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Use of Small Business Innovation (SBIR) Program in Support of Technology Transfer

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1. Abstract

The National Institute of Standards and Technology (NIST) has pioneered a new methodology for US small businesses to spin-out commercially-viable technologies emerging from NIST's focused research. Using its Small Business Innovation Research (SBIR) Program funds, NIST incentivizes small US companies to create financially rewarding innovations by researching and developing NIST-originated technologies with the goal of transitioning NIST intramural research into the market. The goal of transitioning research to the commercial market is also the goal of federal technology transfer programs. The use of SBIR funds to achieve federal technology transfer is a novel systematic approach to merging these two complementary infrastructures in order to leverage the advantages of each program for synergistic growth.

Keywords: Small Business Innovation Research (SBIR) Program; Technology Transfer; Licensing; Commercialization

2. Background

2.a. Small Business Innovation Research (SBIR) Program

The SBIR Program is a federally legislated[1] program that requires federal agencies expending over $100 M annually in extramural research and development (R&D) to reserve 2.5% of that budget for awards to for-profit, small businesses with the following objectives:

- To increase private sector commercialization of innovations derived from federal R&D
- To use small business to meet federal research and development needs
- To stimulate small business innovation in technology
- To foster and encourage participation by minority and disadvantaged persons in technological innovation

The National Institute of Standards and Technology (NIST) has administered an SBIR Program since 1986, and has adapted its implementation to fulfill changing statutory and regulatory requirements. Most notably, in 1992, the reauthorizing legislation placed an

[1] The SBIR program was originally established in 1982 by the Small Business Innovation Development Act (P.L. 97-219). It was then expanded by the Small Business R&D Enhancement Act of 1992 (P.L. 102-564),, extending the program to the year 2000. Subsequent legislation (P.L. 106-554) has extended the program.

increased emphasis[2] on commercializing R&D efforts of the small businesses awarded SBIR funds, SBIR Awardees. To that end, the NIST SBIR Program, like many others, has provided commercialization assistance support to its SBIR Awardees through third party vendors as provided for by the "technical assistance" clause in the legislation.

The authorizing legislation allows each participating federal agency to implement its SBIR Program in a way consistent with and supportive of its mission. NIST's stated mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. Since 1982, NIST has sought R&D products from its SBIR Awardees which directly impact and support both the NIST research mission and the industrial communities that it serves. The NIST SBIR Program awards contracts as the funding vehicle to ensure the delivery of those needed products into its research programs. Those contracts contain required end-point functionality specifications but do not prescribe an approach, thus allowing the contractor to innovate per SBIR intent.

2.b Federal Technology Transfer (TT)

Most of the eleven federal agencies that participate in the SBIR Program conduct significant intramural R&D in addition to the extramural component which triggers their SBIR participation. That intramural research is carried out in federal laboratories and Federally-Funded R&D Centers (FFRDCs) in support of the agency's mission. One outcome of that research is the development of intellectual property (IP) which is identified as having commercial value beyond the stated mission-related objectives that drove it. The Stevenson-Wydler Technology Transfer Act of 1980 and subsequent laws and regulations require that federal laboratories take appropriate measures to ensure the transfer of commercially-viable technologies to the private sector. Technology Transfer Offices (TTOs) within each of the agencies are responsible for identifying, protecting when appropriate, marketing, and licensing their IP with the goal of commercialization. TTOs market their agency's IP in a variety of ways including: direct industrial contacts, web portals, showcases, and intermediaries in an effort to facilitate the commercialization of federal inventions. Although there are examples of creative marketing practices that seek to increase market adoption of federally funded R&D (eg. match-making services, patent auctioning, SBDC-backed licensing ventures, entrepreneur-in-residence programs, and others), there has not been a systematic approach to use the SBIR Program as "seed funding" for federal technology transfer.

3. NIST SBIR-TT Objectives

NIST has established a methodology to spin out its commercially-viable technologies that still require additional research - and hence may face uncertain market adoption because

[2] Other examples of statutory and regulatory requirements include the emphasis on manufacturing-related R&D (EO 13329) and the priority for energy efficiency and renewable energy related R&D (PL 110-140).

of the lack of funds available to bridge the "valley of death" that chokes many early stage research projects - by providing investments through the SBIR Program.

