SBIR/STTR Reauthorization: A Review of Technology Transfer

Chairwoman Comstock, Ranking Member Lipinski, and members of the Subcommittee on Research and Technology, I am honored by your invitation to present this testimony and by the opportunity to discuss the role of the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (SBTT) programs in moving the results of federally funded research and development to the private sector and to the marketplace. The SBIR and STTR programs play a critical role in the continuum that leads from research discoveries to new products and services. Universities generally support the reauthorization of these programs because they are important parts of the innovation ecosystem on campus and in the economy, and indeed, value these programs. A healthy and sustained federal investment in scientific and engineering research is vital to the health and economic competitiveness of the nation and to meeting the challenges we all face. A strong ecosystem to bring innovations into the marketplace to solve societal problems is a part of that investment. However as the federal share of investment in research and development conducted at U.S. universities declines[1], it is important to acknowledge that funding basic science and engineering is a priority that ensures a pipeline of discoveries to feed the innovation ecosystem. Universities are interested in seeking balance in the portion of funds available to the agencies to support the highest quality peer-reviewed research should be maintained.

The Georgia Tech Research Corporation (GTRC) was founded in 1937 as Georgia Tech's contracting entity. As one of the oldest such organizations in the United States, GTRC serves Georgia Tech's faculty in all aspects of research administration, contract negotiation, and technology transfer. GTRC's founding purpose was *"…to stimulate industrial development, to promote the fullest utilization of natural resources, and to foster research invention and discovery so as to provide a constantly improving technique in that behalf."* As a result, Georgia Tech and GTRC have a long history of support for entrepreneurial development of new technologies that result from basic and applied research programs. Such use-inspired research is the precursor to innovation that provides the raw material of entrepreneurship and has a direct, positive impact on the education of students. Three examples will illustrate the process.

Georgia Tech is a comprehensive public university with more than 25,000 undergraduate and graduate students[2]. With a commitment to diversity, Georgia Tech leads in producing graduates in STEM fields. The College of Engineering awards more engineering degrees to women than any other school and confers the most doctoral degrees to African American students among universities in the United States. Georgia Tech also leads in entrepreneurial education with programs such as InventurePrize and Start-up Summer which offer opportunities and support for students to develop their new inventions and, if development goes well, form a company around their technologies. The university was recognized by *Tech.Co* which ranked Georgia Tech as the university that "produces the best start-up talent."[3] Educating students for a future when they will be called upon to be innovators in the companies they join as employees or those they create permeates our educational programs. It is these students who will create the 'next big thing' positively impacting the economies of Georgia and the United States. Research at Georgia Tech has a similar focus on the future of science and technology.

---

[1] NSF. National Center for Science and Engineering Statistics, *Higher Education R&D Series.* Based on national survey date. Includes Recovery Act funding. AAAS 2015.

[2] In academic year 2015-16, graduate enrollment was 9.892 and undergraduate enrollment was 15,142.

[3] http://tech.co/university-college-tech-startup-talent-2015-07

Georgia Tech reported over $765 million dollars[4] in research expenditures in 2015. Funding for sponsored programs came from a variety of federal and non-federal sponsors including, among other agencies, the Department of Defense, National Science Foundation, National Institutes of Health, Department of Energy, and NASA. Private industry sponsors about 13% of the total research activity at Georgia Tech. Executive Vice President for Research Stephen E. Cross describes Georgia Tech's innovation ecosystem as, in part, "an industry-facing research strategy focused both on leading edge, use-inspired research, and economic development."[5] Thus there is a pipeline that leads from basic and applied research—use-inspired research—to discoveries that can be matured and transferred to the private sector through licensing to existing companies and the creation of new ventures. Over the past five years, 81 companies have been formed based on technologies licensed by GTRC. Among the top 25 universities in the number of U.S. utility patents granted in 2014, Georgia Tech seeks to ensure that research outcomes benefit the public at a lively pace. A metric utilized by Georgia Tech, "patent velocity," measures the overall commercial strength of the patent portfolio, by calculating the percentage of Georgia Tech's patents in which commercial rights have been granted to one or more companies at intervals after the issuance of a U.S. patent. Five years after issuance, commercial rights to 84% of patents granted to GTRC have been licensed. As part of enhancing the impact of its patents, Georgia Tech works with its inventors to develop technologies and help define markets for products and services based on those innovations.

