



Testimony of

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SBIR Turns 40: Evaluating Support for Small Business Innovation

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Introduction

Chairwoman Stevens, Ranking Member Feenstra, and members of the Subcommittee, thank you for this opportunity to testify on the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs at the National Science Foundation (NSF), how NSF is supporting the creation of new businesses and bringing new technologies to the public, and to provide comments on H.R. 4033, *The Small Business Innovation Research and Small Business Technology Transfer Improvements Act of 2021*. My name is Ben Schrag, and I am a Program Director and Policy Liaison with NSF's SBIR/STTR program.

NSF is recognized and respected as a global leader in identifying and supporting curiosity-driven, discovery-based explorations and use-inspired, solutions-focused innovations across all fields of science, technology, engineering, mathematics (STEM) and supporting all levels of STEM education. Our process through which we select proposals based on peer review, merit-based evaluations, by definition and by construction, selects the best and most creative ideas, those that offer the greatest promise for success. NSF funding accounts for approximately 24 percent of the total federal budget for basic research conducted at U.S. colleges and universities and has been vital to many discoveries that impact our daily lives and drive the economy. In

many fields such as mathematics and computer science, NSF is the major source of federal support for academic research.

NSF has funded research and researchers, innovations and innovators, and infrastructure that have garnered incredible benefits to the nation. The Internet, Google, Qualcomm, 3D printing, the economic theory underpinning spectrum auctioning and kidney exchanges, and even the discovery of the enzymes at the heart of the polymerase chain reaction, the chemical reaction that enables COVID-19 tests that have been critical in the fight against the pandemic, have been supported by NSF investments. NSF's unique mission to support research and innovation across all fields of science and engineering places the agency at the forefront of discovery. Indeed, 253 Nobel Prize winners have been supported by NSF at some point in their careers. Our awardees are often investigating novel concepts that may have unforeseen applications or immediate commercial use. Recognizing this, NSF has made a concerted effort to support researchers who believe they have a commercially viable idea, and the SBIR and STTR programs are vital components of NSF's agenda to enable commercialization of technologies stemming from basic research.

History of SBIR/STTR

In 1977 the National Science Foundation (NSF) initiated a pilot program that became the “Small Business Innovation Research” (SBIR) program. This program solicited research proposals from profit-seeking small firms. Subsequently in 1982, Congress established the SBIR program across government to provide increased opportunities for small businesses to:

- meet federal research and development needs;
- stimulate technological innovation;
- foster and encourage participation in technological innovation by socially and economically disadvantaged persons; and
- increase private-sector commercialization of innovations derived from federal research and development.

The primary objective of the NSF SBIR program is to increase incentives and opportunities for startups and small businesses to undertake transformative, high-risk, research across all technology areas. NSF funds projects that have the potential for economic payoff and broad societal impact if the innovation is successful. Additionally, the program seeks to stimulate technological innovation in the private sector, increase commercial application of NSF-supported research, and improve the return on our investment in federally funded research for its economic and social benefits to the nation. With this goal in mind, most SBIR/STTR program officers are highly trained scientists who are also former entrepreneurs, investors, or both – and indeed, NSF is one of the only agencies with program officers dedicated strictly to SBIR and STTR.

SBIR has broad reach throughout the government, as eleven federal agencies now have SBIR programs. Government-wide, these programs set aside ~\$3 billion annually and have granted ~160,000 awards. The budget is 3.2% of a research agency's extramural R&D budget – which is approximately \$200 million at NSF.

The STTR program was established in 1992 and, like the SBIR program, focuses on transforming scientific discovery into products and services with commercial potential and/or societal benefit. It differs from SBIR in that a small business must partner with a university or federally funded research center to do a percentage of the R&D work. Five federal agencies have STTR programs. The budget for STTR is 0.45% of extramural R&D.

SBIR/STTR at NSF

Within NSF's mission to advance the frontiers of science and engineering, the SBIR program is an integral part of the NSF strategy to stimulate innovation and address societal needs through the commercialization of the results of fundamental research. NSF's program funds small businesses to de-risk their technology, often long before the private sector is willing to invest.

Unlike some other agencies which award SBIR contracts to meet their own procurement needs, NSF is never envisioned to be the ultimate customer of the technologies it funds. The NSF SBIR research topics are oriented to the needs of the marketplace and the nation as a whole. For example, NSF SBIR seed funding led to Symantec, which is now a global leader in cybersecurity. Symantec was founded in 1982 by Gary Hendrix who was funded by an NSF SBIR grant. Qualcomm was launched after co-founder Andrew Viterbi invented the "Viterbi Algorithm," a mathematical formula to eliminate signal interference, paving the way for widespread use of cellular technology. After receiving NSF SBIR funding during the 1980s in its early years as a small business, Qualcomm has grown to become a world leader in wireless technologies and particularly "5G," a critical technology and industry.

