



Testimony of
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Before The
COMMITTEE ON SMALL BUSINESS AND ENTREPRENEURSHIP
UNITED STATES SENATE

Hearing Entitled
“Reauthorization of the SBIR and STTR Programs”

17 February, 2011

Founded by MIT Researchers in 2006, Cambrian Innovation™ is an environmental product development firm focused on solving basic resource problems using advanced technology and new models of innovation. As a world leader in the commercialization of bio-electrochemical systems, Cambrian is developing a technological platform with application to water sensing, wastewater treatment, renewable natural gas, and a range of other domains. Cambrian also performs market and technical feasibility analyses for corporate and government clients seeking to rapidly evaluate, scale, and market new ideas.

1 Introduction

Chairwoman Landrieu, Ranking Member Snowe, members of the committee, it is a tremendous honor to be able to discuss with you the critical role that the government, and the SBIR program in particular, can play in ensuring that the United States maintains its global leadership position in innovation.

As a recent PhD graduate from the Massachusetts Institute of Technology, where I studied new models of innovation, and founder and CEO of Cambrian Innovation™, an environmental product development firm located in Somerville, Massachusetts, I hope my perspective provides a concrete example of how the SBIR program can help catalyze small business development, create jobs, and build value. In the five years since our founding, Cambrian (formerly called IntAct Labs) has been the fortunate recipient of six SBIR awards from four agencies, enabling accomplishments unimaginable without the program. I will list some of these shortly, but most importantly, we have become a viable player in an increasingly global race to develop next generation water and energy systems based on newly discovered bio-catalytic processes. As a result, we are now valued by our private investors at several times the total SBIR investment.

In this testimony I will discuss our story, emphasizing three points: First, government has an important role to play in early stage innovation, particularly where there is high technical risk. Second, the SBIR/STTR program is a very effective vehicle for this role. Third, for SBIR/STTR to be even more effective it needs long-term stability, less bureaucracy, and faster decision-making. The SBIR/STTR re-authorization act accomplishes most of these needs.

2 The Role of SBIR in Cambrian Innovation's Story

Cambrian was founded in 2006 with the vision of using advanced bioengineering to disrupt the way our society processes basic natural resources, starting at the intersection of energy and water. Currently, the United States produces over 38 billion gallons of wastewater every day and treating this water using our aging infrastructure consumes an estimated 3% of national electricity use. In 1999 novel scientific discoveries suggested that microbes might be able to generate direct electric current while treating wastewater. We imagined a broad platform of solutions stemming from this basic innovation, with the potential to fundamentally affect society's relationship to water, energy, even fuels and chemicals.

The main trouble in 2006 was that the scientific discovery made in universities was too immature for venture investment. Developing energy and water technology entails a lot of technical risk. We needed to design a system for commercial use, prove that it would work on real industrial wastewater, scale it to pilot levels, build a demonstration plant, all while making engineering discoveries about basic process parameters that require iteration and time. Universities don't

carry out this kind of scaling exercise. On the other hand, most venture firms and even angel investors shy away from taking on an investment with high technical risk.

One might argue that large corporations can carry out these kinds of innovations. While true in theory, most of the literature on innovation suggests that they don't do so effectively for a host of reasons. Large corporations have structures that often stifle innovation, move too slowly, or even have incentives to stall innovation that will cannibalize existing products. In reality, most large corporations innovate by acquiring start-ups.

Cambrian's solution to this problem was, in no small part, the SBIR program. After receiving a grant from the NASA Institute for Advanced Concepts in 2006 to demonstrate that our concepts worked at all, we received funding from the USDA SBIR program in 2008 to prove feasibility for agricultural wastewater treatment. Our first design was not satisfactory, but the effort yielded a number of applied discoveries and a better understanding of our market niche. This resulted in new SBIR awards from the NSF and EPA in 2010, and the NSF and NASA in 2011, which have allowed us to attract investors and develop our current product line.

3 Benefits of SBIR for Companies and the Nation

Today, with the help of these SBIR investments and commercial partnerships, Cambrian Innovation™ is commercializing four potentially game-change products. Our Aquavolt™ product line uses electrical active bacteria in an enhanced anaerobic digester that converts dairy and brewery wastewater into useful gases, and we have developed a novel approach to denitrification that we estimate can save the Aquaculture industry up to 70% of the operations costs required to remove soluble nitrogen. We have invented and patented a new water sensor platform, and novel approach to aerospace life support. Six relatively small grants enabled us to:

- Attract angel and corporate foreign direct investment;
- Hire seven employees;
- File five provisional patents, two full Patent Cooperation Treaty (PCT) applications, with over thirteen independent claims between them;
- License outside IP;
- Develop relationships with MIT and Penn State for collaborative R&D; and
- Initiate corporate scale-up discussions with a number of firms.