Georgia Tech's Enterprise Innovation Institute is home to a number of programs that are part of the entrepreneurial pipeline including the Advanced Technology Development Center (ATDC), the longest-running and largest incubator affiliated with a major research university in the United States. ATDC serves about 800 entrepreneurs each year across the state of Georgia and has graduated approximately 170 startups from its ATDC Signature program. Collectively these graduates have received more than $2 billion in investment funds and have generated more than $12 billion in revenue in the state of Georgia. In addition, the NSF Innovation Corps (I-Corps) selected Georgia Tech as one of three original nodes. The I-Corps collaborative teams model matches a principal investigator with an entrepreneurial lead and a mentor, in an effort to broaden the impact of NSF-funded projects through public-private collaboration. The teams focus on economic impact and meeting societal needs through the commercialization of university innovations. Finally, ATDC has an office, the SBIR Assistance Program, which serves as the "SBIR catalyst" for ATDC member companies. The office helps companies learn about federal funding from SBIR and STTR programs and applying for the funds. This office also serves as an interface with Georgia's Manufacturing Extension Partnership connecting ATDC startup companies with manufacturers and manufacturing resources.

Georgia Tech is proud of its leadership role in the commercialization of innovation resulting from federally funded research and its efforts to foster the creation of new companies. The nexus between federal funding for research, the innovation ecosystem at U.S. universities, and appropriately phased federal support for commercialization can be best illustrated in living case studies happening at Georgia Tech.

Pindrop, an Atlanta-based start-up, combats the heretofore intractable challenge of telecommunications fraud through acoustic "fingerprinting." The company licensed technology that resulted from Department of Defense-funded research conducted by College of Computing professor, Mustaque Ahamed. The invention was disclosed in 2010 to Georgia Tech Research Corporation and subsequently licensed to the new company in 2011. Pindrop's management team participated in Georgia Tech's I-Corps. The company sought a grant from the NSF's SBIR program, and received help in developing the application from the SBIR Assistance Program that is part of

[4] As reported in the National Science Foundation's Higher Education Research and Development Survey FY 2015.
[5] A Case Study of a Research University's Role in an Innovation Ecosystem. *Proceedings of the 2nd Annual International Conference on Innovation and Entrepreneurship*, July 2012

Georgia Tech's Enterprise Innovation Institute. Pindrop received $150,000 as a result. In January 2016, A $75 million Series C round of funding, led by Google Capital brought total funding injections to $122 million.[6]

In a heartening second act that demonstrates the leverage federal funding can have in creating an atmosphere of entrepreneurship, another invention from Dr. Ahamed's lab was disclosed in December 2015. Although it is too early to predict success, this is an example of the intersection of graduate education and research in the innovation ecosystem. Building on knowledge from the I-Corps program, a new startup opportunity being pursued by researchers in Dr. Ahamed's lab is currently being funded by the philanthropic dollars made available to Georgia Tech for technology maturation and through a grant from a public-private fund for technology development, the Georgia Research Alliance.

StarMobile, a resident of ATDC and graduate of the university's VentureLab startup incubator program for faculty, students and staff, has now received a total of $1.4 million in grant awards from the NSF SBIR program. The technology around which StarMobile was formed arose from NSF-funded research awarded to Professor Raghupathy Sivakumar from Georgia Tech's School of Electrical and Computer Engineering in 2010. StarMobile is leading a codeless, cloud-based solution focused on delivery of faster, simpler, and lower-cost enterprise mobility. The Georgia Tech spinoff converts desktop enterprise software into mobile applications, reducing cost and time to implement through their conversion product.

