190	15	7.9%
2013	283	243	24	9.9%
2014	214	201	18	9.0%
2015	254	239	18	7.5%
2016	286	269	23	8.6%
2017	292	260	21	8.1%
2018	350	324	41	12.7%
TOTAL	**2100**	**1450**	**140**	**9.7%**

Department of Health and Human Services

Between 2011-2018, the HHS made 5,992 Phase I SBIR awards to a total of 3,820 unique PI (male and female). Of these 785 were female PI or 20.5% - nearly double the percentage one sees with DoD or DOE.

Table 33: PI gender by year awarded HHS SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	698	646	117	18.1%
2012	808	703	140	19.9%
2013	644	583	111	19.0%
2014	809	714	145	20.3%
2015	673	617	111	18.0%
2016	691	598	138	23.1%
2017	738	669	125	18.7%
2018	931	822	166	20.2%
TOTAL	**5992**	**3820**	**785**	**20.5%**

National Aeronautics and Space Administration

Between 2011-2018, NASA made 2,626 Phase I SBIR awards to a total of 1,783 unique PI (male and female). Of these 159 were female PI or 8.9%.

Table 34: PI gender by year awarded NASA SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	450	412	36	8.7%
2012	258	243	18	7.4%
2013	259	237	17	7.2%
2014	348	319	29	9.1%
2015	332	302	23	7.6%
2016	340	305	29	9.5%
2017	338	317	23	7.3%
2018	301	285	19	6.7%
TOTAL	**2626**	**1783**	**159**	**8.9%**

National Science Foundation

Between 2011-2018, the NSF made 2,008 Phase I SBIR awards to a total of 1,885 unique PI (male and female) of which 336 were female PI or 17.8%.

Table 35: PI gender by year awarded NSF SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	272	267	40	15.0%
2012	223	220	37	16.8%
2013	345	344	63	18.3%
2014	224	224	36	16.1%
2015	199	199	31	15.6%
2016	250	250	49	19.6%
2017	240	240	45	18.8%
2018	255	255	54	21.2%
TOTAL	**2008**	**1885**	**336**	**17.8%**

U.S. Department of Agriculture

For USDA, the analysis reveals that during the period 2011-2018, the agency had one of the higher percentages of Women PIs across the its portfolio, with 19.8% of the awards made to unique women PIs.

Table 36: PI gender by year awarded USDA SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	56	53	8	15.1%
2012	63	61	13	21.3%
2013	60	59	13	22.0%
2014	76	74	17	23.0%

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2015	85	83	13	15.7%
2016	76	70	14	20.0%
2017	88	85	22	25.9%
2018	79	77	14	18.2%
TOTAL	**583**	**500**	**99**	**19.8%**

Department of Homeland Security

For DHS, the analysis reveals that during the period 2011-2018 across the entire DHS portfolio, 7.2% of the awards were made to unique women PIs, slightly lower than DOE (9.7%) and DOT (10.0%).

Table 37: PI gender by year awarded DHS SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	47	44	2	4.5%
2012	36	34	4	11.8%
2013	29	29	1	3.4%
2014	34	34	3	8.8%
2015	30	30	3	10.0%
2016	38	37	2	5.4%
2017	16	15	0	0.0%
2018	25	25	4	16.0%
TOTAL	**255**	**221**	**16**	**7.2%**

Department of Commerce

DOC is comprised of two branches: NOAA and NIST. However, as a large number of awards did not have the branch listed, the data are presented for DOC as a whole.

Table 38: PI gender by year awarded DOC by SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	23	23	1	4.3%
2012	16	16	2	12.5%
2013	19	19	1	5.3%
2014	23	23	1	4.3%
2015	35	34	3	8.8%
2016	41	39	5	12.8%
2017	31	31	1	3.2%
2018	42	41	7	17.1%
TOTAL	**230**	**216**	**21**	**9.7%**

Department of Transportation

For DOT, the analysis reveals that during the period 2011-2018 across the entire DOT portfolio, 10.0% of the awards were made to unique women PIs.