The legislated goal for the use of the SBIR Program "to increase private sector commercialization of innovations derived from federal R&D" has heretofore been interpreted by the participating agencies as the commercialization of the work performed by the federal R&D funds expended extramurally, especially the SBIR Awardees. The NIST SBIR TT Program seeks to expand the potential of that legislated goal to include the results of federal R&D conducted by federal laboratories. NIST holds commercially promising innovations that could readily be commercialized by the private sector, namely SBIR Awardees. The SBIR-TT model is focused on providing SBIR funds to intentionally advance federal laboratory technologies toward commercial application. Along with the SBIR funds, intangible resources, such as expert know-how and protected IP, are provided to support the SBIR Awardee in its commercialization effort.

Much of the IP derived from NIST research is relevant to the industries served by its research programs because NIST researchers interact extensively with industrial counterparts as a natural part of their mission. A typical NIST researcher participates in standards committees, trade associations, company collaborative consortia – all platforms which air the technology needs of the participants. Such immediate feedback from industrial sources informs NIST research and maintains its relevance to commercial needs. Consistent with the NIST mission, its researchers engage in scientific and engineering discovery that lead to solutions to measurement science, standards and technology problems expressed by industry. As such, commercially-relevant, and importantly for this new model, commercially-viable technologies are available for companies to advance toward the marketplace.

For the majority of federal IP, Technology Readiness Level [3] (TRL) is at a stage that still requires substantial further research, development, and demonstration, as well as the capital to secure that maturation. Because work performed by the federal laboratories must in all cases not compete with the private sector, NIST (or any federal) researchers generally will not advance a technology to the brink of commercial exploitation. It is incumbent on the private sector to devote the resources to a federal technology to advance it toward the more mature stage(s) and eventual commercialization.

4. SBIR-TT Implementation at NIST

NIST researchers work with their management and the NIST SBIR Program Manager to isolate the specific work that would need to be done by the private sector in order to advance a technology that has been identified as commercially viable and could

[3] TRL is a technology maturation process taxonomy model first developed by NASA and in use by NASA and DOD to assess the maturity of evolving technologies

accomplish a NIST mission-related need. Because of the use of contracts as the funding agreement in the SBIR-TT Program, required end results can be specified in a solicitation while allowing the contractor the freedom to innovate (and conform with SBIR legislated intent) an approach to reach the solicited goals.

The NIST SBIR-TT Program creates and "packages" opportunities for announcement in its annual solicitation that is posted through normal federal acquisitions channels. The SBIR-TT opportunity "packages" are encapsulated in "TT" subtopics within the solicitation and include the following factors:

1) A description of and reference(s) to the background NIST technology. This includes the motivation behind the original NIST research and a brief description of the market opportunity
2) A clear articulation of the research gap(s) that remain for the background technology to be fully exploited. In all cases, innovation is still required in order to advance the background technology toward a higher TRL. Although suggestions may be given for a direction to be taken, potential SBIR-TT Awardees are invited to propose their innovative approaches to the research gap(s) presented. Research gaps typically reside within the dimensions of extended power, wavelength scale, sensitivity, usability, scalability and the like for whatever material, device or component is being solicited. (Note, this is not all-inclusive due to the broad nature of NIST's mission.)
3) NIST assets are offered and clearly described that can prove valuable to the SBIR Awardee in its research and creation of innovations. These assets can include but are not limited to: NIST researcher/inventor consultation time, and access to facilities, materials, equipment, devices, etc.
4) Funding is awarded to prove the feasibility of the proposed approach to advance the NIST background technology, and if the concept is successfully proved, funding is continued for prototype research and development.[4] The SBIR funds incentivize the commercialization of the federal background technology.
5) If the background technology is patented, a non-exclusive, royalty-free research license is granted within the SBIR-TT contract. The SBIR-TT Awardee is given the opportunity to negotiate a commercialization license under 37 CFR § 404.
6) As true with all SBIR awards, the SBIR-TT Awardee retains rights to all its innovations during the SBIR project. SBIR Awardee may choose to pursue patent protection as needed. If the SBIR Awardee chooses to maintain its innovations confidential as a trade secret, the SBIR contract provides for the needed

[4] The structure of the SBIR Program is such that Phase 1, proof of concept, is a required stage preceding the prototype development, or R&D, Phase 2. The NIST SBIR funds Phase 1 awards at $90,000 for 6 months of feasibility study and $300,000 for 2 years of R&D.

confidentiality. In either case, the federal government retains a paid-up license to use the innovation for its purposes.