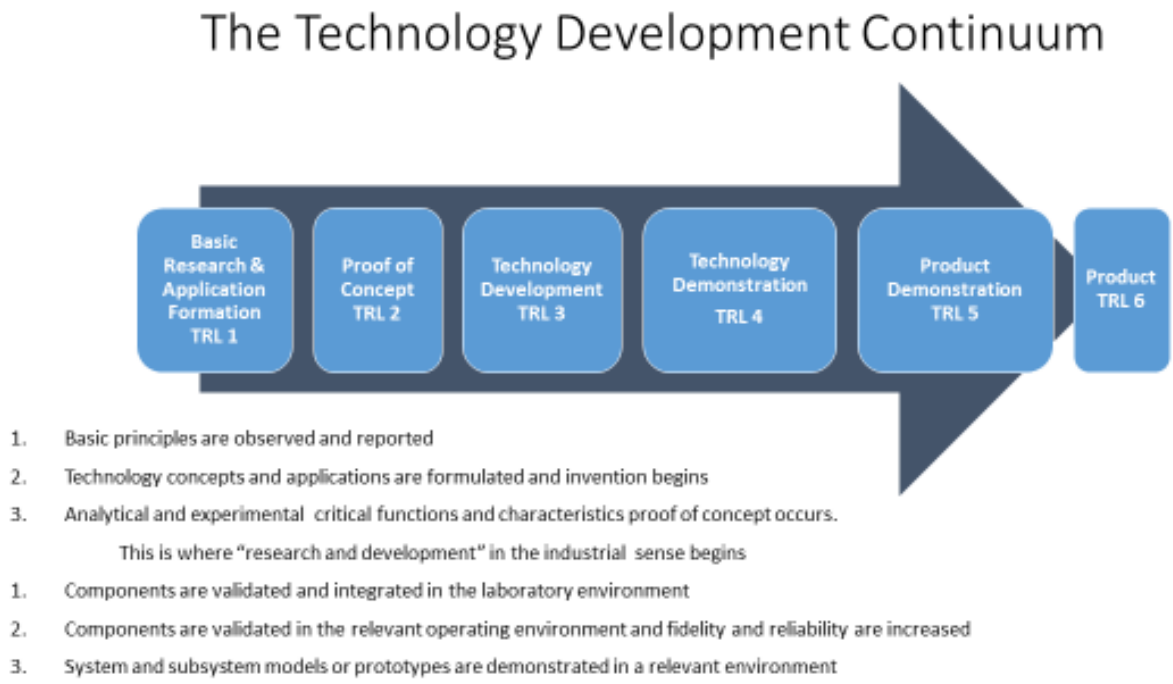
Zyrobotics was launched in September 2013 by Ayanna Howard, the Linda J. and Mark C. Smith Chair professor in Georgia Tech's School of Electrical and Computer Engineering. Zyrobotics is commercializing assistive technology that enables children with limited mobility to operate tablet computers, smartphones, toys, gaming apps, and interactive robots. As the principal investigator describes in her SBIR proposal, an important observation was made while working with pre-college students in the course of NSF-funded fundamental research investigating the use of different interfaces to engage students with disabilities in robotics-based programming activities.

> *"The project came upon an interesting dilemma in 2010 during one of their first summer workshops for high school students with Traumatic Brain Injury. They found that the traditional input devices that currently exist for computer access, such as keyboard and mice, were very difficult to use by students with limited fine motor control or upper-body motor impairments. Upon looking for solutions to this problem, they discovered that there were very few low-cost solutions that exist which could adequately simulate the complexity of the keyboard and mouse interface. As such, their goal was to design a low-cost computer controller for individuals with limited motor skills that was adaptable to individual capability. They expanded this concept to then focus on tablet computers in order to provide a solution that could address other needs of the target demographic -i.e,. portability, adaptability, and low-cost. The success of the controller led them to submit the technology to the NSF I-Corps program….The invention, which was termed TabAccess – a wireless controller for tablet accessibility, was then successfully used in a number of camps with children with limited mobility, including those diagnosed with Cerebral Palsy, Spinal Muscular Atrophy, and Traumatic Brain Injury. Development efforts on the technology with the I-Corps funding and a* [Georgia Research Alliance] *Phase I seed grant enabled progression of the technology to the point that it could be licensed to Zyrobotics for further development activities needed for commercialization."*

[6] As reported by *Forbes,* January 2016.

The startup recently received a $750,000 SBIR Phase II award to advance its development and currently has products on the market.