At NSF, SBIR grants are divided into two competitive phases. Phase I awards have a duration of six to twelve months and a maximum of \$275,000. These awards provide support to conduct feasibility research into new techniques or products. All Phase I awardees are eligible to apply for a Phase II award which can be for up to \$1,000,000 and two years in duration.

NSF has used multiple strategies to encourage new applicants to participate, and to help maximize their chances of success. Our Project Pitch, a short pre-application review covering key aspects of a potential project, gives a new applicant a relatively accessible and fast way to get feedback from our team on whether their proposed project is a good fit for the program. In addition, our creation in 2020 of solicitations with multiple, always-open submission windows has given applicants more flexibility in choosing a timeline to apply. Finally, we have changed the administrative and compliance-checking processes for Phase I proposals, where we now work with applicants to allow them to fix most administrative mistakes included in their

proposal, rather than rejecting the application entirely. This has lowered the percentage of Phase I proposals that are not considered from about 15%, which was typical a decade ago, to about 2 to 3% in recent years.

NSF has also designed several supplemental funding opportunities to spur the commercial success of its SBIR companies. The flagship among these is the “Phase IIB” supplement which provides up to an additional \$500,000 for a firm generating marketplace traction for the first time.

Established in 1998, the Phase IIB supplement incentivizes active NSF-funded Phase II companies to attract private sector funding for further technology commercialization. The Phase IIB proposal is submitted while the company is conducting the Phase II research. The objective of the Phase IIB is to motivate companies to extend the R&D efforts to meet the product, process, or software requirements of a third-party investor, thereby accelerating commercial success of a Phase II project.

Supplements are also available to provide support for college and high school students, and for teachers and veterans to participate in research experiences with SBIR awardees; to enable awardees to form partnerships with minority-serving universities, colleges, and community colleges; and to help firms form partnerships with NSF-funded research centers, among others.

In addition to providing funding, NSF uses experiential education to help researchers gain valuable insight into starting a business or industry requirements and challenges. The NSF Innovation Corps (I-Corps) program helps entrepreneurs and small businesses understand market needs and opportunities, thus increasing their chances of successfully translating new technologies. I-Corps was designed to foster entrepreneurship that will reduce the time it takes to bring technologies from the lab to the marketplace. More than 1,900 teams have participated in the program since 2011. In addition, just under 2,100 NSF SBIR and STTR Phase I awardee companies have participated over the past six years in a condensed version of the I-Corps program called the “Beat-the-Odds Boot Camp”.

Within the last year, NSF announced the first awards made under the I-Corps Hubs program, a modified operational model to leverage and amplify the best practices of the program’s first eight years of operation. The I-Corps Hubs program will create larger university consortia that can more easily share lessons learned. In addition, I-Corps will continue expanding its geographical reach to ensure that all the nation’s communities have the opportunity to learn from and contribute to the innovation ecosystem. The Hubs model also offers a path for promising technologies funded by other federal agencies to benefit from I-Corps training, enhancing access to scientists and engineers in historically black colleges and universities (HBCUs), Hispanic-

serving institutions (HSIs), and other organizations with a rich portfolio of technologies that can potentially benefit the nation.

Another program closely related to I-Corps and similarly aimed at fostering a national innovation ecosystem is Partnerships for Innovation (PFI). The PFI program encourages the translation of promising, fundamental discoveries made by NSF researchers into products and services that benefit the nation. PFI nurtures entrepreneurial spirit by pairing I-Corps training with prototyping and advanced technology development, giving technologists and engineers in academia a set of tools to successfully transition their inventions into impact. Through I-Corps and PFI, NSF helps prepare researchers in advance of starting new firms. These programs serve as important training grounds and help researchers improve their success rates in securing SBIR and STTR funding and follow-on investments.

Together, I-Corps, PFI, and SBIR/STTR constitute a “Lab-to-Market Platform” organized under NSF’s new Directorate for Technology, Innovation and Partnerships. Partnerships being critically important in moving scientific and engineering discoveries funded by NSF to the marketplace, TIP will also serve as a central resource to catalyze and scale public and private partnerships agency wide.

Frequently, NSF-funded researchers will pursue and receive grants from many of these programs in parallel, in sequence, or on a combined path. We are seeing strong interactions between these programs as well as with our SBIR/STTR program where researchers start with NSF-funded fundamental research, participate in I-Corps training to learn about the marketplace and the opportunities for new technologies to impact industry, then create technology demonstration projects in PFI before launching a new firm and pursuing SBIR and STTR funding.