Table 39: PI gender by year awarded DOT by SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	15	14	3	21.4%
2012	21	17	2	11.8%
2013	9	9	1	11.1%
2014	19	19	3	15.8%
2015	35	34	4	11.8%
2016	3	3	1	33.3%
2017	14	14	2	14.3%
2018	15	15	1	6.7%
TOTAL	**131**	**110**	**11**	**10.0%**

Department of Education

For ED, the analysis reveals that during the period 2011-2018 across its entire portfolio, ED had the highest percentage of awards made to women PIs, with 36.8 % of the awards made to unique women PIs.

Table 40: PI gender by year awarded ED SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	25	20	8	40.0%
2012	24	24	7	29.2%
2013	24	20	6	30.0%
2014	24	22	7	31.8%
2015	13	13	6	46.2%
2016	9	9	2	22.2%
2017	11	11	3	27.3%
2018	15	15	8	53.3%
TOTAL	**145**	**117**	**43**	**36.8%**

Environmental Protection Agency

For EPA, the analysis reveals that during the period 2011-2018 across the entire EPA portfolio, 19.1% of the awards were made to unique women PIs, one of the higher percentages as compared to other agencies such as DOE (9.7%) and DOT (10.0%).

Table 41: PI gender by year awarded EPA by SBIR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	28	28	7	25.0%
2012	25	25	5	20.0%
2013	26	26	5	19.2%
2014	21	21	2	9.5%
2015	19	19	4	21.1%

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2016	13	13	2	15.4%
2017	16	15	2	13.3%
2018	17	17	4	23.5%
TOTAL	**165**	**157**	**30**	**19.1%**

Gender of Principal Investigators participating in the STTR program (2011-2018) – by Agency

Department of Defense

With respect to STTR, during the period 2011-2018, the DoD made 1,875 awards to a total of 1,178 PIs, of which 106, with an adjusted average of 9.0% (de-duplicated) made to unique women PIs.

Table 42: PI gender by year awarded DoD STTR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	307	296	22	7.4%
2012	253	247	27	10.9%
2013	225	220	19	8.6%
2014	184	177	20	11.3%
2015	229	224	16	7.1%
2016	209	202	20	9.9%
2017	276	271	27	10.0%
2018	192	185	17	9.2%
TOTAL	**1875**	**1178**	**106**	**9.0%**

Department of Energy

During the period 2011-2018, DOE made a total of 324 Phase I STTR awards to a total of 287 PIs, of which 28, with an adjusted average of 9.8% were made to unique women PIs.

Table 43: PI gender by year awarded DOE STTR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	26	24	1	4.2%
2012	34	34	3	8.8%
2013	38	37	3	8.1%
2014	35	34	4	11.8%
2015	39	38	1	2.6%
2016	44	42	4	9.5%
2017	50	50	6	12.0%
2018	58	57	7	12.3%
TOTAL	**324**	**287**	**28**	**9.8%**

Department of Health and Human Services

During the period 2011-2018, HHS made a total of 1,283 Phase I STTR awards to a total of 1,064 PIs, of which 202 awards were made to unique women PIs, at an adjusted average of 19%.

Table 44: PI gender by year awarded HHS STTR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	84	81	18	22.2%
2012	122	120	28	23.3%
2013	124	119	22	18.5%
2014	164	157	23	14.6%
2015	161	154	29	18.8%
2016	207	199	37	18.6%
2017	184	172	28	16.3%
2018	237	219	41	18.7%
TOTAL	**1283**	**1064**	**202**	**19.0%**

National Aeronautics and Space Administration

During the period 2011-2018, NASA made a total of 361 Phase I STTR awards to a total of 302 PIs, of which 28 or 9.3% were made to unique women PIs.

Table 45: PI gender by year awarded NASA STTR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	45	37	8	21.6%
2012	40	40	3	7.5%
2013	33	33	3	9.1%
2014	32	32	3	9.4%
2015	49	47	5	10.6%
2016	58	56	8	14.3%
2017	60	59	5	8.5%
2018	44	44	3	6.8%
TOTAL	**361**	**302**	**28**	**9.3%**

National Science Foundation

During the period 2011-2018, NSF made a total of 376 Phase I STTR awards to a total of 369 PIs, of which 68 or 18.4% were made to unique women PIs.