These accomplishments were due to funding, but they also worked in concert with an ecosystem of innovation such as the MIT business plan awards, and collaboration with the Penn State Licensing Office. Risks certainly remain for our firm, and we have some time to go before the technology is proven at the scale we would like. But one thing is clear – without the SBIR program, we could not have even taken these risks. As a result, I venture to say that the US would be further behind in the global race to commercialize an important clean energy and water technology.

4 Areas For Improvement and the Need for the Reauthorization Bill

Our story is but one example, out of thousands, of how the SBIR program can help an early stage company. In Cambridge, I know of many other early stage ventures, such as Ginkgo Bioworks, Fusion Research Technologies, Saperix, and Levant Power that have leveraged the program to received substantial external benefits. I also know of innovation services such as the Drydock Incubator and the Fraunhofer Tech Bridge Initiative that can multiple the effect of such programs. However, as I mentioned in the beginning, there is room for improvement:

- First and foremost, uncertainty around the future of the program makes it very difficult for small businesses to plan projects and attract investment. Permanence will increase effectiveness, and the Act accomplishes this.
- Second, the time-scale for agency responses is too slow. In a perfect world, the allocations should be made based on results. If a faster result has been obtained and validated, Phase II awards should be administered quickly. At the very least, responses should be made in three months. Section 209 of the re-authorization act seems to address this.
- Third, all agencies should minimize bureaucracy and make immediate use of information technology to reduce paperwork. The NSF does a terrific job of this compared to other agencies that we have interacted with, and we would strongly advocate that all the other agencies adopt similarly low-paperwork contracting methods.

In addition, sections 204 and 205, which recognize the need to provide follow-on commercialization readiness funding for certain grant recipients, and section 106, which enables flexibility between funding agencies, are good ideas for improving success.

On the VC question, while I welcome the basic compromise as a way to bring stability to the program I must admit that I am somewhat concerned about opening the program to companies majority owned by VC firms. Recent data by the National Venture Capital Association indicates that in 2010 VC firms made 363 seed stage investments, versus 5,809 SBIR awards in 2009. VC firms are increasingly investing in late-stage innovation, and this suggests that the VC-backed firms which do apply will, on average, use the program to make incremental adjustments to a developed technologies. This is not, I believe, where the government can make the most impact. Rather, the government should invest where VC firms fail to invest – often in areas with high technical risk or with somewhat lower expected economic returns but high societal value. On the other hand, the program does need to emphasize viable commercialization, not just R&D. The 25% rule is a good compromise. It can be made even better if the evaluation criteria differ between VC-backed and non-VC backed companies, and reviews of this aspect of the program are rigorous.

5 Concluding Thoughts from a National Policy Perspective

There is much more to say, of course, both about Cambrian's experience with the program and the ways in which the government can best catalyze innovation. I would refer the committee to my full testimony for some broader thoughts about the program and particularly some distinctions that could be made to increase effectiveness. The follow are some high level distinctions to consider in this or follow-on legislation:

Infrastructure for Innovation: Most importantly, particularly for hardware innovations in energy, water, and fuels, there is a grey area where VCs will not likely invest, but universities no longer develop inventions. I believe that government should support small businesses taking risks in this grey-zone, with the eye towards creating an infrastructure for innovation. For example, we still might better leverage new models of innovation, prize funding, social networking, and other developments to get new solutions out faster. Lower cost innovation will be the key to competitive advantage for both companies and countries in the 21st century, and will ensure that the US continues to lead the world economically, and more generally.

Distinctions within the Program: In general, the program may benefit from distinguishing between:

- Early stage innovation
- Small businesses already selling products
- VC-backed firms

These kinds of small business all have different needs with respect to innovation, and would benefit from different evaluation criteria.

SBIR Shops: I've heard that companies can turn into SBIR shops focused on R&D as a service, and that some consider this a problem. An anecdotal observation in this regard is that such shops are more likely to persist where SBIR/STTR funding comes from an agency that will be a user of the technology in their operations (e.g. NASA, Military) rather than one that is more domain-agnostic (NSF, EPA). The former group can treat the program essentially as low-cost R&D. In this sense, the shops can be considered viable businesses, like other government contractors. In fact, the return on investment for the government is likely much higher given the efficiency of small businesses. Therefore, it may make sense to distinguish a market-commercialization focused SBIR program from an agency-focused technology development activity. Small businesses will have a role to play in both.

Thank you, again, for inviting me to contribute to this important hearing, and for supporting small businesses and entrepreneurs that can help re-build our country. I look forward to answering your questions.