



Testimony of

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Before the

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Committee on Science, Space, and Technology
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I-Corps

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Chairman Brooks, Ranking Member Lipinski, and distinguished Members of the Subcommittee, thank you for inviting me to participate in this field hearing here at prestigious Northwestern University, on NSF's Innovation Corps, or I-Corps. I am pleased to have the opportunity to discuss this exciting program with you.

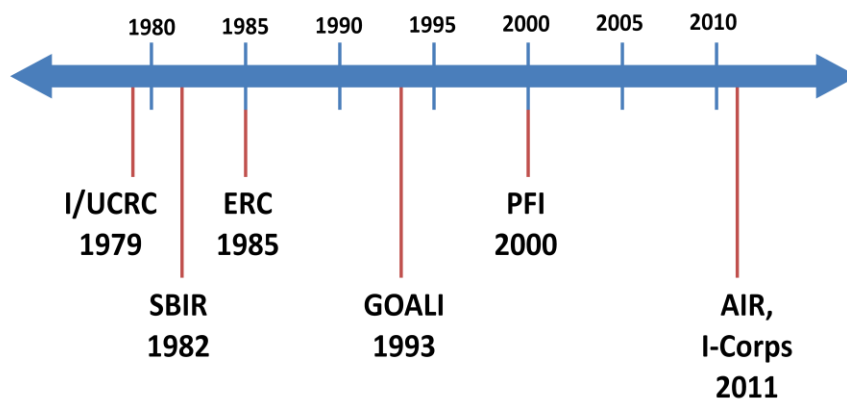
NSF is recognized and respected worldwide for identifying and supporting fundamental research and education in science and engineering, through peer review evaluation of the merits of the ideas proposed. That process, by definition and by construction, selects the best and most creative ideas, those that offer the greatest promise for success. We invest more than \$7 billion annually in these efforts. Our grantees are the winners in this process, so too are the taxpayers who have invested in this research through the NSF.

Let me illustrate one way, through our recently launched I-Corps program, the American taxpayer benefits from NSF investments. Important discoveries that expand our knowledge of the universe, our natural world and our human-made environment are made every day by NSF-

funded researchers. Those researchers have been chosen for financial support from NSF through NSF’s merit review process, the gold standard world-wide for competitively choosing the best research and education ideas. Some of that research addresses our most fundamental and basic curiosities, such as the origins of the universe. And some of that research leads to advancement in science in technology that can directly benefit the world in which we live, such as a better understanding of the environment, methods for generating energy, or the benefits of certain materials properties. It is good stewardship, we believe, if we can assist those current and past NSF-funded researchers to identify the realistic potential for developing their ideas into a product or process of societal benefit.

I-Corps has its genesis in many of the Foundation’s long standing innovation ecosystem programs. Those existing NSF innovation research alliances include consortia such as Engineering Research Centers (ERC), Industry University Cooperative Research Centers (I/UCRC), Partnerships for Innovation (PFI), Science and Technology Centers (STC), Nanoscale Science and Engineering Centers (NSEC) and Materials Research Science and Engineering Centers (MRSEC). They are also exemplified by the Grant Opportunities for Academic Liaison with Industry (GOALI) program, and of course the Small Business Innovation Research (SBIR) program. These programs complement our other significant investments in fundamental scientific and engineering research by offering multiple pathways to moving discovery to innovative technologies.

Many of these programs have been part of the NSF investment portfolio for decades. For example, SBIR is a government-wide program initiated at the NSF in the early 1980’s.



Timeline for Inception of Current NSF programs Supporting the Innovation Ecosystem

Most closely related to I-Corps is the Accelerating Innovation Research (AIR) program in the Directorate for Engineering (ENG) also started in FY 2011. The AIR program:

- encourages the translation of the numerous, technologically-promising, fundamental discoveries made by NSF researchers, while drawing upon and building the entrepreneurial spirit of the researchers and students; and
- fosters connections between existing NSF innovation research alliances.

Both I-Corps and AIR are designed to strengthen the U.S. innovation ecosystem.

To build a national “culture of innovation” we not only need sustained research investment but also skillful and deliberate catalysts to hasten the application of scientific discoveries. A robust innovation ecosystem could also help us conceive novel research questions and shift S&E knowledge paradigms altogether. That, in effect, is what we seek to accomplish through the Innovation Corps program.