Table 46: PI gender by year awarded NSF STTR Phase I awards (2011-2018)

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2011	4	4	1	25.0%
2012	17	17	2	11.8%
2013	36	36	8	22.2%
2014	78	78	17	21.8%

Year	Total Awards	Unique PIs (male and female)	# Unique Women PI	Women PI
2015	70	70	11	15.7%
2016	81	81	12	14.8%
2017	53	53	11	20.8%
2018	37	37	7	18.9%
TOTAL	**376**	**369**	**68**	**18.4%**

Appendix C:
Agency Program Manager Interview Script

Thank you for taking time to speak with us today.

As Jennifer mentioned in her email, the purpose of this interview is to discuss outreach methods that [AGENCY] uses. By "outreach" we mean methods of reaching out to individuals, in this case entrepreneurs or potential entrepreneurs who are not familiar with the SBIR/STTR programs. The purpose of the outreach is to apprise them of the SBIR/STTR programs that your agency provides. In terms of how this information will be used - our intent is to summarize our findings from these interviews. We are not looking to identify and/or find fault with any program. When best practices are identified, we may decide to mention the agencies name.

1. What are the primary outreach methods you use to bring new entrepreneurs into the SBIR/STTR programs? Please list methods.

2. In the next two questions, I use the word "target" when talking about a specific population - this implies intentional identification and outreach to that population.

   What methods do you use to target your SBIR/STTR outreach initiatives to women-owned small business and/or potential women entrepreneurs that are not currently engaged with these programs?

3. What methods do you use to target ethnically and racially diverse women entrepreneurs? Women entrepreneurs of various ages? Women entrepreneurs who are disabled?

4. What metrics do you use to evaluate the effectiveness of your outreach initiatives? In other words, how do you know it is working? What do you expect to see as a result of your outreach?

5. How do you currently track the effectiveness of each of the outreach methods that you use? (Who is responsible for collecting and compiling the information regarding the metrics)

6. What have you found to be the most effective way(s) to interest WOSB and potential women entrepreneurs in the SBIR/STTR programs?

7. Are there any other comments you would like to add about outreach?

Appendix D:

Discussion Guide for SBA Resource Partner Personnel (FAST, GAFC)

Thanks for taking the time to talk with us today. My name is [XXXX], and I am a researcher with Dawnbreaker. I am joined by my colleague [XXXX], who will be taking notes during today's discussion. Dawnbreaker is under contract to the U.S. Small Business Administration to conduct research on the agency's behalf to learn more about the involvement of women-owned small businesses in the services that you provide. As required by the Paperwork Reduction Act, this discussion cannot take place without approval from the Office of Management and Budget. SBA obtained that approval under OMB Control # 3245-0398. Your participation in this research effort is completely voluntary. The total estimated time for participating in this discussion is forty-five to sixty minutes. You may send comments regarding this burden estimate or any other aspect of this discussion to Brittany Sickler, brittany.sickler@sba.gov. There may be some data that you may need to look up after this call. I will call you back to discuss that data with you.

Dawnbreaker is an independent contractor. We will keep the information you provide confidential to the extent permitted by law. Your name and organization will not be associated with any of your responses in the published report.

Today's discussion has two parts. I'd like to start by asking some very general questions about women-owned small businesses. I then have some more specific questions that relate to data that you may or may not collect about the profile of clients that you serve. With your approval, I would also like to talk with the person that is responsible for the outreach for your organization.

The note taker will take note of the following information at the outset:

- Organization Name:
- Individual Interviewed:
- Title of Individual interviewed:
- Number of Years in that position:
- Name of Discussion Leader:
- Name of Notetaker:
- Date Interview conducted:

Outreach to and Engagement of Women Participating in Programs conducted by SBA Resource Partners

Questions for use with FAST and GAFC Personnel

1. Has your organization placed a special emphasis on involving women in the services that your organization provides?
2. If yes, can you tell me more about what you have done to emphasize your services to women?
3. In the data that you collect regarding the services provided, do you track engagement by gender, by race/ethnicity, by disability status? If yes, how long have you been collecting the data in that fashion?
4. I am interested in knowing how many women and/or women-owned companies received each of the following services annually? How does this compare to the total number of clients served?