7) Although NIST does not allow for concurrent SBIR (or other funding) award and CRADA,[5] there are other agencies that find the pairing fit and may therefore allow additional rights to the SBIR awardee in the form of the CRADA option to negotiate an exclusive license to a subject invention developed under the paired agreements.

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Technologies emerging from research labs call for a continuum of varying levels of needed additional research to prove technical voracity, market acceptability, and scalability. As indicated above, NIST researchers' participation in industrial dialogues and collaborations not only informs their research directions but also the steps that are needed to build upon their work with the goal of maturing it to a level needed for market adoption. In addition to the contracted goals for the research (factor #2 above), the collaboration that may form under factor #4 supports the small business throughout its SBIR project and provide intangible but valuable "in-kind" support in addition to the other tangible support mechanisms.

5. Discussion of Methodology

Selected background technologies for advancement through SBIR-TT may be either patented or not. For those that are dedicated to the public domain, there is no issue of potential conflict of interest in having the researcher participate in his/her work's commercialization. For patented background technologies, NIST has developed certain firewalls to insulate the inventor(s) from the perception of conflict of interest. In those cases, NIST management is responsible for the decision to delegate activities of a NIST inventor in the advancement of his/her patented technology. Further, inventors do not participate in any way in the selection of SBIR-TT awardees.

The selection of SBIR-TT Awardees is like that for all SBIR Awardees: an open, fair, competitive process. No advance notice is given to any potentially interested small business before the solicitation announcement is made public. During the open solicitation period, no direct communication between a potential proposer and NIST researchers is allowed. Rather, a publicly-available web-based discussion forum invites technical and general questions from the public and posts those along with responses from NIST experts onto a website that is referenced within the solicitation.

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[5] A Cooperative Research and Development Agreement (CRADA), pursuant to 15 U.S.C. Section 3710a is a formalized collaboration between the Federal government and private sector participants to work together on a mutually beneficial project

Through an open and competitive process, small companies are selected based on established, publicly-announced criteria to conduct the research necessary to advance “background” NIST technologies toward the marketplace. These criteria include: the scientific and technical merit of the proposed research as well as its innovation, originality, and feasibility and relevance and responsiveness to the subtopic to which it is addressed; the quality of facilities, equipment, personnel; and quality of the proposal’s commercialization potential as evidenced by a record of commercializing other research products; existence of outside, non-SBIR, funding or partnering commitments; or the presence of other indicators of commercial potential of the idea.

Once selected according to published criteria, all NIST SBIR Awardees are under contractual obligation to provide interim progress reports describing in detail the technical aspects of the project and their activities focused on gaining market acceptance (market analysis, follow-on investments, partnering, etc.). The payment schedule is established to ensure that the SBIR Awardee has access to capital when needed but only upon acceptance of progress reports.

The SBIR-TT projects result in a partnership of mutual fulfillment. The SBIR-TT Awardee is given access to certain assets (financial, tangible and intangible) and thus is incentivized to bring to practical application the NIST background technology and drive its maturation toward profitability. On the other side, the NIST researcher is motivated to see his/her research reach practical application due to mission need and professional satisfaction.

As is the case with all NIST SBIR awards whenever funding is available, commercialization assistance from a third-party vendor is provided to the small businesses to support their market analysis and marketing efforts. Additionally, the services of the Manufacturing Extension Partnership (MEP) are made available to each awardee for manufacturing and scale-up assistance.

Once selected and supported with a NIST technology, and a license if needed, the SBIR-TT Awardee will: have access to NIST personnel, facilities, and knowledge regarding the invention (as necessary); be in a position to create and add their own innovation(s); and potentially develop a product based on the NIST patent.