Goals

The goals of the I-Corps program are:

- to build on NSF’s investment in fundamental research;
- to offer academic researchers and students an opportunity to learn firsthand about technological innovation and entrepreneurship, and thereby fulfill the promise of their discoveries; and
- to prepare students for real-world experience through curricular enhancements, and provide them with opportunities to learn about and participate in the process of transforming scientific and engineering discoveries to meet societal needs.

The I-Corps program is comprised of three elements, namely:

- Financial support to the team to assist the development of a prototype or a proof of concept;
- A specific structure for the I-Corps team, comprised of a principal investigator, an entrepreneurial lead, and an innovation/entrepreneurial mentor; and
- A strong educational component focusing on a hypothesis driven approach to developing a methodology for evaluating both the technical merits and the marketability of the concept being proposed.

Because the hypothesis-testing approach of the customer development process used in I-Corps is so similar to the Scientific Method, it is easily accepted by the scientists and engineers we touch with I-Corps. This approach is proving to be instrumental in helping teams to take a practical look at what is involved in going to the next step. Also, because the teams proceed together in cohorts of approximately 25, the peer-to-peer environment greatly enhances the effectiveness of the overall effort; independent teams help, encourage and drive one another. Finally, the business model canvas which is employed in the curriculum puts a straightforward go/no go assessment and commercialization plan in place during the effort. Together, these elements enable the teams to effectively assess the commercial viability of the proposed innovations. At this stage of the effort, the teams do not need to focus on business plans per

se, rather they need to focus on the nature of the commercial opportunity enabled by the proposed innovation and fleshing out the gaps in knowledge required to be successful. What they take away are the skills and tools that they will need to move forward to become great entrepreneurs.

I-Corps is designed to create a national network of scientists, engineers, innovators, business leaders, and entrepreneurs to accelerate and strengthen our national innovation ecosystem. I-Corps taps into the American entrepreneurial spirit to identify opportunities. The idea is not to take money away from basic research but rather to look at research already completed that can be leveraged with a little nudge into translational activities of potential commercial benefit.

NSF participation in I-Corps includes every directorate and NSF's Offices of Cyberinfrastructure and Polar Programs. The structure of I-Corps mirrors the NSF Director's vision of OneNSF, working together seamlessly in well-integrated and efficient ways across organizational and disciplinary boundaries. The internal review structure for the program involves a core of cognizant program officers in partnership with topic-specific program officers in each of the seven directorates and the Offices of Cyberinfrastructure and Polar Programs.

The I-Corps award mechanism includes 'seed/pre-seed' funding, mentorship, and focused instruction in a hypothesis-driven approach to evaluating potential commercial viability of completed scientific and engineering research. Academic institutions are key partners in the I-Corps national network, as is the private sector. Technology developers, business leaders, venture capitalists, and experienced entrepreneurs serve as mentors, providing critical support by sharing knowledge and experience. This network operates to enhance the ability of NSF-supported researchers to turn scientific results into potentially successful technologies. I-Corps also provides students with opportunities to participate.

I-Corps targets the critical gap that occurs just before researchers have advanced their ideas sufficiently to apply for Small Business Innovation Research funding. In that sense this is a 'pre-seed' investment. The phrase "jumpstart" is used to describe the needed push. NSF investments will strategically strengthen the innovation ecosystem by addressing the challenges inherent in the early stages of the innovation process.

In FY 2012, the I-Corps program will support up to 100 projects, at \$50,000 each, for six months.

In FY 2013 I-Corps will support up to 250 awards. Going forward, some adjustments may be made to the program, possibly including:

- The duration of the award;
- The number of team members required/allowed to participate in all aspects of the educational elements of the program; and
- The geographic distribution of the providers of the educational content of the program.

We plan to retain the current model of a hypothesis driven approach to evaluating technical and market viability. This approach has proven to be very successful and experience to date indicates it provides significant "value added" to the principal investigators (PIs) and their teams. While this curriculum is currently offered to the teams by one university (Stanford University), other universities are being invited to leverage and integrate it into similarly productive curricula, including Georgia Tech and the University of Michigan. We anticipate, in FY 2013, to offer opportunities to other universities to further develop the curriculum, using the lessons learned in the execution of the I-Corps program in FY 2011 and FY 2012. We also anticipate the establishment of regional I-Corps nodes, wherein the hypothesis driven innovation educational offerings for PIs and their teams would be developed and provided by the universities involved in these nodes.

Teams that advanced their efforts toward commercializing technology were facilitated by inclusion of public- and private-sector experts to provide guidance, from, participation in tailored curriculum, and funds to evaluate the commercial readiness of technology ideas. These first technologies include photocatalysis to help clean up contaminated water, a new technology for semiconductor-based hydrogen and hydrocarbon sensors, and production of graphene film. I-Corps presents a new model for public-private partnerships that leverages our significant investment in basic research with relatively smaller I-Corps funding thus offering a bigger bang for the buck.