   NOTE: If the organization does not collect gender information, this question will be skipped – with the comment made that the organization does not collect this type of data.

Data request list for FAST Personnel

	# Women	Total # participants
Outreach event participants		
Webinar participation		
Proposal writing assistance		
Other technical assistance		
Solicitation matching		
Conference grants		
Bridge awards		
New Phase I SBIR/STTR applicant		
How are these data collected?		

Data request list for GAFC Personnel

	# Women	Total # participants
Mentorship		
Commercialization Assistance		
Introductions		
Pitch Opportunity		
Resource sharing		
Small amount angel seed $$		
Specialized or structured loans		
New Phase I SBIR/STTR applicant		
How are these data collected?		
Do you provide SBIR/STTR proposal assistance services?		

5. What do you consider the objective of outreach to be?

6. What types of outreach does your organization use to promote the services that you provide?

7. How do you determine if your outreach has been effective? What metrics do you use?

8. Which outreach method do you find to be the most effective?

9. How do you find new women-owned small businesses and/or new potential women entrepreneurs to include in your outreach?

10. (10)Using a scale of 1 to 5 with 1 meaning very little and 5 indicating a lot – rate the extent to which your outreach efforts specifically includes each of the following:

    a. College/University students/Postdoc
    b. Early career (outside of academic career)
    c. Faculty
    d. Mid-to-late career
    e. Racially and ethnically diverse women
    f. Women with disabilities

11. Do you experience any organizational restrictions on outreach?

12. What have you found to be the most effective ways to interest WOSB and potential women entrepreneurs in the SBIR/STTR program or the services that you provide?

13. From your perspective, what are some of the barriers that may make it difficult for women entrepreneurs to pursue an entrepreneurial career path?

14. What would you single out as your best practice for involving women entrepreneurs?

15. Is there anything else you would like to share?

Table 47: Brief description of GAFC organizations interviewed

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The Capital Network
thecapitalnetwork.org

In collaboration with the investors who fund startups in the Boston area, The Capital Network (TCN) creates 45+ workshops, roundtables, 1 on 1 mentoring and bootcamps a year for entrepreneurs. Whether it's a program on choosing the right financing option, setting a valuation, constructing the optimal pitch deck or knowing how to negotiate with investors – TCN's in-depth and practical content reflects the latest trends and insights in the fundraising and startup community.

Health Wildcatters
healthwildcatters.com

Health Wildcatters was founded in 2013 to address the need for a health innovation hub in the Dallas/Fort Worth Metroplex healthcare industry. Since its inception, the Health Wildcatters portfolio has grown to 68 startups and has raised over $70 million solidifying Health Wildcatters as one of the top healthcare accelerators in the country. Eight to 12 startups join the accelerator program annually and participate in a three-month program. The startup receives an investment from Health Wildcatters and many in-kind perks.

Innovation Works
innovationworks.org

AlphaLab is Innovation Works' nationally ranked software accelerator, an immersive program with funding for early stage tech companies. AlphaLab is unique in that its focus is on the earlier stages of initial product and customer development. The cohorts are small with 6-8 companies per cycle for a more personal and tailored experience. Throughout and after the program, AlphaLab provides:(1) Connections to top mentors, experts, and our robust alumni network; (2) Weekly programming by industry leaders; (3) Office space in a collaborative yet structured work environment; (4)Up to $50K in funding and the opportunity to raise money from the Innovation Works seed fund.

Life Sciences Washington Institute
lswinstitute.org

The Life Sciences Washington Institute provides support to life science entrepreneurs and start-up companies via educational, economic and other resources crucial for their success. Modeled after the MIT Venture Mentoring Service and Chicago Innovation Mentors, the WIN program provides entrepreneurs with professional advice from teams of professionals with deep and diverse expertise in commercialization and business execution. The Institute also provides SBIR/STTR proposal preparation services.

Rocky Mountain Innovation Initiative dba Innosphere Ventures
innosphereventures.org

Innosphere Ventures is a fee-based 501c3 with a mission to help S&T startups in the state of Colorado. Innosphere typically runs two cohorts of companies each year that are each made up of 10-13 companies. With 20 years of experience, Innosphere's model has supported hundreds of companies in reaching their key milestones. Companies entering the incubation program are supported by not only their Innosphere liaison, but also work with former C-level executives, experienced staff, and industry-specific advisors.