Workforce Development

There are several ways in which NSF SBIR and STTR awards contribute to the development of an advanced workforce for the entire research enterprise. Firms may take advantage of the many supplements available to all NSF investigators through short-term training activities such as the Research Experiences for Undergraduates (REU), Research Experiences for Teachers (RET), Research Assistance Supplements for High School Students (RAHSS), INTERN, a graduate student supplement, and the Veterans Research Supplement (VRS) program. These NSF programs have had tremendous impacts beyond technical and economic development. They support future researchers, engineers, entrepreneurs, and educators in STEM fields as well.

Professional development of students through research experiences in a fast-paced entrepreneurial setting is an important part of NSF’s SBIR and STTR programs. Undergraduates typically work ten weeks in the summer and receive an average stipend of \$8,000. Throughout

NSF, REU is a critical program to creating the next generation of STEM professionals, and REU slots are hotly competed for by students.

The RAHSS program is designed to foster both opportunity and interest in science and engineering among female and minority high school students. The program provides an opportunity to work on scientific and engineering projects, and we hope fosters these students' interest in pursuing science, technology, and engineering studies in college. This program is unique to NSF and is only one element of our broader support of inclusion.

NSF remains deeply committed to providing access for all the nation's communities to participate in the economic and industrial transformation offered by technology translation opportunities. NSF's inclusion initiative built on the three pillars of affinity, community, and opportunity. NSF partners with affinity groups, such as groups focused on underrepresented STEM students, to identify young scientists and engineers interested in understanding the potential impact of their technologies. By creating models for shared leadership between the affinity group and the I-Corps community to jointly provide experiential learning opportunities, NSF accelerates the process by which enterprising researchers throughout the country learn about innovation opportunities.

The RET program brings high school teachers and community college professors to work at a small business in SBIR/STTR-funded research projects. They can then bring their experiences in engineering and technological innovation into their classrooms, and ultimately to their students.

Another supplement, INTERN, is designed to prepare highly trained graduate students for the workforce by funding a six-month internship in a non-academic setting, such as in industry, a government laboratory, or a policy think tank. INTERN provides up to \$55,000 for a graduate student to work with a non-academic mentor in one of these settings.

The Veterans Research Supplement (VRS) is another supplement opportunity that NSF offers to engage former service members in the research enterprise. NSF offers up to \$10,000 to awardees to engage veterans who are full- or part-time students or even serving as STEM teachers or faculty.

Together these programs enhance the capabilities of students and teachers, and synergistically foster an interest in technical innovation, engineering, and entrepreneurship in the broader community.

Comments on H.R. 4033

NSF appreciates the attention of the Congress and this Committee to these important programs and efforts to improve the opportunities for startups and small businesses to successfully enter

the marketplace. While the Administration has not taken a position on H.R. 4033, *The Small Business Innovation Research and Small Business Technology Transfer Improvements Act of 2021*, let me provide here some comments on those parts of the legislation that relate most directly to NSF.

First, allow me to start with an overview of the role of these programs. The SBIR and STTR programs, now several decades old, are central to the health of our nation's economy. Startups and small businesses create jobs for Americans. Plus, companies with roots in science and engineering – and with intellectual property – present opportunity for unusually high economic and social impact. Unfortunately, the changing investment landscape makes it difficult for startups or small businesses founded around disruptive technical innovations to attract private capital. Therefore, SBIR and STTR fill a significant gap by enabling firms with significant potential to grow, addressing both technical and economic risks as they become ready for the private markets.

Sections 4 and 5 of the legislation instruct the Administrator of the Small Business Administration to ensure that, in selecting small businesses to participate in SBIR or STTR programs, federal agencies give high priority to small manufacturing companies and business concerns engaged or planning to engage in manufacturing R&D, and small business concerns that are engaged in cybersecurity, respectively. The NSF SBIR/STTR programs fund a broad set of technologies. For example, in the manufacturing space alone, we support advanced manufacturing, advanced materials, new chemical technologies, the Internet of things, nanotechnology, photonics, instrumentation and hardware systems, robotics, semiconductors, space technologies, and wireless systems. And in the cybersecurity space, we support work that spans artificial intelligence, cryptography, quantum information technologies, and distributed ledgers, among other areas.

All of these areas represent innovations important to current and future economic growth. NSF appreciates the flexibilities provided by the current authorities, which allow NSF to support activities to strengthen the nation's innovation ecosystem across all areas of research and education supported by the Foundation.

Section 6 of the legislation stipulates the issuance of Phase III awards to SBIR and STTR award recipients that developed the technology as direct follow-on awards without further competition. As mentioned earlier, NSF's Phase IIB program helps bridge the gap in funding between Phase II and ultimate commercialization. A Phase IIB Supplement of up to \$500,000 is available for small businesses able to attract third-party investment. NSF has found that awardee companies that qualify for Phase IIB successfully commercialize their innovations and that the NSF funding is critical in helping these firms address the remaining technical and market risk. Many Phase IIB

firms have grown in both revenue and employment and are even ready for acquisition by larger firms.