In the first two cohorts, (21 + 24), over 4000 discussions took place between I-Corps teams and potential partners, customers and other stakeholders. As of today, there are a total of 100 teams. There are 100 mentors with these teams, plus over 70 additional mentors who have been identified as ready and willing to join teams.

While evaluation and assessment of the progress towards achieving the prescribed goals is important for *all* NSF programs, it is particularly so for the I-Corps program. As such, I-Corps is the subject of one of NSF's three Priority Goals for FY 2012 and FY 2013. Progress towards Priority Goals is assessed quarterly by agency senior management and will be reported on the website Performance.gov. The relevant priority goal is to *increase the number of entrepreneurs emerging from university laboratories*. Specifically, the Priority Goal states that by September 30, 2013, 80 percent of teams participating in the Innovation Corps program will have tested the commercial viability of their product or service.

Additional primary outcomes for the I-Corps program center on those tangible measures that relate directly to the societal application realized from NSF's investments in basic research. For example, successful completion of the I-Corps grant would be expected to contribute to one or more of the following:

- New start-up businesses;
- Licensing;
- SBIR proposals;
- A business opportunity suitable for review by third-party investors;

- Students prepared to be entrepreneurially competitive; and
- New curriculum development or improvement in current curricula focusing on entrepreneurship and innovation.

These outcome indicators will become critical to monitor as the program matures, and establishing a realistic timeline over which these measures will change is critical. It will take more than a single one-year cycle to see real and substantive changes in these measures. .

In the meantime, we are monitoring process measures such as level of interest, number of proposals, completion rates, and the ability to expand the mentor network. Being very analytical, but also realistic, about the measures of success and when it will be appropriate to use each particular metric, a projected timeline is:

- FY 2012: Up to 100 awards at \$50,000 each – The Foundation will establish baseline activities “Pre ICorps” and begin data collection of the metrics described above.
- FY 2013: Up to 250 awards at \$50,000 each– The Foundation will initiate evaluations utilizing the metrics developed in FY 2012.
- FY 2014-FY 2016: NSF will continue with regular evaluations of the previously described metrics, developing a chronological database that allows for more detailed historical analysis of program success.

The approach will be similar to that taken with the very successful Engineering Research Centers and Industry/University Cooperative Research Centers programs since 1985.

Summary

Initial anecdotal indicators suggest that the I-Corps program has been a significant positive addition to the NSF investment portfolio, even though it constitutes less than one-third of one percent of the NSF budget. For those teams who have participated, it has been truly transformational to thinking in a more entrepreneurial way. An enormous and significantly underutilized storehouse of creative ideas with potential economic benefit exists in our nation’s colleges and universities, and I-Corps is simply a way to help unlock and unleash some of those ideas generated by current and previous NSF investments. I thank the committee for their interest in this exciting program, and for giving me the opportunity and the privilege to come here today to tell you about it. I would be happy to answer any questions.

BIO for THOMAS W. PETERSON

Thomas W. Peterson is the Assistant Director of the National Science Foundation, for the Engineering Directorate. Prior to joining NSF, he was Dean of the College of Engineering at The University of Arizona. He received his B.S. degree from Tufts University, M.S. from the University of Arizona, and Ph.D. from the California Institute of Technology, all in Chemical Engineering. He has served on the faculty of The University of Arizona since 1977, as head of the Chemical and Environmental Engineering Department from 1990-1998, and as Dean from 1998 until January 2009.

During his service as Dean, Dr. Peterson was a member of the Executive Board for the Engineering Deans' Council of ASEE, and was Vice-Chair of EDC from 2007-2008. He has served on the Board of Directors of the Council for Chemical Research, and on the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET). He was one of the founding members of the Global Engineering Deans' Council, and while at Arizona, he made global education experiences a high priority for his engineering students. He is a Fellow of the American Institute of Chemical Engineers and a recipient of the Kenneth T. Whitby Award from the American Association for Aerosol Research.

The Engineering Directorate at NSF provides critical support for the nation's engineering research and education activities, and is a driving force behind the education and development of the nation's engineering workforce. With a budget of approximately \$800 million, the directorate supports fundamental and transformative research, the creation of cutting edge facilities and tools, broad interdisciplinary collaborations, and through its Centers and Small Business Innovation Research programs, enhances the competitiveness of U.S. companies.