Seed Spot
seedspot.org

Seed Spot is a 501c3 nonprofit dedicated to supporting all social entrepreneurs creating a product, service, or technology that improves lives or makes the world a better place. The organization supports entrepreneurs by surrounding them with the right access to resources, mentors, business fundamentals, community partners, capital sources, and anything they need to succeed.

SIU Research Park
researchpark.siu.edu

The SIU Research Park is a non-profit corporation affiliated with Southern Illinois University Carbondale (SIU Carbondale) promoting technology and knowledge-based enterprise development within the Park and southern Illinois. It is the primary innovation and technology space in the southern third of Illinois , a member of the Association of University Research Parks (AURP), and has hosted a Small Business Development Center in the Research Park since 1985.

Start-Up Tucson
startuptucson.com

Startup Tucson provides comprehensive services for entrepreneurs that include Discovery and Networking Events, Educational Programming and a free membership hub called The Startup Tucson Network. The organization is known for its larger regional ecosystem building events, TENWEST Festival of Innovation and IdeaFunding. The Startup Tucson model was tailored to Tucson's unique ecosystem through implementing a combination of national best practices, entrepreneurs' feedback, and the Startup Tucson Advisory Council. The organization is "industry agnostic" and open to entrepreneurs of all kinds-- from software and technology to artisans and creatives.

The AWIS Accelerator

stemtomarket.org/accelerator

STEM to Market: the AWIS Accelerator is a pioneering program created by AWIS, an organization with nearly half a century of experience in advancing the goals of women in science. Through flexible and holistic support, AWIS works with participants to set and

meet their goals. There are three stages of the program: Foundation, Transition, and Collaborative Implementation. The program requires 11-13 hours per week for five months. Transition requires 16-22 hours in two weeks, 10 of which is the in-person workshop. Collaborative Implementation requires 2-5 hours per week, plus more time depending on the participant's plans.

VentureWell
venturewell.org

VentureWell is a higher education network that cultivates revolutionary ideas and promising inventions. The organization has been on a mission to launch new ventures from an emerging generation of young inventors driven to improve life for people and the planet. Student inventors are at the heart of VentureWell. VentureWell helps them cultivate skills and creativity. Often VentureWell is first to validate, support and guide an idea with potential, allowing student entrepreneurs to take the important first step toward launching a business.

Table 48: Brief description of FAST organizations interviewed

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Colorado SBDC (Boulder)
bouldersbdc.com/about/our-team

Boulder Small Business Development Center (SBDC) supports the growth and resiliency of small businesses in Boulder County by providing free business consulting, practical workshops & events and connection to resources, including financing. The SBDC helps all types of small businesses – from startups through 2nd stage, from "Main Street" through highly scalable technology ventures.

Connecticut Innovations (CTNext)
ctnext.com

CTNext supports the success of companies and entrepreneurs by providing guidance, resources, and networks to accelerate their growth. CTNext offers free technical consultations to help you improve your chances of winning a federal SBIR/STTR grant. Our goal is to provide you with the experienced support you need to navigate through the complex phases of the federal program. Support includes conference fee reimbursements, proposal accounting support, application reviews and strategy sessions.

First Flight Venture Center, Inc.
ffvcnc.org

FFVC is one of the nation's largest, most stable incubators with a proven record of success. We've hosted more than 350 companies and helped launch businesses that have commercialized important new technologies, while creating thousands of jobs in North Carolina. FFVC supports the development of innovative technologies and economic growth by providing early stage businesses with affordable laboratory and office space, management guidance and counseling, as well as shared business and technology support services. FAST funding was used to bring more women into the LIFT OFF program.

Hawaii Technology Development Corp. (HTDC)
htdc.org

HTDC is a state agency responsible for diversifying Hawaii's economy developing a flourishing technology industry that provides quality, high- paying jobs for Hawaii residents. HTDC aims to accelerate the growth of Hawaii's technology industry by providing capital, building infrastructure and developing talent to foster innovation. HTDC is attached to the Department of Business, Economic Development and Tourism (DBEDT).