Sec. 7 of the legislation requires increased outreach efforts to Historically Black Colleges and Universities (HBCUs) and Hispanic-Serving Institutions (HSIs). As part of the inclusion initiative described earlier, NSF has multiple outreach efforts focused on underrepresented communities in STEM. These include Accelerating Women And under-Represented Entrepreneurs (AWARE), a set of awards to recruit, educate, and retain underrepresented groups in entrepreneurship; Culturally Relevant Enterprise Development (CRED), consisting of short courses piloted with the Native American/Alaska Native (NA/AN) communities to develop entrepreneurial skills and new ventures aligned with their communities' needs and priorities; Innovative Postdoctoral Entrepreneurial Research Fellowship (I-PERF), a partnership with the American Society of Engineering Education (ASEE) to provide scientists and engineers underrepresented in innovation and entrepreneurship with postdoctoral fellowships in startups; and women's networking sessions at all SBIR/STTR Phase I workshops. These programs complement other NSF broadening participation programs to recruit and retain all STEM communities.

With respect to Section 9, NSF has many programs that address commercialization readiness and foster innovation and technology transfer. We are continually reevaluating these programs for effectiveness with then inputs of NSF Advisory Committees and Committees of Visitors, which aim to review each of NSF's programs, including SBIR and STTR, at regular intervals.

Section 12 expands SBIR Phase flexibility to NSF, which would allow us to consider new approaches to supporting a wide variety of entrepreneurs and innovators at various stages and across many industries.

Section 13 makes the administrative funding pilot permanent, which would allow us to continue to utilize this flexibility to continue our important efforts to improve the commercialization outcomes of our program, attract new and high-potential applicants to the program, and increase the participation of underrepresented groups and geographies in the program.

Section 15 calls for the extension of the commercialization assistance pilot program. NSF has in place multiple programs that accomplish the objectives of this pilot program. For example, NSF provides supplemental funding to grantees through its Technology Enhancement for Commercial Partnerships (TECP) program. The TECP supplement is intended to pave the way for partnerships with strategic corporate partners and investors as a means to increase the potential for the SBIR-STTR awardees to successfully commercialize their technology. The supplemental funding allows the small business to conduct additional research needed to meet the needs of a

corporate partner or customer that will consume the commercial outcome. The TECP supplement can be up to 20% of the original Phase II award for a maximum TECP supplement of \$200,000.

Finally, NSF provides additional funding to small businesses through its Phase IIB matching funds program as described above. It has been our experience that almost all of the major commercial successes to come out of our program have required substantial follow-on funding from angel investors, venture capitalists, corporate partners to reach their ambitious goals, and the Phase IIB program ensures that awardee firms focus on preparing for the transition to the next stage of funding.

Conclusion

For over 40 years, NSF has helped startups and small businesses across the country transform their ideas into marketable products and services through our SBIR and STTR programs – programs that, without Congressional action, will expire at the end of the fiscal year.

NSF focuses on high-risk, high-impact technologies in startups – those teams and technologies that show promise but whose success hasn't yet been validated. Our goals are to foster innovation and spur businesses and job creation in the United States. Between fiscal years 2016 and 2020, America's Seed Fund powered by NSF made over 2,200 awards to startups and small businesses. During approximately the same period, fiscal years 2016 through 2021, the NSF-funded startups and small businesses (including those funded prior to 2016) portfolio subsequently raised more than \$14 billion in private investments. Furthermore, an estimated 200 companies ultimately generated returns to their investors through so-called "exits," in which the awardee organization becomes a public company or undergoes a successful merger or acquisition with another company.

NSF is always assessing its performance against the broad goals of the SBIR and STTR programs, and this process has led to new supplements, new outreach, and enhancements to other NSF programs because it takes far more than the SBIR or STTR investment to translate a technical vision into a realized solution. NSF is focused on helping startups address all the potential risks – marketplace and technical risks, and even potential skills gaps – that researchers may experience in exploring the broader market. The SBIR/STTR programs anchor an extensive activity in identifying and leveraging the opportunities that new technologies offer the nation.

On behalf of the National Science Foundation, the SBIR/STTR programs and our awardees, I want to thank you for your support of NSF and for this opportunity to highlight programs that provide startups and small businesses with the means to keep America on the forefront of innovation. I would be pleased to answer any questions at this time.



Dr. Ben Schrag is an SBIR/STTR Program Director and Policy Liaison. He joined NSF as a Program Director in 2009, leading the Advanced Materials and Instrumentation portfolios. Prior to NSF, he was the Director of Research and Development at Micro Magnetics, where he led an effort to commercialize a new family of high-performance magnetic microsensor products. During this time, he also served as a visiting scientist at Brown University. Ben received his Ph.D. in Physics from Brown University.