The benefits to the public of federal funding for research and the subsequent transfer of technology is well-studied. The Association of University Technology Managers (AUTM) reports that between 1996 and 2013, university and non-profit licensing had a $518 billion impact on the gross domestic product of the United States and contributed more than $1.1 trillion to the country's gross domestic output[7]. In fiscal year 2014 alone, 914 companies were launched and 965 products based on university research were introduced into the marketplace.[8] The process of maturation of technologies from the earliest nascent technology to a product on the market is a process in which a new and novel idea is protected, converted to a prototype, and the market for it defined and assessed. Marketable inventions then need to become investable, *i.e.* it must be shown that they can be produced or offered at a scale and at a cost that will be profitable and practical. Viewed as a continuum, the successful development of technologies follows a predictable course.



As demonstrated in the examples offered above, federal funding agencies often play a key role in helping ensure that early-stage technologies are developed so that they can be commercialized. Programs such as the NSF I-Corps, were designed to foster entrepreneurship that will lead to the commercialization of technologies that were previously funded by the federal government. NSF I-Corps aids in the stage of technical development between invention and working prototype that is often called the "valley of death." I-Corps and similar programs support entrepreneurial researchers—particularly graduate students —in both technical development and in identifying

[7] http://www.autm.net/AUTMMain/media/About/Documents/AUTM_Infographic_FY2014.pdf
[8] *ibid*

and clarifying potential markets to guide the direction of development. The risk inherent in commercialization is reduced through development of the technology and the likelihood that a successful company can be formed around the technology is increased.

The SBIR and SBTT programs are a long-standing and established component of the next stage of maturation of technologies in the United States. For the Department of Defense, SBIR and STTR programs play a role in ensuring that the needs of the military and the warfighter are addressed by the private sector as new technologies become available as off-the-shelf products when they have both civilian and military uses. Funds from these programs are awarded to the company in the early phases of private sector development after the technology has been transferred from the university to the company usually via a license to commercialize it. However, it still remains the case that funding for development of prototypes is often unavailable. Accordingly, members of the higher education community have recommended creating a new SBIR program that could focus on commercialization[9]. Often called "Phase 0 awards" these could to be used by universities to engage in prototyping, funding mentoring talent and supporting market-readiness initiatives.

Universities seek an understanding of the overall research to product pipeline. Increasing the set-aside for SBIR and STTR programs could have the paradoxical effect of starving innovation since it is a process that relies on the raw material of discovery. Inventions from research fuel the innovation ecosystem. As many universities, non-profit research organizations, and higher education associations have noted[10], the proposed increase in the allocation for SBIR and STTR programs at a time when funding levels at federal agencies are uncertain would have the effect of shifting funds away from basic science and engineering research. This comes at a time when it is almost unprecedentedly difficult for faculty to obtain federal funding for research. As paylines remain low, and the spending caps enacted through the Budget Control Act of 2011 limit the growth in defense and non-defense discretionary programs to 7.5% from 2018 to 2021, competitive research programs of major funding agencies— the Department of Defense, NIH, NSF, NASA, Department of Energy, and others—would necessarily be curtailed and with it the prospects for researchers for initiating new research programs or continuing existing programs.

The best way to increase funding for the SBIR and STTR programs is, most likely, to increase the level of federal funding for all research rather than reallocation within constrained budgets. Limiting funds for peer-reviewed science and making it more difficult for new investigators to become established diminishes the pipeline of invention and deprives the innovation ecosystem of new technology. The growth in funds available for SBIR and STTR programs at NIH and NSF has outpaced the grown in funding for research in recent years. Since 2011, the SBIR program at NSF has grown 5% per year or at three times the rate of the remainder of the agency's programs. NIH's SBIR and STTR programs grew by 29% over five years while the total NIH budget grew 4.5%. Ideally, the funding balance should be restored, paving the way for a long-term innovation strategy that fosters basic and applied research and use-inspired research to build the economy and meet the challenges facing the United States. Additional information from the federal SBIR and STTR funding agencies could clarify the relative success rates of programs and provide important indicators that would help strike an appropriate balance in funding and performance across the spectrum of research through technology maturation and commercialization so that all parts of it remain healthy.

---

[9] Letter dated April 15, 2011 to Secretary Locke from NACIE. http://www.jackmwilson.com/NACIE-LetterToDeptOfCommerce.html

[10] Letter dated May 10, 2016 to the Science, Space and Technology Committee signed by 77 Scientific and professional Societies

I would like to thank the committee for the opportunity to provide insights from the university perspective on this important question about the future of research and the federal investment in innovation.