A persistent challenge inherent in the SBIR Program is the effective assessment of the eventual commercialization of its R&D investments. The difficulty arises from a variety of factors including: the transient condition of some small businesses; the struggling existence of the very small companies that prefer to devote resources to the science or engineering rather than reporting which they deem unproductive; the lag in time, perhaps due to the need to leverage multiple projects, from single project conclusion to commercial event(s); or the lack of resources at most programs to conduct the necessary industrial forensics. The elusiveness of commercialization metrics have been studied and reported (Wessner, 2008). Because of the unique nature of the SBIR-TT program and the

need to assess its return as well as the responsibility for tracking the commercialization of NIST technologies, robust commercialization reporting is required from the SBIR Awardees in order to formulate reliable metrics. The NIST SBIR Program initiated a new scheme for obtaining commercialization data from SBIR Awardees by extending the contract duration by one year after the expiration of the R&D period of performance. The original contract is written for the 2 year R&D period of performance plus one additional year for a total contract term of 3 years. The contract award amount minus a nominal amount of, say, $10,000 is disbursed throughout the R&D period in order to cover the labor and all expenses related to the project. One year after the R&D period of performance is concluded, the SBIR Awardee must deliver a commercialization report addressing key questions[6] in order to invoice the remaining funds and close the contract. This withholding of a final payment may be the necessary incentive to coax the commercialization data so vital for metrics that will assess the success of SBIR-TT in implementing its commercialization objective.

6. Results

At the time of this publication, a total of 27 SBIR-TT projects have been awarded to advance the maturity level of NIST technologies by small US companies.

The first implementation of the SBIR-TT model was a pilot launch in 2008 which resulted in: 11 phase 1 projects; one commercialization license; and two research licenses. The following year, nine of the eleven prior-year phase 1 projects were awarded phase 2 contracts and 16 new phase 1 projects were initiated which included 9 research licenses and one additional commercialization license. It is anticipated that given funding availability, roughly half of new NIST SBIR awards will be made annually toward SBIR-TT projects. The other awards will continue to be made toward projects that fulfill specific mission-related NIST R&D needs.

7. Next Steps

The preliminary results of this SBIR-TT approach have been welcomed by other federal SBIR programs as a potential tool that they may be able to adopt within their own agencies to effect the desired outcomes of the legislated SBIR and technology transfer intents. The relatively small size of the NIST budget as compared to most other agencies made it a convenient petri dish for this experiment. Furthermore during the first two years of the program, the functional proximity of the TTO and the SBIR Program within NIST enabled the first steps to be taken without barriers. The adoption of this approach by other agencies may require coordination between functional units and a systematic

[6] The commercialization report must include details about additional activities that have been planned and executed along with future plans to derive revenues from the technology; these may include but are not limited to: pricing, partners, licensing, production plans, manufacturing partners, follow-on R&D funding. Resources committed by the SBIR Awardee to effectively commercialize technologies developed under the SBIR project will be clearly demonstrated as well as projections for further commercialization.

procedure for identifying commercially-viable intramural technologies for which a champion can articulate the needed research steps for commercialization.

Additionally, commercially-viable technologies derived from university research may likewise be transferred to market sectors through innovations funded by the SBIR Programs. University research results prime for advancement toward commercialization may be the focus of Principal Investigator initiated research projects to be considered by grant awarding SBIR Programs. This type of technology transfer out of universities through the SBIR Program does currently exist in limited areas but not in a nationally coordinated fashion with coherent efforts to align university resources with entrepreneurs to maximize the formation of high-growth ecosystems.

8. Conclusion

The SBIR-TT approach that has been pioneered at NIST provides a systematic means of advancing federally developed technologies toward a maturity level that allows those federal investments to reach practical application in the marketplace. By providing SBIR funding, access to federal background technology which may be patent protected, and other supports that may include know-how and materials, the SBIR-TT Program enables and encourages the successful commercialization of federal technologies – a legislated goal of federal technology transfer programs.

9. Acknowledgements

As with all technology transfer endeavors, this effort could not be accomplished without the full cooperation of the NIST researchers who demonstrated their professional dedication to advancing US industrial competitiveness by collaborating with the process and with the SBIR Awardees who became new partners. Likewise, the SBIR Awardees who took on the challenge of proposing and working on new innovations to advance NIST background research are the entrepreneurs who fully appreciate the promise not only of the technologies but of the opportunities afforded by open innovation.[7]

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[7] The term open innovation represents the reliance of a company on externally-developed inventions for its growth (Chesbrough 2003).

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