Launch Tennessee
launchtn.org

Launch Tennessee is a public-private partnership, guided by a vision of making Tennessee the most startup-friendly state in the nation. Its' mission is to empower a high-functioning network of resources focused on core priorities that support Tennessee's entrepreneurial ecosystem. Partnering with Entrepreneur Centers in seven regions of the state, LaunchTN creates collaboration among entrepreneurs, the private sector, capital sources, institutions, and government to offer entrepreneurs what they need to succeed and stay in Tennessee to build companies and create jobs. They have a variety of Investment Programs – some of which they emphasize with women.

Louisiana Technology Transfer Office
lsu.edu/innovationpark/ LTTO-SBIR/index.php

The Louisiana Technology Transfer Office (LTTO) facilitates collaborative partnerships between Louisiana businesses, federal labs, and university/ research institutions, accomplished by leveraging research capabilities with the commercial development potential of the private sector. This mission is accomplished through the LTTO's statewide activities and offices located on the campus of LSU Innovation Park and an office at NASA's John C. Stennis Center in Mississippi. The LTTO is the official entity in Louisiana for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs.

Maryland Technology Development Corp
tedcomd.com

TEDCO's mission is to enhance economic development by fostering an inclusive and entrepreneurial innovation ecosystem - to identify, invest in, and help grow technology companies in Maryland. With the FAST grant the TEDCO team provided a new SBIR Proposal Lab developed with the goal of improving proposal quality, submissions, and win rates for SBIRs/STTRs.

Montana Innovation Partnership (MTIP)
tedcomd.com
MTIP works with individuals and small businesses engaged in research and development (R&D) of truly innovative technologies or products. They also focus on helping women-owned, minority- owned, veteran-owned, and rural tech companies to successfully compete for SBIR/STTR capital. With FAST funding they initiated more focused outreach to Women In STEM.

Nebraska Business Development Center
unomaha.edu/nebraska- business- development-center/ index.php

NBDC offers a wide array of assistance including a focus on Innovation and Technology and SBIR/STTR funding. NBDC SBIR/STTR grant assistance services help you: locate agencies with an R&D focus that fits your innovation, connect to the appropriate program manager, develop budget and financial projections for your proposal, improve and provide third-party review of your proposal to ensure that it meets all agency requirements, and find and develop useful partnerships.

New Mexico FAST
https://arrowheadcenter.nmsu.edu/program/nm- fast/

The NM Federal and State Technology (NM FAST) partnership program provides SBIR and STTR proposal development assistance to small businesses throughout NM. Securing federal funding for your innovative idea or technology is a critical step towards commercial success. The SBIR and STTR programs, often referred to as "America's Seed Fund," are

an excellent source of undiluted funding, but are highly competitive. NM FAST provides the resources, support, and expertise necessary to submit a highly competitive proposal.

Oklahoma Catalyst Program
okcatalyst.com/

The Oklahoma Catalyst Programs provide networking, training, and mentoring to entrepreneurs and small business owners in Oklahoma. They provide an SBIR Accelerator which aligns resources needed to be successful in submitting a Phase I SBIR proposal to the Department of Defense or the National Institutes of Health. Participants are shepherded through the process of incorporating your company (if necessary), registering with the correct government authorities, and writing your SBIR proposal.

University of Nevada, Reno
unr.edu/enterprise/contact

Enterprise & Innovation provides support to University faculty, staff and students for spinouts, tech transfer and IP protection services. For entities outside the University, we assist with anything relating to commercialization of research and licensing of available University technology.

VertueLab
vertuelab.org

VertueLab partners with funders and innovators in clean technologies to make a global environmental impact. Through a series of focused programs and funding opportunities, we advance promising technologies to market while helping innovators find the resources they need to move their vision forward. The company also provides assistance to qualified applicants seeking to apply for an SBIR/STTR Grant throughout each step of the application process.

Wichita State University
wichita.edu/research/ WSUInitiatives/index.php

WSU Strategic Initiatives empowers market-driven technology development, demonstration, and deployment by providing unparalleled access to WSU facilities, faculty, and students as problem solvers for business/industry, innovators, and students to explore, evaluate, customize, and implement new technology.